RMOD-SPCP Modem Application Notes

RMOD-SCPC-5-20Mbps-70/140MHz-p3

Index

Configuration Detail

A Standard modem should look like this with blank panel.

A dual internet option modem should look like this (2 Ports)

A Quad E1 will have 4 RJ45 ports here

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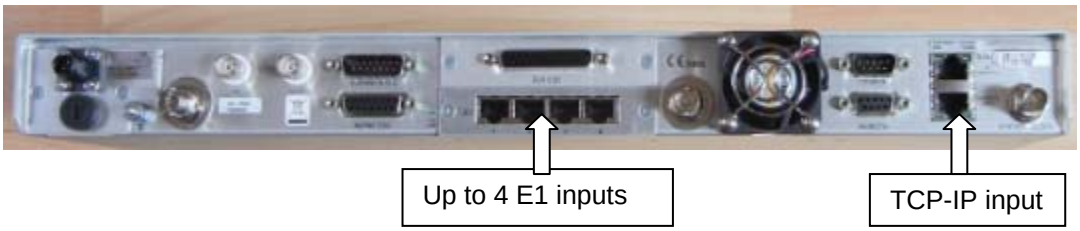
Multi-E1/IP Option

The Multi-E1/IP option is a very useful way to combine up to 4x E1 (balanced/G.703) inputs or 3XE1 and an IP input, simultaneously, for transmission on one satellite channel.



The maximum data rate when using the MUX option is 2Mbps, at any port.

If IP is used, an IP accelerator is recommended,
either as an option within the modem or a third party external one.
The data rate is limited, otherwise, due to the satellite propagation delay.

Without any IP accelerator you may not see data rates above 200Kbps on the IP channel.

Note:
Fitting or removing any option cards can only be done by an authorized RADITEK service center, or by a fully trained RADITEK engineer. It is not a customer serviceable option.

Software activation is also needed to upgrade any modem to the new option

Summary of Features:

- All E1 MUX options include Drop and Insert and full E1 setup.
- Supports Extended Drop and Insert with 1-31 timeslots
- Requires IBS/SMS option in the host modem.
- Modem can easily be 1+1 redundancy protected

Option list: (4x E1 (balanced/G.703) inputs or 3XE1 and an IP input)

3E1 + IP: for 3 x E1 and IP option

3E1 +IP +A: for 3 x E1 and IP with accelerator

4E1: for 4 x E1 and no IP support

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Interference analysis

In-band interference can seriously degrade the demodulated BER of a receiver and hence also degrade the link quality of service.

Such interference can arise due to:

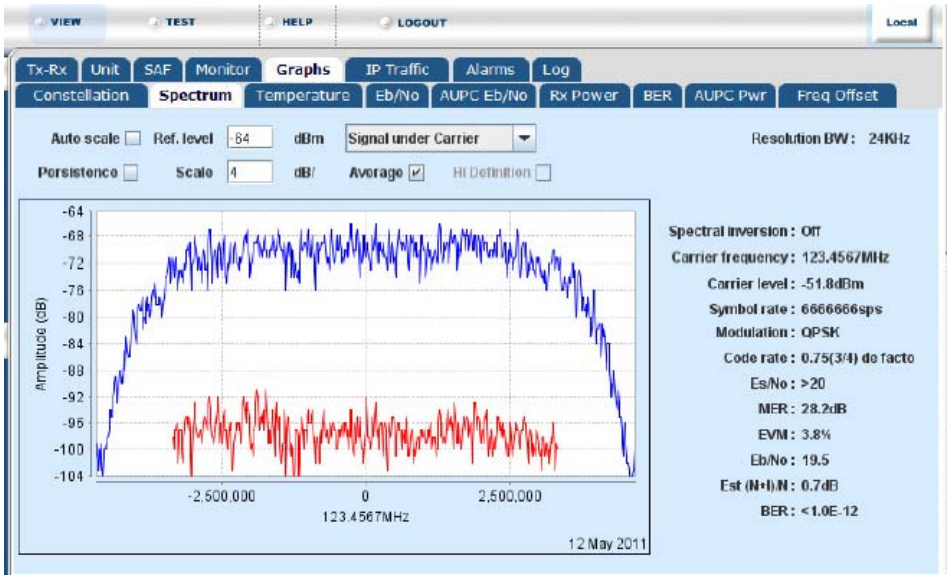
- A user accidentally interfering with another due to configuring equipment wrongly or due to a frequency planning problem.
- Malicious interference by another party (jamming).
- Self-generated interference due to the presence of a non-linearity in the communications path.
- Insufficient cross-polarization rejection due to poor antenna or OMT alignment.

