M7XC
Compact Satellite Modem

Installation and Operation Manual

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Table of Contents

Figures

Tables

NOTE: All appendices may not be present in manual. Some Appendixes may be shipped with the option.

Preface

This manual is intended for use by personnel with reasonable knowledge of satellite communications and earth station terminology. This manual provides Installation, Operating, and Maintenance procedures for the M7XC Compact Satellite Modem and available options.

Standard Designations

The M7XC designation is used throughout this manual where references apply to the M7XC Compact Satellite Modem. The designation for the M7XC may also be referred to as 'modem' or 'unit' interchangeably.

Recommended Standard (RS) designations (i.e., RS-232) have been superseded by the new designation of the Electronic Industries Association (EIA) designations (i.e., EIA-232). The RS and EIA designation may be used interchangeably within the manual and protocol documentation and have the same electrical and mechanical meaning.

Electrical Safety and Compliance Notice

The M7XC has been safety tested and shown to comply with standard EN 60950 Safety of Information Technology Equipment (Including Electrical Business Machines).

Never operate the unit with the cover removed. Never remove a cover with power applied. As a safety measure the power cord must be disconnected from the unit when preparing to remove the cover.

Battery

The M7XC optionally contains a Lithium Battery. Danger of explosion exists if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries in accordance with local and national regulations.

EMC (Electromagnetic Compatibility) and Safety Compliance

CE

This equipment has been tested in accordance with FCC and ESTI standards.

- FCC: Part 15, Subpart B, Class A
- ETSI EN 301 489-1 V1.9.2 (2011-09) (Emissions and Immunity)
- EN 55022 (2010) (Emissions)
- EN 55024 (2010) (Immunity)
- EN 60950-1:2006 (2nd Edition) and IEC 60950-1:2005 (Safety)

To maintain compliance with these standards the following the precautions must be observed.

- The unit must be operated with the cover attached with all cover screws in place.

- All connections are designed to have integral shielding on the cable and connector assembly.

Telecommunications Terminal Equipment Directive (TTED)

In accordance with the TTED 91/263/EEC, the M7XC should not be connected directly to the Public Telecommunications Network.

RoHS Compliance

The M7XC satisfies the requirements specified in the European Union Directive on the Restriction of Hazardous Substances, Directive 2002/95/EC (EU RoHS).

Environmental

The M7XC is designed to operate in an enclosed environment. Operation while exposed to precipitation, condensation, relative humidity above 95%, excessive dust, or temperature outside the operating range of -40° C to +60° C temperature range may cause damage to the unit and will void the warranty. Maximum storage temperature is -55° C to +70° C.

Do not operate the modem in an unsafe environment near explosive or flammable gases or liquids.

If the M7XC is to operate in a mobile environment, the user must take precautions to provide a stable environment consistent with the equipment specifications.

Grounding

Insure good grounding practices. Where a ground lug is provided, the modem should be connected to a good earth ground with low impedance cable in installations.

About This Manual

This manual is composed of several separable documents. The main body of the manual is separated into several “Chapters” and “Sections”. The Chapters within the main manual are the Modem Description, Installation, Operation, and Maintenance. The Appendices include the Specifications, Remote Control Protocol and information on Options, Cabling and information related to placing the Modem in service.

A Section is considered a sub-section of a Chapter. For example, Section 4.1.2 is a numbered section within Chapter 4. Page numbers include the Chapter (i.e., Page 3-14) and all Tables and Figures will show the Chapter in the caption (i.e., Table 1-2).

This manual is available in a printed form and as an electronic “Portable Document Format” or .PDF file. The electronic format is produced as a universal Adobe Acrobat readable file, and can be requested directly from Datum Systems, Inc., or via download from the web at www.datumsystems.com. The electronic format on the web is always the latest revision.

Revision History

Release Number	Release Date	Comments
Revision 0.01	04/01/2021	Initial Public Release
Revision 0.02	04/01/2023	Updated to reflect current capabilities

Pen and Ink Changes Made to this Manual

1 Introduction

1.1 Modem Description

The M7XC, represented in Figure 1-1, is a major extension of our innovative design concepts that have been proven and refined in over twenty years of production. The M7XC is capable of independent transmission and reception of carriers compliant to most satellite communications standards. The M7XC uses the latest Digital Signal Processing (DSP) technology and other proprietary techniques to provide unsurpassed performance. The M7XC is a highly modular design made possible by a higher level of integration.

Figure 1-1 - Compact Satellite Modem

The dimensions of the black enclosed M7XC with fan and heatsink are 5” (L) x 3” (W) x 1.3” (H) and weighs < 2 lbs.

The dimensions of the silver enclosed M7XC without fan and heatsink are 5” (L) x 3” (W) x 1.0” (H) and weighs < 2 lbs.

The M7XC is end-to-end compatible with all Datum Systems M7 series modems.

The M7XC is designed to be integrated into a compact satellite terminal for use in a variety of satellite systems. The satellite terminals may be small fly-away systems, Manpack, Airborne/UAV, or other mobile satellite terminal applications.

The M7XC design can also be integrated with other M7XC units into a master hub station.

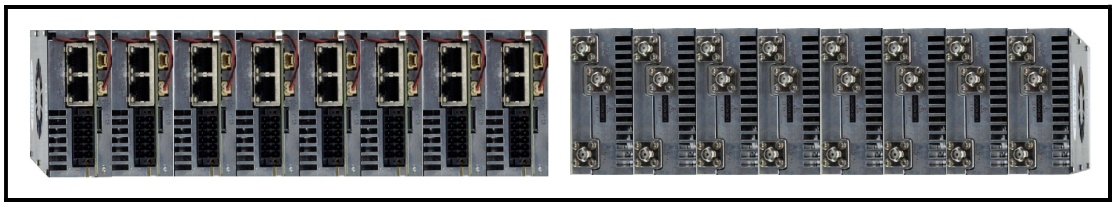


Figure 1-2 - Compact Hub Modems

The highly integrated design allows system designers the flexibility to integrate units into many different innovative hardware system designs. The M7XC is an

integral part of a satellite earth station's equipment operating between the Data Terminal Equipment and the station RF equipment.

The M7XC is designed for operation in different network types. Operating modes may be dedicated or shared. In a dedicated system two modems are set for continuous operation with each other. In shared systems, the modem carriers are typically controlled by a Network Management System (NMS).

1.2 Network Types

The M7XC is extremely flexible regarding the network types that can be configured. Depending on the network type, different baseband interface options are available that will maximize the capability for the network. The main network types are:

- Point-to-Point
- Point-to-Multipoint
- Mesh
- Hybrid

In a Point-to-Point (P2P) network, the M7XC provides the industry leading Eb/No performance and flexible baseband interface options. This performance improvement and the Ethernet/IP interface in the M7XC provide the network operator with the latest technology needed to extend cellular backhaul connectivity and Internet access to remote locations. With Ethernet bridging capabilities internal to the M7XC, there is a significant reduction in the number of devices that need to be managed and maintained. A typical P2P network is shown in Figure 1-3.

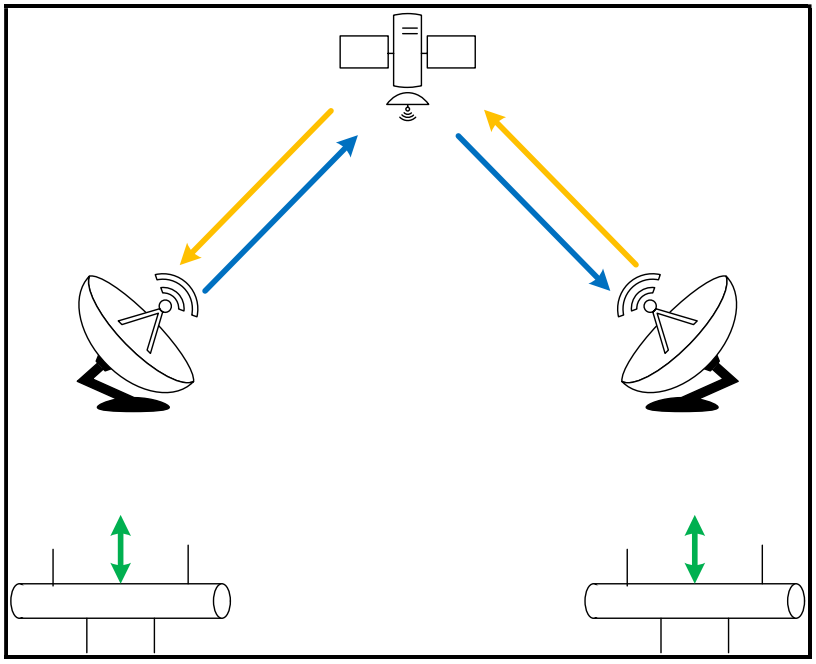


Figure 1-3 - Point-to-Point Network

Point-to-Multipoint (P2MP) networks are used to connect a central location to multiple remote locations. The central Hub location will output a continuous carrier that is received by all the remote sites. The central Hub location will also receive the individual carriers from each of the remote sites on individual demodulators. Within the shared outbound carrier will be all the information destined for each of the remote sites. At each of the remote sites, the M7XC with an Ethernet/IP interface will filter only the information that is to be received by that site. There is considerable statistical bandwidth savings by using a shared outbound carrier in an IP based network because of the typical traffic patterns consistent with IP networks. A typical P2MP network is shown in Figure 1-4.

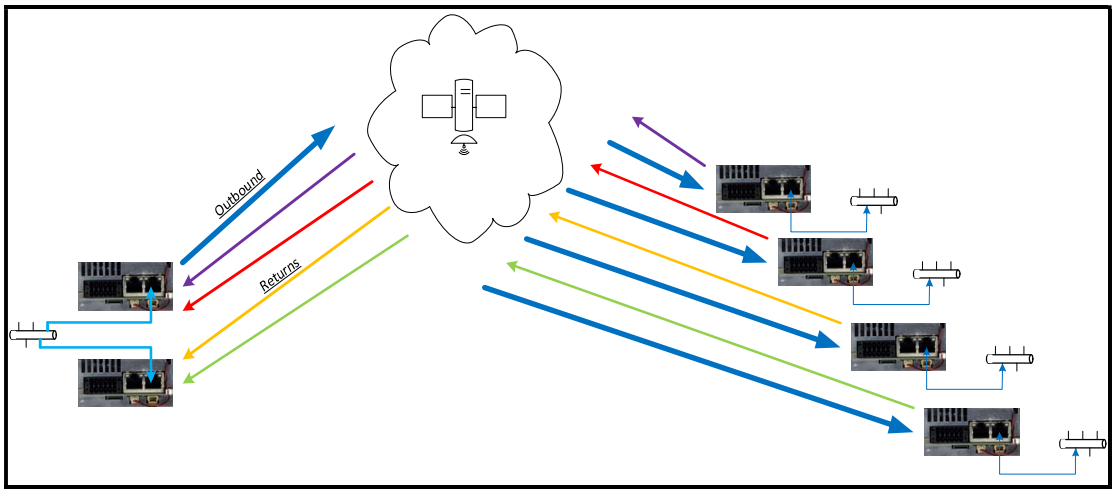


Figure 1-4 - Four (4) Site Point-to-Multipoint Network

A Mesh network is used when all sites in a network need to be connected to all other sites within that same network with a single satellite link. This could be done by installing multiple P2P networks between each network site, but as the number of network nodes increases, there is a dramatic increase in the number of carriers and an increase in the number of modems required at each site. At some point, this becomes unmanageable, and cost prohibitive. The alternative is to use a Mesh network topology instead of multiple P2P networks. At each site in a Mesh network there is a single carrier that contains all the information destined for all the nodes within the network. In an IP based network there is considerable statistical satellite bandwidth savings by using the shared outbound carrier from each site because of the typical traffic patterns consistent with IP networks. A typical Mesh network is shown in Figure 1-5.

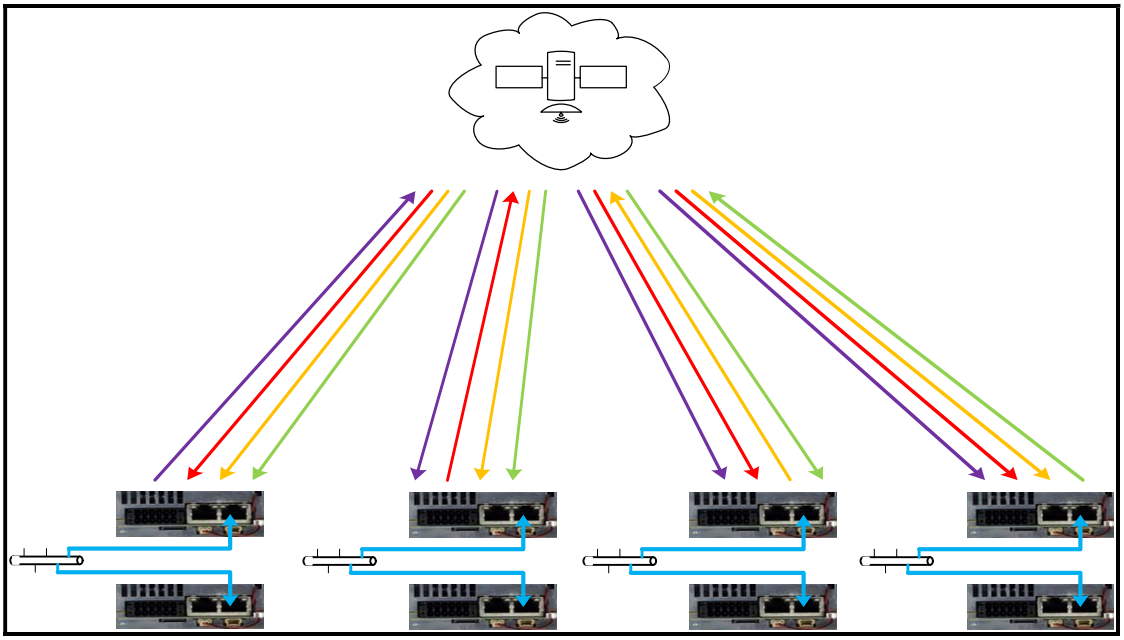


Figure 1-5 - Four (4) Site Mesh Network

A hybrid network is a combination of any of the networks shown above.

1.3 What's New – This Modem

The M7XC is similar in operation to the previous Datum Systems M7 modems except there is no integrated front panel. The monitor and control will be via the RS-232 serial interface, SNMP, and Web Browser connections. When compared to the previous modem releases, there are several changes in this modem. The list below shows some of the differences between the M7XC and the previous Datum Systems M7 modem products.

1.3.1 M7XC Highlights

- Powered by +10 to +36 VDC input with a max of 30 Watts.
- Transmit and Receive L-Band 950 to 2250 MHz.
- Up to 350 Mbps (Waveform Dependent).
- QPSK, 8PSK/APSK, 16APSK, 32APSK, 64APSK, 128APSK and 256APSK.
- Contains separate Modulator and Demodulator cards.
- Capable of being a TX/RX Modem, a TX only Modulator, or a RX only Demodulator.
- Independent TX/RX FlexLDPC, DVBS2/DVBS2X, and Vit/RS/TPC.
- Multi-Demods up to 16 FlexLDPC or two DVBS2X Independent RX Channels.
- Segmented feature up to Sixteen TX FlexLDPC channels.
- GigE IP Control interface provides remote control via a HTTP/S web browser user interface and SNMP protocol.
- Complete monitor and control functions as well as firmware/software updates from the web browser.
- IP Control management interface connection is separate from the IP Data traffic interface connection.
- RS-232 serial remote-control interface binary packet control protocol is also provided.
- Baseband traffic Data is connected via the GigE Layer 2 Switched Bridged Ethernet Protocol interface.
- Available with Sharp Carrier Technology that provides eight (8) filter roll-off options from 0.40 Alpha to 0.02 Alpha.
- Available with second-generation advanced carrier canceller for Point-to-Point (P2P) and Point-to-Multipoint (P2MP) networks.
- Compliant with Mil-STD 165B Standard for TX Spurious and Phase Noise
- AES 128/256 (FIPS-140-2 Compliant), 32k P/N Generated Rolling Keys
- High Stability 10/50 MHz Reference (In/Out), supports BUC/LNB Reference
- LNB Power (+13 and +18 VDC Selectable)
- -40^{o} C to + 60^{o} C Temp Range
- MIL-STD-810G – Vibration

1.4 Modem Assemblies

The M7XC consists of four (4) main functional elements arranged on two (2) electronic printed circuit board assemblies shown in Figure 1-6.

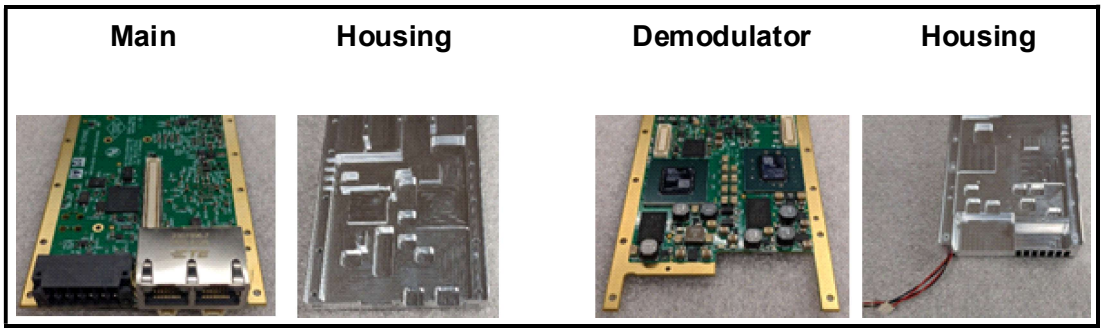


Figure 1-6 - Major Assemblies

The modem assembly consists of the following major assemblies:

A. M7XC digital PSK main board assembly with L-Band carrier generation, monitor/control microprocessor, GigE control and data interfaces.
B. M7XC digital PSK demodulator board assembly that accepts carriers in the L-Band frequency range. The Digital Signal Processor Acquisition subsystem is part of the demodulator board assembly.
C. M7XC 'clamshell' metal housing.

A functional block diagram of the M7XC is shown in Figure 1-7.

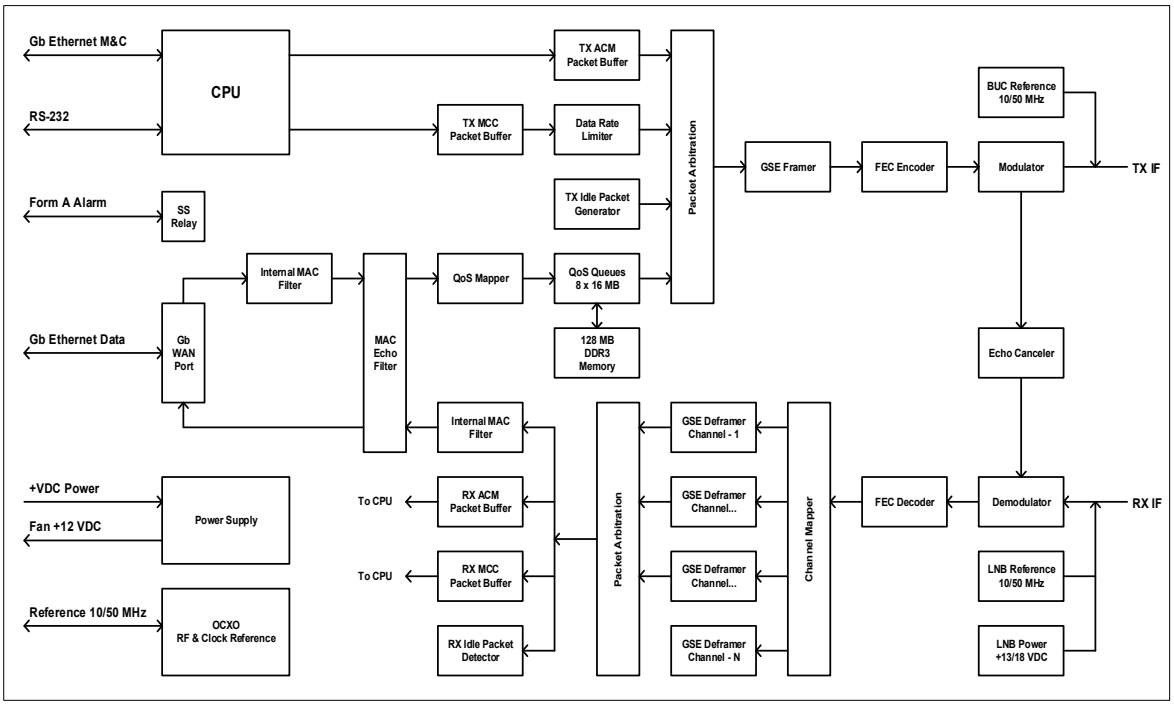


Figure 1-7 – Functional Block Diagram

1.5 Capabilities

1.5.1 Inter-Facility Interface (IF)

The M7XC transmit and receive L-Band IF frequency range is 950 to 2250MHz.

The M7XC transmit and receive IF also provides for either 10 or 50 MHz Frequency References for the BUC and/or LNB. The modem is ideal for earth stations that are designed with block Up and Down conversions.

1.5.2 Reference In/Out (Ref)

The M7XC provides an interface for the external references that are to be supplied to the modem to frequency lock all signals generated by the modem. This interface may be configured as an output to provide a reference to other units. The Input or Output Reference Frequency is configurable to 10 MHz or 50 MHz.

1.5.3 GigE Baseband Interface (IP)

The M7XC connects to the Local Area Network (LAN) via the local GigE Ethernet interface. The interface supports connections between the LAN and the satellite modem WAN as part of a point-to-point or a point-to-multipoint network. The GigE Ethernet interface port is a RJ-45 connector. The Data and IP Control Ethernet interfaces are separate.

1.5.4 TX and RX Carrier Segmentation

Refer to Appendix H - M7XC Modem TX and RX Carrier Segmentation for details.

1.5.5 Sharp Carrier Technology

The M7XC provides multiple settings for the modulation carrier roll-off that will permit interoperability with industry standards and increase the number of carriers that can be placed in a satellite transponder. This Datum Systems capability is referred to as “Sharp Carrier Technology”.

There are ten (10) filter roll-off options available to the modulator and demodulator control functions. These selectable filter “Alpha” values are “0.40”, “0.35”, “0.30”, “0.25”, “0.20”, “0.15”, “0.10”, “0.05” and “0.02”. Figure 1-8 shows a comparison of two (2) spectrum plots one which is 0.35 Alpha (blue) and the other 0.02 Alpha (red).

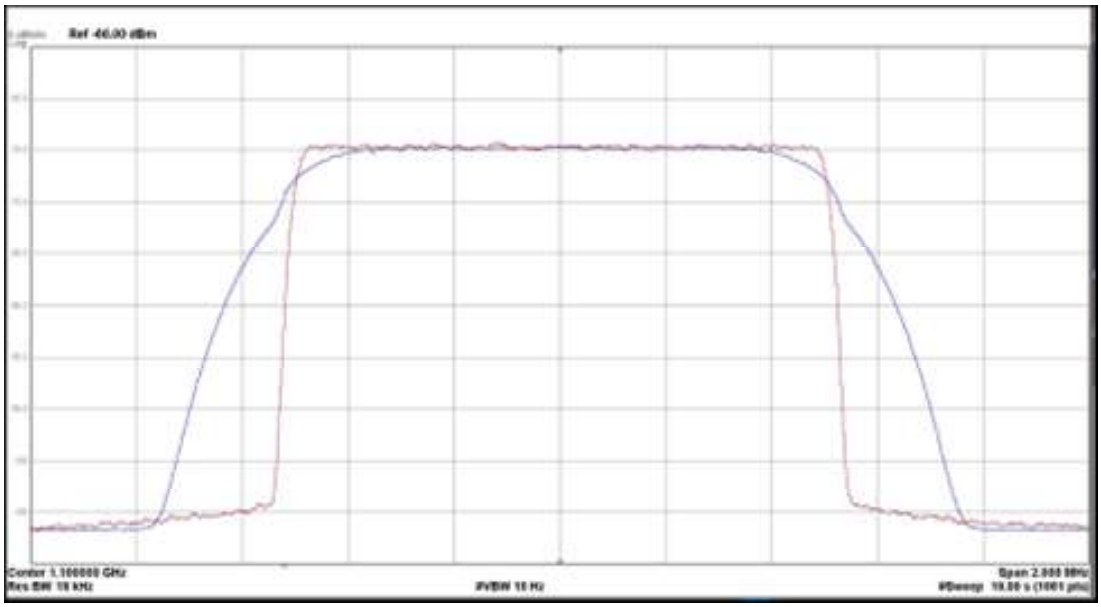


Figure 1-8 - Spectrum Analyzer Plot of 0.35 verses 0.02 Roll-off factors

A significant benefit of this technology is the reduction in carrier spacing required on the satellite. With a filter roll-off of 0.4, the carrier spacing would be 1.4 times the carrier symbol rate. When the carriers are changed to a 0.05 roll-off, this carrier spacing can be reduced by more than 30% to 1.05 times the carrier symbol rate. A spectrum analyzer plot demonstrates this capability is shown in Figure 1-9.

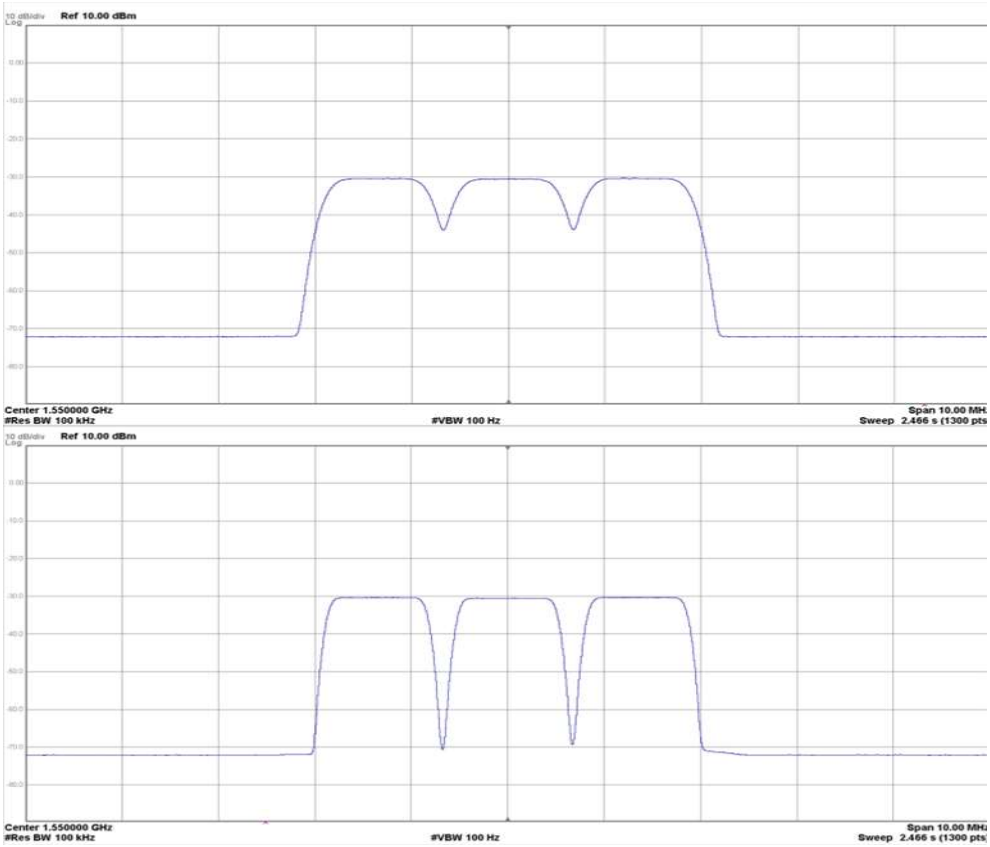


Figure 1-9 - Carrier Alpha = 0.4 vs Carrier Alpha = 0.02 Carrier Spacing

For example, in a typical 36MHz transponder configured with 1Msps carriers with a 0.4 roll-off there could be twenty-five (25) carriers. If the 1Msps carrier roll-off was changed to 0.08, there now could be 32 carriers – a 28% increase in transponder throughput. Table 1-1 shows the relative improvement gained in a bandwidth limited 36MHz transponder by changing the carrier Alpha settings from 0.4.

Table 1-1 - Bandwidth Savings Related to Carrier Alpha

Carrier Alpha	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0.02
# of 1Msps Carriers	25	26	27	28	30	31	32	34	35
% Improvement from 0.4 Alpha	0	4	8	12	20	24	28	36	40

1.5.6 Smart Carrier Cancelling Overview

Smart Carrier is a patent pending second-generation advanced carrier canceller which allows two carriers to occupy the same transponder spectrum. Our advanced carrier canceller not only provides excellent performance but is different from the other cancellers. Our canceller is a baseband canceller instead of an IF canceller. The canceller is easy to setup and requires no additional cabling. Smart

Carrier Cancelling is compatible with all Datum Systems Modulation/FEC types and is well suited to be used with Sharp Roll-Off factors down to 2%. Our technique provides a Shannon Capacity improvement of ~ 2 dB, which is a ~50 % increase in the fundamental channel capacity as shown in Figure 1-10.

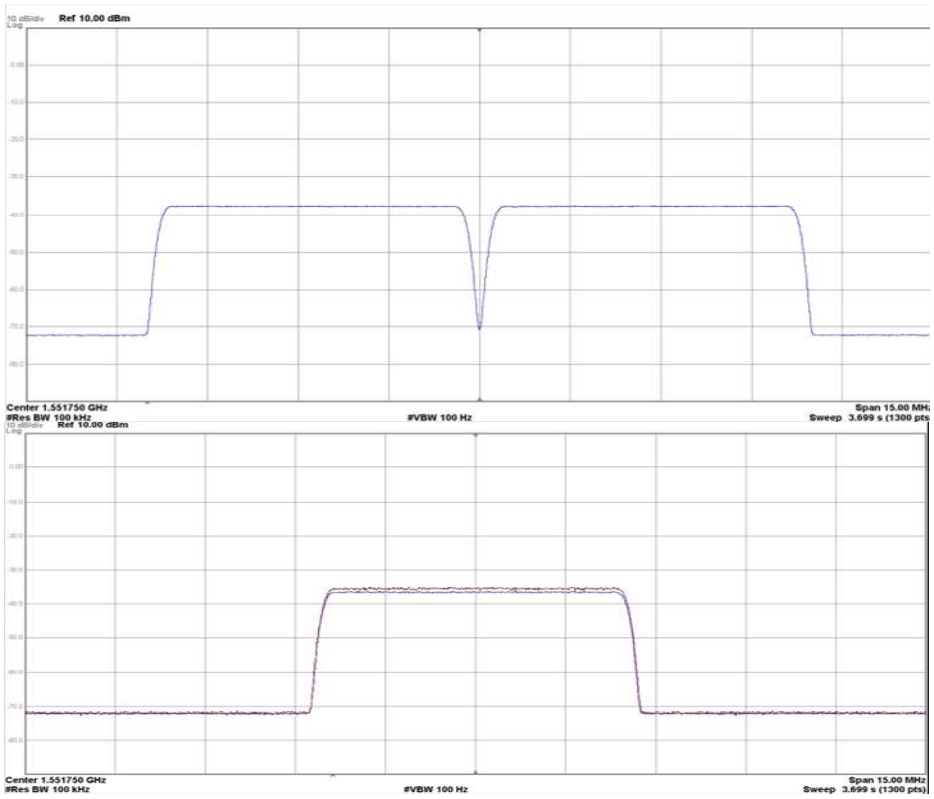


Figure 1-10 - Smart Carrier Bandwidth Savings of 50%

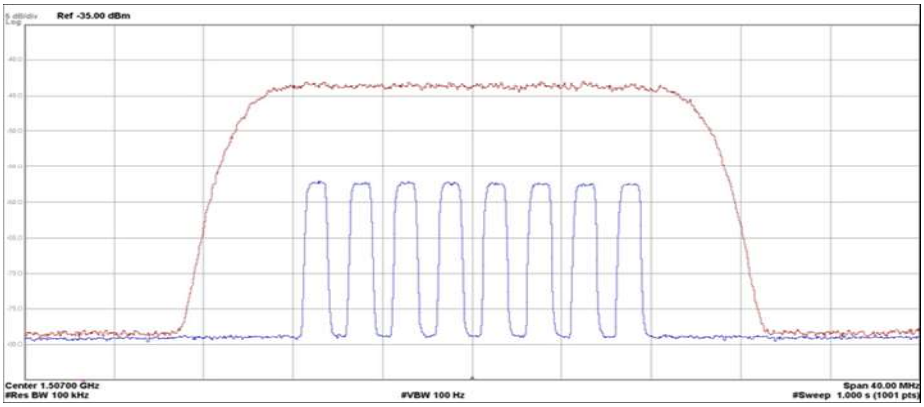


Figure 1-11 – P2MP Hub Carrier Canceling Bandwidth Savings

1.5.7 Modem Control Channels (MCC + AUPC + ACM)

The MCC provides AUPC plus ACM plus Remote Modem Control Channels and Auxiliary Control Bits.

