
AutoEQ™ Interface Operation Guide

D

D.0 Introduction

Appendix C outlines the operation and configuration of the AutoEQ™ PIIC Interface. The AutoEQ™ Interface is used in conjunction with the DM240XR.

D.1 Applicable Documents

The following documents can be used for reference in aligning and troubleshooting the AutoEQ system. Insure that the document revision is the same as the hardware revision of the assembly.

- AN208: DM240XR Firmware Upgrade Procedure

D.2 AutoEQ™ PIIC Interface Theory of Operation

AutoEQ™ PIIC Interface allows the ability to compensate for the overall system Group Delay and Amplitude Equalization over the satellite by pre-distorting the Uplink Carrier, eliminating the need for external Group Delay/Amplitude Equalizers. AutoEQ™ will automatically generate the proprietary profile for the DM240XR to pre-distort the modulator, resulting in Amplitude and Group Delay equalization over the Satellite Link.

AutoEQ™ supports SCPC equalization of Group Delay and Amplitude over the satellite system. When installed into the PIIC slot of the DM240XR (with Firmware Revision FO5377-J or higher), the AutoEQ™ Calibration menu will be displayed allowing for selection and monitoring of the AutoEQ™ functions. The AutoEQ™ will operate over the full transponder from a symbol rate of 10.1 Msps to 38 Msps.

When the AutoEQ™ Calibration mode is selected, the DM240XR will disable the existing programmed modulated outbound signal, and replace it with the AutoEQ™ calibration signal at the same Symbol Rate, Roll off, and Transmit frequency as programmed into the DM240XR. This signal is transmitted to the satellite, and received (Satellite Loop-Back) by the DM240XR AutoEQ™ input at the L-Band downlink frequency. The AutoEQ™ calibration mode will demodulate the received signal, and automatically calculate the required pre-distortion parameters for the Satellite Link.

This information is read by the DM240XR modulator where the new pre-distort values are programmed into the outbound carrier, resulting with the required pre-distortion of the TX output. Upon successful completion of the calibration cycles, the DM240XR will automatically return to the programmed outbound signal (such as DVB-S2) with the proper pre-distortion for the satellite loop per the selected symbol rate, roll off and transponder frequency. If any parameters are changed affecting Symbol Rate or Roll off, AutoEQ™ must be re-calibrated to the new parameters. At any time, AutoEQ™ can be enabled or disabled.

The DM240XR is capable of retaining 30 AutoEQ™ satellite loop pre-distortion values, which can be useful for systems requiring relocation to different transponders or Satellites. Once the applicable transponder is calibrated, the calibration information can be stored in memory for use now or in the future. All storage locations can be renamed by the user to correspond with the identification of the transponder, and recalled for operational use.

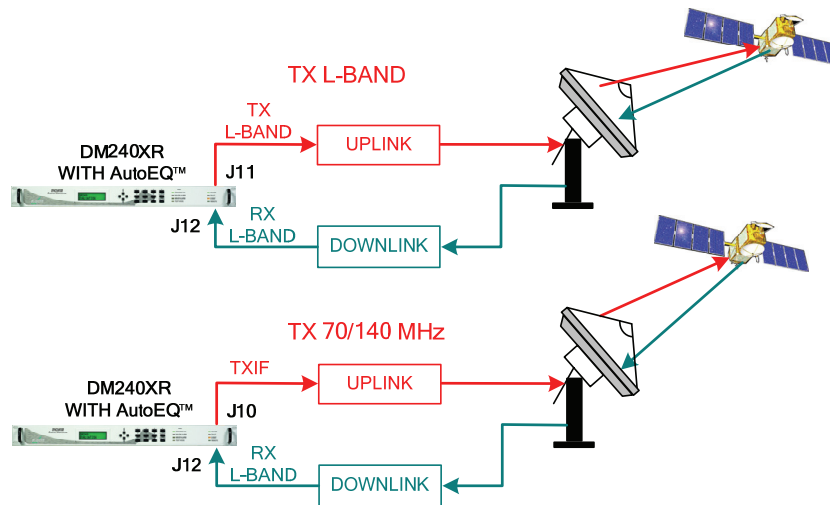


Figure 1 AutoEQ™ Satellite Loopback

D.3 AutoEQ™ Menu Options and Parameters

These Menu options are only available when the DM240XR is configured for AutoEQ™ operation. Refer to Figure 2 for the AutoEQ™ portion of the DM240XR Menu Tree. The DM240XR must have software Version FO5377-J or higher to operate the AutoEQ™ PIIC Interface Card. These Menu options are also available on the Ethernet Web browser (J6), the RS232 (J1) terminal port, and the Remote Port (J4) of the DM240XR. Refer to the DM240XR Manual for all Modulator related options and Parameters.