Sometimes the interference can be obvious when viewed on a spectrum analyzer.
This is especially the case if the interference is narrowband or tonal.
However, if the interference is broader band and lying underneath the wanted carrier, then it may not be perceptible on a normal spectrum analyzer.

As a manufacturer of satellite communication equipment, RADITEK takes the problem of unwanted interference seriously and has developed patent-pending technology to detect the presence of in-band interference, using information already available within the receive signal path of the satellite modem. This allows a wide range of different types of interference to be detected including (but not restricted to) Wi-MAX, radar, tonal interferers (such as CW) and other modulated satellite carriers.

Implementation

Using advanced digital signal processing techniques, it is possible to analyze carriers to detect the presence of in-band interference. This builds upon our existing ability to capture baseband received signals from which spectrum and constellation information can be displayed to the user via the modem web-user interface.



It is possible to further process the captured data to detect the presence of in-band interference. This is achieved by using an algorithm that extracts the spectrum of the noise surrounding the baseband constellation symbols. The algorithm runs on the host processor within the modem. The host processor is also responsible for serving the spectrum data to the client PC responsible for monitoring and controlling the modem via the web interface.

The feature can be enabled by selecting the 'Signal under Carrier' drop-down menu on the 'View\Graphs\Spectrum' tab of the web user interface as shown in Figure 1 below.

Figure 1 - Signal in the Absence of AWGN and Interference

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Figure 1 - Signal in the Absence of AWGN and Interference
Note that two spectra are displayed:
• The blue trace represents the spectrum of the total signal being received.
• The red trace represents the spectrum of the residual signal after the wanted signal is suppressed.
In other words, the red trace represents the signal lying underneath the wanted carrier.
Both waveforms share the same Y-axis, X-axis and resolution bandwidth.
In the above example, the Y-axis has been scaled by the user.
To edit the Y-axis scaling, uncheck 'Auto-Scale' and edit the 'Ref. Level' and 'Scale' fields.

In the above example, a 10Mb/s, QPSK, TPC FEC rate 3/4 signal on 123.4567MHz is being received in the absence of AWGN (Additive White Gaussian Noise) or interference. The red trace lies approximately 28dB below the blue trace. The noise is a combination of the receiver system noise and the wanted signal suppression performance of the signal-under-carrier algorithm. The algorithm estimates the amount of in-band interference present in the received signal. It does this by first making an estimate of the received signal-to-noise ratio. The estimate includes the presence of any interference that may be present. The measurement is made by integrating the noise floor of the residual signal (red trace) and that of the received signal (blue trace) to obtain (C+N)/N in dB.

Additionally, an estimate of the available Es/No (Energy per symbol over noise power density) is performed; representing the SNR (Signal to Noise ratio) available if any interference is removed. The measurement is made by determining the noise floor of the red trace excluding interference. The (C+N)/N is then recalculated and converted to Es/No.
The difference between the two Es/No estimates detailed above is then made and displayed in the 'Est. (N+I)/N' field. This represents the estimate of the Noise plus Interference to Noise ratio in dB. It is a figure of merit for the degradation caused by the presence of interference. The estimated (N+I)/N is also displayed on the right hand side
of the pane, as shown in Figure 1.

The (N+I)/N can be compared by the modem to a user defined threshold (default is 1.5dB) above which a warning alarm will be raised and logged. To enable the interference detection alarm, navigate to the 'Edit\Unit\Advanced\Alarms' tab and enable the 'Monitor Over-threshold Interferer' check box as shown below in Figure 2. The (N+I)/N threshold, above which a warning alarm will be raised, can be defined in the user edit field immediately below the check box.