Within the Ethernet baseband interface, the MCC channel is provided without the need to set-up a separate multiplexer or demultiplexer function.

AUPC operation is under control of the modem while the AUPC facility in the MCC provides the channel for the information. This channel provides a 500-10 kbps control channel in each direction to allow the modems at both ends of the link to interactively maintain the receive Eb/No by controlling the power output at each transmit site.

Refer to the AUPC operation description in Section 3.8.

1.6 Forward Error Correction (FEC) Options

The standard M7XC contains the hardware for FlexLDPC and for DVB-S2X FEC types with basic functional capability for all standard operating networks.

1.6.1 FlexLDPC FEC

The FlexLDPC FEC performance improvement achieved is the highest and most flexible of any specialized FEC technology to date, outperforming Viterbi and TPC across all modes. For example, the FlexLDPC at rate 1/2 can operate at a sustained Eb/No of +1.5 dB with an error rate less than 10^{-9}.

1.6.2 DVB-S2X

Refer to Appendix G DVB-S2X Operation for more information.

1.7 1:1 Redundancy Function

NOTE: Both Primary and Backup modems must be at the same hardware and firmware versions for redundancy to operate properly.

More information on the set-up and use of the 1:1 redundancy functions and modes is given in Section 3.11

2 Installation

2.1 Installation Requirements

The Datum Systems M7XC Compact Satellite Modem is primarily designed for installation in an integrated satellite terminal and requires 1.3” (H) x 3” (W) x 5” (D) of space (excluding cabling). The M7XC is shipped with a mating connector for connection to DC power. An optional AC to DC external power converter module designed to accept a 3-wire AC line cord is available on request. Installation and connection to the AC power line must be made in compliance to local or national wiring codes and regulations. The M7XC may be placed on a table or other stable flat surface is required for testing.

⇒ CAUTION!!! There are no user-serviceable parts or configuration settings located inside the M7XC modem chassis.

⇒ CAUTION!!! Before initially applying power to the modem, it is a good idea to disconnect the transmit output from the satellite ground station equipment. This is especially true if the current modem configuration settings are unknown, where incorrect settings could disrupt existing communications traffic.

2.2 Unpacking

The M7XC was carefully packed to avoid damage and should arrive complete with the following items for proper installation:

- M7XC Modem Unit
- DC power mating connector
- AC to DC Adapter (Optional)
- Installation and Operation Manual plus other information on CD

2.2.1 Removal and Assembly

If using a cutting knife or blade to open the carton, exercise caution to ensure that the blade does not extend into the carton, but only cuts the tape holding the carton closed. Carefully unpack the unit and ensure that all the above items are in the carton. If the Prime AC power available at the installation site requires a different power cord/AC connector, arrangements to receive the proper power cord will be necessary prior to proceeding with the installation.

The M7XC is shipped fully assembled and does not require removal of the covers for any purpose during the installation. All hardware configuration is under software control. The type of Feature Sets, FEC Options and other configurable options are available via the Web Browser.

2.3 Mounting Considerations

When mounting the unit in an integrated terminal, adequate ventilation must be provided. The ambient temperature in the enclosure must stay between -40° C to + 60° C and held constant for best equipment operation. The air available to the terminal should be clean and relatively dry. Modem units should not be placed immediately above high heat or EMF generator to ensure the output signal integrity and proper receive operation.

Do not mount the modem in an unprotected outdoor location where there is direct contact with rain, snow, wind, or sun. The modem is designed for enclosed applications that can be indoor or outdoor.

Tools and accessories required for mounting the modem:

- Six (6) 6x32 screws
- Screwdriver

The following interface connections must be available at the mounting location:

- Prime DC power
- 50Ω Transmit IF cable with SMA male connector
- 50Ω Receive IF cable with SMA male connector
- 50Ω External Reference cable with SMA male connector (Optional)
- RJ-45 cables to mate with the modem's two Ethernet interfaces

2.4 Modem Connections

Connections to the modem are located on both ends of the unit. The connector definitions in the following sections describe the connectors on the modem. Any

connection interfacing to the modem must be done with the appropriate mating connector. Refer to Figure 2-1 for the location of the baseband connections and Figure 2-2 for the IF connections.

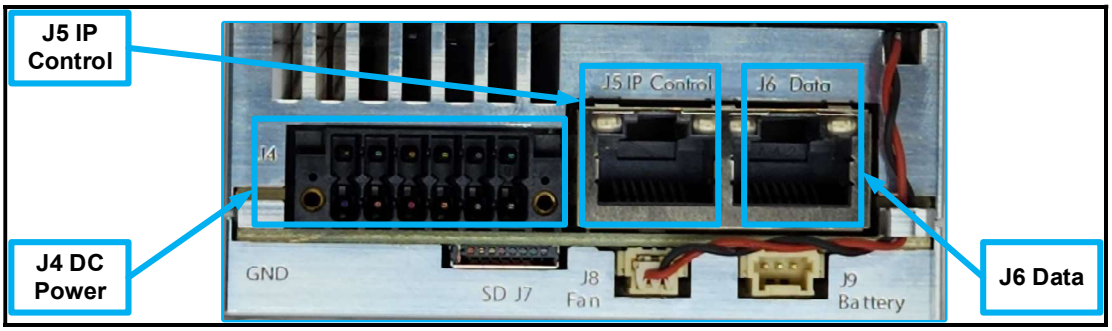


Figure 2-1 - Baseband Connections

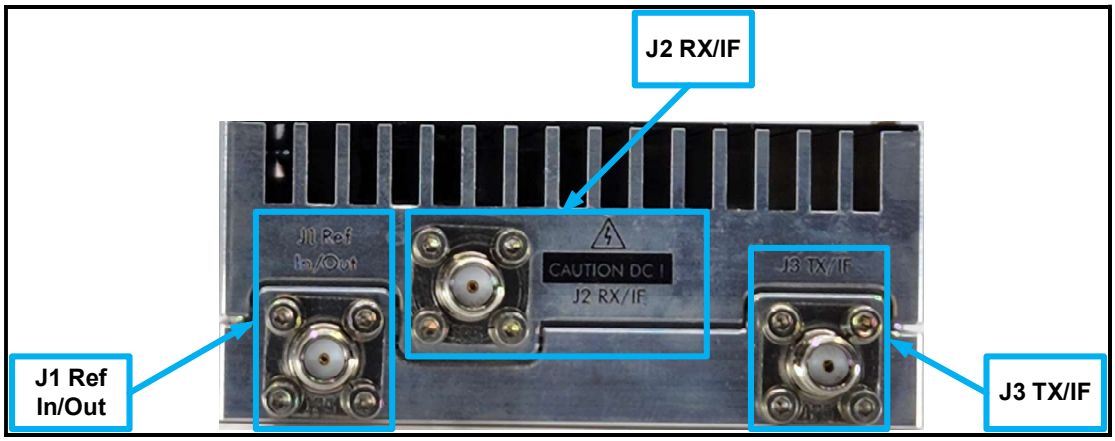


Figure 2-2 - IF Connections

2.4.1 Reference Input / Output - SMA (f) (J1)

The M7XC J1 Reference In/Out SMA (f) connector accepts 10 MHz or 50 MHz external reference for signals generated by the modem, or the modem can provide 10 MHz or 50 MHz output that is based on the internal OCXO (1 x 10-8 Stability).

2.4.2 L-Band Demodulator L-Band RX / IF Input - SMA (f) (J2)

The M7XC J2 IF Input is a 50-ohm SMA (f) connector that is L-Band from 950 to 2250 MHz.

2.4.3 L-Band Modulator L-Band TX / IF Output - SMA (f) (J3)

The M7XC J3 IF Output is a 50-ohm SMA (f) connector that is L-Band from 950 to 2250 MHz.

2.4.4 Multi-Function Connector Pinout (J4)

The multi-function (J4) connector provides pins (Table 2-1) for DC Power, RS-232 Control & Monitor, and Alarm contact closures.

The M7XC input power (+10 to +36 VDC) is on Pin 2 with the Main Power Ground on Pin 1.

The modem has a configurable form-A dry contact alarm relays on Pins 3 & 4. The actuation of this alarm relay is configurable via the alarm control interfaces.

NOTE: By convention, “NO” means Normally Open which is the non-powered, Alarm State.

The analog monitor output on Pin 9 is configurable via the control interfaces to select Receive Eb/No, Receive AGC voltage, or Transmit output power.

The analog monitor input on Pin 5 is configurable via the control interfaces to select the input voltage detection.

The RS-232 control interface is on Pins 6, 8, and 10.

Pins 11 and 12 are provided to reset the IP address on the modem. Connecting these two pins will reset the IP address to the factory default setting of **192.168.0.222.**

Table 2-1 - Multi-Function Connector Pinout (J4)

Pin #	Name	Description	Direction
1	Ground	Main Power Ground	Ground
2	Power	Main Power +10 to +36 VDC	Input
3	Alarm	Form Relay A - NO on Alarm	
4	Alarm	Form Relay B - NO on Alarm	
5	Monitor	Analog Monitor Input 0 to +5V	Input
6	Transmit	RS–232 Transmit	Output
7	Ground	Monitor Common	Ground
8	Ground	RS-232 Common	Ground
9	Monitor	Analog Monitor Output 0 to +5V	Output
10	Receive	RS–232 Receive	Input
11	Reset	IP Reset to Factory	Input
12	Ground	IP Reset Common	Ground

2.4.5 SD Flash Slot (J7)

The M7XC provides a SD Flash memory slot for configuration and re-boot if necessary.

2.4.6 Fan Connections (J8)

The M7XC provides a connection for an internal and external fan. The compact unit comes standard with an internal fan.

2.4.7 Battery Connections (J9)

The M7XC provides an input connection for an optional external Lithium battery to maintain a real time clock and if configured, to hold an encryption key.

2.4.8 GigE IP Control RJ-45 (J5)

The 1000BaseT IP Control RJ-45 (J5) connection provides remote control of the modem thru a Web Browser page or SNMP. Refer to Table 2-2 for the pinout of the RJ-45 connector.

2.4.9 GigE Data Interface RJ-45 (J6)

The 1000BaseT Ethernet Data Interface RJ-45 (J6) connection provides data interface to the Local Area Network (LAN) via Layer 2 Switched Bridge traffic. Refer to Table 2-2 for the pinout of the RJ-45 connector.

Table 2-2 - GigE Data Interface Connector Pinout (J6)

Pin #	Signal Name	Use	Direction
1	TX D1+	Tx Data+ Pair A	I/O
2	TX D1-	Tx Data- Pair A	I/O
3	RX D2+	Rx Data+ Pair B	I/O
4	BI D3+	Bi Data+ Pair C	I/O
5	BI D3-	Bi Data- Pair C	I/O
6	RX D2-	Rx Data- Pair B	I/O
7	BI D4+	Bi Data+ Pair D	I/O
8	BI D4-	Bi Data- Pair D	I/O

2.4.10 Physical Setup

This section will describe a simple physical connection set up to get the user started.

1. Plug both of the RJ-45 cables into your modem (J5 IP Control, J6 Data)
2. Connect the Ext Ref SMA cable to your modem (J1 Ref In/Out)
3. Connect the RX SMA cable to your modem (J2 RX/IF)
4. Connect the TX SMA cable to your modem (J3 TX/IF) after verification that TX Output power is OFF
5. Plug the Multi-Function connector (DC Power) into your modem (J4)
6. The modem/fan should power on and the PWR (Blue) LED should be illuminated
7. Open Web Brower and Login into the modem using the default username and password using the directions in section 3.3
8. Configure the modem using the directions in section 3.3

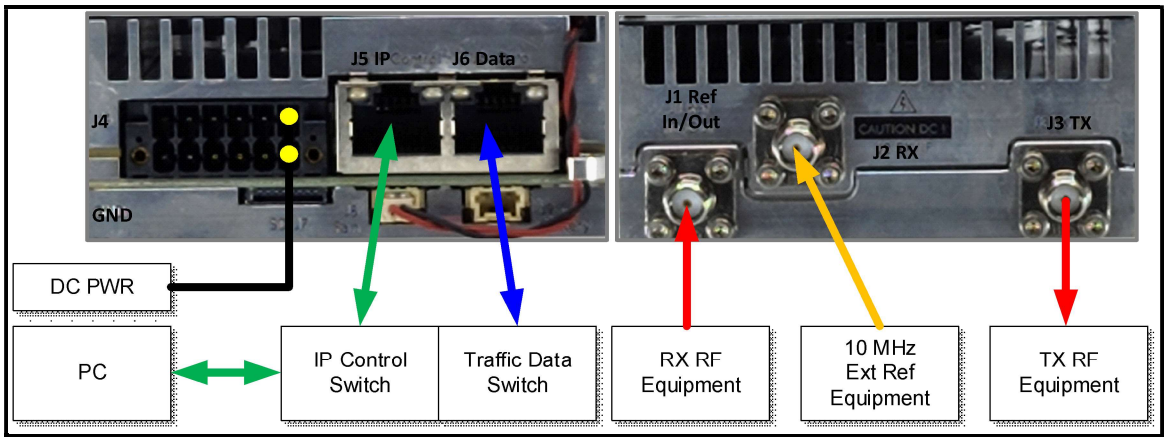


Figure 2-3: Simple Physical Connections

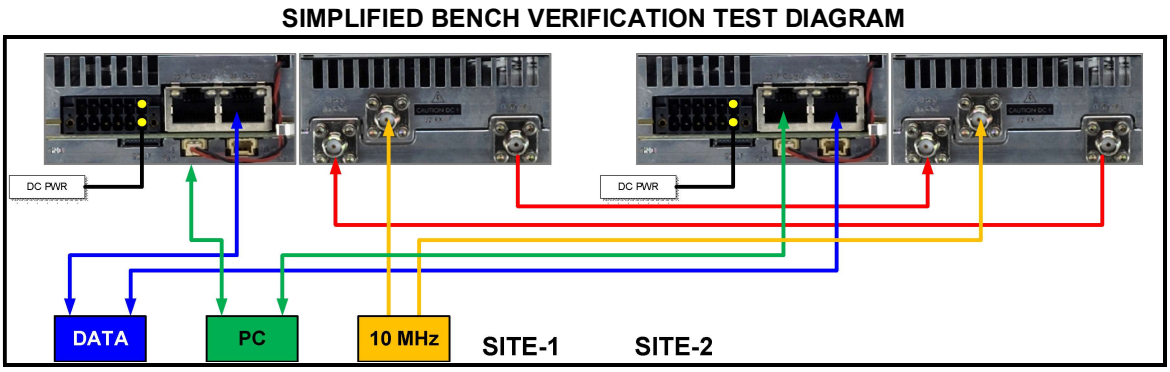


Figure 2-4: Simplified Bench Verification Test Diagram

3 Operation

3.1 Indicators

There are seven (7) LED indicators (Figure 3-1) on the side of the M7XC that give a quick visual indication of the status of the unit. These indicators are:

- RCV LOCK: Green – indicates the demodulator has locked to the incoming carrier
- RCV ERRS: flashing Yellow – indicates that there are frame errors in the link
- LNB PWR: Blue – when optioned, indicates the LNB Power is active on the RX IF connector (J2)
- XMT ON: Green – indicates a carrier is active on the TX IF Connector (J3)
- ALARM: Red – indicates a summary alarm for the unit
- ON-LINE: Green – indicates the on-line/off-line status when configured in redundancy
- PWR: Blue – indicates power is applied to the unit

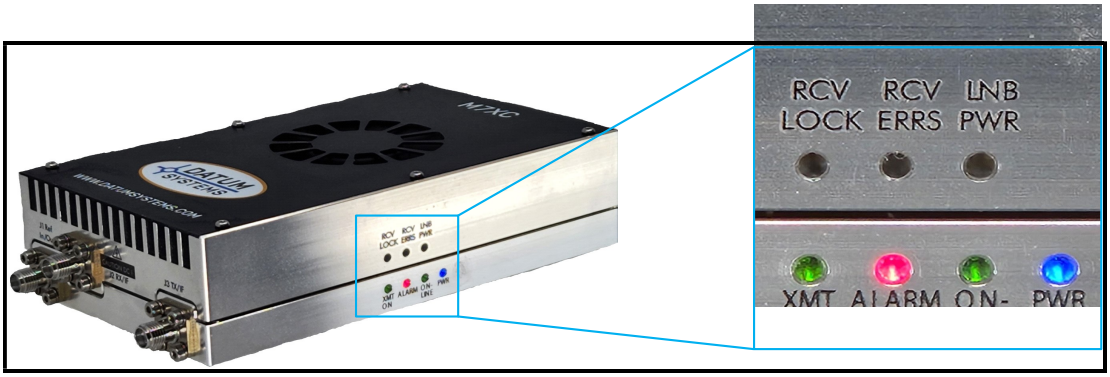


Figure 3-1 – LED Indicators

3.2 Operating Procedures

Operation of the Datum Systems M7XC Compact Satellite Modem consists of controlling the unit's operating parameters, monitoring its status and responses thru one of the control interfaces. There are three possible control methods for the modem:

- Web Browser as discussed in Section 3.3.
- SNMP v1, v2c, and v3 as discussed in Appendix F.
- Command Interface Binary Control via rear panel RS-232 as discussed in Section 3.4.

Any of these methods may be used separately or together to monitor and control the modem. Each of these three interfaces and their respective methods are discussed separately below in the sections noted above.

Additional operating procedures are presented later in this section on using some of the unique features of the M7XC that would not normally be set-up during installation. These include items such as the storing and recalling configuration information, AUPC, the analog monitor output, redundancy, and automatic recovery.

3.3 Web Browser Operation

Initiate the M7XC Web Browser function by opening an Internet Browser (Microsoft Edge, Google Chrome, Firefox or similar) on the computer and typing in the IP address of the M7XC in the text bar of the browser. The default IP address of the M7XC modem is **192.168.0.222**.

Note: This is the *ONLY* IP address assigned to every unit when shipped from the factory.

If the IP address is unknown, the use of a program like Wireshark may help in finding the IP address. Power cycle the M7XC modem and look for the ARP message that indicates the IP address of the M7XC modem. At that point, set the computer IP address in the same address range. Open the Web Browser, set the unique IP address using the Unit page > IP Control tab > IP address. All IP Control interface parameters can be set in this tab. Alternatively, the IP address may be reset to the factory default by connecting pins 11 and 12 together on the multi-function connector (J4).

After boot-up, the operator will be prompted (Figure 3-2) to enter the username and password. The default Username is ***Admin***, and the default Password is ***Datum***.

Figure 3-2 - Login Page

NOTE: Login security may be configured in the Web Browser 'Unit' page in the 'HTTP' tab. Available configuration items are Full Access Name, Full Access Password, Read Access Name, Read Access Password. Once this parameter is active, the operator will be prompted to enter the username and password.

3.3.1 Page Sections

There are four (4) main sections on all M7XC web pages (refer to Figure 3-3).

- Tabs
- Status
- Page Menu
- Parameter Window

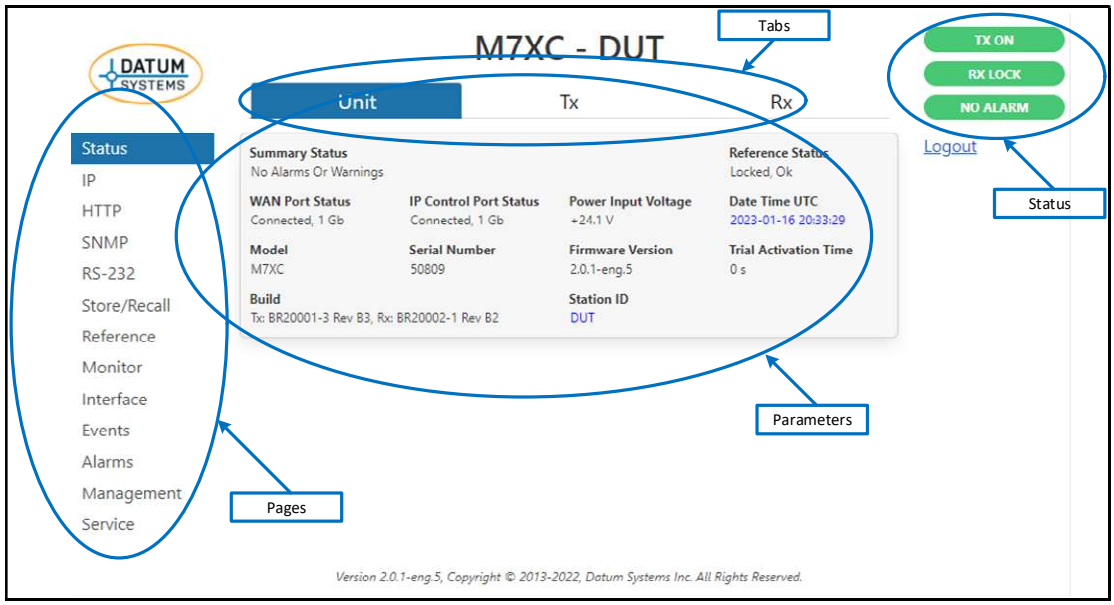


Figure 3-3 - Web Browser Page Sections

Throughout this manual, reference to Web Browser sections will follow the following designation. <Tab: Page – Parameter>. For example, if the user is looking for the frequency of the modulator output the designation would be <TX: Modulator – Carrier Frequency (GHz or MHz)>. The setting of the parameter would be identified in “Quotes”.

The main Window provides the user a summary status of the M7XC. Active TX, RX and Alarm functional status are shown with color-coded text (Green, Yellow, Red). The Alarm section on the right screen will display the current statuses of the (Unit, TX, or RX).

Clicking on Logout will revert back to the User Login page.

The Tab Menu (Figure 3-4) allows the operator to navigate between the modem functions - Unit, TX, and RX.

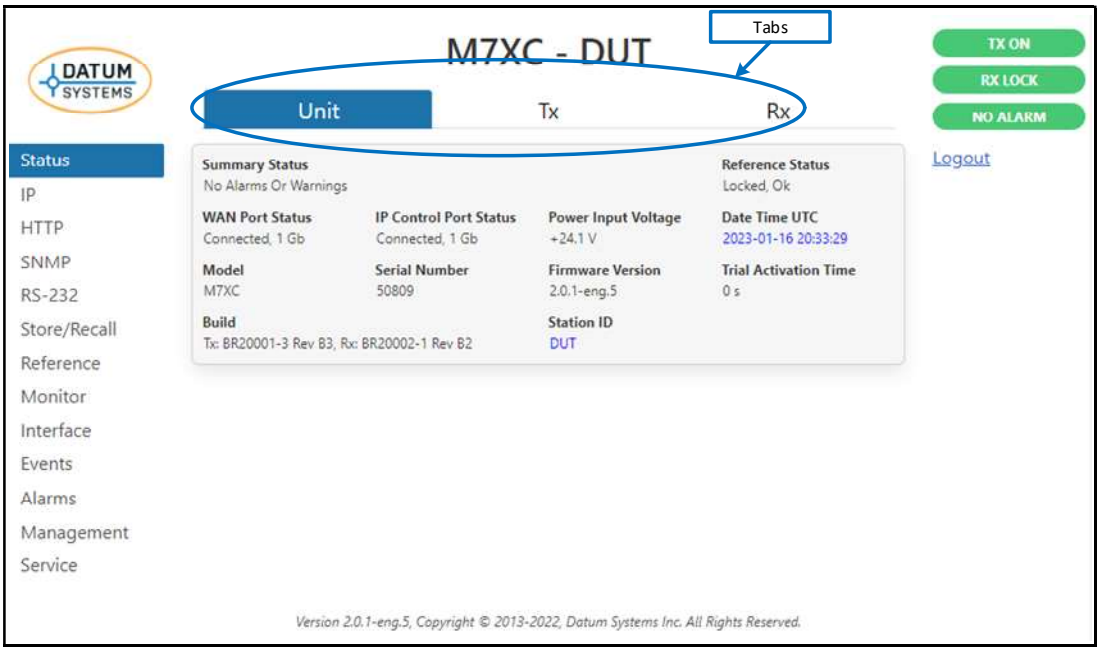


Figure 3-4 - Web Browser Tab Menu

The Tab Window (Figure 3-5) is the section of the M7XC Web Browser that allows detailed status and modification of every parameter of the M7XC. The Tab Window is divided into sub-pages for the desired function. The M7XC Web Browser allows the user to make all the desired changes and execute them at one time. When all of the changes are done, the operator must click the “Set Config” button for any change to be accepted. Clicking on the “Cancel” button or closing the browser will cancel any pending changes.

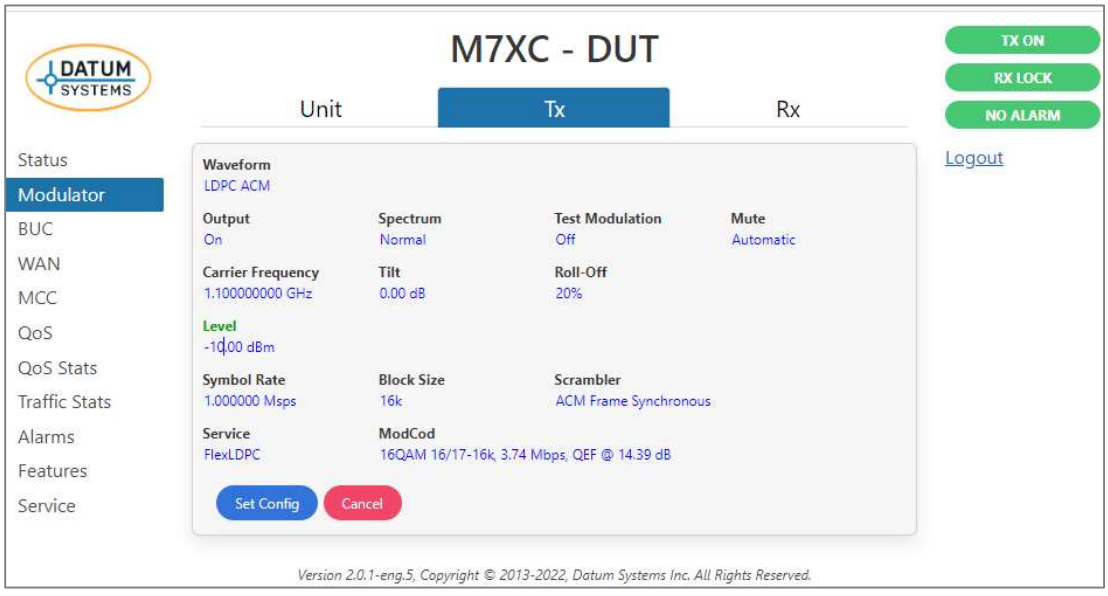


Figure 3-5 - Web Browser Tab Window

3.3.2 M7XC Web Browser Pages

3.3.2.1 Unit Status Page

The Unit Status page (Figure 3-6) will be the first page that is displayed when the User logs in. The Unit Status page provides the user a snapshot of the current M7XC status. The status window displays the Summary, Reference, WAN & IP Control Port Status, Voltage and System information. The status window also displays Date & Time and Station ID that can be edited accordingly.

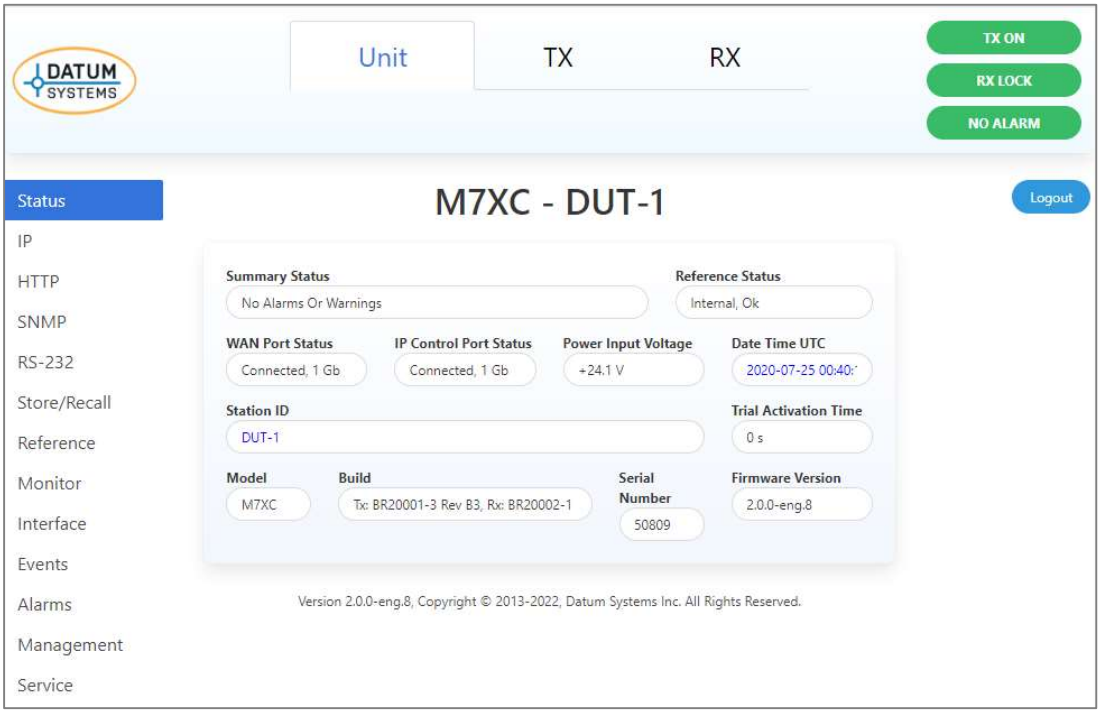


Figure 3-6 - Unit Status Page

From the Unit Status page, the user may navigate to the other modem functional pages by selecting the desired page on the “Page Menu”. The other available Tab pages are “TX” and “RX”. Within each tab there are pages that relate to specific parameters that can be configured.

3.3.2.2 Unit Status Page

The Unit “Status” page (Figure 3-7) is used to configure the common parameters of the M7XC. The Date Time and Station ID parameters are Set in the “Unit” page.

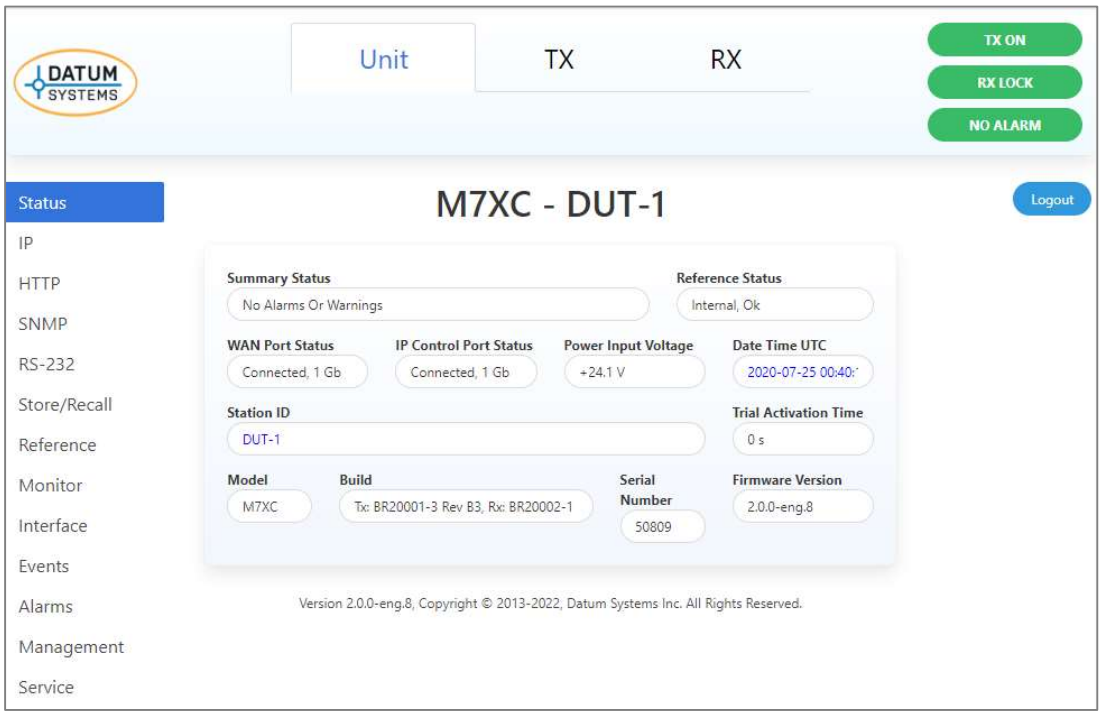


Figure 3-7 - Unit Status Page

- *Summary Status:* Displays current status of the modem
- *Reference Status:* Displays current status of the reference
- *WAN Port Status:* Displays current status of the WAN Port
- *IP Control Port Status:* Displays current status of the IP Control Port
- *Power Input Voltage:* Displays the current Input Voltage level
- *Date Time UTC:* Set and Display the current Date and Time
- *Station ID:* Enter Station ID
- *Trial Activation Time:* Displays the current elapsed time of the Trial Activation
- *Model:* Displays the current model number of the modem
- *Build:* Displays the current build numbers of the modulator and demodulator
- *Serial Number:* Displays unit Serial Number
- *Firmware Version:* Displays the current Firmware Version

3.3.2.2.1 Unit IP

The Unit “IP” tab (Figure 3-8) provides the ability to set the IP access information for the Web Browser and the M&C settings.