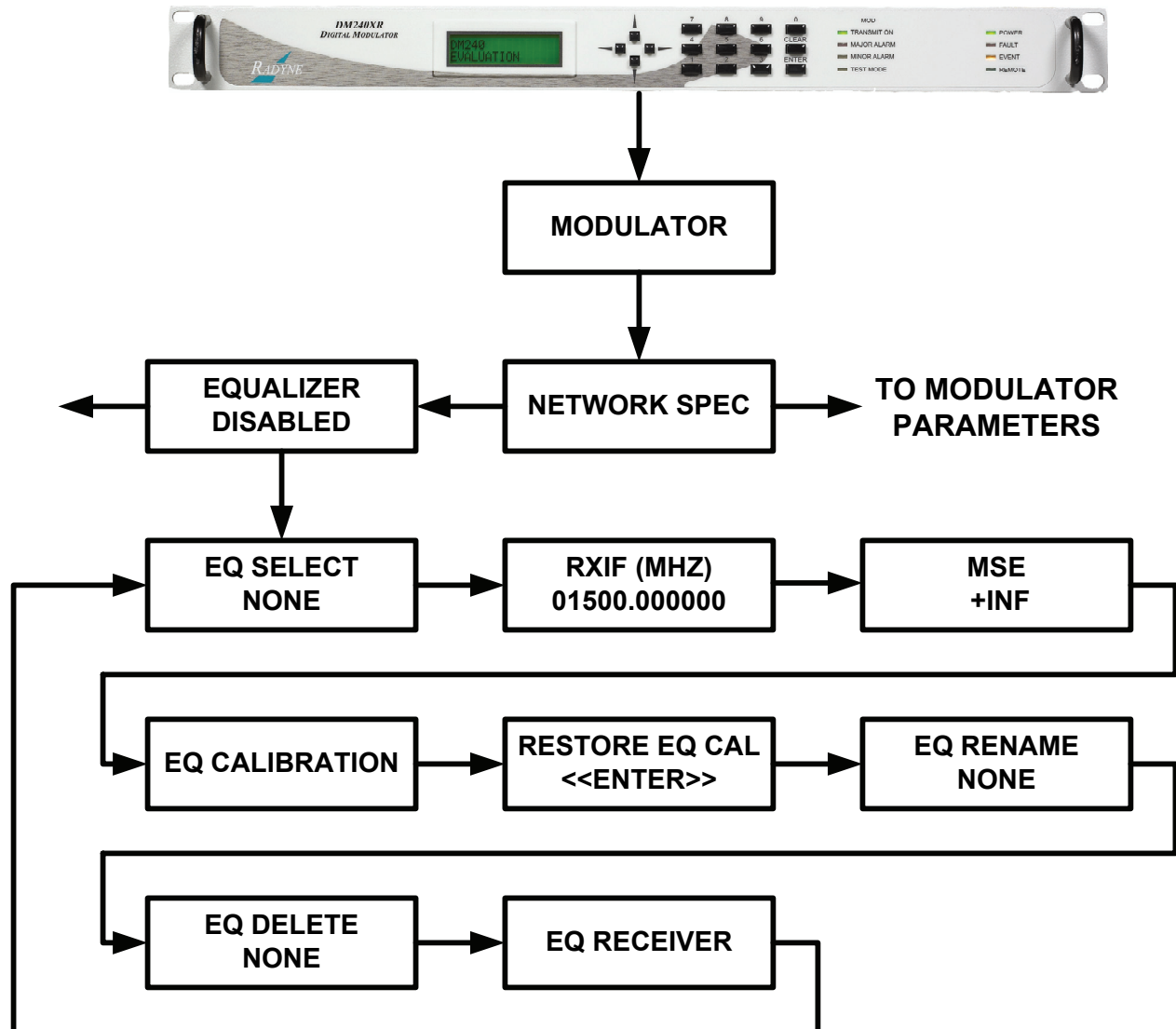


Figure 2 AutoEQ™ Menu Tree

EQ ENABLE:	{Enable, Disable} Allows the DM240XR Modulator to implement the AutoEQ™ coefficient values as specified by the EQ Select.
EQ SELECT:	{None, User Specified Name} Allows the DM240XR Modulator to select the stored AutoEQ™ coefficient file to be implemented. Up to 30 User Nameable storage locations are available.
RXIF:	{950 – 2050 MHz} Sets the receive input center frequency for the AutoEQ™ Interface Card. This programmed frequency must be within ± 25 kHz of the actual desired system downlink center frequency to insure proper acquisition.
MSE:	{Value} Displays the Mean Squared Error (MSE) value of the equalizer. A value of 1 E-5 or less indicates a successful calibration run with acceptable coefficients for operation over the satellite.
EQ CAL:	{Normal, Calibrating, Ref ACQ} Allows the DM240XR Modulator to select the AutoEQ™ interface mode of operation. Normal: When in this state, the AutoEQ™ is in monitoring mode, with no Calibration or Reference Acquisition functions being preformed. Calibrating: When in this state, the AutoEQ™ will program the DM240XR modulated output for the AutoEQ™ calibration signal. The calibration output bandwidth is set by the symbol rate currently programmed into the DM240XR Modulator. During calibration, the AutoEQ™ will compute the coefficient values required to successfully equalize the group delay and amplitude of the satellite link over the programmed symbol rate. During this process, the MSE can be monitored reflecting the calibration process. Upon successful completion of the calibration, the EQ CAL will revert to the “Normal” state, and the event log of the DM240XR will reflect “AutoEQ™ CAL SUCCESSFUL”.

(EQ CAL: Cont)

REF ACQ: Although default reference files are provided, the operator may wish to acquire the best possible reference from their modulator. A mechanism to accomplish this is allowed by REF ACQ, this overwrites the stored default and replaces it with a new reference. Prior to entering this state, the L-Band output of the DM240XR (J11) must be connected to the AutoEQ™ RXRF Input (J12) as shown in Figure . The DM240XR Output power should be set to -20 dBm, and a 20 dB in line attenuator should be used. The Modulator output frequency should be set to set to the corresponding AutoEQ™ RXRF Input Frequency. When properly connected and in this state, the AutoEQ™ will program the DM240XR modulated output for the AutoEQ™ calibration signal. The calibration output bandwidth is set by the symbol rate currently programmed into the DM240XR Modulator. During reference calibration, the AutoEQ™ will obtain receive lock and establish the baseline coefficients for internal reference. References are captured for each modulator roll-off and oversample rate. During this process, the MSE can be monitored reflecting the Reference Acquisition process. Upon successful completion of the Reference Acquisition, the REF ACQ will revert to the “Normal” state, and the event log of the DM240XR will reflect “REF ACQ SUCCESSFUL”.

RESTORE EQ CAL:**{Filename}**

Allows the selected Calibration coefficient file to be Restored.

EQ RENAME:**{Filename}**

Allows the Calibration coefficient file to be renamed using Alpha-numeric characters.

EQ DELETE:**{Filename}**

Allows the selected Calibration coefficient file to be deleted.

EQ RECEIVER:**{Local, Remote}**

Allows selection of Local or Remote Equalization.

D.4 AutoEQ™ Back Channel Menu Options and Parameters

These Menu options are only available when the DM240XR is configured for AutoEQ™ operation. Refer to Figure 3 for the back channel portion of the DM240XR Menu Tree. The DM240XR must have software Version FO5377-J or higher to operate the AutoEQ™ PIIC Interface Card. These Menu options are also available on the Ethernet Web browser (J6), the RS232 (J1) terminal port, and the Remote Port (J4) of the DM240XR. Refer to the DM240XR Manual for all Modulator related options and Parameters.