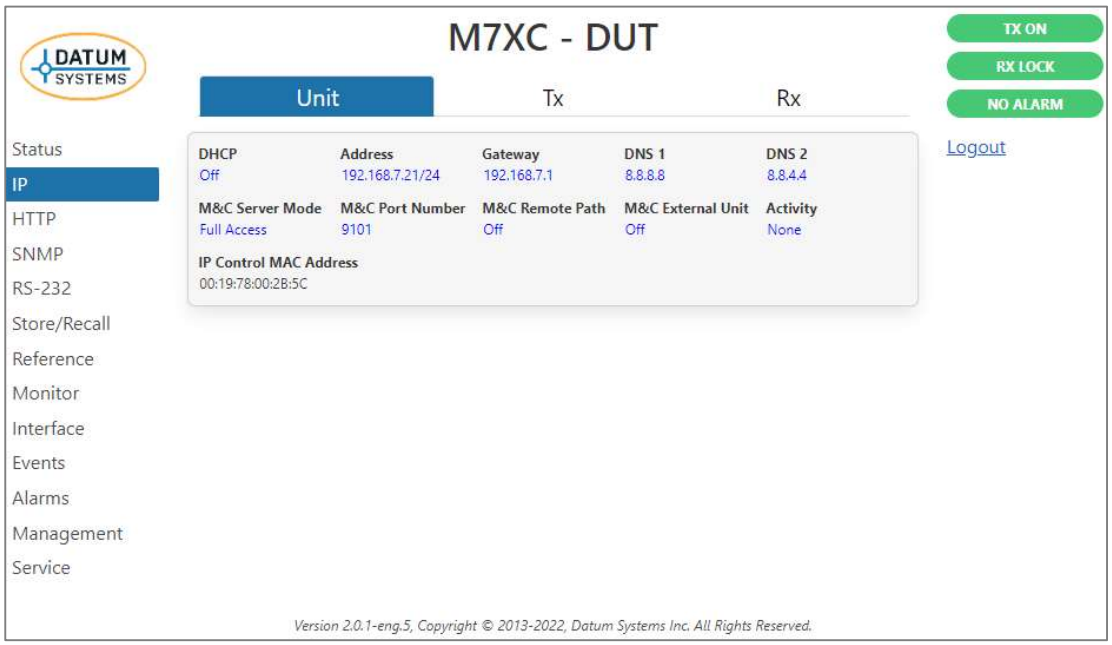


Figure 3-8 - Unit IP Page

- *DHCP:* Set DHCP access to On or Off (Default = Off)
- *Address:* Enter the unique Unit IP Address information
- *Gateway:* Enter the unique Gateway IP Address information
- *DNS1:* Enter the unique DNS 1 IP Address information
- *DNS 2:* Enter the unique DNS 2 IP Address information
- *M&C Server Mode:* Set the mode access (Off, Read Only, Full Access)
- *M&C Port Number:* Enter port number (Default = 9101)
- *M&C Remote Path:* Set Remote Path access (Default = Off)
- *M&C External Unit:* Set External Unit access (Default = Off)
- *Activity:* Set the side panel LED alert action to take when there is IP port activity (None, Flash Online)
- *IP Control MAC Address:* Displays unit MAC Address

3.3.2.2.2 Unit HTTP

The Unit “HTTP” tab (Figure 3-9) provides the ability to set the access control for the Web Browser.

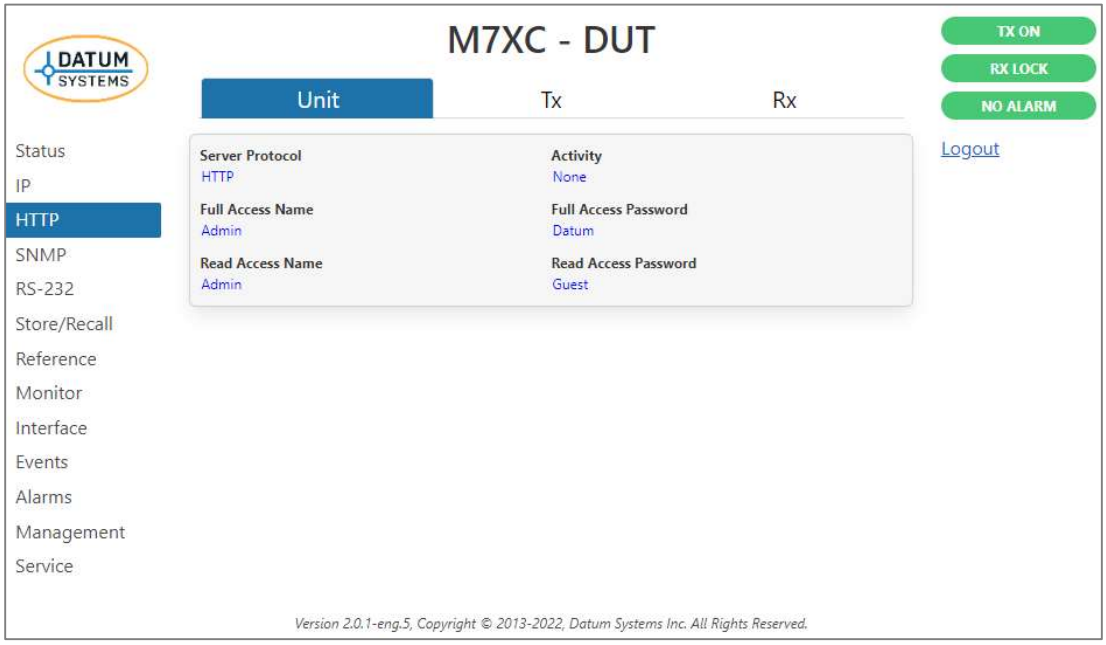


Figure 3-9 - Unit HTTP Page

- *Server Protocol:* Control access mode to the Web Browser (HTTP, HTTPS)
- *Activity:* Set the side panel LED alert action to take when there is HTTP port activity (None, Flash Online)
- *Full Access Name:* HTTP full access username (Factory Default = Admin)
- *Full Access Password:* HTTP full access password (Factory Default = Datum)
- *Read Access Name:* HTTP read only access username (Factory Default = Admin)
- *Read Access Password:* HTTP read only access password (Factory Default = Guest)

3.3.2.2.3 Unit SNMP

The Unit “SNMP” tab (Figure 3-10) provides the ability to set the parameters for the SNMP Agent.

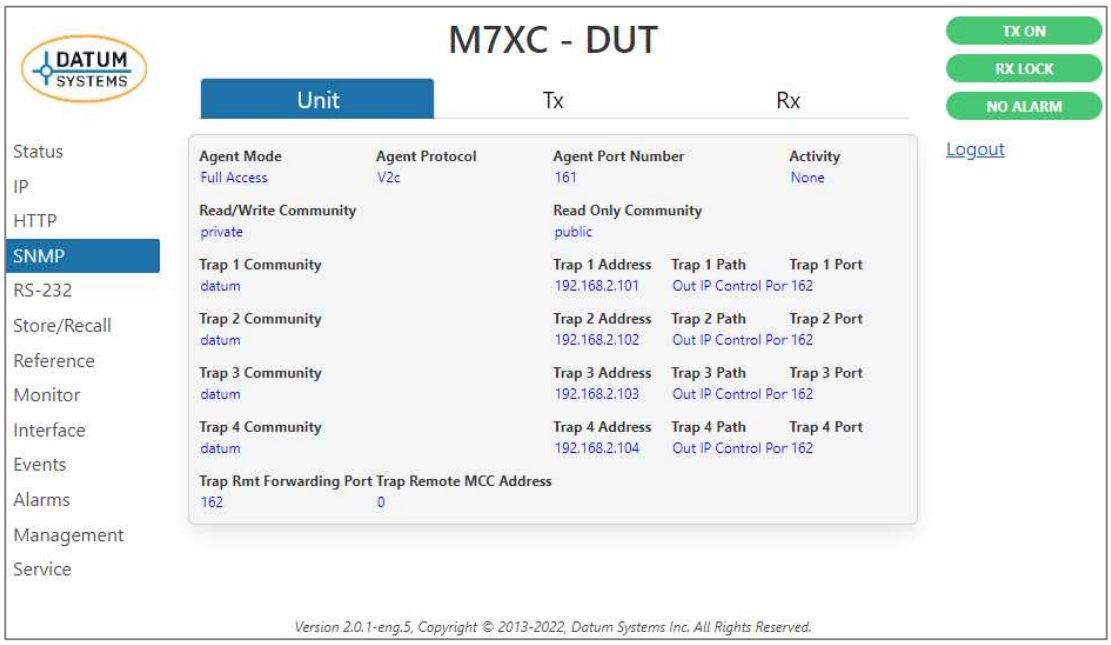


Figure 3-10 - Unit SNMP Page

- *Agent Mode:* Control access and mode to the SNMP Agent (Off, Full Access, Read Only)
- *Agent Protocol:* Set the SNMP Server type (V1, V2c)
- *Agent Port Number:* Set the Internet socket port number for the SNMP server (default = 161)
- *Read-Only Community:* Set the Read-Only community name for authentication for SNMP traffic (default = public)
- *Read/Write Community:* Set the Read/Write community name for authentication for SNMP traffic (default = private)
- *Trap Client:* Select the Trap Client number (1, 2, 3, 4)
  - *Community* (1, 2, 3): Set the Trap community name for authentication for SNMP traffic
  - *Path* (1, 2, 3, 4): Set the signal path for the SNMP Trap (Out IP Control Port, Out MCC Port, Unused)
  - *Address* (1, 2, 3, 4): Set the IP Address for the SNMP Trap
  - *Port* (1, 2, 3, 4): Set the Internet socket port number for the SNMP trap (default = 162)
- *Trap Forwarding:*
  - *Remote MCC Address:* Set the MCC address signal path for forwarding the SNMP Trap from the remote modem
  - *Rmt Forwarding Port:* Set the Internet Socket forwarding Port for the SNMP Trap (default = 162)
- *Activity:* Set the side panel LED alert action to take when there is SNMP port activity (None, Flash Online)

3.3.2.2.4 Unit RS-232

The Unit “RS-232” tab (Figure 3-11) provides the ability to set the parameters for the RS-232 Serial Access interface (J5).

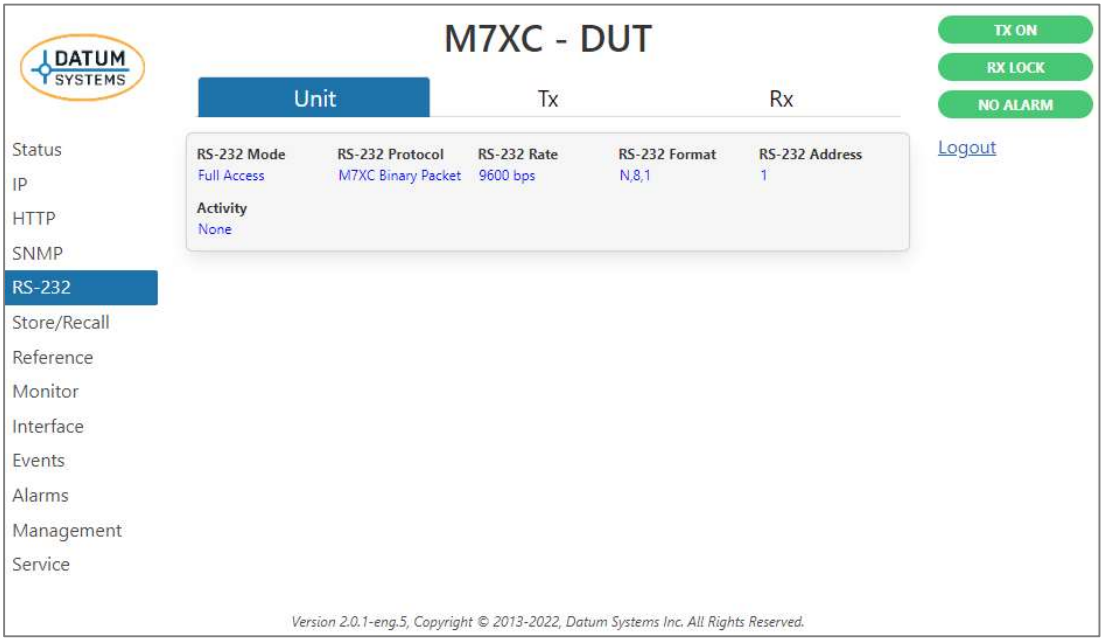


Figure 3-11 - Unit RS-232 Page

- *RS-232 Mode:* Remote control access mode allowed (Off, Full Access, Read Only)
- *RS-232 Protocol:* Remote control mode type (M7XC Binary Packet)
- *RS-232 Rate:* Remote port bit rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, where default = 9600)
- *RS-232 Format:* Remote control data/stop bits and parity (N,8,1, E,8,1, O,8,1, M,8,1, S,8,1, where 8=data bits, 1=stop bit, N=None, E=Even, O=Odd, M=Mark, S=Space, where default = N,8,1)
- *RS-232 Address:* Address used to access this unit via remote control packets (default = 100)
- *Activity:* Set the side panel LED alert action to take when there is Remote port activity (None, Flash Online)

3.3.2.2.5 Unit Store/Recall

The Unit “Store/Recall” tab (Figure 3-12) provides the ability to save known M7XC modem configurations to be recalled later.

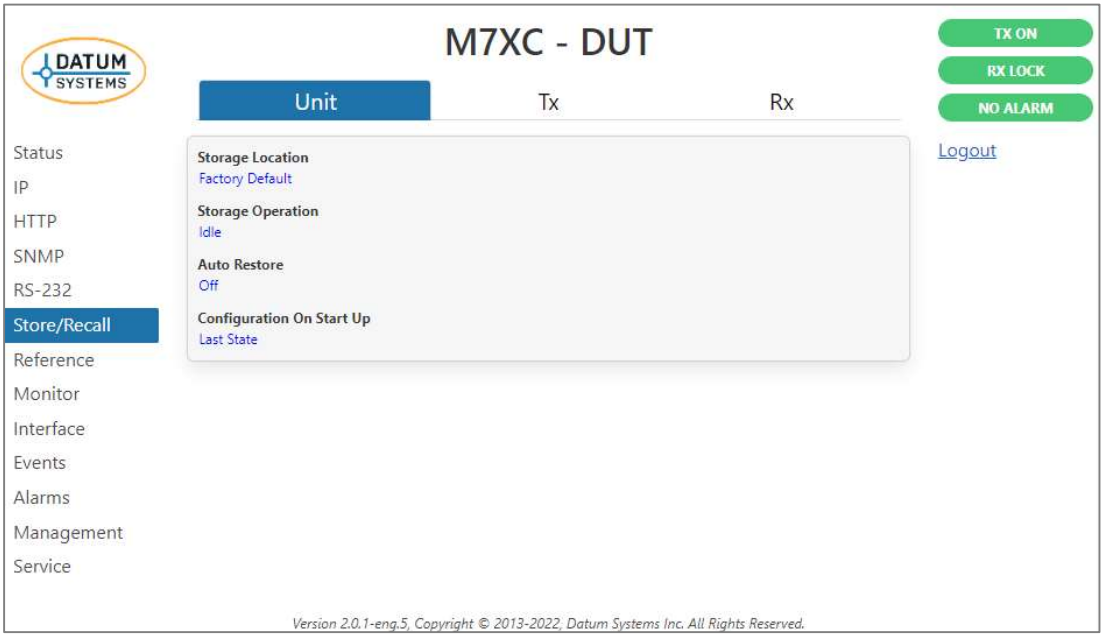


Figure 3-12 - Unit Store/Recall Page

- *Storage Location:* Setting the configuration to use “Auto Restore” (0 to 99, Empty, Factory Default)
- *Storage Operation:* Set operation mode (Idle, Store)
- *Auto Restore:* Set a configuration defined in the “Storage Location” parameter based on loss of Demod carrier (Off, Restore All, Restore Unit Only, Restore TX & RX Only, Restore TX Only, Restore RX Only)
- *Configuration On Start-Up:* Behavior on power-up (Default = Last State)

3.3.2.2.6 Unit Reference

The Unit “Reference” tab (Figure 3-13) provides the ability to set the parameters for the system reference on J1.

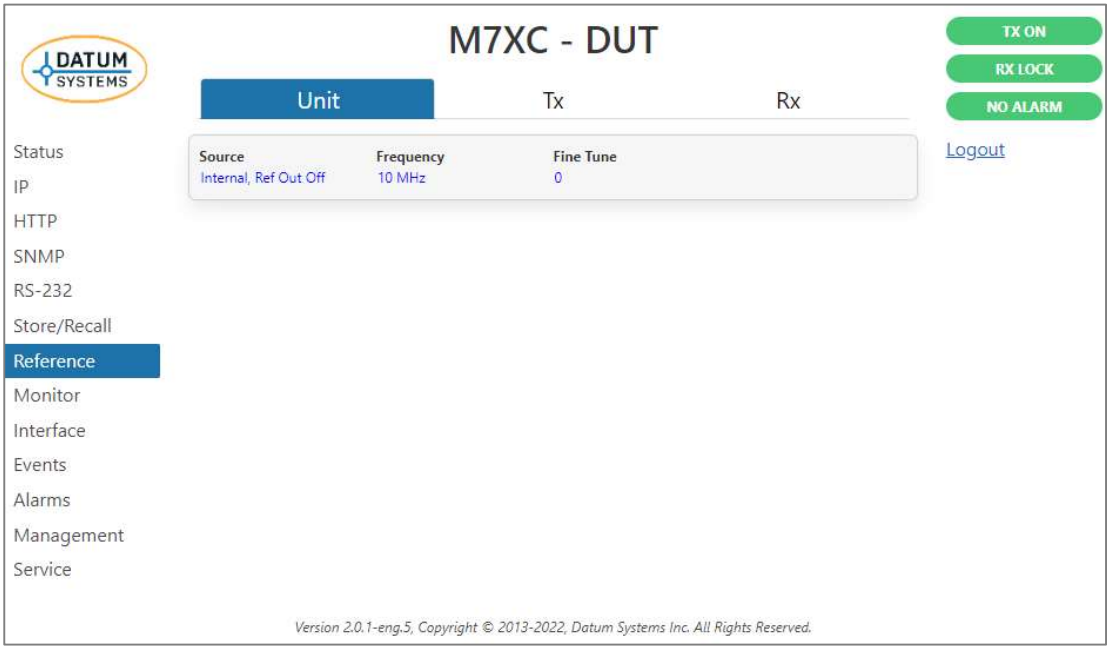


Figure 3-13 - Unit Reference Page

- *Source:* Set rear panel source (Internal, Ref Out Off/On, External Input)
- *Frequency:* Reference input frequency at rear panel in MHz (10 MHz, 50 MHz)
- *Fine Tune:* Internal reference fine adjustment. Only available if “Source” is set to internal reference (-/+2000, 0 = Calibration Value)

3.3.2.2.7 Unit Monitor

The Unit “Monitor” tab (Figure 3-14) provides the ability to set the parameters for the Output Mode.

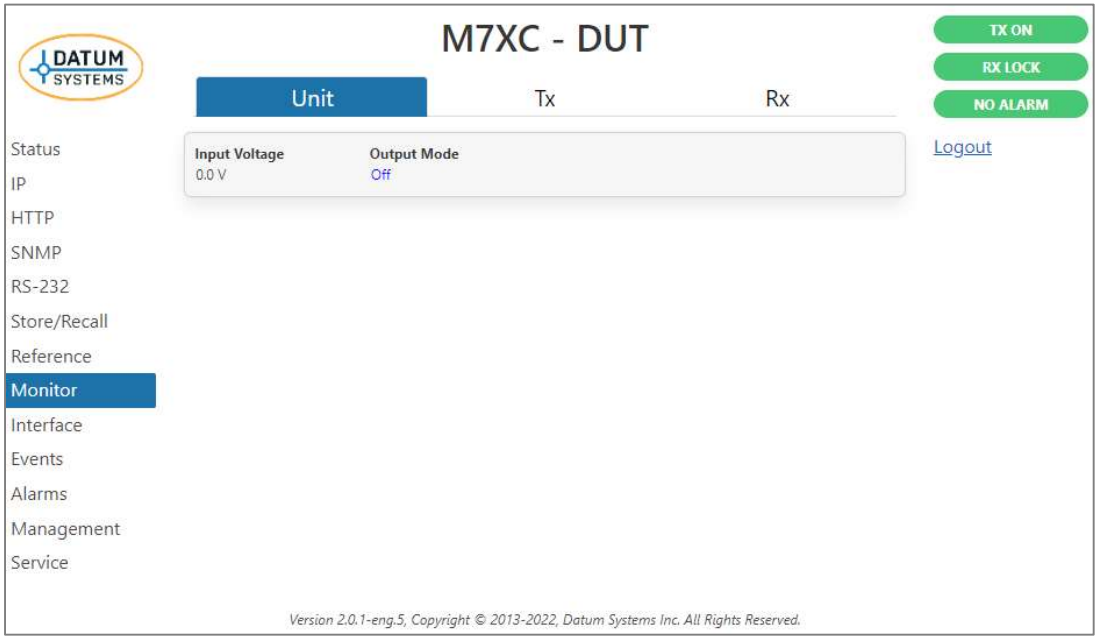


Figure 3-14 - Unit Monitor Page

- *Output Mode:* Selects source of analog output (Off, TX Level, TX ACM, RX Level, RX Es/No)
- *Input Voltage:* Displays the analog input signal (0.0 to 5.0)

3.3.2.2.8 Unit Interface

The Unit “Interface” tab (Figure 3-15) provides the ability to set the parameters for the WAN Offline Mode.

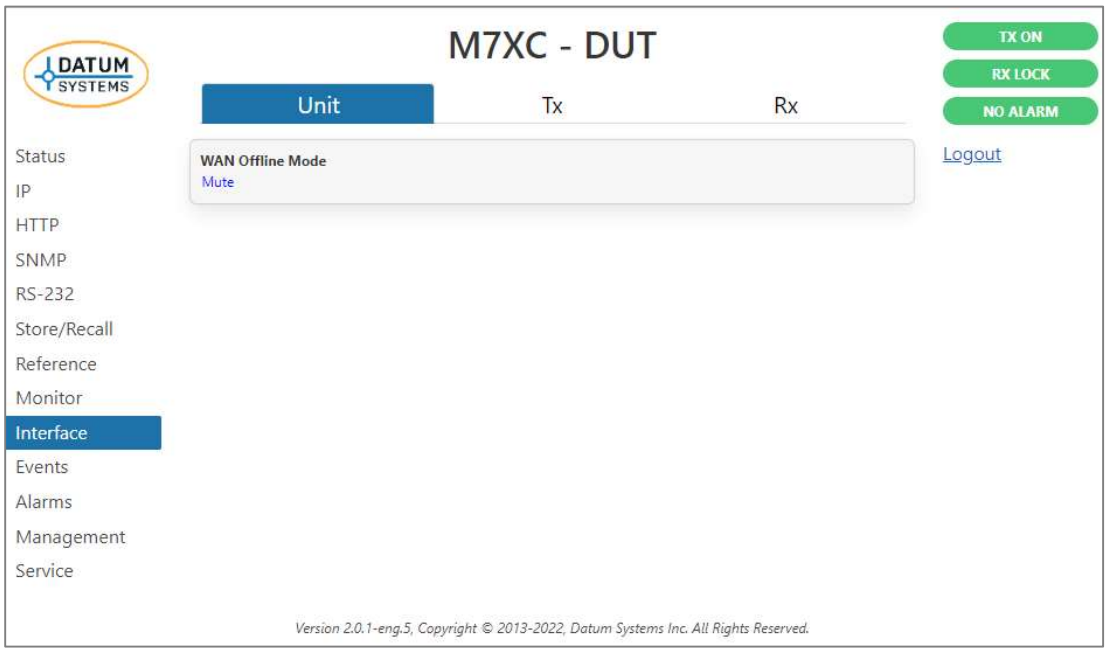


Figure 3-15 - Unit Interface Page

- *WAN Offline Mode:* Selects WAN Mode (Mute, Unlink)

3.3.2.2.9 Unit Event

The Unit “Event” tab (Figure 3-16) provides the ability to configure the M7XC modem to log, not log, or log and send an alert for change in status of various modem minor and major alarm events.

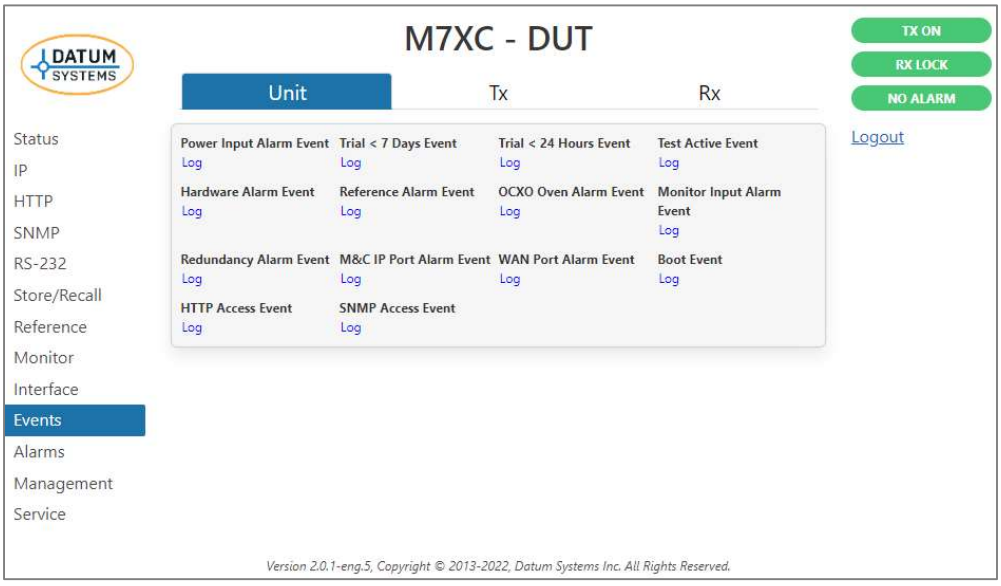


Figure 3-16 - Unit Events Page

- *Power Input Alarm Event:* Selects whether to log the status of the power input alarm event
- *Trial < 7 Days Event:* Selects whether to log the status of the trial event
- *Trial < 24 Hours Event:* Selects whether to log the status of the trial event
- *Test Active Event:* Selects whether to log the status of the test active event
- *Hardware Alarm Event:* Selects whether to log the status of the hardware alarm event
- *Reference Alarm:* Selects whether to log the status of the reference oscillator alarm
- *OCXO Oven Alarm Event:* Selects whether to log the Oven status alarm event
- *Monitor Input Alarm:* Selects whether to log the status of the analog input alarm
- *Redundancy Alarm:* Selects whether to log the status of the redundancy status
- *M&C IP Port Alarm Event:* Selects whether to log the status for the M&C IP Port alarm event
- *WAN Port Alarm Event:* Selects whether to log the status for the WAN Port alarm event
- *Boot Event:* Selects whether to log the status for the Boot event
- *HTTP Access:* Selects whether to log activity of the HTTP access
- *SNMP Access:* Selects whether to log activity status of the SNMP access

3.3.2.2.10 Unit Alarms

The Unit “Alarms” tab (Figure 3-17) provides configurable action to be taken by the M7XC modem when a unit alarm occurs. The modem provides two (2) alarm relay contact closure connections that can be used to trigger external alarm notifications.

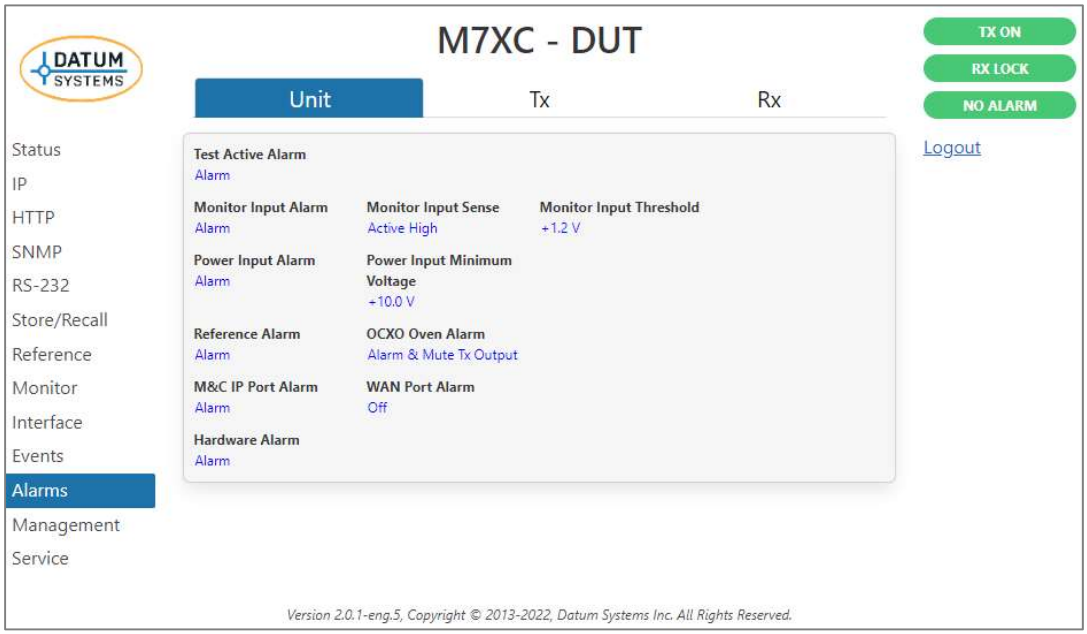


Figure 3-17 - Unit Alarms Page

- *Test Active Alarm:* Selects destination and action taken for test active alarm types
- *Monitor Input Alarm:* Selects destination and action taken for the analog input alarm
- *Monitor Input Sense:* Selects the input sense action taken for the analog input alarm
- *Monitor Input Threshold:* Enter the input voltage threshold (+0.5 V to +50 V)
- *Power Input Alarm:* Selects destination and action taken for the input power DC voltage threshold alarm
- *Power Input Minimum Voltage:* Threshold setting for the input power DC voltage alarm (Default = +10 V)
- *Reference Alarm:* Selects destination and action taken for reference status alarm
- *OCXO Oven Alarm:* Selects destination and action taken for oven status alarm types
- *M&C IP Port Alarm:* Selects destination and action taken for IP port status alarm types
- *WAN Port Alarm:* Selects destination and action taken for WAN port status alarm types
- *Hardware Alarm:* Selection of action to be taken by the modem on status of a Hardware Alarm

3.3.2.2.11 Unit Management

The Unit “Management” tab (Figure 3-18) has the 2 functions.