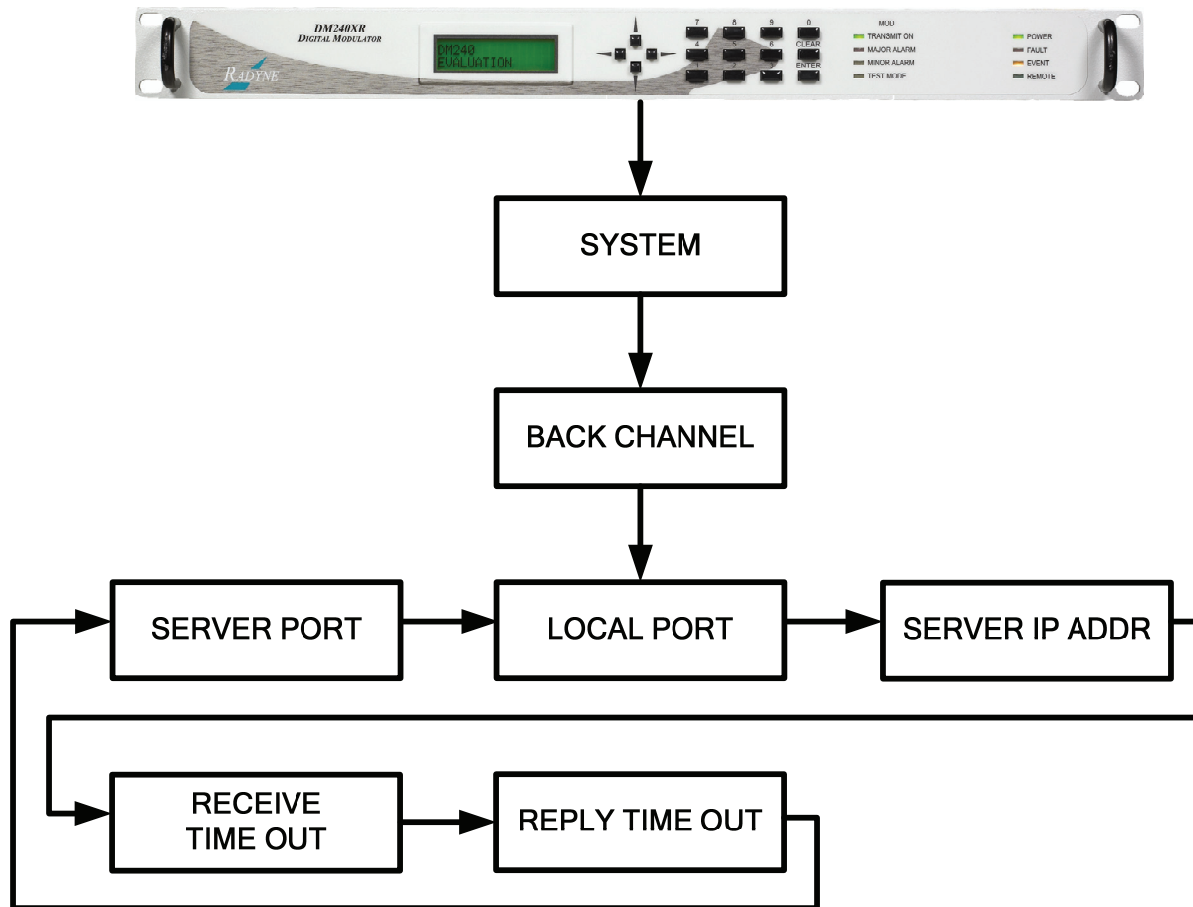


Figure 3. AutoEQ™ Back Channel Menu Tree

D.5 AutoEQ Backchannel Setup

Introduction

To support remote equalization with the AutoEQ system, the equalization data is transported over TCP/IP using a backchannel protocol. Before setting up the backchannel, perform the TCP/IP Ethernet setup as outlined in the TCP/IP Ethernet Setup section of the user manual. This document is to be used only as a guideline for setting up the backchannel menus. Contact the Network administrator for proper guidance and support to ensure setup is successful.

Backchannel Configuration

Using the Front Panel display and arrow keys, scroll thru the System menu until the Backchannel sub menu is displayed. Both the local unit (the Modulator) and the remote unit (with the AutoEQ card installed) require the proper configuration with the correct network settings.

Refer to Figure 3.

Note: *The router/gateway/firewall system must be configured to allow these ports to pass on each communication end. Contact your Network Administrator for allowable port numbers and to open up the ports on the firewall if necessary.*

Enter into the Backchannel menu and the following sub menus will appear, however the order may vary.

LOCAL PORT: {XXXX}
The local port number must be set to the same value at both the local and remote sites.

SERVER PORT: {XXXX}
The server port number must be set to the same value at both the local and remote sites.

Note: *The local port and server port values must be different from the local and remote sites.*

SERVER IP ADDR: {XXX.XXX.XXX.XXX} Hexidecimal Address
{ddd.ddd.ddd.ddd} Decimal Address
On the local unit, this should have the value of the remote unit's IP address.