- Update modem firmware
- Feature and Trial Activation

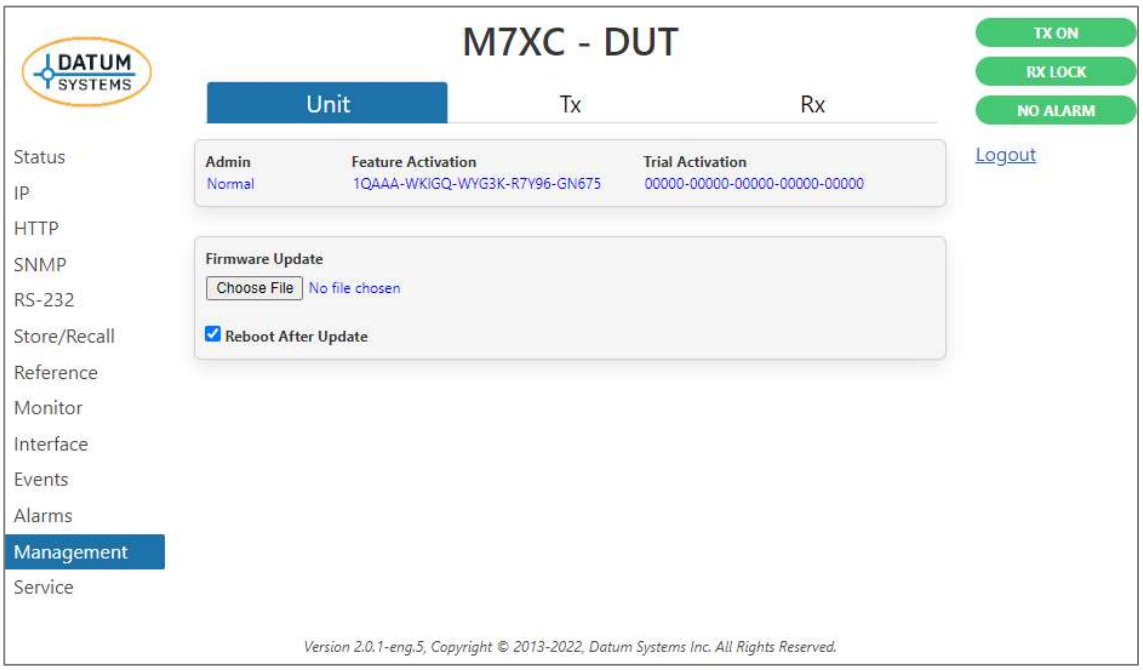


Figure 3-18 – Unit Management Page

- *Admin:* Sets admin mode (Norm, On)
- *Firmware Update:* This window allows the update of the modem FW which will upload and overwrite the FW in the non-running flash partition. After reboot, this FW will become the current running firmware and be displayed as such in the Unit “Status” tab. The current running FW will remain in its Flash partition. Please refer to the modem FW update procedure for more details on the update of the M7 Tropo Modem FW
- *Feature Activation:* Allows entry of a Feature code to activate new features for a trial time period
- *Trial Activation:* Allows entry of a Feature code to activate new features on a trial basis

3.3.2.2.12 Unit Service

The Unit “Service” tab (Figure 3-19) displays the temperature of the major modem system components.

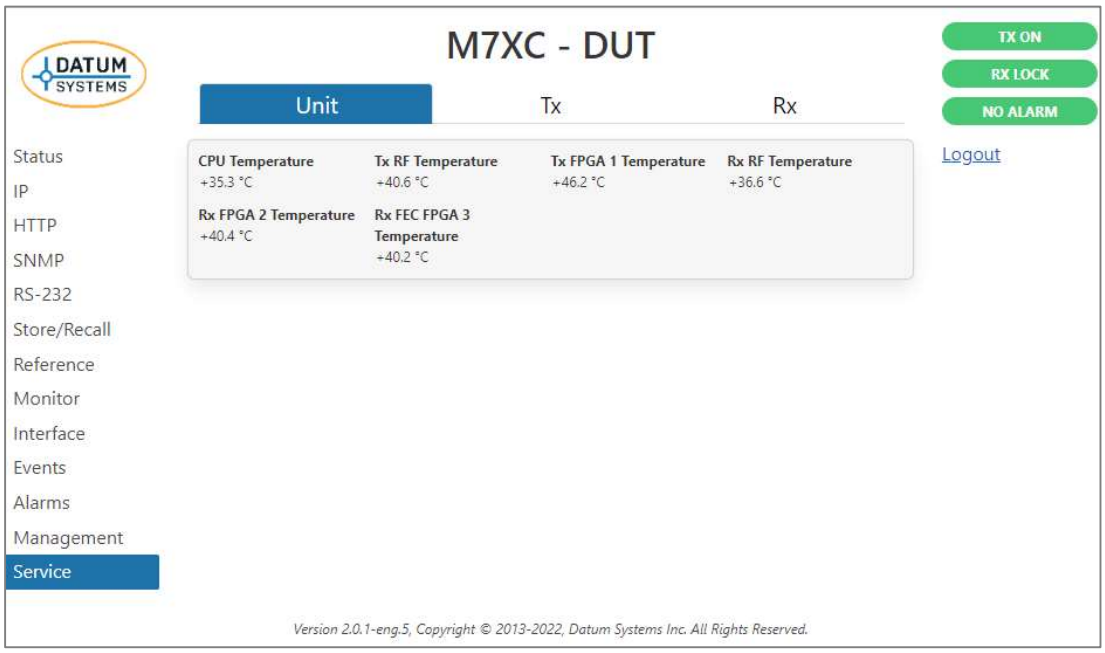


Figure 3-19 - Unit Service Page

- *CPU Temperature:* Displays the current temperature of the CPU
- *TX RF Temperature:* Displays the current temperature of the TX RF
- *TX FPGA 1 Temperature:* Displays the current temperature of the TX FPGA
- *RX RF Temperature:* Displays the current temperature of the RX RF
- *RX FPGA 1 Temperature:* Displays the temperature of the RX FPGA
- *RX FPGA 2 Temperature:* Displays the temperature of the RX FPGA

3.3.2.3 TX Pages

The TX pages are used to configure the transmit parameters of the M7XC. The IF, Symbol, Data Rates, and other transmit parameters are controlled in the “TX” pages. Figure 3-20 through Figure 3-31 represent the pages available to the user.

3.3.2.3.1 TX Status

The TX “Status” tab (Figure 3-20) displays the TX Status of the transmit parameters and remote receive levels.

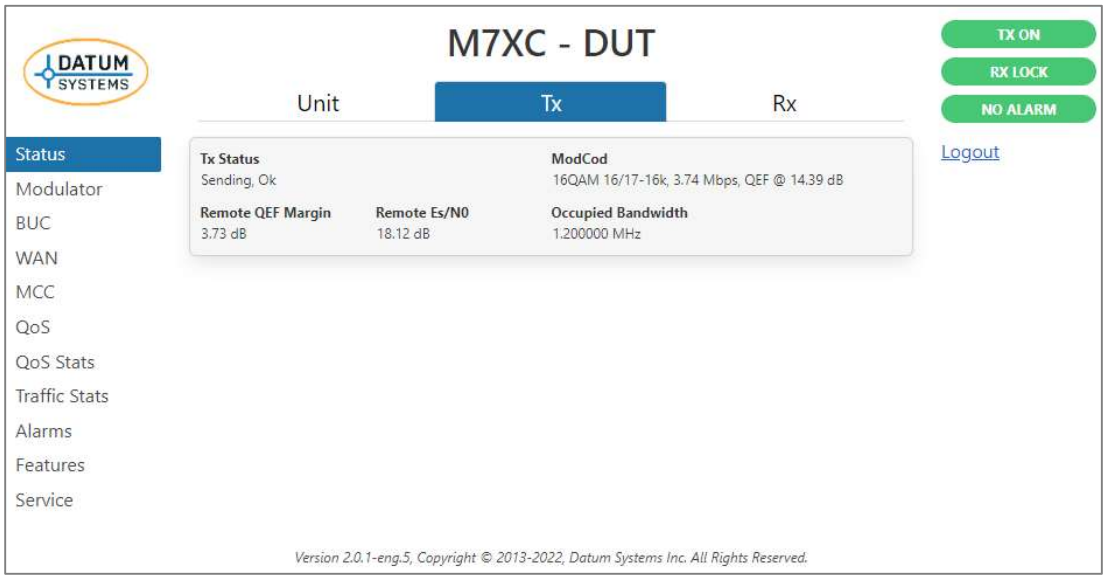


Figure 3-20 - TX Status Page

- *TX Status:* Displays current status of the transmit section parameters
- *ModCod:* Displays current ModCod setting
- *Remote QEF Margin:* Displays current QEF Margin
- *Remote Es/No:* Displays current Remote Es/No level
- *Occupied Bandwidth:* Displays the current Occupied Bandwidth

3.3.2.3.2 TX Modulator

The TX “Modulator” tab (Figure 3-21) provides the ability to set the parameters for the Modulator.

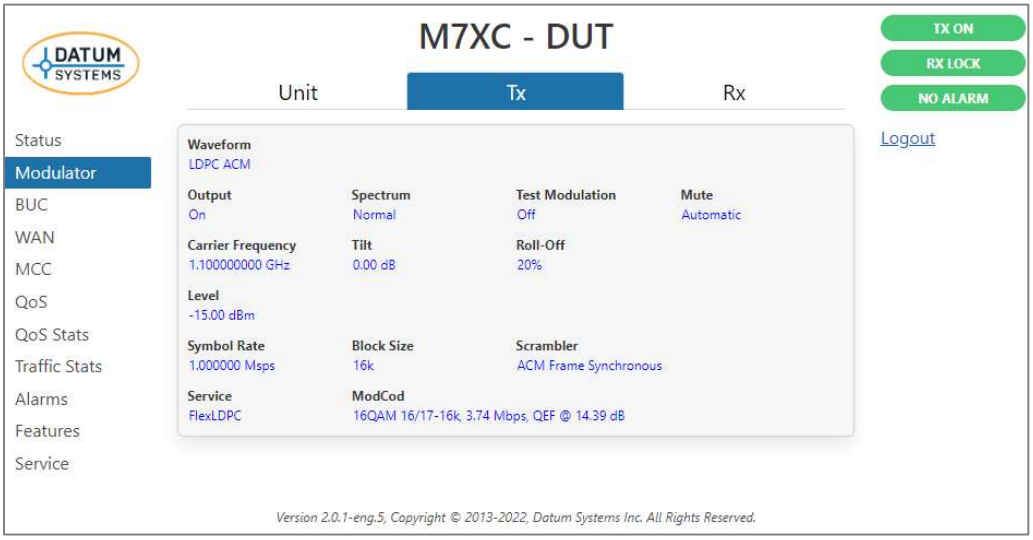


Figure 3-21 – TX Modulator Page

- *Waveform:* Set the transmit waveform (TX Off, DVB-S2X, LDPC ACM, Segmented LDPC ACM)
- *Output:* Set the transmit Output function (Off, On)
- *Spectrum:* Set the transmit Spectrum function (Normal, Inverted)
- *Test Modulation:* Set the transmit Test function (Off, Pure Cxr, Alt 1/0, Lower Sideband, Upper Sideband, QPSK PN Sequence)
- *Mute:* Set the transmit Mute function (Automatic, Confirm, Manual, Manual & Power Loss)
- *Carrier Frequency:* Set the transmit frequency
- *Tilt:* Set the transmit Tilt function to match transponder slope
- *Roll-Off:* Set the transmit Roll-Off factor (35%, 30%, 25%, 20%, 15%, 10%, 5%, 2%)
- *Level:* Set the transmit output Level
- *Symbol Rate:* Set the transmit output Symbol Rate
- *PLS Scrambler Sequence:* Set the transmit output PLS (0-262)
- *Block Size:* Set the transmit Frame Size (Normal, Short)
- *Service:* Set the transmit Service (DVB-S2, DVB-S2 ACM Preferred, DVB-S2X, DVB-S2X ACM Preferred, DVB-S2X ACM Preferred-L, FlexLDPC, Flex LDPC ACM)
- *ModCod:* Set the transmit ModCod

3.3.2.3.3 TX BUC

The TX “BUC” tab (Figure 3-22) provides the ability to set parameters of the transmit RF conversion equipment to display the RF frequency transmitted based on the IF frequency setting. This is helpful to the operator to confirm the transmit carrier is in the proper transponder location.

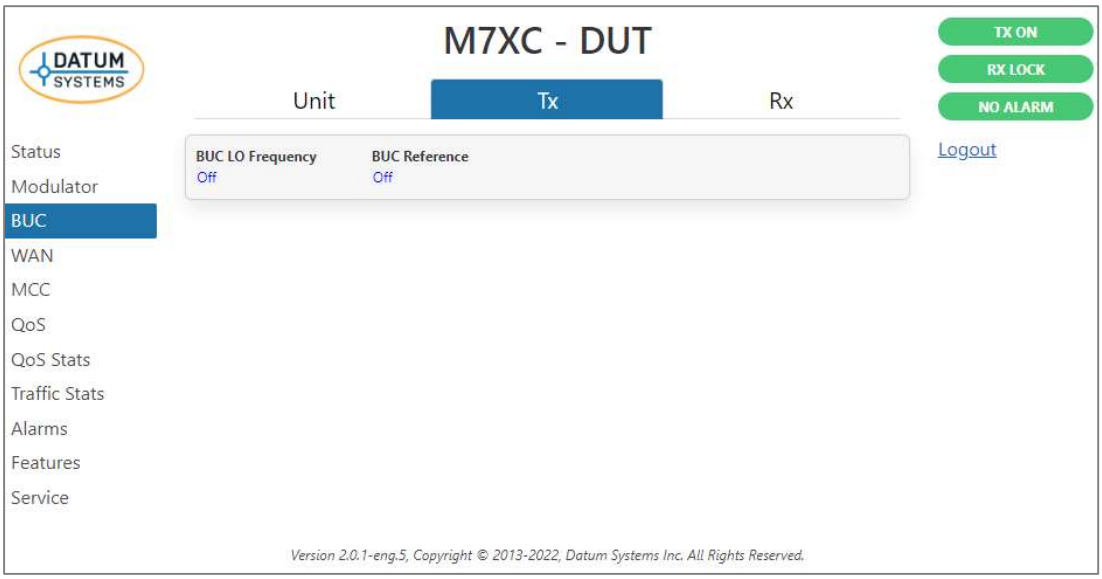


Figure 3-22 - TX BUC Page

- *BUC LO Frequency (GHz):* Configuration of the BUC LO frequency to calculate and display the RF frequency in the TX Modulator tabs. If set to zero (0) then the RF frequency display is the same as the IF frequency and “Off” will be shown
- *BUC Reference:* Set the configuration of the BUC Reference (Off, On)

3.3.2.3.4 TX WAN

The TX “WAN” tab (Figure 3-23) provides the ability to set the parameters for the Modulator WAN.

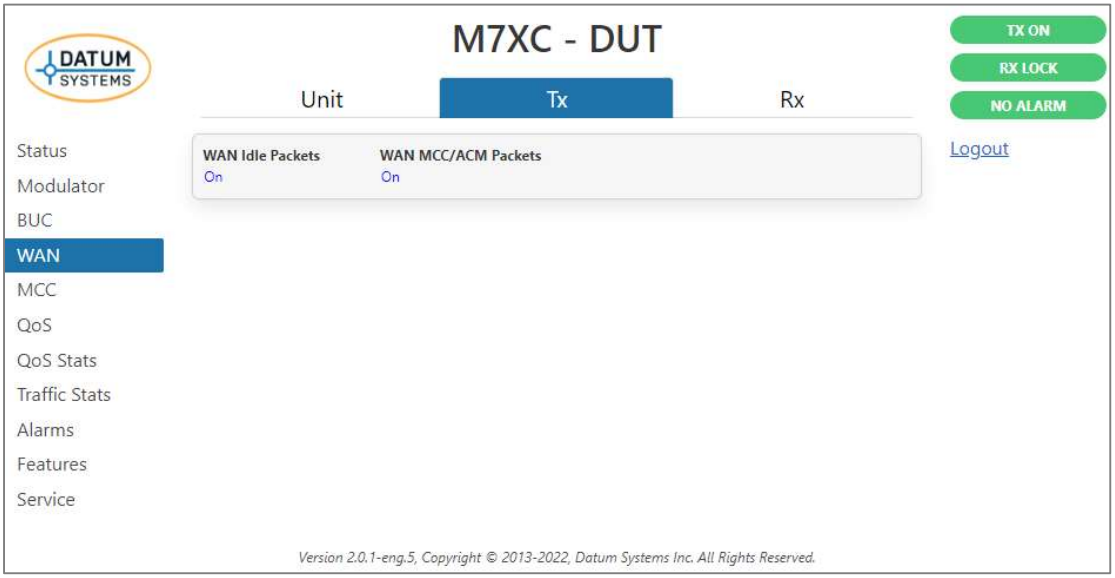


Figure 3-23 - TX WAN Page

- *WAN Protocol:* Set the transmit WAN Protocol (GSE DVB, GSE Low Overhead, GSE CT)
- *WAN Idle Packets:* Set the transmit Idle Packet function (Off, On)
- *WAN MCC/ACM Packets:* Set the transmit MCC/ACM function (Off, On)

3.3.2.3.5 TX MCC

The TX “MCC” tab (Figure 3-24) provides the ability to set the parameters of the Send and Receive Modem Communications Channel (MCC) between the local and remote modems.

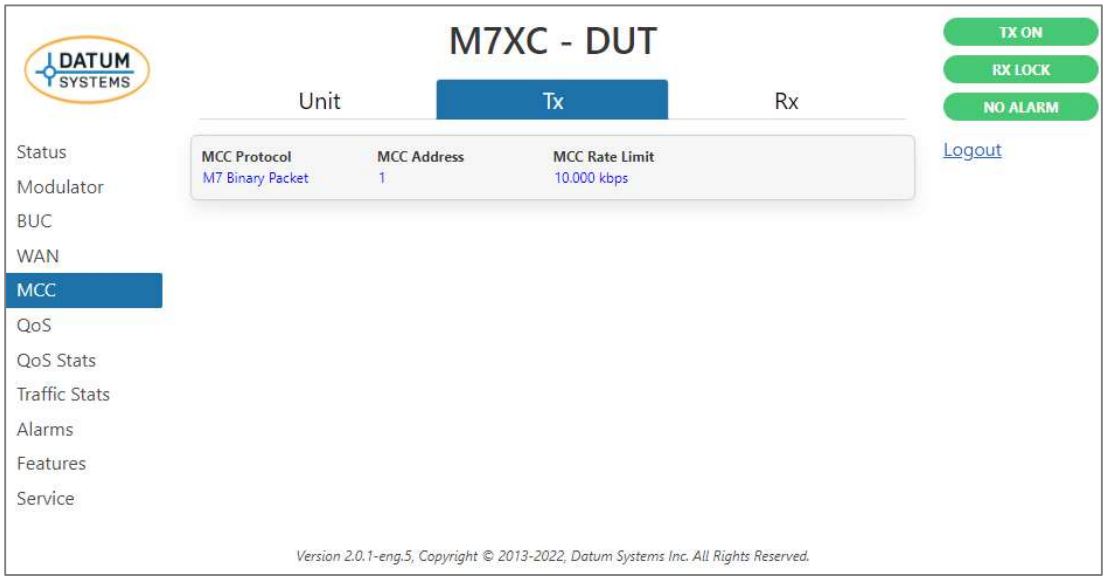


Figure 3-24 - TX MCC Page

- *Protocol:* Sets the MCC channel protocol (Default = M7 Binary Packet)
- *Send Rate Limit:* Sets the maximum rate of the MCC channel (.5-100 kbps)
- *Send Address:* Sets the address of the Send MCC port (1 to 255, 255 = Global)

3.3.2.3.6 TX QoS

The M7XC is expected to have a variable rate data load on the Local Area Network (LAN) side of the interface with a fixed rate data load transmission to the satellite (WAN) side. The data network interface provides flow control between the LAN and the WAN. QoS buffering is provided at the output of the internal Ethernet switch to store data until it can transmit to the WAN. The QoS Tab is shown in (Figure 3-25)**Error! Reference source not found.**.

The QoS mode can be configured to either be “Disabled”, “WRED” (Weighted Random Early Detection), “Strict Priority”, or “Custom”. These settings will determine the procedure for dropping packets at the point where the QoS buffer has reached the point of congestion. The default setting is WRED.

The data network interface allows the user to set the QoS buffer queue size for non-congested and fully congested WAN traffic. The proper settings of the QoS queue size are dependent on the variability of the type of traffic, i.e., VoIP, Web, Streaming Video, FTP, etc. The QoS queue can be set between 0 and 130msec with 0 equal to disabled.

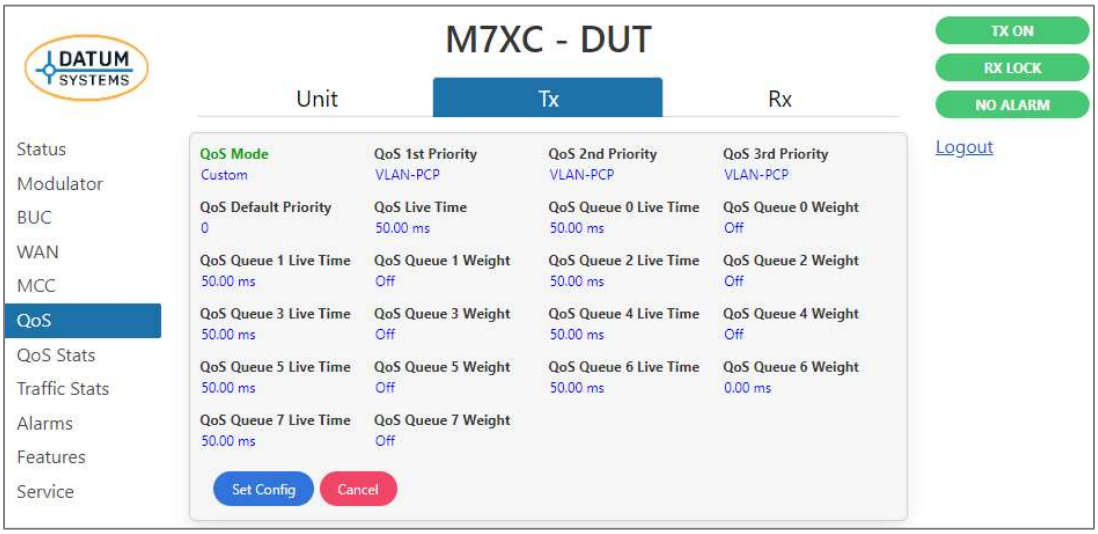


Figure 3-25 - TX QoS Custom Page

- *Mode:* Selects the procedure for dropping packets when the QoS buffer is congested (WRED, Strict Priority, Custom, Disable)
  - When the QoS mode is set to “Off”, the QoS buffer queue acts as a FIFO with no priority setting for the queue
  - When the QoS mode is set to “WRED”, the QoS buffer queue uses a traffic profile for the packet drop probability associated with a particular traffic class shown in Figure 3-26
  - When the QoS mode is set to “Strict Priority”, the QoS buffer queue minimize delay by assigning all delay-sensitive packets to the strict-priority queue
  - When the QoS mode is set to “Custom”, the QoS buffer queue allows configuration of eight (8) QoS buffer queues, assigning a weight and maximum latency independently for each priority queue

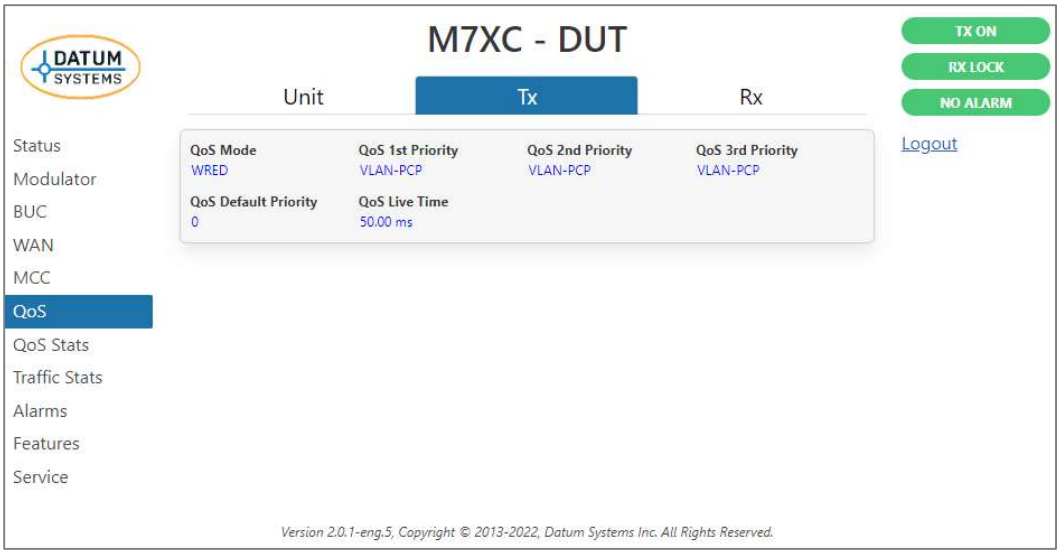


Figure 3-26 - TX QoS WRED Mode Page

- *Live Time:* Set the maximum latency of the QoS Queue (not available with QoS mode = Custom)
- *1st Priority:* Set the 1st priority preference for the Drop function using the priority tags (VLAN-PCP, VLAN-ID Using ID 3MSb, MPLS-EXP, MPLS-EXP Using IP Only, IPv4-DSCP/IPv6-TC)
- *2nd Priority:* Set the 2nd priority preference for the Drop function using the priority tags (None, VLAN-PCP, VLAN-ID Using ID 3MSb, MPLS-EXP, MPLS-EXP Using IP Only, IPv4-DSCP/IPv6-TC)
- *3rd Priority:* Set the 3rd priority preference for the Drop function using the priority tags (None, VLAN-PCP, VLAN-ID Using ID 3MSb, MPLS-EXP, MPLS-EXP Using IP Only, IPv4-DSCP/IPv6-TC)

NOTE: PCP (Priority Code Point) a priority value between 0 and 7 in the VLAN tag DSCP (Differentiated Services Code Point) a priority setting in the IPv4 header TC (Traffic Class) a priority setting in the IPv6 header

3.3.2.3.7 TX QoS Stats

TX QoS Stats tab provides the user with active statistics for each of the QoS buffer queues. These stats are only available when the QoS mode is set to Custom. The TX QoS Stats tab is shown in Figure 3-27.

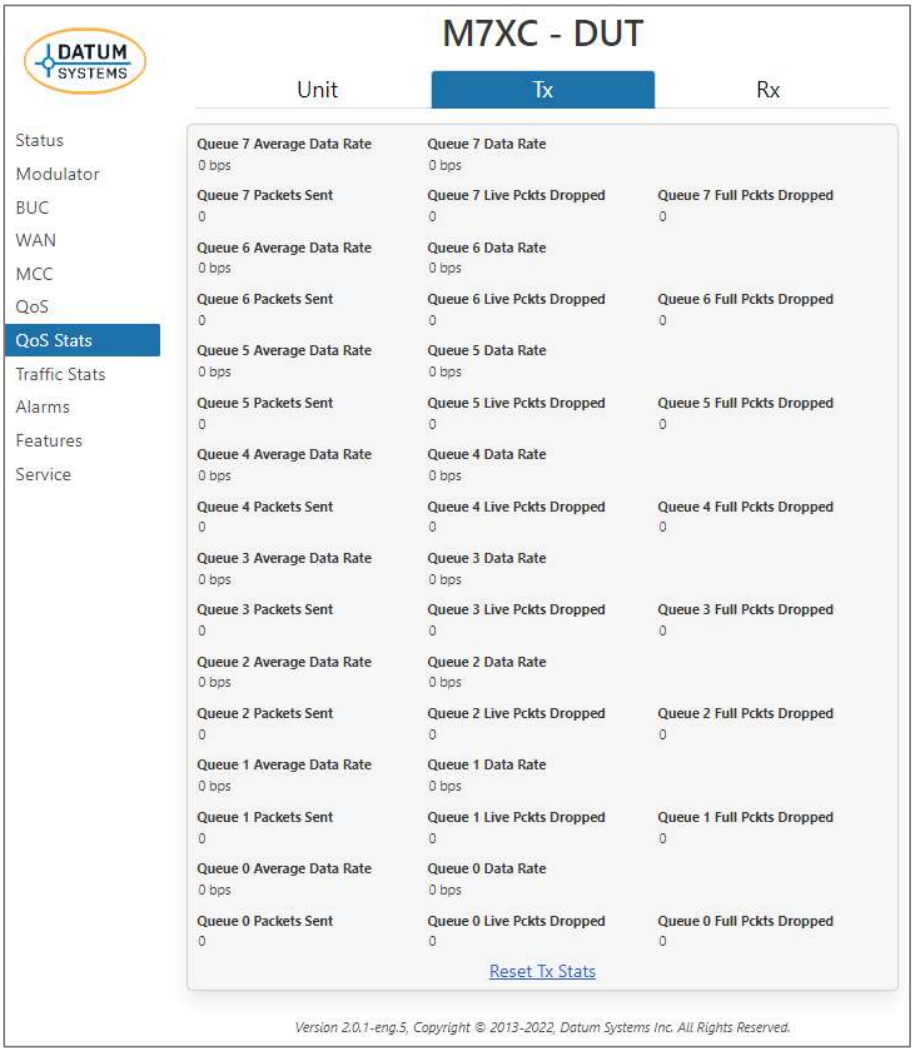


Figure 3-27 - TX QoS Stats Page

The Tx QoS buffer functionality has been modified. The QoS Live Time setting use to be limited to 130 ms. Now it is limited to 650 ms. The QoS Stats now report Live Packets Dropped and Full Packets Dropped instead of just Packets Dropped for each Tx QoS Queue. Each Tx Queue is 16 MB deep. There are 8 Tx QoS Queues each with a different priority level. The lowest numbered queue is the lowest priority. So now Tx packet traffic data can be more bursty in nature and not be dropped. A large burst of packets can come in and as long as they get sent before the live time expires and they do not overflow the 16 MB queue they won't be dropped. If the live time does expire before being sent then it is counted in Live Packets Dropped and if the queue overflows the packets lost are counted as a Full Packets Dropped.

3.3.2.3.8 TX Traffic Stats

The TX “Traffic Stats” tab (Figure 3-28) displays the TX Traffic Stats of the transmit Data and Packet parameters.

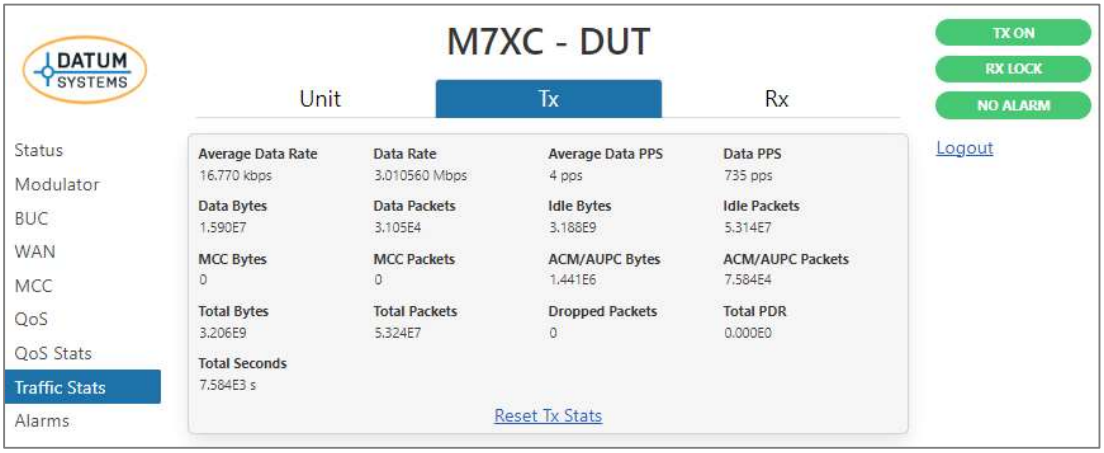


Figure 3-28 - TX Traffic Stats Page

- *Average Data Rate:* Displays current statistics of the transmit Average Data Rate
- *Data Rate:* Displays current statistics of the transmit Data Rate
- *Average Data PPS:* Displays current statistics of the transmit Average Data PPS
- *Data PPS:* Displays current statistics of the transmit Data PPS
- *Data Bytes:* Displays current statistics of the transmit Data Bytes
- *Data Packets:* Displays current statistics of the transmit Data Packets
- *Idle Bytes:* Displays current statistics of the transmit Idle Bytes
- *Idle Packets:* Displays current statistics of the transmit Idle Packets
- *MCC Bytes:* Displays current statistics of the transmit MCC Bytes
- *MCC Packets:* Displays current statistics of the transmit MCC Packets
- *ACM/AUPC Bytes:* Displays current statistics of the transmit ACM/AUPC Bytes
- *ACM/AUPC Packets:* Displays current statistics of the transmit ACM/AUPC Packets
- *Total Bytes:* Displays current statistics of the transmit Total Bytes
- *Total Packets:* Displays current statistics of the transmit Total Packets
- *Dropped Packets:* Displays current statistics of the transmit total Dropped Packets
- *Total PDR:* Displays current statistics of the transmit Packet Dropped Rate
- *Total Seconds:* Displays current elapsed time of the traffic statistics
- *Reset TX Stats:* By clicking on the “Reset TX Stats” button, all stat information will reset to “0”

3.3.2.3.9 TX Alarms

The TX “Alarms” tab (Figure 3-29) provides configurable action to be taken by the M7XC when a TX alarm condition occurs.

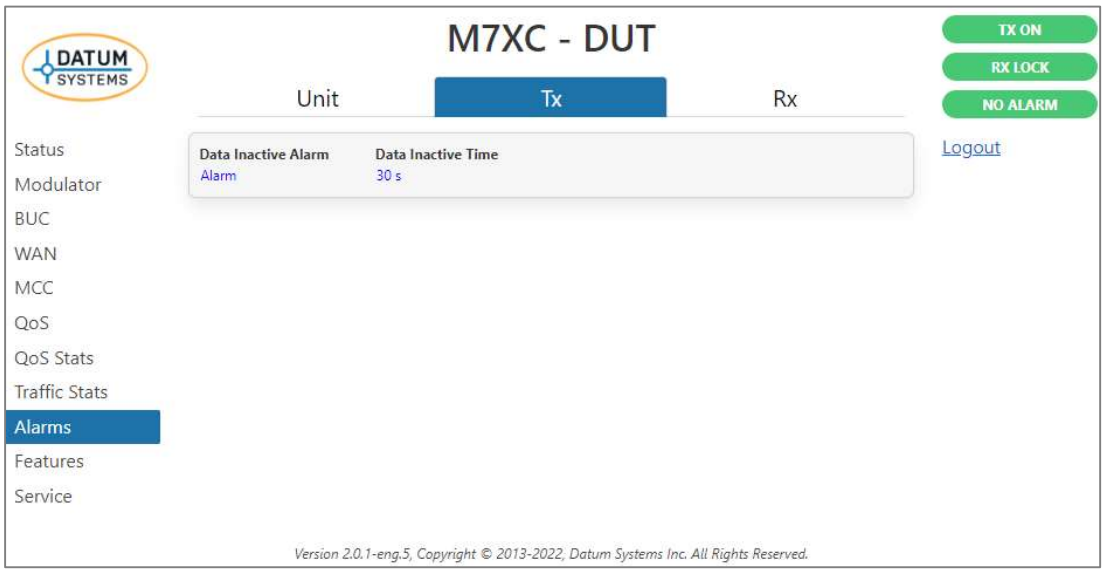


Figure 3-29 - TX Alarms Page

- *Data Inactive Alarm:* Selects destination and action taken for TX active alarm types (Off, Report, Report Mute TX Output, Alarm, Alarm Mute TX Output, Alarm Relay Output, Alarm Relay Output & Mute TX Output)
- *Data Inactive Time:* Enter alarm reporting delay time (5 to 100,00 seconds)

3.3.2.3.10 TX Features

The TX “Features” tab (Figure 3-30) displays the current feature capability of the M7XC.

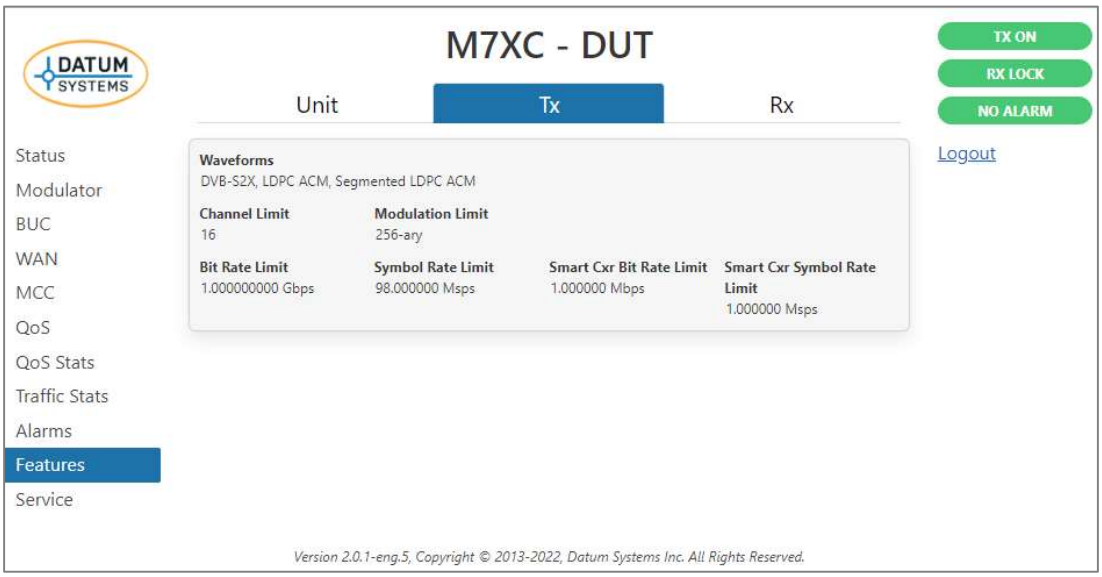


Figure 3-30 - TX Features Page

- *Waveforms:* Displays the selections of transmit waveforms available to the SDR Modulator
- *Channel Limit:* Display of the modulator Channel Limit
- *Modulation Limit:* Display of the modulation maximum capability of any active transmit carrier
- *Bit Rate Limit:* Display of the bit rate maximum capability of any active transmit carrier
- *Symbol Rate Limit:* Display of the symbol rate maximum limit of any active transmit carrier
- *Smart Cxr Bit Rate Limit:* Display of the bit rate maximum capability of any active smart Cxr transmit carrier
- *Smart Cxr Symbol Rate Limit:* Display of the symbol rate maximum limit of any active smart Cxr transmit carrier

3.3.2.3.11 TX Service

The TX “Service” tab (Figure 3-31) displays the temperature of the major modulator system components.

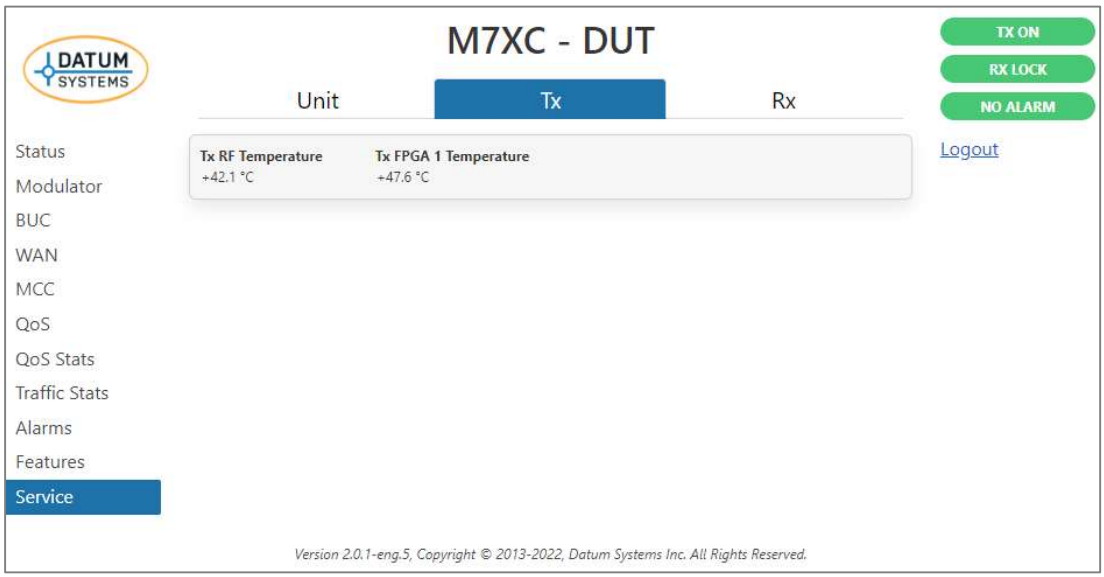


Figure 3-31 - TX Service Page

- *TX RF Temperature:* Displays the current temperature of the TX RF
- *TX FPGA 1 Temperature:* Displays the current temperature of the TX FPGA

3.3.2.4 RX Pages

The RX pages are used to configure the receive parameters of the M7XC. The IF, Symbol Rates, and other receive parameters are controlled in the “RX” pages. Figure 3-32 through Figure 3-42 represent the pages available to the user.

3.3.2.4.1 RX Status

The RX “Status” tab (Figure 3-32) displays the RX Status of the receive parameters and frame statistics.

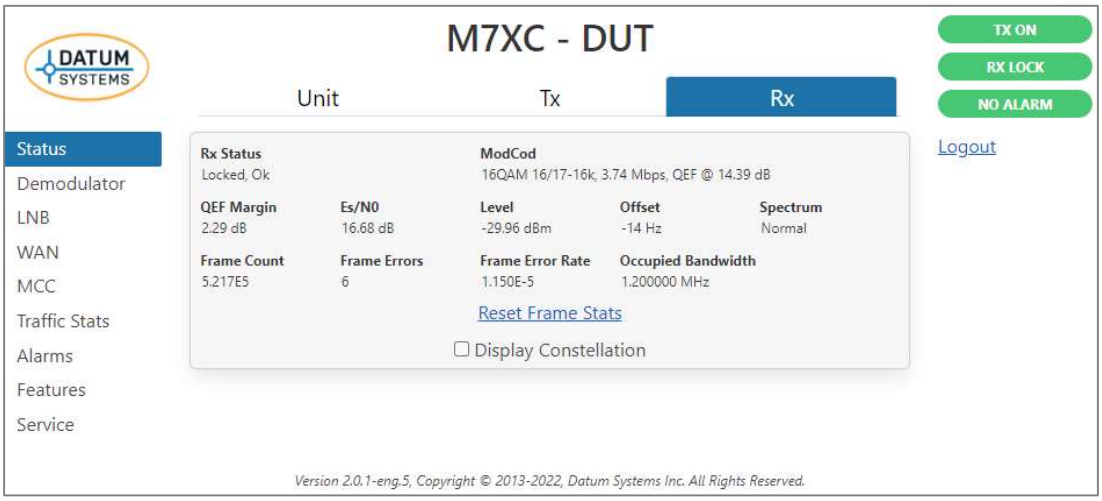


Figure 3-32 - RX Status Page

- *RX Status:* Displays current status of the receive section parameters
- *ModCod:* Displays current ModCod setting
- *QEF Margin:* Displays current receive QEF Margin
- *Es/No:* Displays current receive Es/No level
- *Level:* Displays current receive signal level
- *Offset:* Displays current receive offset level
- *Spectrum:* Displays current receive spectrum status
- *Frame Count:* Displays current receive frame count
- *Frame Errors:* Displays current receive frame error count
- *Frame Error Rate:* Displays current receive frame error rate
- *Occupied Bandwidth:* Displays the current Occupied Bandwidth

By checking the “Display Constellation” box, the receive constellation pattern will be displayed.

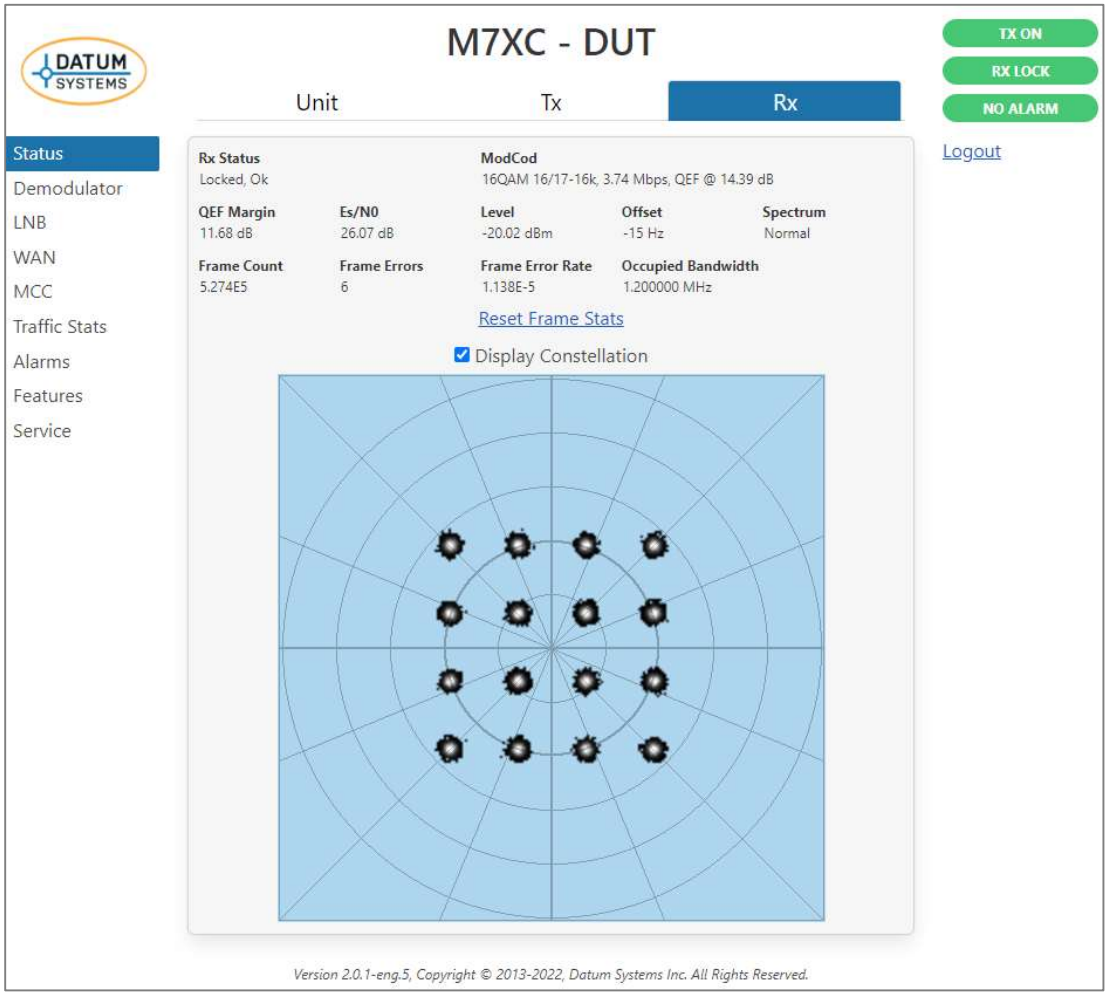


Figure 3-33 - RX Status Page with Constellation

3.3.2.4.2 RX Demodulator

The RX “Demodulator” tab (Figure 3-34) provides the ability to set the parameters for the Demodulator.

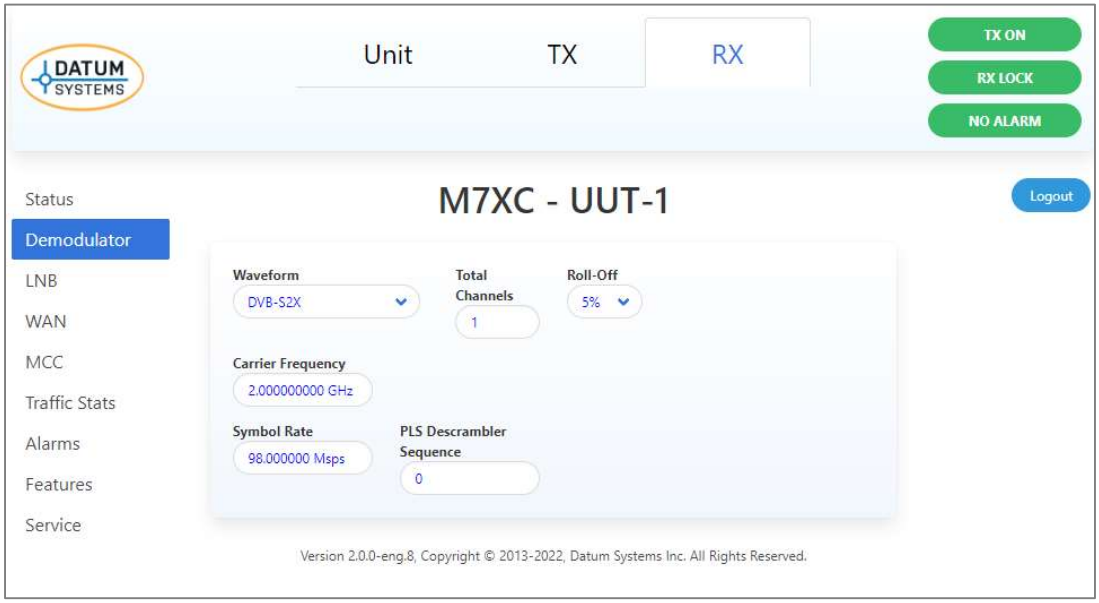


Figure 3-34 - RX Demodulator Page

- *Waveform:* Set the receive waveform (RX Off, DVB-S2X, DVB-S2X VCM, Segmented LDPC ACM, Spectrum Analyzer)
- *Total Channels:* Set the number segmented channels (1 to 16)
- *Roll-Off:* Set the transmit Roll-Off factor (35%, 30%, 25%, 20%, 15%, 10%, 5%, 2%)
- *Carrier Frequency:* Set the transmit frequency
- *Symbol Rate:* Set the transmit output Symbol Rate
- *PLS Scrambler Sequence:* Set the transmit output PLS (0-262)

By selecting “Spectrum Analyzer”, the receive carrier/s will be displayed.

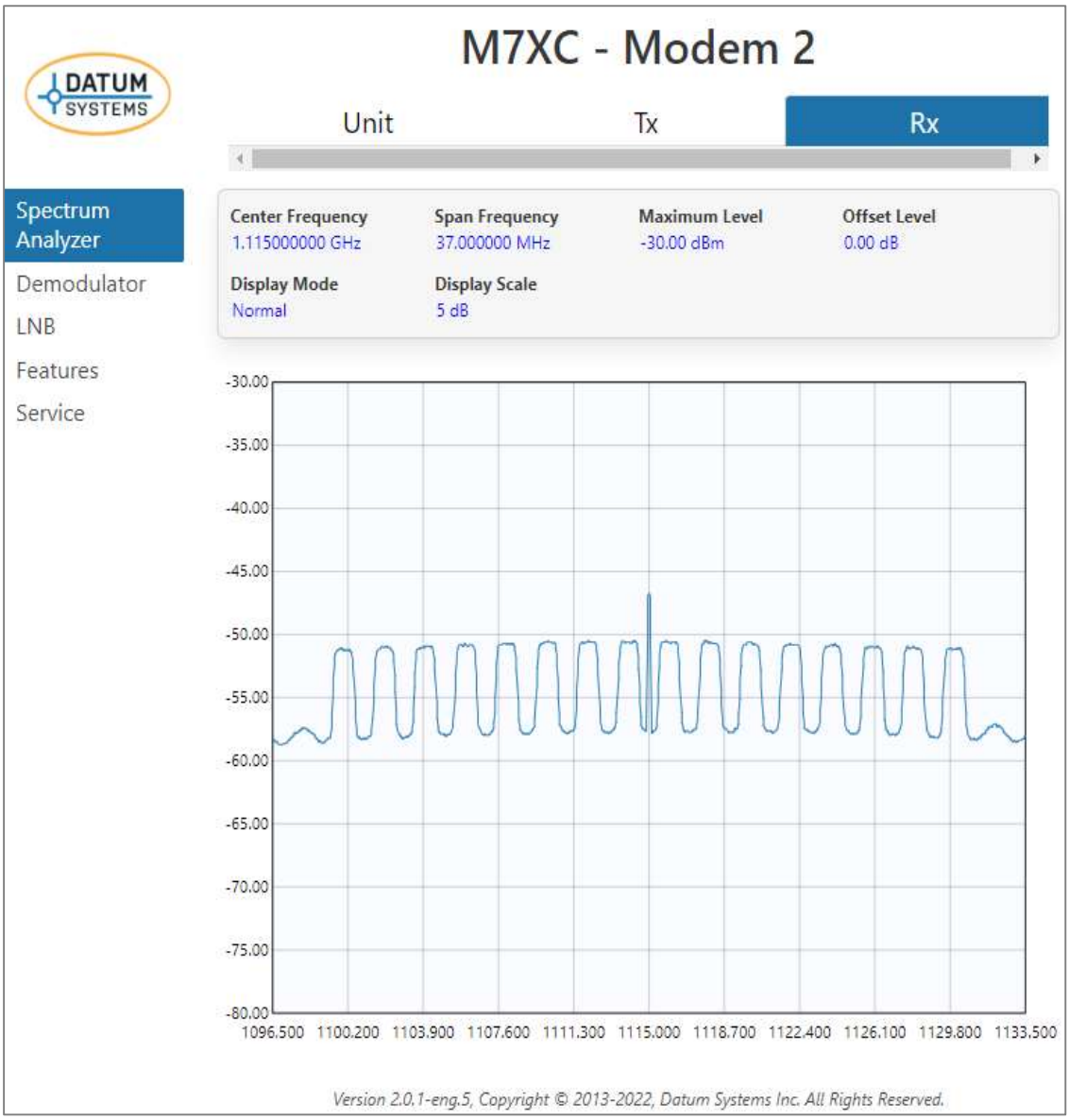


Figure 3-35 - RX Demodulator Page with Spectrum Analyzer

3.3.2.4.3 RX LNB

The RX “LNB” tab (Figure 3-36) provides the ability to set parameters of the receive RF conversion equipment to display the RF frequency to be received based on the IF frequency setting. This is helpful to the operator to confirm that the transmit carrier is in the proper transponder location.

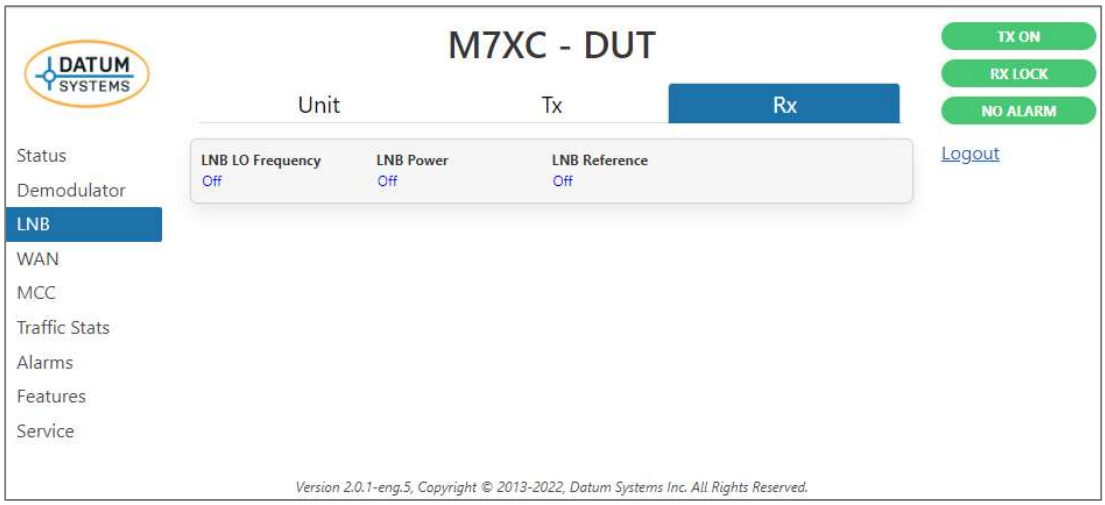


Figure 3-36 - RX LNB Page

- *LO Frequency (MHz):* Configuration for the LNB LO frequency to calculate and display the RF frequency. If set to zero (0), the RF frequency displayed is the same as the IF frequency and “Off” will be shown
- *LNB Power:* Configuration for the LNB VDC Power (Off, + 13V, + 18V)
- *LNB Reference:* Configuration for the LNB Reference (Off, 10 MHz, 50 MHz)

3.3.2.4.4 RX WAN

The RX “WAN” tab (Figure 3-37) provides the ability to set the parameters for the WAN parameters.

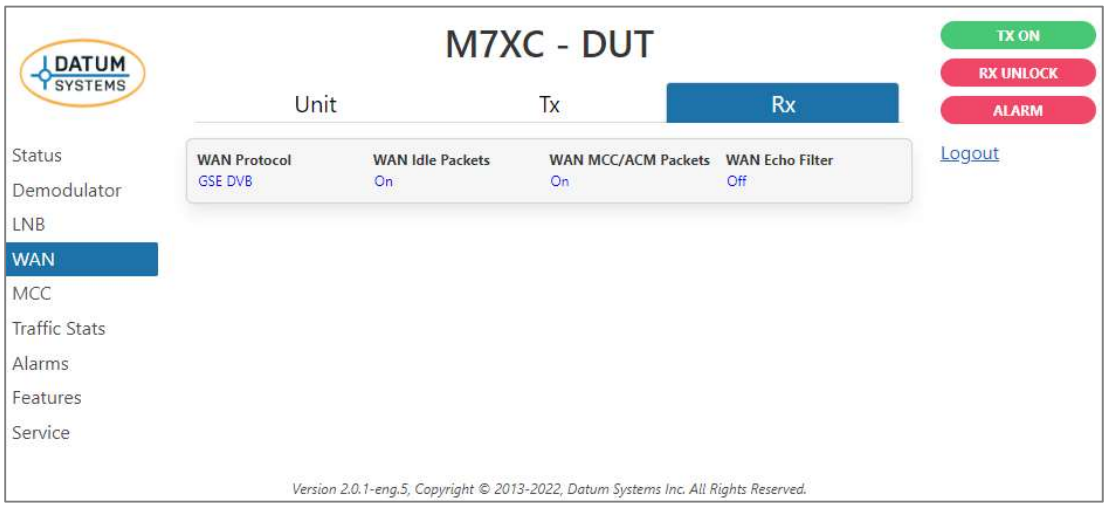


Figure 3-37 - RX WAN Page

- *WAN Protocol:* Selects WAN Protocol Mode (GSE DVB, GSE Low Overhead, GSE CT)
- *WAN Idle Packets:* Selects WAN Idle Packets (Off, On)
- *WAN MCC/ACM Packets:* Selects WAN MCC/ACM Packets (Off, On)
- *WAN Echo Filter:* Selects WAN Echo Filter (Off, Learn TX, Filter RX)

3.3.2.4.5 RX MCC

The RX “MCC” tab (Figure 3-38) provides the ability to set the parameters of the Send and Receive Modem Communications Channel (MCC) between the local and remote modem.

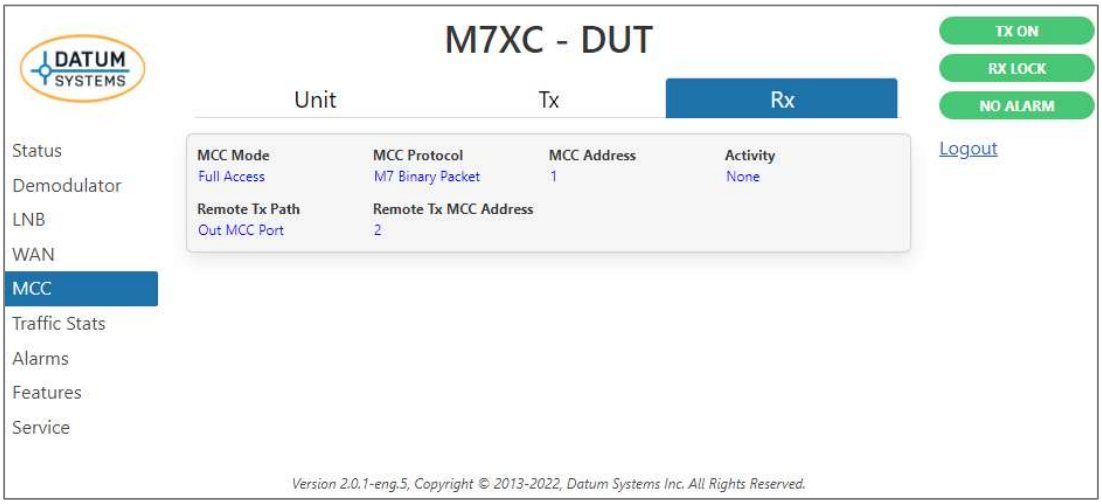


Figure 3-38 - RX MCC Page

- *MCC Mode:* Sets the MCC access mode (Read Only, Full Access)
- *MCC Protocol:* Sets the MCC channel protocol (M7 Binary Packet)
- *MCC Address:* Sets the address of the Send MCC port (0 to 255, 255 = Global)
- *Activity:* Sets the Activity function (None, Flash Online)
- *Remote Tx Path:* Sets the MCC return path function (Off, Local, One Channel Only, Out MCC Port)
- *Remote Tx MCC Address:* Sets the address of the MCC port (0 to 255, 255 = Global)

3.3.2.4.6 RX Traffic Stats

The RX "Traffic Stats" tab (Figure 3-39) displays the RX Traffic Stats of the receive Data and Packet parameters.

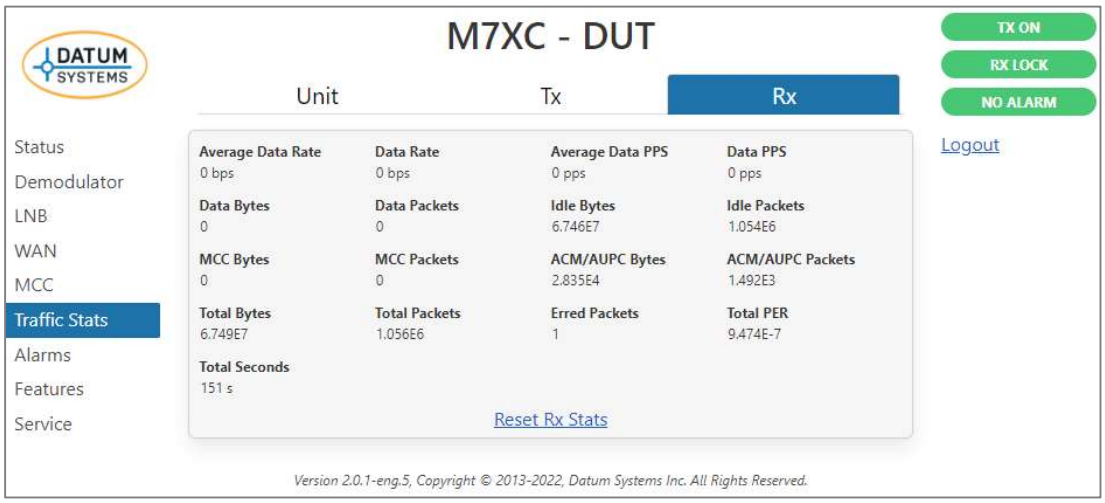


Figure 3-39 - RX Traffic Stats Page

- *Average Data Rate:* Displays current statistics of the receive Average Data Rate
- *Data Rate:* Displays current statistics of the receive Data Rate
- *Average Data PPS:* Displays current statistics of the receive Average Data PPS
- *Data PPS:* Displays current statistics of the receive Data PPS
- *Data Bytes:* Displays current statistics of the receive Data Bytes
- *Data Packets:* Displays current statistics of the receive Data Packets
- *Idle Bytes:* Displays current statistics of the receive Idle Bytes
- *Idle Packets:* Displays current statistics of the receive Idle Packets
- *MCC Bytes:* Displays current statistics of the receive MCC Bytes
- *MCC Packets:* Displays current statistics of the receive MCC Packets
- *ACM/AUPC Bytes:* Displays current statistics of the receive ACM/AUPC Bytes
- *ACM/AUPC Packets:* Displays current statistics of the receive ACM/AUPC Packets
- *Total Bytes:* Displays current statistics of the receive Total Bytes
- *Total Packets:* Displays current statistics of the receive Total Packets
- *Dropped Packets:* Displays current statistics of the receive total Dropped Packets
- *Erred Packets:* Displays current statistics of the receive total Erred Packets
- *Total PER:* Displays current statistics of the receive Packet Error Performance
- *Total Seconds:* Displays current elapsed time of the receive statistics
- *Reset TX Stats:* By clicking on the "Reset TX Stats" button, all stat information will reset to "0"

3.3.2.4.7 RX Alarms

The RX “Alarms” tab (Figure 3-40) provides configurable action to be taken by the M7 modem when a RX alarm condition occurs.