Note: *If the remote IP address is not publicly accessible then its translated NAT (Network Address Translation) needs to be applied.*

RECEIVE TIMEOUT: {X.X MINUTES}
This value is factory set, and should only be adjusted as directed by your Network administrator or Radyne Customer Service.

REPLY TIMEOUT: {XX secs}
This value is factory set, and should only be adjusted as directed by your Network administrator or Radyne Customer Service.

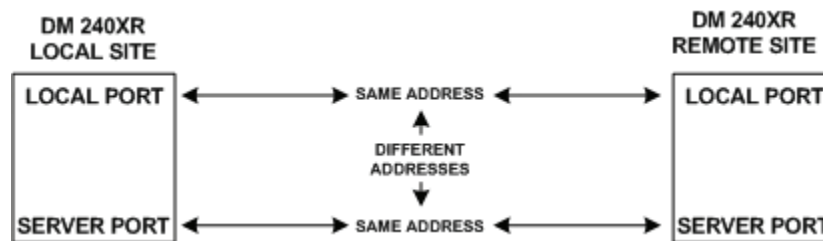


Figure 4. AutoEQ™ Backchannel Setup

Ethernet Test**Verify Local Router:**

On the local unit, using the Front Panel display and arrow keys, scroll thru the Monitor menu and clear the Event Log.

Now scroll thru the Test menu and Ping Test the TCP/IP ROUTER. If the event LED on the front panel does not light, communications between the modem and its router was successful.

Verify Remote Router:

Perform the same test on the remote unit as detailed under Verify Local Router.

Verify Local to Remote Connection:

On the local unit, using the Front Panel display and arrow keys, scroll thru the Monitor menu and clear the Event Log.

Now scroll thru the Test menu and Ping Test the BK CHAN SERVER. If the event LED on the front panel does not light, communications between the local modem and the remote modem was successful.

D.6 AutoEQ™ Operation Procedure

The following sequence must be followed in order to perform the initial AutoEQ™ Calibration. The sequence is identified into three (3) individual sections: 1) Reference Acquisition Calibration (REF ACQ) - optional, 2) Equalizer Calibration (CALIBRATING), and 3) Equalizer Modes (NORMAL). These three menu selections are selectable under EQ CAL.



NOTE

All DM240XR Faults and Alarms must be cleared prior to any AutoEQ™ Calibration process. If Data is not present on the DM240XR Data interface causing a data Alarm, Advanced ASI may be selected for the AutoEQ™ Calibration (Advanced ASI inserts Null Packets into the Data Stream)

D.7 Reference Acquisition Calibration (Optional Step)

This Section will establish the calibration reference for the AutoEQ™ Interface Card. This optional step may be performed prior to Equalizer Calibration. This step is optional as default reference(s) are already loaded into the system. This operation will replace the default reference(s) with the actual references measured during the calibration cycle. The modulator must be programmed for an L-Band frequency and the AutoEQ™ RXIF Frequency programmed to match.

1. Install the AutoEQ™ PIIC Interface into one of the available PIIC Slots on the DM240XR.
2. Verify that the DM240XR revision is FO5377-K or greater.
3. Insure that there is a Flash Card installed in the Flash Card slot on the DM240XR.
4. Using the Front Panel menu, set the DM240XR Modulator Data Rate, Modulation type, Roll off, and remaining Modulator parameters to the required system settings.
5. Using the Front Panel menu, scroll to “RXIF” located under the EQUALIZER menu and set the AutoEQ “RXIF”.



NOTE

For best results it is suggested that the RXIF frequency used to acquire the reference be the actual frequency used to perform the equalization calibration

6. Using the Front Panel menu, set the DM240XR Transmit Frequency (L-Band) to match the programmed AutoEQ RXIF Frequency.
7. Using the Front Panel menu, set the DM240XR TX Output Power to -10 dBm.
8. Connect the DM240XR L-BAND Output (J11) through a 20 dB attenuator then to the AutoEQ Interface RXRF Input (J12) using a suitable L-Band Cable.