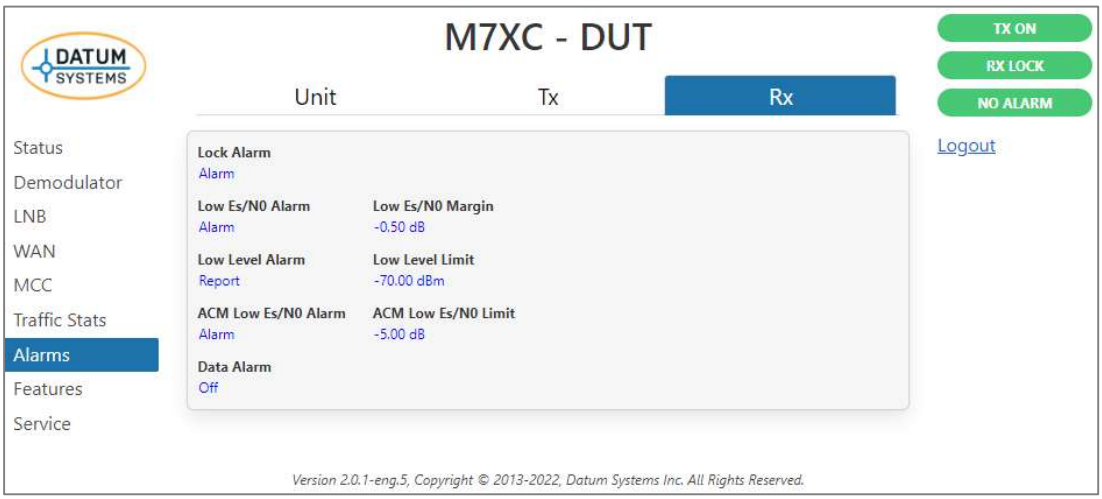


Figure 3-40 - RX Alarms Page

There are three (3) different actions as well as combinations of two (2) of them that can be configured:

- Off
- Report, Report Mute Tx Output
- Alarm, Alarm Mute Tx Output

Common receive carrier parameters for all channels:

- *Lock Alarm:* Selection of alarm notification taken by the modem on the status of the Carrier Lock Alarm of the receive channel
- *Low Es/No Alarm:* Selection of alarm notification taken by the modem when the Es/No of the receive channel is below the Low Es/No Margin setting.
- *Low Es/No Margin (dB):* Configuration of the receive channel’s Es/No margin threshold that will trigger the Low Es/No Alarm (-0.50 to 5.00)
- *Low Level Alarm:* Selection of alarm notification taken by the modem when the input level of the receive channel is below the Low-Level Limit setting
- *Low Level Limit (dBm):* Configuration of the receive channel’s input level margin threshold that will trigger the Low-Level Alarm (Range = 10 x log10(SR) - 130 dBm)
- *ACM Low Es/No Alarm:* Selection of alarm notification taken by the modem when the input level of the receive channel is below the ACM Low Es/No Limit setting
- *ACM Low Es/No Limit (dBm):* Configuration of the receive channel’s input level margin threshold that will trigger the ACM Low Es/No Alarm
- *Data Alarm:* Selection of alarm notification taken by the modem when the data input level of the receive channel is Inactive

3.3.2.4.8 RX Features

The RX “Features” tab (Figure 3-41) displays the current feature capability of the modem.

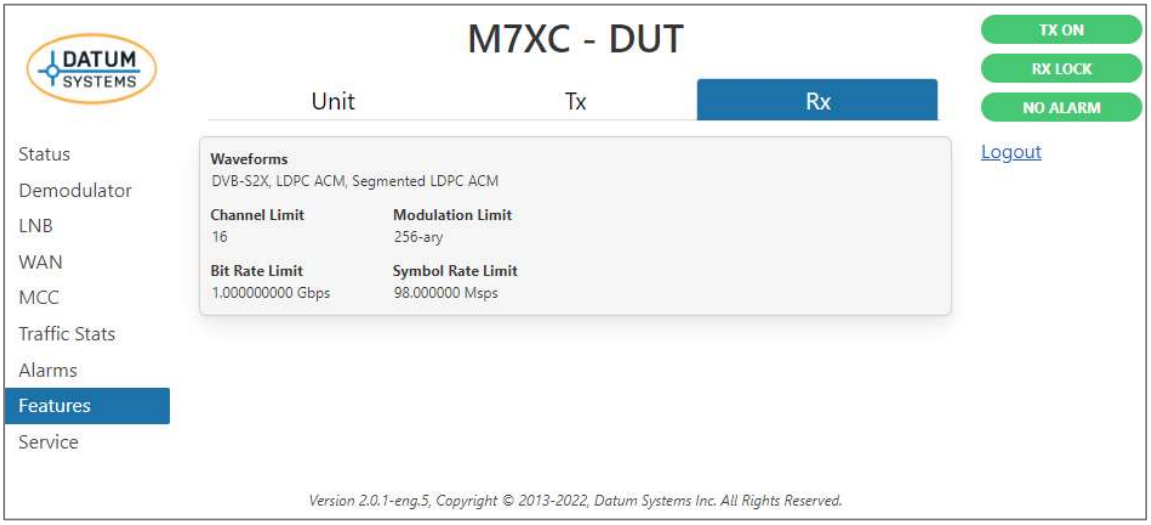


Figure 3-41 - RX Features Page

- *Waveforms:* Displays the receive waveforms available to the SDR Demodulator
- *Channel Limit:* Display of the modulator Channel Limit
- *Modulation Limit:* Display of the modulation maximum capability of any active receive carrier
- *Bit Rate Limit:* Display of the bit rate maximum capability of any active receive carrier
- *Symbol Rate Limit:* Display of the symbol rate maximum limit of any active receive carrier

3.3.2.4.9 RX Service

The RX “Service” tab (Figure 3-42) displays the temperature of the major demodulator system components.

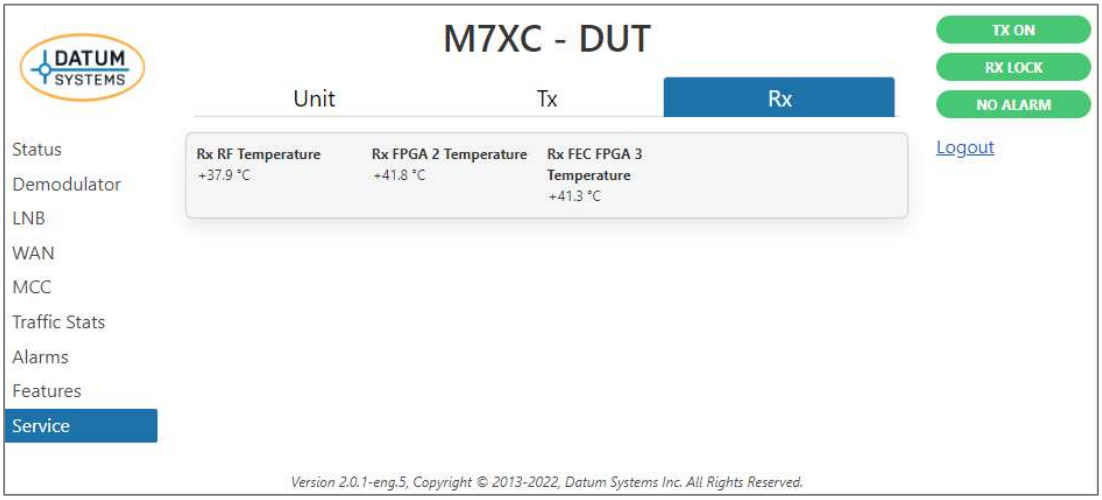


Figure 3-42 - RX Service Page

- *RX RF Temperature:* Displays the current temperature of the RX RF
- *RX FPGA 2 Temperature:* Displays the current temperature of the RX FPGA
- *RX FPGA 3 Temperature:* Displays the current temperature of the RX FPGA

3.4 Remote Command Interface Control

The modem command mode allows the use of an external controller or computer to monitor and control the modem via a packet-based message protocol. This mode normally uses a RS–232 connection and is only for a single controller, a single modem cannot share the command link with other devices.

The packets use a unique address for each controlled device, which is set using the modem's web browser. The message packets themselves use a binary format for efficiency. Contact Datum Systems for the complete control protocol.

The protocol consists of messages from the controller to the modem and response messages from the modem back to the controller. The modem never initiates communications without having first received a correctly addressed and formed message requiring a response.

Message packets to the modem can take two forms:

Messages requesting information in a response message or "Read"

Messages commanding a change in operating parameters or "Write"

Any write information is automatically saved to non-volatile memory

The packets of both incoming and outgoing messages take the same generic form. First are pad and opening flag, then the destination and source addresses, followed by the command code (and read or write mode), then necessary data. The message packet is closed with a closing flag and check word to verify the packet integrity. The use of a source address allows multiple controllers on a single control link.

NOTE: Special considerations are required when legacy modems are to be connected on the same command line with the latest modes. Contact Datum Systems for more information.

3.4.1 Setting the Modem Serial Address for Command Mode Operation

If Command Mode Binary Packet Operation is desired, the modem packet "address" must be set before the modem will recognize packets.

Configuration of the Modem Serial Address will be described in the following steps.

1. In the "Unit" tab "RS-232" section (Figure 3-43), set the "RS-232 Mode" to "Full Access". This activates Binary Packet RS-232 remote control.
2. Set the RS-232 Address, navigate to the parameter, and use the numeric keypad to enter the address from 0 to 255. Then press the "Set Config" button to enable the change.

   Note: The address 255 is "global" and all units will respond to a message packet with this address regardless of its setting, but no unit will return a response message. It is suggested that you do not use addresses 1 or 255 (1 is the factory setting, and any new unit added to a system will have address 1).

The address “0” is also unique. This address causes the modem to accept commands and send responses without the address fields normally required in the command packets.

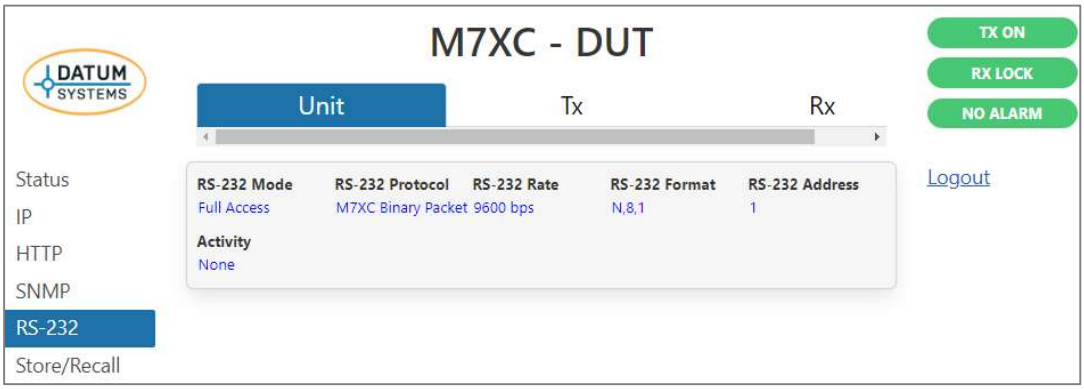


Figure 3-43 – Serial address configuration web page

3.5 Modem Configuration

Configuring the modem operating parameters is essential prior to placing the unit into service. The operating parameters can be set by using any of the control interfaces. The binary remote-control input may be used if the remote interface parameters are already known and set.

3.5.1 Configuring the Modem for Operation

The following description assumes that the modem configuration setup is to be performed manually at a depot location. The modem can also be automatically configured using a central controller command line interface. No control application software is provided by Datum Systems and is the responsibility of the user organization.

3.5.1.1 Setting the Modem Station ID Name

Each modem contains two unique identification entries available via any control interface. They are the unit serial number and the Unit Name or “Station ID”. The serial number is set at the factory and cannot be changed. The Station ID is entered and changed whenever necessary. This field allows identification of the modem with up to 28 characters.

The Station ID is entered directly as text in the “Unit” tab, “Status” page, “Station ID” parameter and is shown in Figure 3-44 below. Once entered, the Station ID will be displayed at the top of the web page with the Model Name.

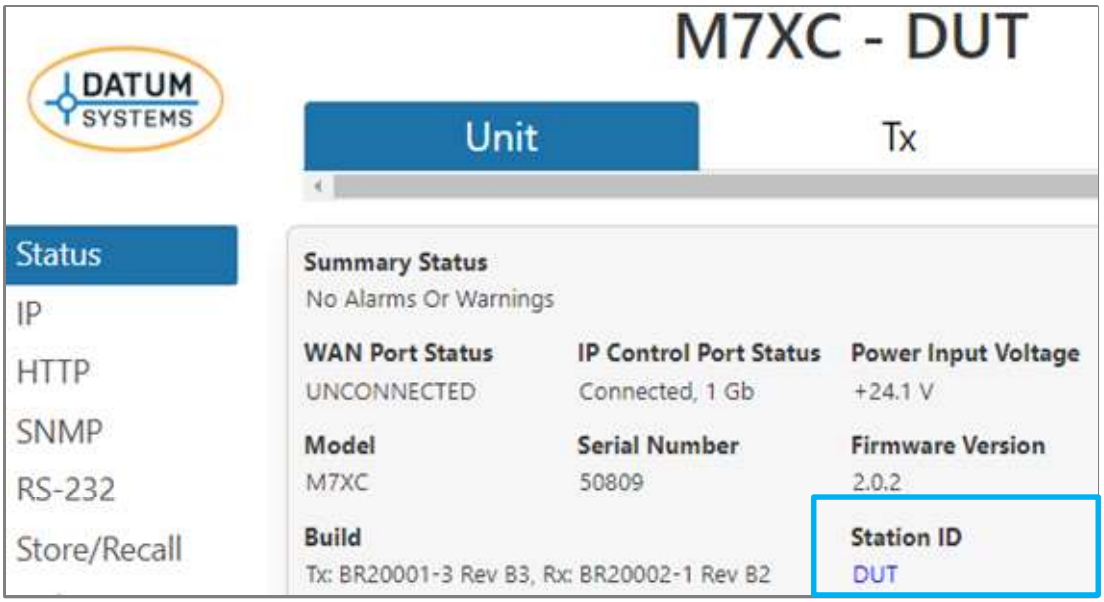


Figure 3-44 – Station ID web page configuration

3.5.2 Setting Essential Parameters

Setting of the parameters below is essential to achieving proper operation. An improper setting of any one of these parameters will result in failure to close the link with the far end.

There are many other parameters that might need to be set on the modem for operation within the system. These include, but not limited to, interface compatibility parameter settings, automatic link property corrections, alarm relay function settings and configuration displays. The discussion in the following sections is to be used as a starting point and is not expected to explain every possible configuration available in the modem. These basic parameters are here to serve as a minimum checklist for basic operation.

Modulator and Demodulator

Carrier Frequency
Symbol Rate
Roll-off
Scrambler
Waveform
WAN

Unit

External reference
IP access

Modulator

Output Level
Carrier Enable
BUC and LNB Reference
Modulation Mode

Demodulator

FEC Code Rate
LNB voltage supply

3.5.3 Using Store/Recall

The following parameters shown in Figure 3-45 describe the basic functions of the Store/Recall feature.

1. "Storage Location" points to the flash memory storage location the "Storage Operation" will use. There are 99 user entries plus the factory default configuration which is read only. For SNMP, set this to one of the storage locations and then read the storage description to see what is stored there if anything. To store with SNMP, you set the location and then set the description before doing the store.
2. "Storage Operation", is the operation to be applied to the selected storage location. When storing a configuration, all of the non-volatile settings in the modem are stored. The user can selectively recall different sections. The user can recall the Unit, TX, and RX separately or in various combinations. The Unit recall does not recall the IP settings or the "Configuration On Start Up" items. The user can delete stored configurations.
3. "Store Description", is a user-defined description that can be up to 80 characters long and is stored with each configuration. The storage location will display the description in the drop-down list, so the user knows what is stored where. The user is prompted to provide this information when store is selected. SNMP can read/write this as required.
4. "Auto Restore", automatically restores the selected configuration after the Rx is unlocked for a user specified amount of time. Each configuration that is restored can have different auto restore settings allowing them to be chained together or even be circular. This provides a way for the modem to automatically fall back to a home channel to recover it if something goes wrong with the link.
5. "Auto Restore After", is the amount of time from 5 to 100,000 seconds that has to pass with the Rx continually unlocked before restoring the selected configuration.
6. "Auto Restore Location", is the location of the stored configuration to restore the configuration. When a configuration is restored, this is updated too, allowing a series of chained restores if the Rx remains unlocked, stopping if it does lock.
7. "Configuration On Start Up", is the configuration to use when the modem starts up, reboots, or powers up. "Last State" is the last state of the modem before being powered down or rebooted.

   Note: The configuration on startup recalls the IP settings that were stored with that particular configuration. This can put the modem in a fixed known state each time it starts up. The "Last State" non-volatile memory is the normal memory used for user configuration operations. This memory is magneto resistive and does not wear out with any amount of reads or writes. The Store/Recall storage location memory is flash based and does wear with each write function. There is wear leveling both in the modem code and the flash device itself. It is not recommended to do large numbers of writes to this memory (>10,000). Wear causes data retention duration degradation while unpowered.

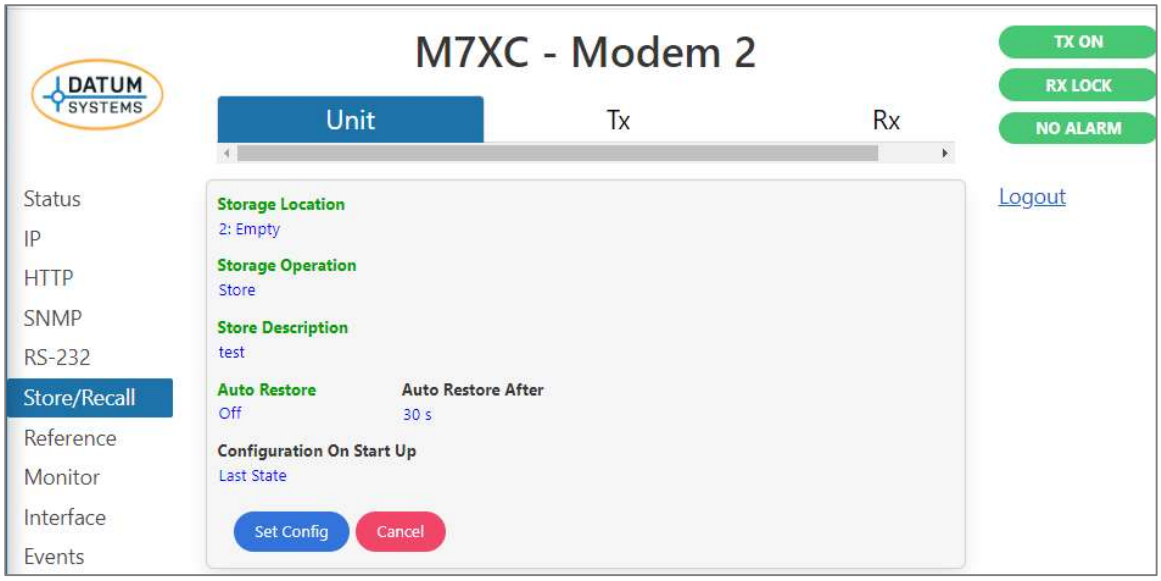


Figure 3-45 – Store/Recall configuration web page

3.5.3.1 Storing and Recalling Configuration

The modem Store and Recall function allows the operator to store the current configuration and recall it from any one of the 99 numbered locations.

1. Set the “Unit” tab, “Store/Recall” page, “Storage Location” parameter from “1” to “99” or Factory Default.
2. Any stored configuration can then be recalled, by accessing the “Unit” tab, “Store/Recall” page, “Configuration on Start Up” parameter from “1” to “99” or Factory Default.

3.5.4 Using the Internal or External Reference

The modem is designed with an internal Oven Compensated Crystal Oscillator (OCXO) that has a nominal stability of 20 ppb over normal operating temperatures, and ages less than 0.1 ppm per year. The internal reference determines the accuracy of all frequencies and symbol/data rates of the modem. If the accuracy is not sufficient, an external reference can also be used.

The external reference is applied at SMA connector J1 shown in Figure 3-46.

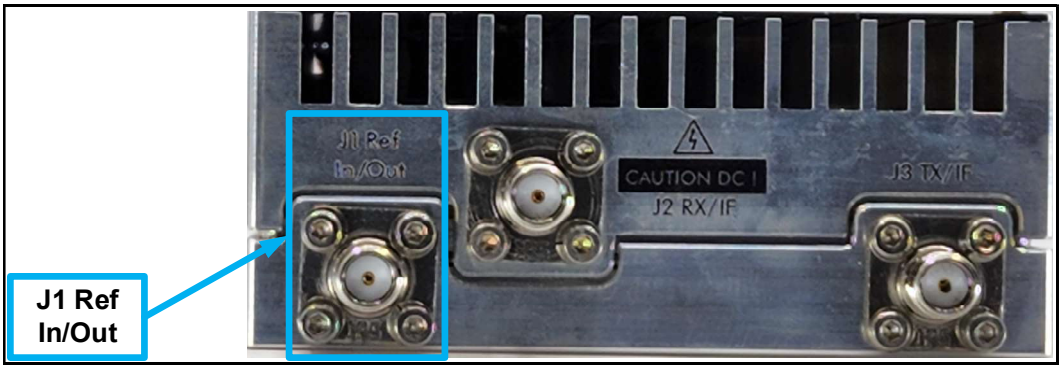


Figure 3-46 – Reference connector J1

The reference frequency is either 10 or 50 MHz and can be selected using any of the control interfaces. An example of the web page configuration is shown in Figure 3-47.

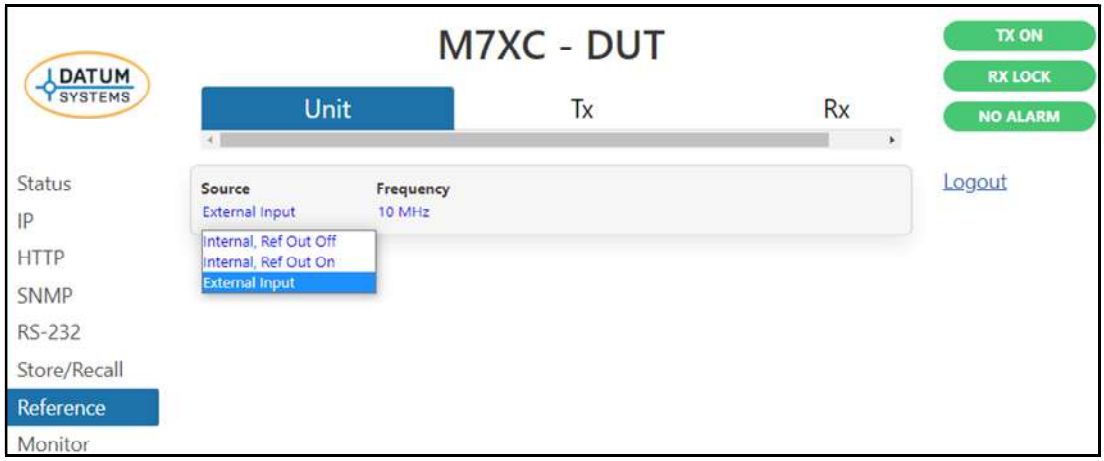


Figure 3-47 – Reference web page configuration

The external reference input provides band-pass filtering from ~1 to 12 MHz. The external frequency reference source output must be low in phase noise.

3.5.5 Using the M7XC BUC Reference Control

The M7XC provides an internal high stability 10/50 MHz reference signal to the Block Up Converter (BUC) via the transmit IF cable. The configuration of the reference is done by way of any of the modem control interfaces. Some BUCs use the 10 MHz signal to control the muting of the HPA RF output power.

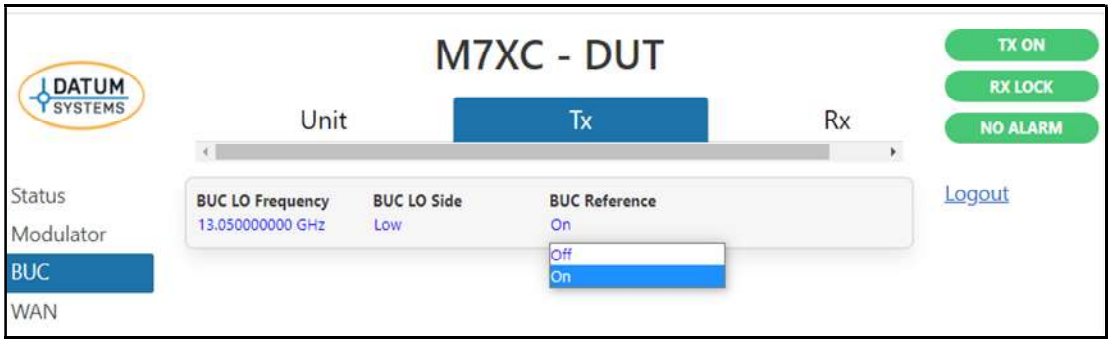


Figure 3-48 – BUC Reference web page configuration

3.5.6 Using the M7XC LNB Reference Control

The M7XC provides an internal high stability 10/50 MHz reference signal to the Low Noise Block Down Converter (LNB) via the receive IF cable. The configuration of the reference is done by way of any of the modem control interfaces.

Figure 3-49 – LNB Reference web page configuration

3.5.7 Using the M7XC Transmit RF Frequency Feature

The M7XC transmit output can be tuned to any frequency between 950 to 2250 MHz in 1 Hz increments and also display the actual satellite RF frequency being transmitted at the BUC output shown in Figure 3-50. To enable this feature, set the “TX” tab, “BUC” page, “BUC LO Frequency” parameter to a value other than “0”. When the BUC’s LO frequency is entered, the modem will compute and display the BUC output RF frequency.

The M7XC modem will also set the proper spectrum for high side or low side LO. If the BUC has a Low side LO, the spectrum is not inverted and the <TX: Modulator – Spectrum> setting will show “Norm”.

To return to using the L-Band IF frequency display, enter a value of “0” as the “TX” tab, “BUC” page, “BUC LO Frequency” parameter.

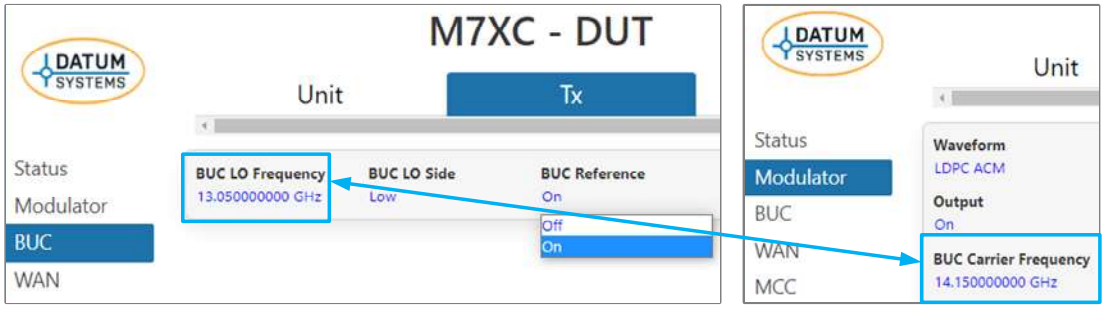


Figure 3-50 – BUC LO Frequency web page configuration

3.5.8 Using the M7XC Receive RF Frequency Feature

The M7XC receive input can be tuned to any frequency between 950 to 2250 MHz in 1 Hz increments and also display the actual satellite RF frequency being received at the LNB input shown in Figure 3-51. To enable this feature, configure the “RX” tab, “LNB” page, “LNB LO Frequency” parameter to a value other than “0”. When the LNB’s LO frequency is entered, the modem will compute and display the LNB input RF frequency.

NOTE: After entering a new “RX” tab, “LNB” page, “LNB LO Frequency” parameter, the modem requires entry of the receive frequency “RX” tab, “LNB” page, “LNB LO Frequency” parameter at the actual satellite downlink RF frequency to recalculate the proper input frequency setting.

The M7XC modem will also automatically set the proper Receive RF spectrum for high side or low side LO (Inverted or Norm).

To return to using the L-Band IF frequency display, enter a value of “0” as the “RX” tab, “LNB” page, “LNB LO Frequency” parameter.

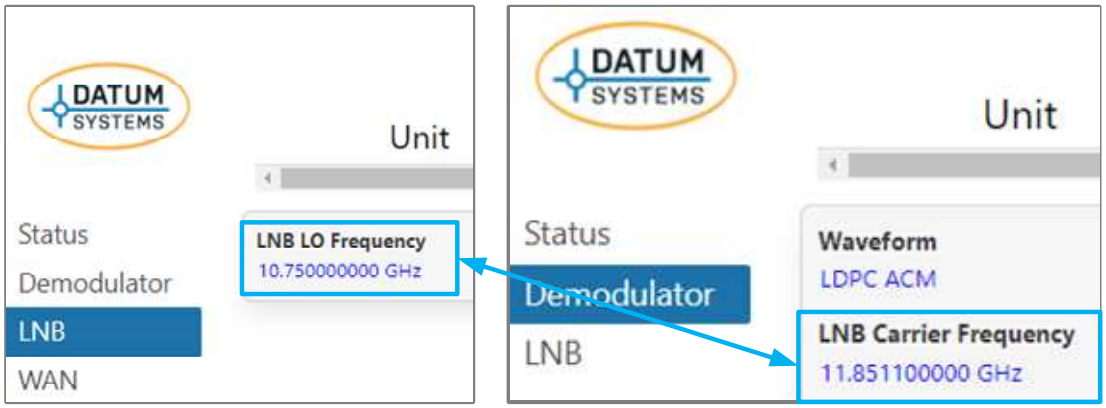


Figure 3-51 – LNB LO Frequency web page configuration

3.5.9 Carrier Acquisition Operation

There are two acquisition methods used by the modem. The normal mode for fastest possible acquisition (especially at low data rates) is the “Fast” mode which utilizes an onboard Digital Signal Processor (DSP) to mathematically determine the location of the carrier and lock as fast as possible. This mode initially goes for the largest carrier power within the acquisition range. A new acquisition attempt will always repeat the same process and go to the same carrier. The “fast” acquisition mode is optimized for the fastest possible acquisition speed and is set as the default acquisition mode for the modem.

A second mode called “Search” also uses the DSP but performs a piece-wise sweep of the programmable acquisition range to locate the carrier and lock to it. If the modem cannot lock to the first carrier it detects it will attempt to find another carrier in the next step of frequency. The sweep always starts at the low end of the acquisition range and moves upward, wrapping around to the low end when the top is reached.

NOTE: The Search mode is optimized for crowded spectrum applications where nearby high-power carriers may interfere with the standard “Fast” acquisition mode.

3.5.10 Alarm Configuration

The modem alarm system represents a sophisticated method of controlling visual, relay and logical alarm outputs which can be used for multiple purposes including redundancy. The modem alarm outputs are:

- A ‘Type A’ alarm relays on J4 (Multi-Connector – pins 3 and 4)
- four (4) LEDs (Modulator- Major/Minor and Demodulator – Major/Minor)

A basic representation of the alarm system functioning is shown in the Figure 3-52.