AutoEQ™ REFERENCE ACQUISITION

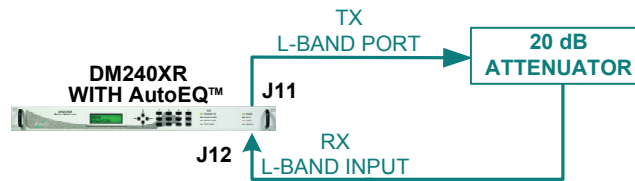


Figure 5. AutoEQ™ Ref Acq Set-up



NOTE

For results place the attenuator pad as close to the AutoEQ port (J12) as possible

9. Clear the events of the modulator by scrolling to <MONITOR> then down and over to <PRESS CLEAR TO ERASE EVENTS> and press clear. Verify that the Event LED is now off.
10. Using the Front Panel menu, scroll to “EQ CALIBRATION” and set to “REF ACQ”
 - a. After a successful calibration the event log will display “REF ACQ SUCCESSFUL” upon completion of this step. When the REF ACQ is complete, the “EQ CALIBRATION” will revert to “NORMAL”.
11. Remove the interconnect cable installed in Step 8 above.
12. Verify through the event log that the system successfully calibrated the reference.

D.8 Equalizer Calibration

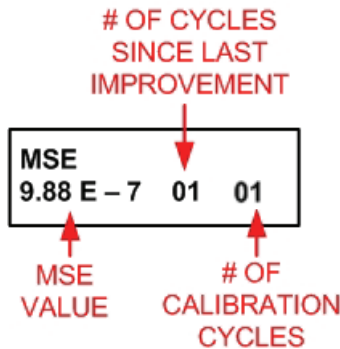


NOTE

For best AutoEQ equalization calibration it is recommended that the amplifier be run in its linear range and not saturated

The AutoEQ™ RXRF Acquisition range is ± 25 kHz from the programmed frequency and is not programmable. To insure proper operation, the actual center frequency of the carrier should be accurately measured with this measured value programmed into the AutoEQ™. This can be accomplished by generation a CW (Carrier Wave) frequency with the modulator, and measuring the downlink L-Band frequency with an accurate frequency counter or spectrum analyzer.

1. Reprogram the DM240XR Modulator output frequency to the proper operating frequency of the Uplink system (if it was reprogrammed for Section 4.1 above) and the output power to the system operating level. Connect the DM240XR Modulator output to the Uplink system. Enable the modulator and adjust all uplink parameters as required for proper uplink operation.
2. Measure the center frequency of the down converted modulated signal. Using the front panel Menu, reprogram the AutoEQ™ to the center frequency of the down converted signal. The AutoEQ™ programmed frequency must be within ± 25 kHz of the measured frequency in order to assure proper acquisition of the downlink signal. Connect the AutoEQ™ Input (J12) to the earth Station L-Band Downlink System. The desired downlink carrier should be typically between the range of -50 to -30 dBm.
3. Clear the events of the modulator by scrolling to <MONITOR> then down and over to <PRESS CLEAR TO ERASE EVENTS> and press clear. Verify that the Event LED is now off.
4. Using the Front Panel menu, scroll to “EQ CAL” and set it to “CALIBRATING”. This will start the AutoEQ™ Calibration for the Satellite Link.



- a. After each data acquisition and processing cycle the MSE display will be updated. A normal calibration cycle will take 60 to 90 seconds, and system typically performs two or three of these cycles.
- b. During this calibration, the MSE can be monitored showing the progress of the cycle. A value of 1 E-5 or less will reflect a success full completion of this step. Additionally, event light will come on, and the event log will display “EQ CAL SUCCESSFUL” upon completion of this step. When the EQ CAL is complete, the “EQ CAL” will revert to “NORMAL” and the AutoEQ file will be named “UNTITLED”.



The AutoEQ calibration must be saved or powering down of the system will loose the calibration

5. To change the name of the “UNTITLED” file, using the Front Panel menu, scroll to EQ RENAME, Press ENTER, use the Up/DN Arrows on the Keyboard to change the name, and press ENTER to save the new name for the file.
6. Using the Front Panel menu, scroll to “SAVE EQ CAL”, and press ENTER to save the file.

D.9 Equalizer Modes

The AutoEQ feature must be enabled on the DM240XR, and section 4.2 Equalizer Calibration must be performed prior to this section.

Disable Mode

To disable a programmed Equalizer Setting, use the Front Panel and scroll to “EQUALIZER”, press the Enter key, change the selection to “DISABLE”, and press the Enter key. This will disable the Equalizer, and allow for normal operation of the DM240XR.