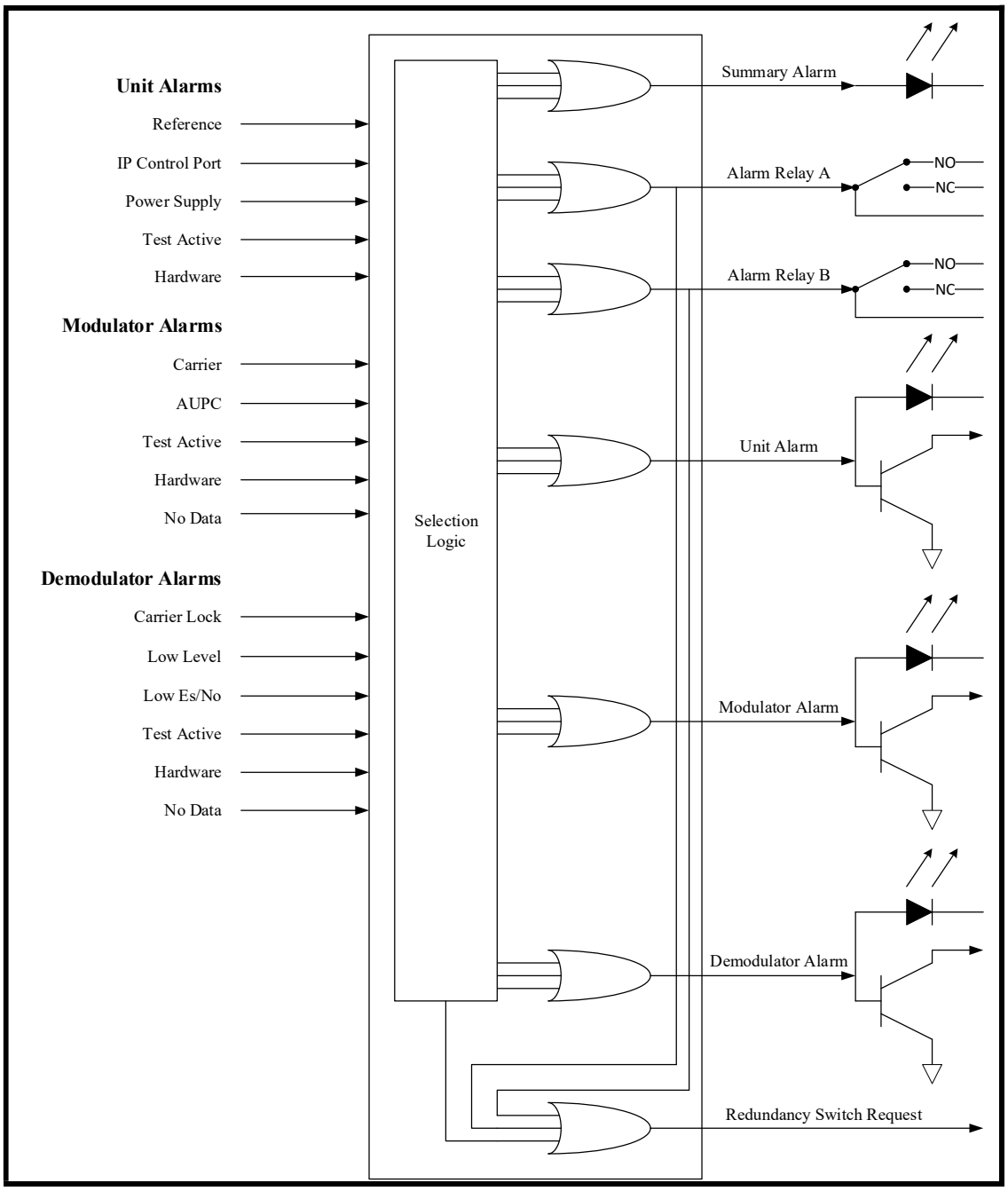


Figure 3-52 - Alarm Processing

There are many possible alarms depending on the modem options and configuration. Each of the individual alarms has a configuration selection parameter under the “Unit” tab, “Alarms” page, “Parameters” section of the modem functional pages. Alarms can be set to OFF, Report, Alarm, and Alarm & Relay Output. The default setting for the alarm matrix is for all modulator and all demodulator related alarms activate the Alarm Relay.

The modem’s built-in redundancy switch logic uses the Alarm Relay to activate a switch request via the inter-modem communication channel.

The summary Alarm LED is the “OR” function of any modem alarms. The modem allows the user to select such items as a low input level or Es/No to activate an alarm.

3.6 Data Interface Technical Details

3.6.1 GigE Interface

The GigE Interface is a Layer 2 Switched Bridge that provides high speed Internet capability to the M7XC. The GigE interface will not provide any IP routing functionality.

The purpose of the GigE is to act as an interface between the modem LAN ports and a point-to-point or point-to-multipoint satellite network.

3.6.1.1 Gigabit Ethernet Port

The physical interface connector is a RJ-45 1000BaseT copper interface. The Ethernet port can be activated or disabled by any of the control interfaces.

3.6.1.2 Flow Control

The M7XC transmission is classified as FDMA, and as such, has a constant bit rate for transmission over the satellite, which is the WAN side of the GigE interface. Conversely, an Ethernet interface can have significant variability in the instantaneous bit rate and through flow control will settle into a long-term average of the constant bit rate of the FDMA link. QoS buffering is provided at the output of the internal Ethernet switch to store data until it is needed for transmit to the WAN. The QoS mode can be configured in the “TX” page, “QOS” tab “QOS Mode” parameter to either “WRED” (Waited Random Early Detection) or “Strict Priority”. These settings will determine the procedure for dropping packets at the point where the QoS buffer has reached the point of congestion. The default setting is WRED.

Additionally, the GigE allows the user to set three (3) QoS Priorities with five (5) different code points.

The GigE allows for Ethernet bridge functionality in either a point-to-point (P2P) or a point-to-multipoint (P2MP) satellite network.

Configuration of the proper “WAN Protocol” will automatically set the proper MAC learning and packet forwarding to prevent duplicate MAC addresses and enable proper network operation.

Note: The Tx QoS buffer functionality has been modified. The QoS Live Time setting use to be limited to 130 ms. Now it is limited to 650 ms. The QoS Stats now report Live Packets Dropped and Full Packets Dropped instead of just Packets Dropped for each Tx QoS Queue. Each Tx Queue is 16 MB deep. There are 8 Tx QoS Queues each with a different priority level. The lowest numbered queue is the lowest priority. So now Tx packet traffic data can be more bursty in nature and not be dropped. A large burst of packets can come in and as long as they get sent before the live time expires and they do not overflow the 16 MB queue they won't be dropped. If the live time does expire before being sent then

it is counted in Live Packets Dropped and if the queue overflows the packets lost are counted as a Full Packets Dropped.

3.7 Modem Control Channels (MCC + ACM + AUPC)

The modem's satellite WAN interface provides an in-band management channel that allows communications over the satellite link between the hub and remote modem(s).

Configuration of the in-band MCC, ACM and AUPC channels will be described in the following steps.

1. In the "TX" tab, "MCC" section (Figure 3-53), verify the default setting for the "MCC Protocol" is "M7 Binary Packet".
2. Set the "MCC Address". For normal point to point configurations, this address can be set to from 0 to 255, typical value is 1. The same value can be set on both ends. For point to multipoint configurations, the remotes must have a unique MCC address so they can be distinguished individually at the hub. This also provides the TX side with the other end's RX Es/No for ACM MODCOD management.
3. Set the "MCC Rate Limit" from 0.500 to 10 kbps.

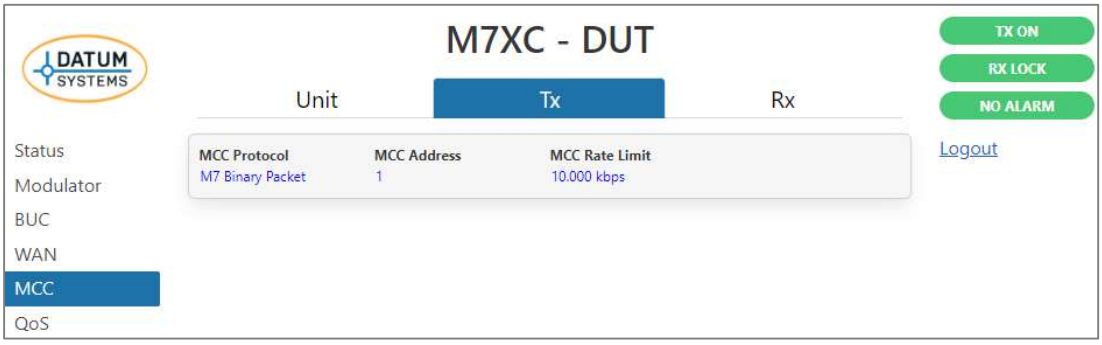


Figure 3-53 – MCC configuration web page

1. In the "RX" tab, "MCC" section (Figure 3-54), set the "Remote Tx Path" to "Out MCC Port".
2. Set the "Remote Tx MCC Address" to the other end's Rx MCC Address, typically 1.
3. Set the "MCC Mode" to "Full Access".
4. Verify the default setting for the "MCC Protocol" is "M7 Binary Packet".
5. Set the "MCC Address".
6. Set "Activity" to desired function.

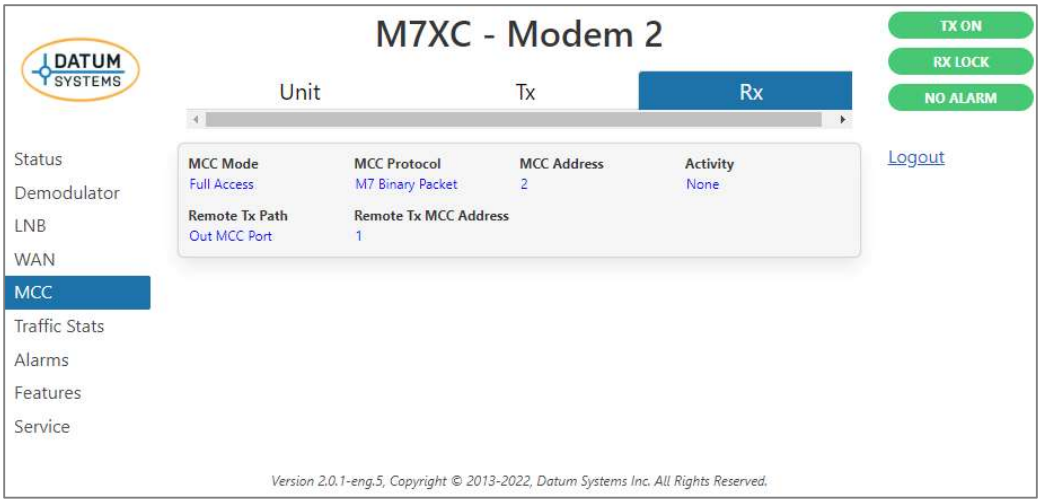


Figure 3-54 - MCC configuratiom web page

1. In the “TX” tab, “Modulator” section (Figure 3-55), set the "Service" to "FlexLDPC ACM". This enables Tx ACM ModCod management.
2. Set the "ACM Margin" to the Es/No margin needed above the ModCod's QEF value. Note: How much margin needed is dependent on how fast signal fades can occur and whatever error rates are required. The ACM responses to Es/No changes are delayed due to satellite link delay, receive noise averaging and other mitigating factors. More margin may be needed if signal fades occur more rapidly; allowing more time for the ACM to catch up with those changes.
3. Set the "ACM Min Es/No" to the Tx ModCod value used when the far end demod is unlocked for more than 0.5 seconds and/or when the far end Es/No data is not being received for more than 1.0 second. Once the far end is locked, the Tx ACM MODCODs can track above and below this value to maintain lock. Ideally this should be set to the lowest expected operating Es/No value. This provides the most throughput from the start of far end Rx lock.
4. Set the "ACM Max Es/No" to the upper limit of Tx ModCod used. If the link performs poorly at some high Es/No ModCod due to channel distortion, phase noise, etc. this can be used to prevent those MODCODs from being selected.
5. Set the "ACM *-ary Hysteresis" to the hysteresis needed for each modulation order. This value is added to the margin and QEF ModCod value as the threshold to enter that modulation order ModCod. Once in that ModCod only the QEF and margin are used for that ModCod's lower threshold to remain in it.

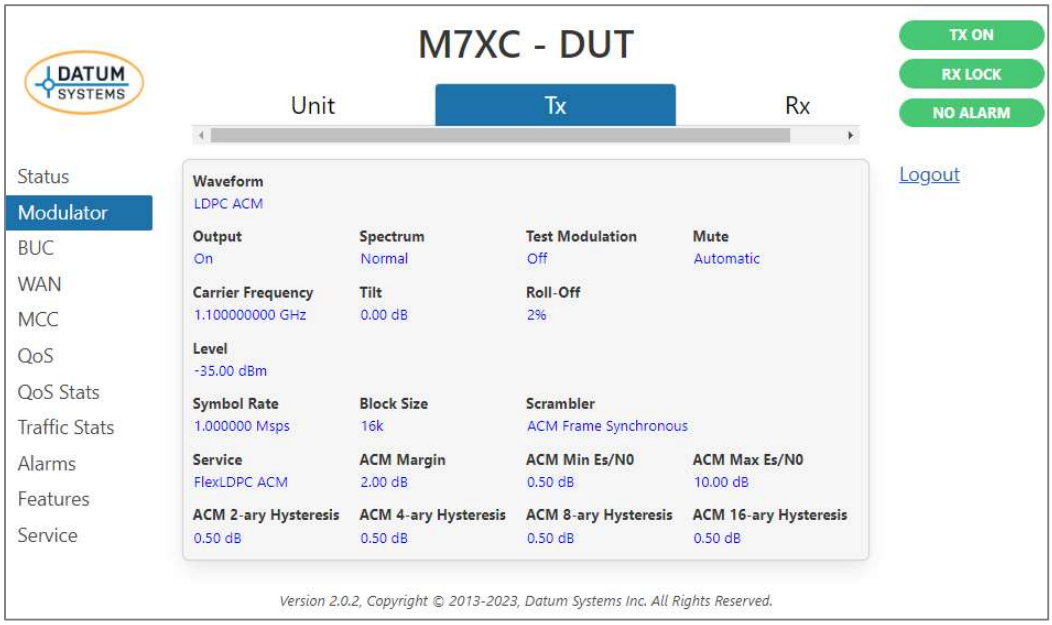


Figure 3-55 – ACM configuration page

3.8 Automatic Uplink Power Control (AUPC) Operation

Refer to Appendix J for more information.

3.9 Special Control Mechanisms

The modem includes special control mechanisms and are not considered normal operation so care must be taken if they are used.

- Power-Up Behavior
- Analog Monitor Output

3.9.1 Power-Up Behavior

The modem can be set to always revert to the transmit carrier disabled on power-up. Example: This might be useful in mobile environments where the antenna may not be deployed or could be misaligned on power-up. Setting this option in the “TX” tab, “Modulator” page, “Mute” parameter to “Manual & Power Loss“ allows such operation.

In other cases, the user may require that the modem always revert to a specific configuration on power-up. The normal behavior is for the modem to power-up with the last settings still in effect. The option is in the Unit configuration column “Unit” tab, “Store/Recall” page, “Configuration on Start Up” parameter to the default setting of “Last State”.

A user can select any of the stored configurations to be recalled for each power-up cycle. This could be useful in a mobile environment or a DAMA system where a control channel is desired on each power-up. In a large system, units can be pre-set to a specific configuration during initial commissioning, but then easily changed to another configuration for normal operation.

3.9.2 Analog Monitor Output Operation

The modem has a built-in function to output an analog voltage representing the current value of one of five internal parameters by setting the “Unit” tab, “Monitor” page, “Output Mode” parameter. The available parameters that can be selected for this output are:

- TX Level
- TX Remote Es/No
- TX ACM
- RX Level
- RX Rs/No

The analog output can be tailored to the user requirements through any of the control interfaces. The output of the processor allows control of the full-scale voltage by setting the “Unit” tab, “Monitor” page, “Output Full Scale” parameter to a range of +1.0 Volts to +5.0 Volts and the slope by setting the “Unit” tab, “Monitor” page, “Output Slope” parameter to Positive or Negative. These two settings control the output slope (gain and direction) of the analog output voltage.

To illustrate, consider the example of using the Receive carrier level for the monitor output to automatic antenna positioning equipment. For this example, the modem has a carrier input range of –20 to –60 dBm.

If the antenna auto-track controller requires a positive slope between 0 and +5 Volts, where +5 Volts represents the maximum received signal level, set the “Unit” tab, “Monitor” page, “Output Full Scale” parameter to “+5.0” and the “Unit” tab, “Monitor” page, “Output Slope” parameter to “Negative”. These settings will have the effect of inverting the slope of the AGC signal and setting the gain of the voltage to match the input to the antenna controller.

NOTE: The output voltage is always a positive voltage.

The analog output presented at pins 9 (+voltage) and 7 (gnd) on the rear panel Multi-Function connector (J4). The voltage pin has a1kΩ output impedance, protecting the driver circuitry from shorts.

3.9.3 Analog Monitor Input Operation

The modem allows for an analog voltage input between 0 and +5V at pins 5 (+voltage) and 7 (gnd) on multi-function connector (J4). The analog input signal can be set to control the following functions:

- Report
- Set Alarm & Relay
- Mute transmit carrier

The “Unit” tab, “Alarms” page, “Input Voltage” parameter is a real time monitor of the voltage at the analog input.

3.9.4 Automatic Configuration Recovery (ACR)

The modem allows any of the 99 configurations that can be set to be automatically recalled in the event of receive carrier loss after a specified number of seconds.

To activate this feature, set the “Unit” tab, “Store/Recall” page, “Auto Restore” parameter to “Off, Restore All, Restore Unit Only, Restore TX & RX Only, Restore TX Only, or Restore RX Only ”. The configuration that is to be restored in the “Unit” tab, “Store/Recall” page, “Storage Location” parameter.

NOTE: ACR is also commonly used to disable the transmit off after loss of receive carrier.

NOTE: The ACR is not available when the modem is operating in a redundancy mode.

3.10 Trial / Backup Activation Mode

3.10.1 Introduction

The M7XC contains a unique feature capability called Trial Activation Mode. (TAM). When activating TAM, the M7XC activates every software feature available that is supported by the installed hardware in the M7XC.

TAM may be active for up to 1000 hours (30+ days) before having to be reset by a factory provided code. The TAM countdown timer is active when the modem has the transmitter ON, and the demodulator has carrier lock.

TAM can also be used in a redundancy system to enable a modem with minimal features to be installed as a backup modem. Once the TAM code installed in the backup modem, any feature in the on-line modem will have redundancy in the backup modem. If the backup modem is never placed on-line, the TAM timer will never start counting down.

3.10.2 Operation

To activate TAM, enter the 20-digit code via the web interface (Figure 3-56).

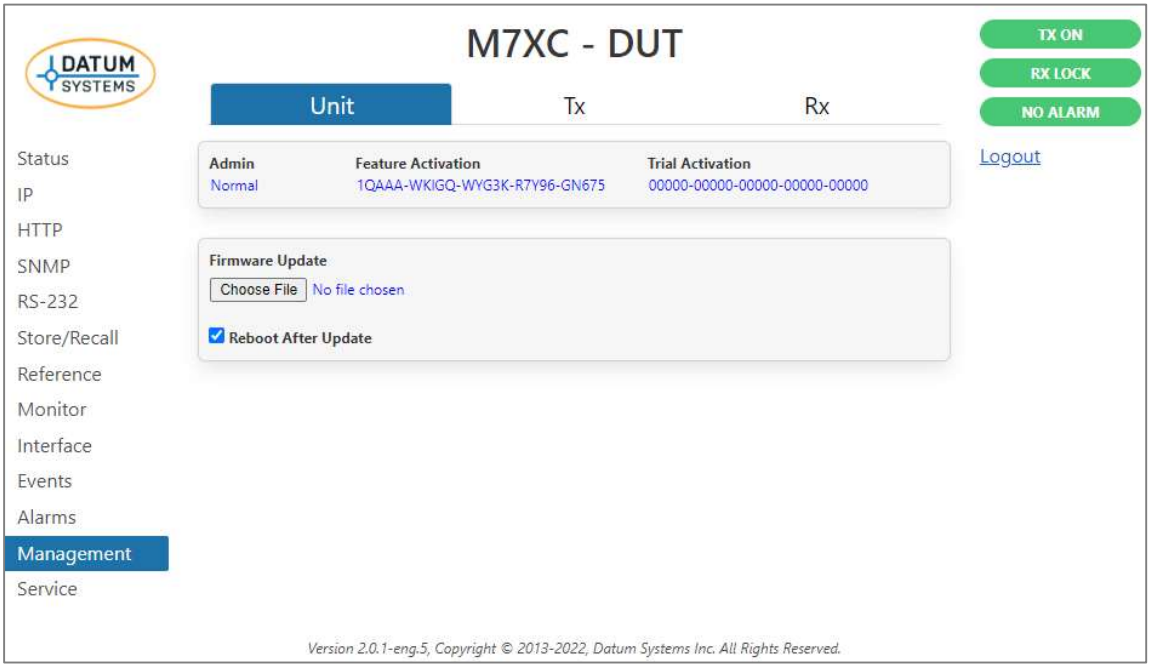


Figure 3-56 - TAM Web Interface

The 20-digit TAM code is provided by the factory and includes the serial number of the unit to be utilized. Please have this information available when requesting a TAM activation code.

3.11 Built-in 1:1 Redundancy Mode Operation

Refer to Appendix J 1:1 redundancy mode operation.

4 Maintenance

4.1 Periodic Maintenance

The M7XC requires no mandatory periodic field maintenance or adjustments. The internal digital calibration data is held inside the modem EEPROM. There are no batteries or parts contained within the modem case requiring periodic service. The only moving part is the optional fan that is designed with a service life of 200,000+ hours. There is also no external fuse on the M7XC Modem.

4.1.1 Internal Reference Calibration

During factory testing and calibration, the modem unit is compared to a known in-house reference and calibrated. The default value is permanently stored representing this factory calibration. The unit may be offset from this factory value by using the manual tuning.

Manual tuning of the modem's reference is accomplished using the "Unit' tab, "Reference" page, "Fine Tune" parameter and entering a value from +/–2000.

The factory calibration may be restored by setting the "Unit" tab, "Reference" page, "Fine Tune" parameter value to "0".

4.2 Modem Checkout

The following descriptions assume that the full system is in operation and the software is running properly on the central processor.

4.2.1 Initial Power-Up

⇒ CAUTION!!!: Before initial power-up of the modem, it is recommended to disconnect the transmit output cable from the satellite ground station equipment. This is especially true if the current modem configuration settings are unknown. Incorrect settings could disrupt existing communications traffic and potentially harmful results. New modems from the factory are normally shipped with a default configuration of setting the transmit carrier OFF.

The modem does not have a power switch so turning the unit "ON" is done by connecting the DC power to the DC input pins on the multi-function connector J4. At every power-up, the modem processor tests itself and several of its components before beginning its main program. The power-up diagnostics take approximately 5 seconds and show no results if successful. If a failure is detected, the indication may vary depending on the type of fault detected. A serious failure will result in the side panel Alarm LEDs flashing at a rate of approximately 4 times a second.

Most potential failures will result in the modem giving a description of the problem in the Unit status web page.

The initial field checkout of the modem can be accomplished from the web pages.

4.2.2 Factory Default Parameters

New modems from the factory have default values placed into the non-volatile memory for operating parameters. If a Monitor/Control System does not configure the modem automatically via remote control, the modem can be easily configured from the front

panel or through the HTTP interface using a standard internet browser. A modem can be returned to the factory default settings by using the command **<Unit: Store/Recall – Storage Location = Factory Default>**, then editing and choosing the "Factory Default" option.

The most common factory default parameters placed into the non-volatile memory are shown in Table 4-1.

Table 4-1 – Factory Default Parameters

Modulator:	**Demodulator:**
Carrier Frequency = 1500.00 MHz	Carrier Frequency = 1500.00 MHz
Data Rate = 256 kbps	Data Rate = 256 kbps
Modulation = QPSK	Modulation = QPSK
Code Rate = Rate 1/2	Code Rate = Rate 1/2
Differential Encoder = Enabled	Differential Decoder = Enabled
PLS Scrambler = 0	PLS Descrambler = 0
Carrier = Off	All Demod Alarms to Relay
All Mod Alarms to Relay	
Modem Unit:	**Interface:**
Modem Reference: Internal, 10 MHz	WAN Offline Mode = Off
Remote Port Address = 1	
Remote Port = RS-232	
Remote Mode = Binary Packet	
Remote Rate = 9.6 kbps	
Remote Data Format = 8 data bits, 1 stop, no parity	

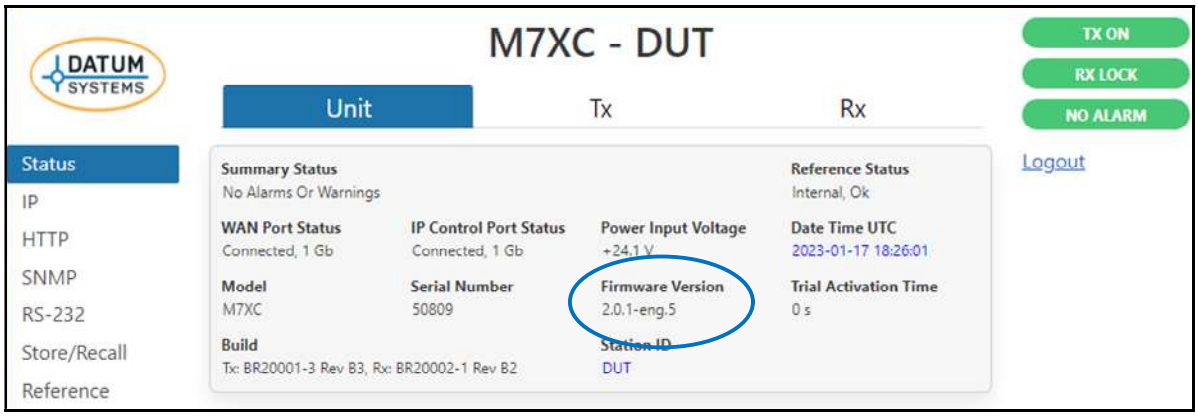
4.3 Updating Modem Firmware

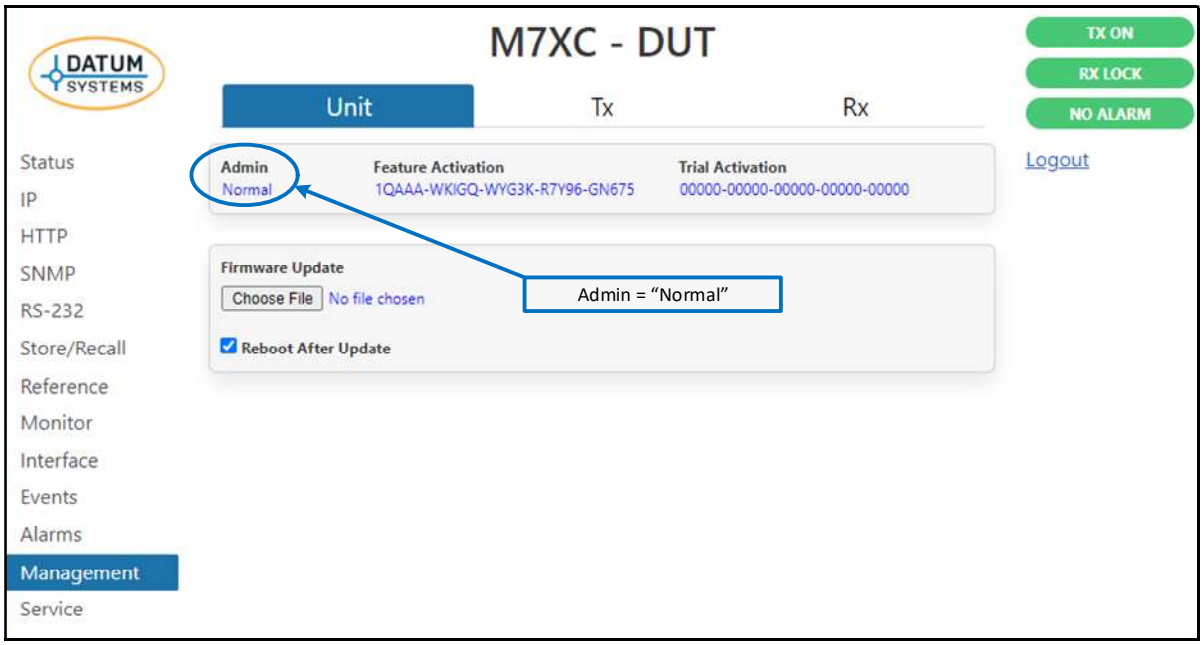
The M7XC modem series system firmware is updated by reprograming the SD card or via the web browser. If the unit requires a firmware update, contact Datum Systems customer service to request the firmware. The proper firmware will be available for download on the Datum FTP web site at www.datumsystems.com.

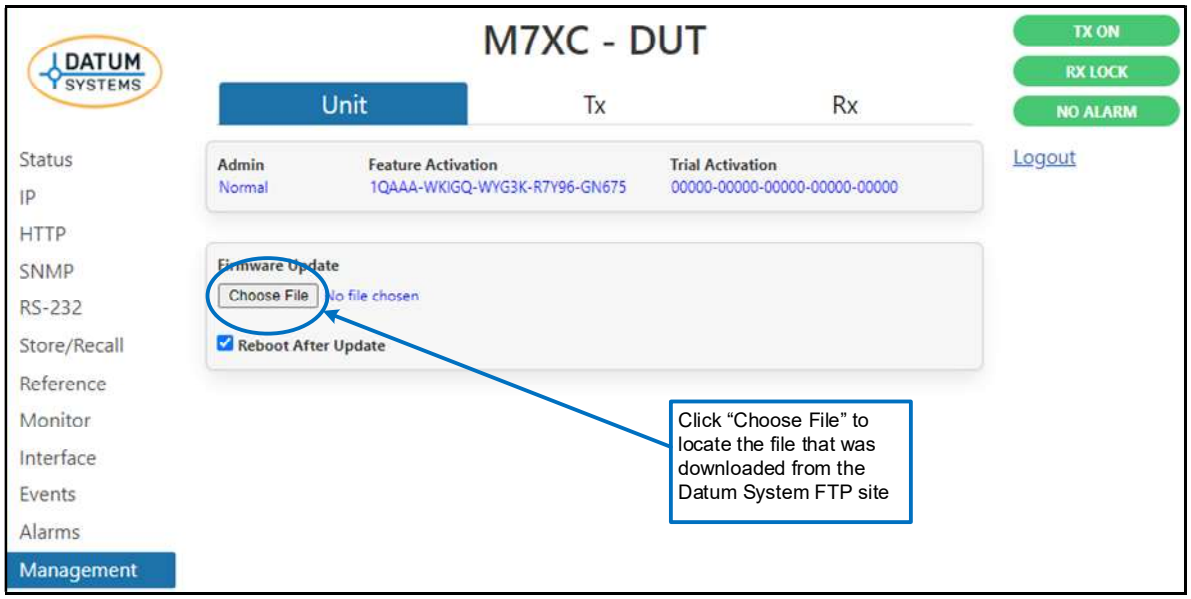
4.3.1 Software Update using the Web Browser

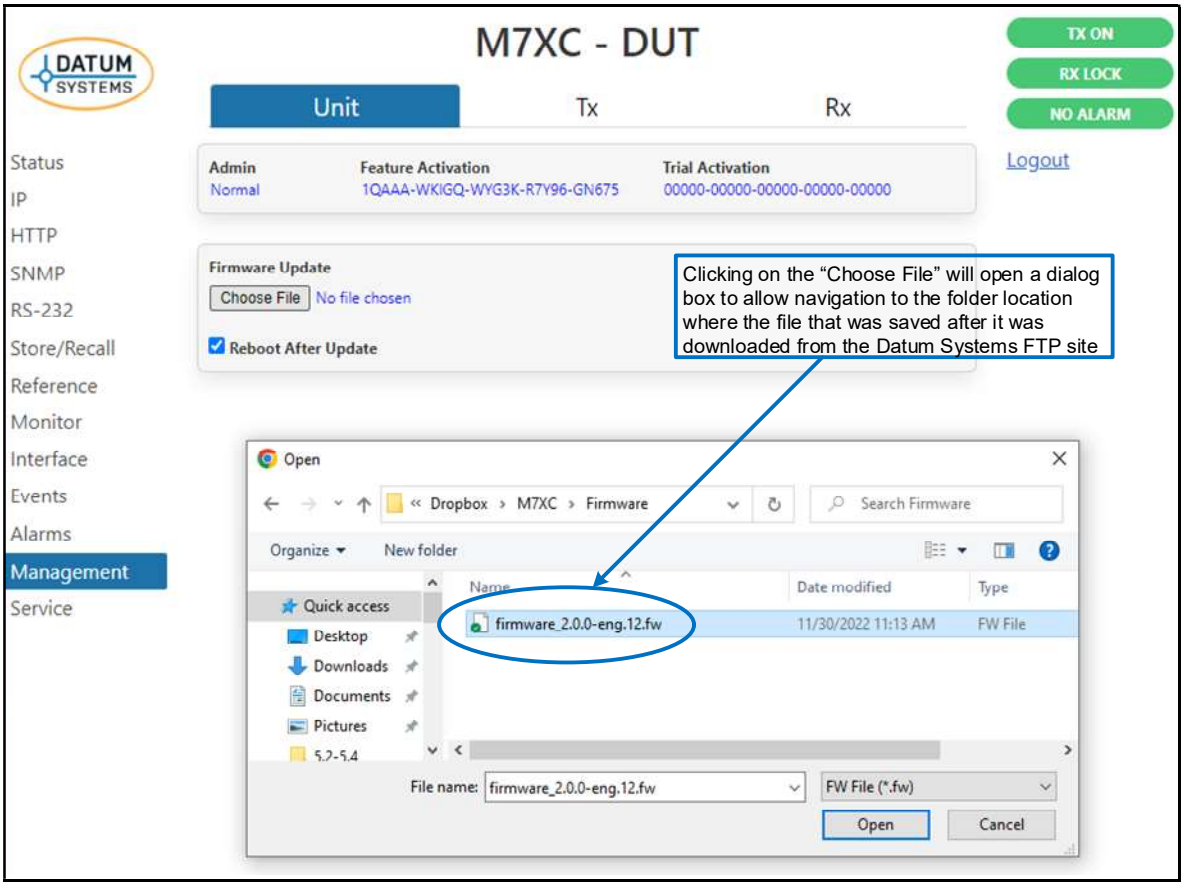
The following section will provide a step-by-step process on how to update the M7XC Firmware Version using the Web browser interface. Instructions on how to set up and communicate to the M7XC via the Web browser are found in Section 3.3.