Enable Mode

To enable the equalizer, use the front panel and scroll to “EQ SELECT” and press the Enter key. Using the Up/Dn keys, scroll to the desired saved equalizer file, and press the Enter key to select the file. Scroll back to Equalizer, press the Enter key, and using the Up/Dn keys, scroll to “ENABLE” and press the Enter key. This will enter the selected equalizer file parameters into the DM240XR Modulator and initiate AutoEQ™ equalization.

D.10 AutoEQ™ Remote Operation

To operate the AutoEQ™ system in remote, perform the following setup steps.

1. The TCP/IP Ethernet Setup described in the operator manual
2. The Backchannel Setup as described in Section 4.0.
3. Select REMOTE under the EQ RECEIVER Submenu
4. Perform the Operations as described in Section 5.0 for equalization.

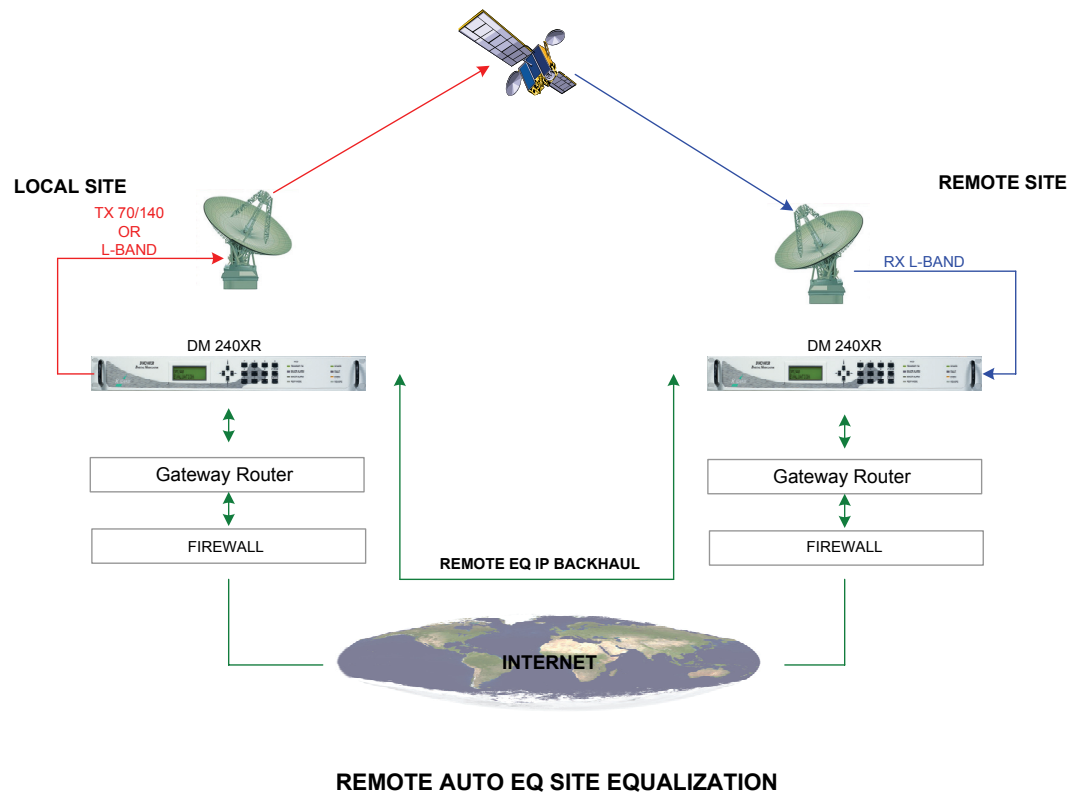


Figure 6. Remote AutoEQ™ Site Equalization

D.11 Additional Features

D.11.1 AutoEQ™ Status Indicator

The LED on the back of the AutoEQ™ interface card can provide additional status for the operation of the AutoEQ™ system.

Short Blink Green	Heartbeat, board ready for operation.
Solid Green	AutoEQ™ test pattern lock.
Solid Yellow	AutoEQ™ data being accessed.
Blink Red	AutoEQ™ test pattern unlocked. Signal error.

D.11.2 LNB Power Connector

On the back of the AutoEQ™ interface card is the connector J13 that can be used to insert LNB power to the J12 SMA connector to feed DC to the LNB.

Mating Connector: PP3-002A 5.5mm x 2.1mm x 9.5mm In-Line DC Power Plug.
(www.cui.com)