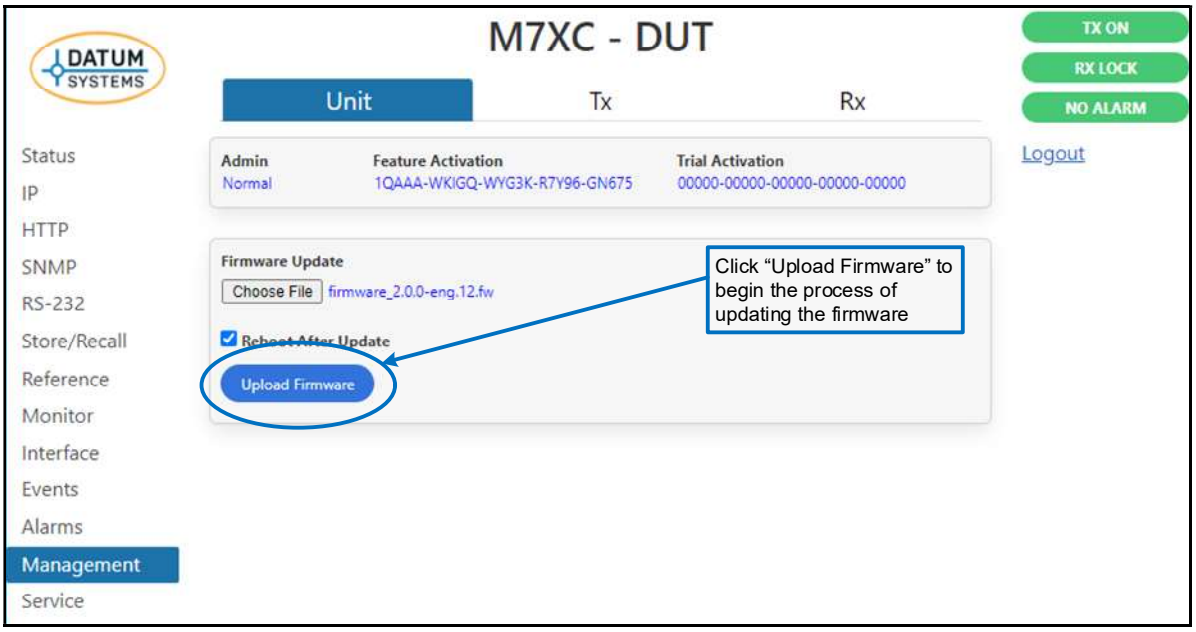
Before starting the update process, access the "Unit" tab, "Status" page and verify the installed Firmware Version.

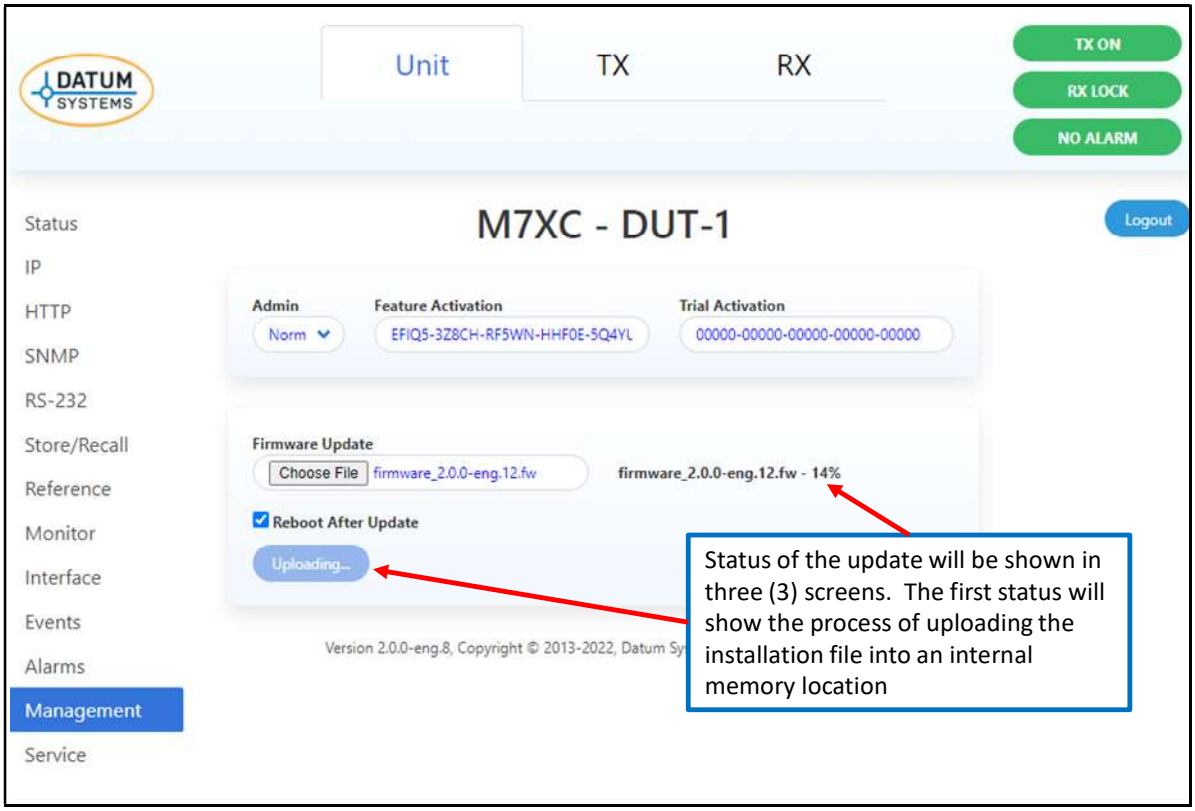

M7XC - DUT
TX ON
RX LOCK
NO ALARM
Logout
Unit
Tx
Rx
Status
IP
HTTP
SNMP
RS-232
Store/Recall
Reference
Summary Status
No Alarms Or Warnings
Reference Status
Internal, Ok
WAN Port Status
Connected, 1 Gb
IP Control Port Status
Connected, 1 Gb
Power Input Voltage
+24.1 V
Date Time UTC
2023-01-17 18:26:01
Model
M7XC
Serial Number
50809
Firmware Version
2.0.1-eng.5
Trial Activation Time
0 s
Build
Tx: BR20001-3 Rev B3, Rx: BR20002-1 Rev B2
Station ID
DUT

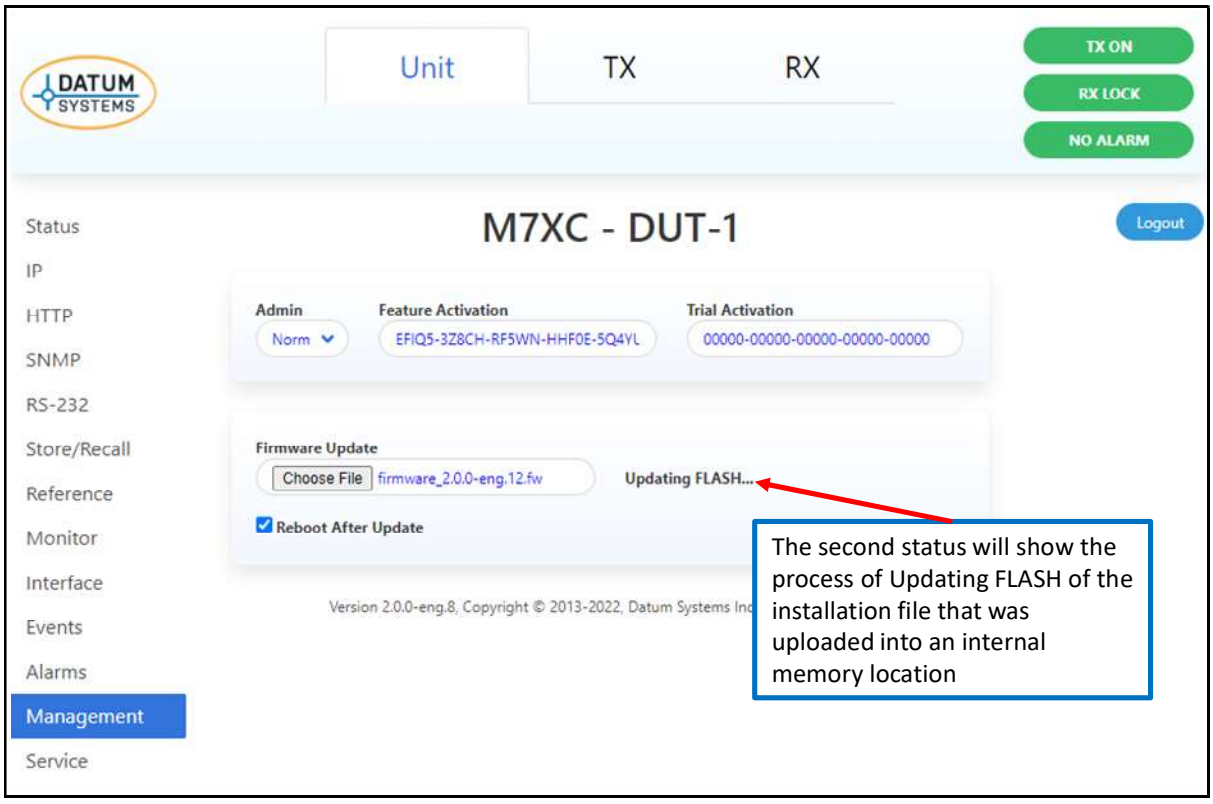

M7XC - DUT
TX ON
RX LOCK
NO ALARM
Logout
Unit
Tx
Rx
Status
IP
HTTP
SNMP
RS-232
Store/Recall
Reference
Monitor
Interface
Events
Alarms
Management
Service
Admin
Normal
Feature Activation
1QAAA-WKIGQ-WYG3K-R7Y96-GN675
Trial Activation
00000-00000-00000-00000-00000
Firmware Update
Choose File
No file chosen
Reboot After Update
Admin = “Normal”

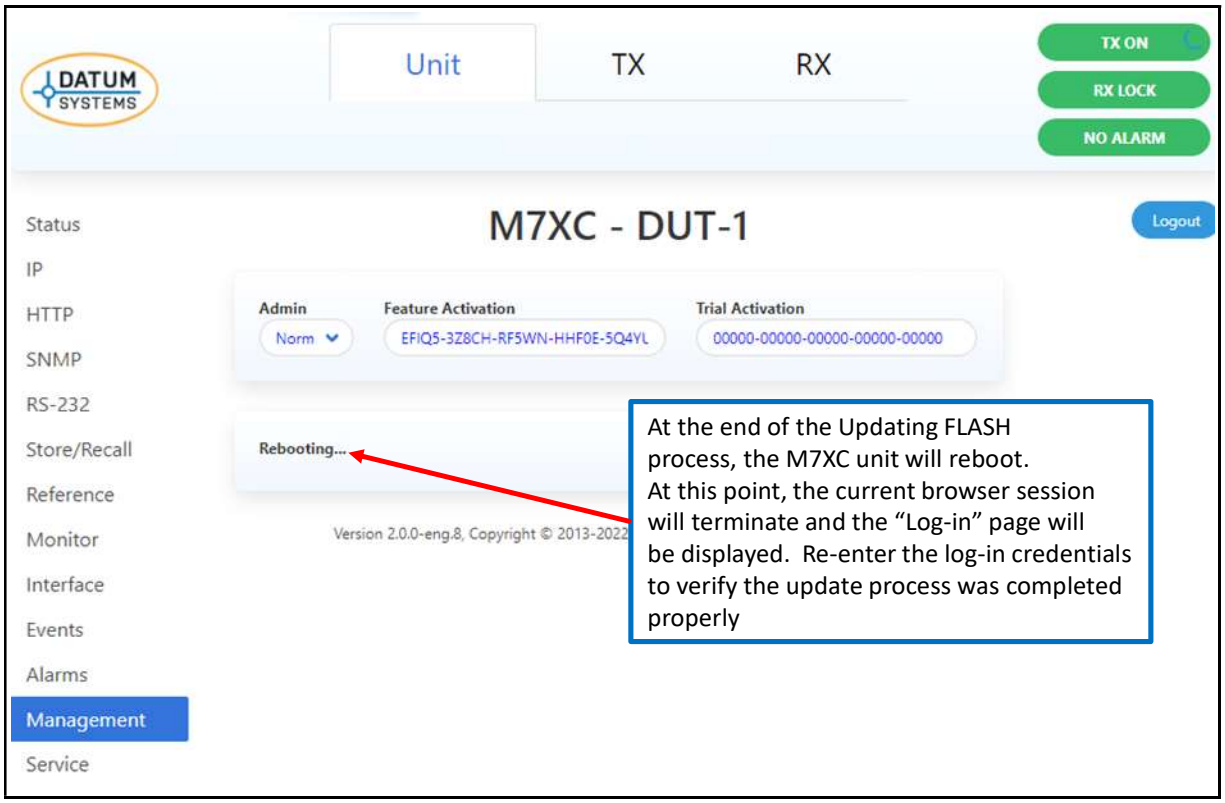

M7XC - DUT
TX ON
RX LOCK
NO ALARM
Logout
Unit
Tx
Rx
Status
IP
HTTP
SNMP
RS-232
Store/Recall
Reference
Monitor
Interface
Events
Alarms
Management
Admin
Normal
Feature Activation
1QAAA-WKIGQ-WYG3K-R7Y96-GN675
Trial Activation
00000-00000-00000-00000-00000
Firmware Update
Choose File
No file chosen
Reboot After Update
Click “Choose File” to locate the file that was downloaded from the Datum System FTP site

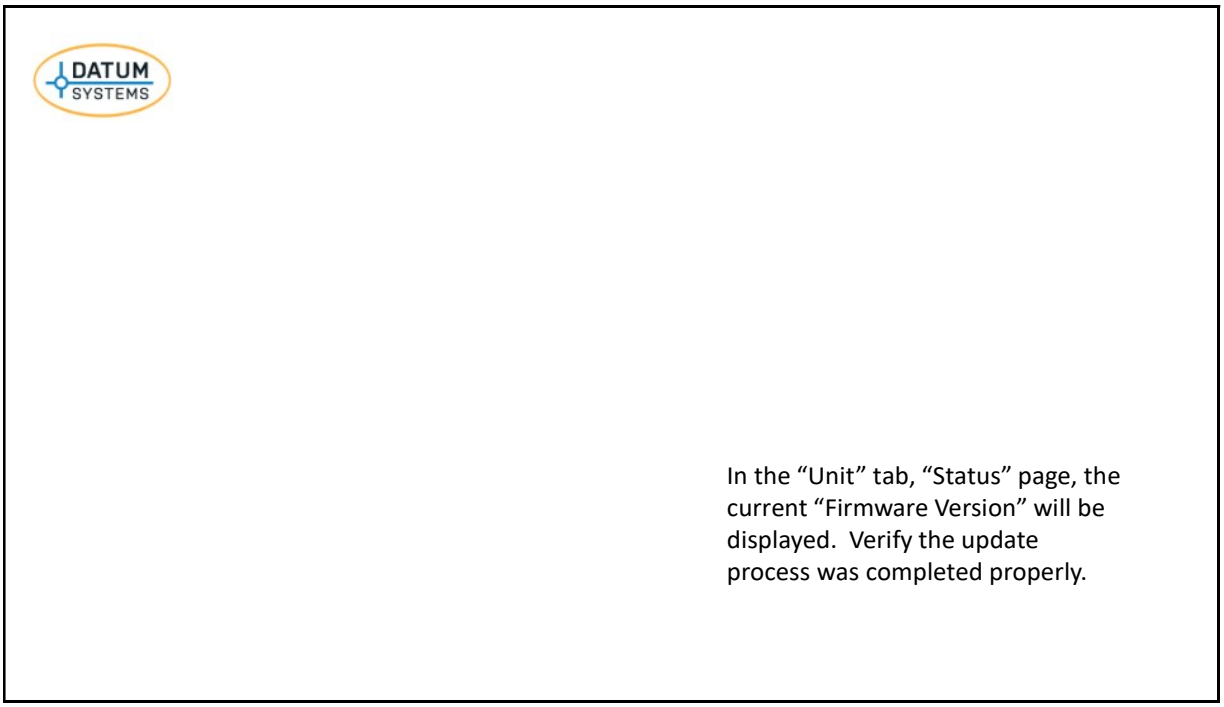

M7XC - DUT
TX ON
RX LOCK
NO ALARM
Logout
Unit
Tx
Rx
Status
IP
HTTP
SNMP
RS-232
Store/Recall
Reference
Monitor
Interface
Events
Alarms
Management
Service
Admin
Normal
Feature Activation
1QAAA-WKIGQ-WYG3K-R7Y96-GN675
Trial Activation
00000-00000-00000-00000-00000
Firmware Update
Choose File
No file chosen
Reboot After Update
Clicking on the “Choose File” will open a dialog box to allow navigation to the folder location where the file that was saved after it was downloaded from the Datum Systems FTP site
Open
Dropbox › M7XC › Firmware
Search Firmware
Organize
New folder
Quick access
Desktop
Downloads
Documents
Pictures
Name
Date modified
Type
firmware_2.0.0-eng.12.fw
11/30/2022 11:13 AM
FW File
File name:
firmware_2.0.0-eng.12.fw
FW File (*.fw)
Open
Cancel


M7XC - DUT
TX ON
RX LOCK
NO ALARM
Unit
Tx
Rx
Logout
Status
IP
HTTP
SNMP
RS-232
Store/Recall
Reference
Monitor
Interface
Events
Alarms
Management
Service
Admin
Normal
Feature Activation
1QAAA-WKIGQ-WYG3K-R7Y96-GN675
Trial Activation
00000-00000-00000-00000-00000
Firmware Update
Choose File
firmware_2.0.0-eng.12.fw
Reboot After Update
Upload Firmware
Click "Upload Firmware" to begin the process of updating the firmware


Unit
TX
RX
TX ON
RX LOCK
NO ALARM
M7XC - DUT-1
Logout
Status
IP
HTTP
SNMP
RS-232
Store/Recall
Reference
Monitor
Interface
Events
Alarms
Management
Service
Admin
Norm
Feature Activation
EFIQ5-3Z8CH-RF5WN-HHF0E-5Q4YL
Trial Activation
00000-00000-00000-00000-00000
Firmware Update
Choose File
firmware_2.0.0-eng.12.fw
firmware_2.0.0-eng.12.fw - 14%
Reboot After Update
Uploading...
Version 2.0.0-eng.8, Copyright © 2013-2022, Datum Sy
Status of the update will be shown in three (3) screens. The first status will show the process of uploading the installation file into an internal memory location


DATUM SYSTEMS
Unit
TX
RX
TX ON
RX LOCK
NO ALARM
Logout
M7XC - DUT-1
Status
IP
HTTP
SNMP
RS-232
Store/Recall
Reference
Monitor
Interface
Events
Alarms
Management
Service
Admin
Norm
Feature Activation
EFIQ5-3Z8CH-RF5WN-HHF0E-5Q4YL
Trial Activation
00000-00000-00000-00000-00000
Firmware Update
Choose File
firmware_2.0.0-eng.12.fw
Updating FLASH...
Reboot After Update
Version 2.0.0-eng.8, Copyright © 2013-2022, Datum Systems Inc
The second status will show the process of Updating FLASH of the installation file that was uploaded into an internal memory location


DATUM SYSTEMS
Unit
TX
RX
TX ON
RX LOCK
NO ALARM
Logout
M7XC - DUT-1
Status
IP
HTTP
SNMP
RS-232
Store/Recall
Reference
Monitor
Interface
Events
Alarms
Management
Service
Admin
Norm
Feature Activation
EFIQ5-3Z8CH-RF5WN-HHF0E-5Q4YL
Trial Activation
00000-00000-00000-00000-00000
Rebooting...
Version 2.0.0-eng.8, Copyright © 2013-2022
At the end of the Updating FLASH process, the M7XC unit will reboot.
At this point, the current browser session will terminate and the “Log-in” page will be displayed. Re-enter the log-in credentials to verify the update process was completed properly



4.4 Upgrading the Modem Features

Each of the modulator and demodulator cards in the M7XC series are available with a different set of features that enable a cost-effective approach for matching the modem capability to the system requirement. Upgrading from one set of features to another is a simple process that can be accomplished from any of the control interfaces.

The first step is to contact your local reseller or Datum Systems directly requesting a feature upgrade. When requesting an upgrade, the information required is:

- Modulator Serial Number
- Demodulator Serial Number
- Features desired to be upgraded

Upon confirmation of the upgrade purchase, a specific 20-digit code will be sent to enable the upgraded features. The code is unique to the serial number of the card to be updated and will not work in any other card.

The most common way to insert the feature code into the M7XC is via the web browser.

4.4.1 Using the web browser

To insert the code, go to the “Management” page in the Unit (Figure 4-2) tab and enter the 20-digit code directly in the “Feature Activation” box, then press the “Execute & Save” button. If correctly entered the modem will now display the new features in the various “Feature” (Figure 4-2 and 4-3) tab parameter box.

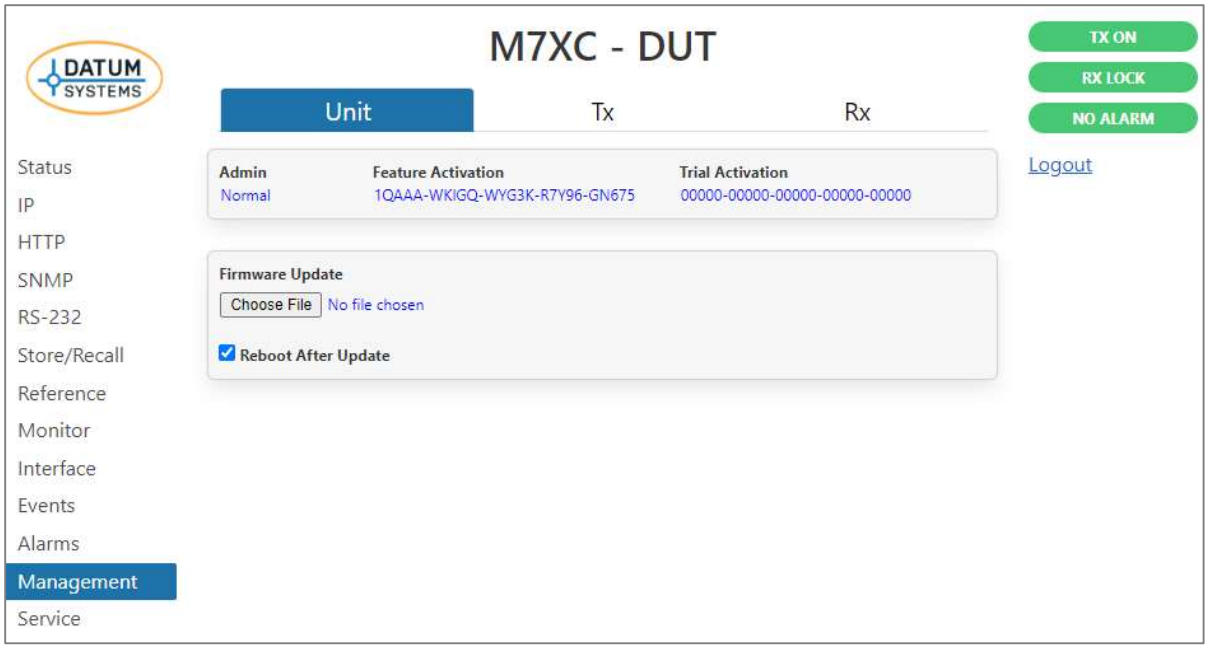


Figure 4-1 - Unit Feature Page

Feature sets can only be upgraded. There is no code to downgrade a feature set to a lower one.

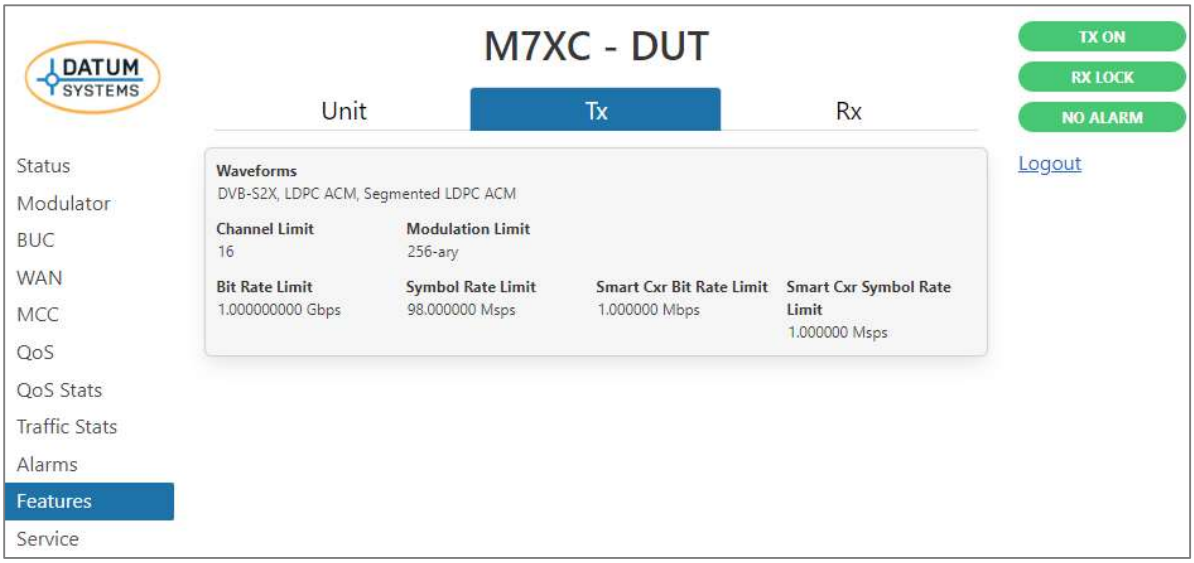


Figure 4-2 - TX Feature Page

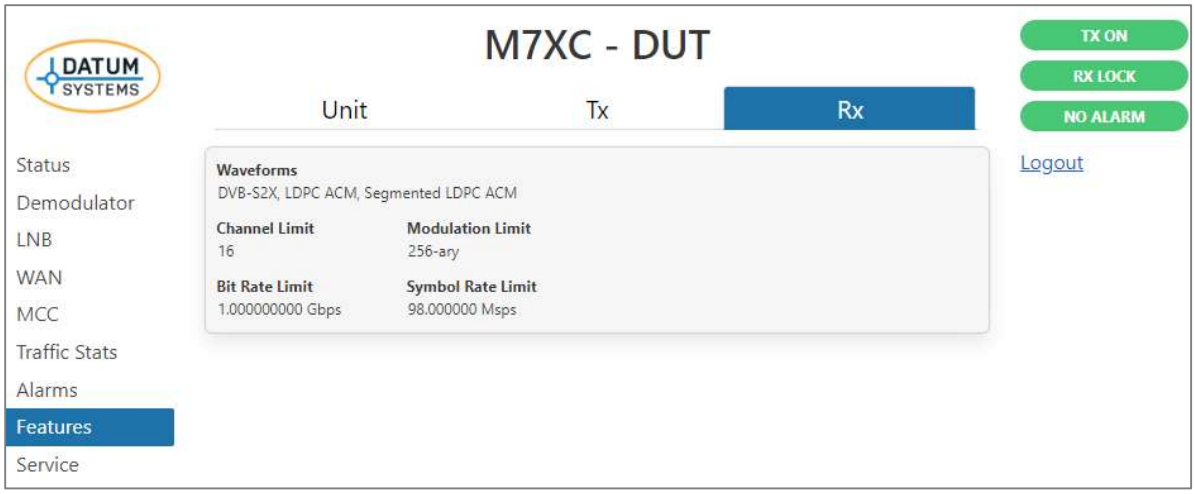


Figure 4-3 - RX Feature Page

4.5 What do the abbreviations in the manual mean?

A good example is the display and manual representation "Redundcy SW Rqst". Unfortunately, the display does not hold enough characters to display the full text of "Redundancy Switch Request". Following is a list of abbreviations used.

Abbreviation	Full Text
1:1, 1:N, M:N	One for One, One for N and M for N. All redundancy switch types.
ACR	Automatic Configuration Recovery
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
ALC	Automatic Level Control
Alm	Alarm
Alt	Alternate
AUPC	Automatic Uplink Power Control
AUFC	Automatic Uplink Frequency Control
BER, BERT	Bit Error Rate, Bit Error Rate Test
BUC	Block Up-Converter
Cal	Calibrate
Clk	Clock
Config	Configuration
Cntst	Contrast
CXR	Carrier
Dem	Demodulator
Dif	Differential
ESC	Engineering Service Channel
Erred	Errored
FEC	Forward Error Correction
Freq, Frq	Frequency
Frmt	Format
HSSI	High Speed Serial Interface (used with routers)
IDcOff, QDcOff	I and Q channel DC Offset
I/O	Input/Output
Intf	Interface
Keybrd	Keyboard
LCD	Liquid Crystal Display

LDPC & FLDPC	(Flexible) Low Density Parity Check FEC
LNB	Low Noise Block downconverter
LO	Local Oscillator
Loopbck	Loop-back
Lvl	Level
Max	Maximum
MCC	Modem Control Channel
Min	Minimum
Mod	Modulator
Mux	Multiplexer
Opt	Option
OverHd	Overhead
RCV, Rcv	Receive, into the Demodulator
Redundcy	Redundancy
Ref	Reference
Rqst	Request
RS, R-S	Reed-Solomon – Type of FEC
Sat	Satellite
SCPC	Single Channel Per Carrier
SER	Symbol Error Rate
SnIP	Satellite network Interface Processor, our name for an Ethernet Interface running Linux.
SW, Sw	Switch
Sync	Synchronous or Synchronization
SysClk	System Clock
Ter, Terr	Terrestrial – Line side of modem
TPC	Turbo Product Codes – Type of FEC
Tst	Test
USB	Universal Serial Bus
VSAT	Very Small Aperture Terminal
XMT, Xmt	Transmit, from the Modulator

Appendix

Appendix A Specification

Contact Datum Systems for a copy of the current M7XC Specification

Appendix B Remote Protocol

Contact Datum Systems for a copy of the M7XC Remote Control Protocol document.

Appendix C Cabling Specifications

Contact Datum Systems for details of the M7XC Cabling Specification requirements.

Appendix D Interface Options

Contact Datum Systems for information on the available M7XC Interface Options.

Appendix E Smart Carrier Cancelling

Contact Datum Systems for information on the M7XC Smart Carrier Cancelling Feature

Appendix F Modem SNMP

Contact Datum Systems for information on the M7XC Interface SNMP

Appendix G Modem DVB-S2X Operation

Contact Datum Systems for information on the M7XC DVB-S2X Operation

Appendix H Modem TX and RX Carrier Segmentation

Contact Datum Systems for information on the M7XC Carrier Segmentation

Appendix J Modem Redundancy Operation

Contact Datum Systems for information on the M7XC 1+1 Operation

M7XC

Compact Software Defined Modem

Configuration Options

- ✓ Simplex DVB-S2X
- ✓ Duplex DVB-S2X
- ✓ Dual DVB-S2X Demods
- ✓ ACM *FlexLDPC*
- ✓ 16 Channel TX LDPC
- ✓ 16 RX Channel LDPC
- ✓ 16 TX Segmented LDPC
- ✓ 16 RX Segmented LDPC
- ✓ TPC, Viterbi, OM-73
- ✓ TRANSEC (AES-256)
- ✓ Spread Spectrum (x32)
- ✓ Troposcatter
- ✓ Carrier Canceling
- ✓ Hub Canceling
- ✓ Modulator or Demodulator Only
- ✓ Modulator and Demodulator
- ✓ Hub or Remote

Full M7XC System HUB and REMOTE General Advantages

Common Hardware Platform
Major SWAP Reduction
Shipping and Logistics Savings
Common Sparing, Training and Support
Single Hardware Platform can Support multiple Network Missions
Highly Robust and Reliable Hardware Package

Contact

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