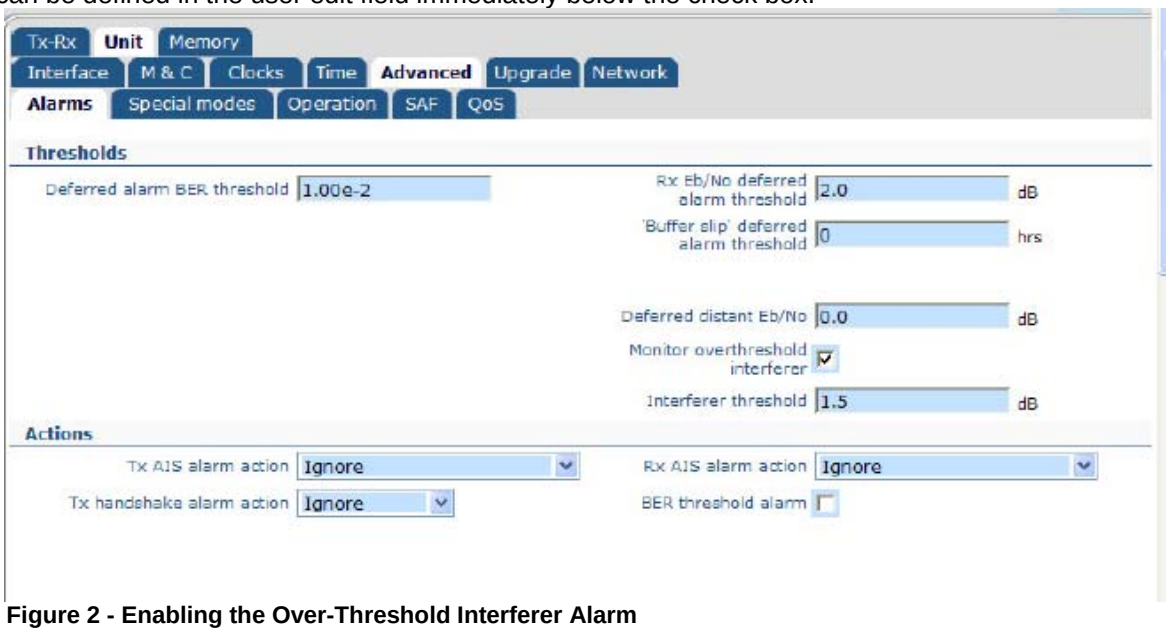

Figure 2 - Enabling the Over-Threshold Interferer Alarm

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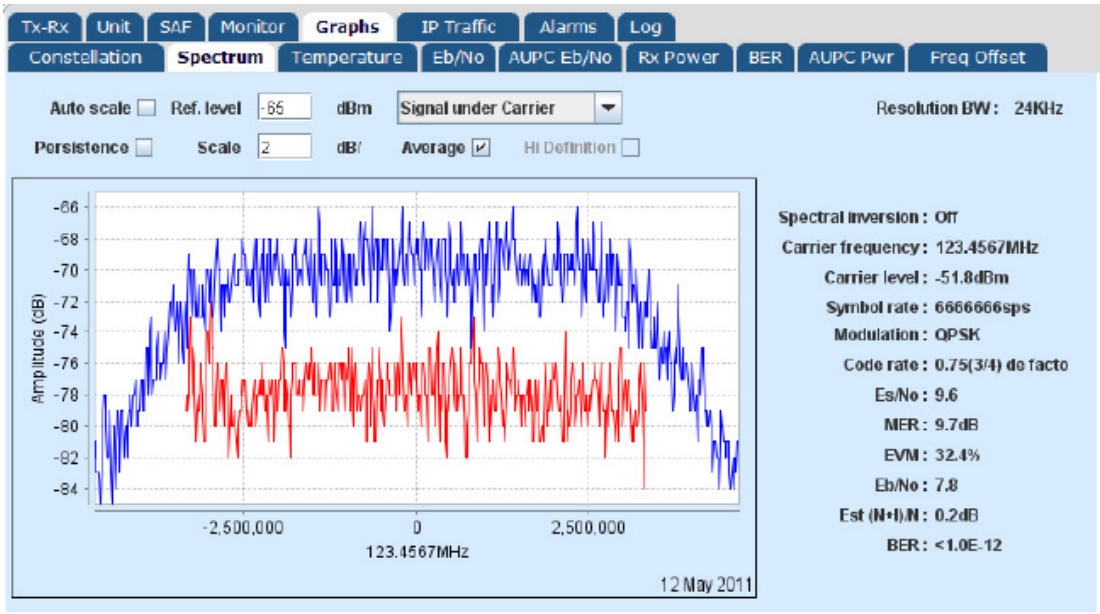

Figure 3 Traces

Of course, the above Es/No of 28dB is not operationally representative. Figure 3 above show how the traces look in an operationally representative Es/No of approximately 10dB.
The red trace is approximately 9dB below that of the blue trace and the (N+I)/N is registering a low value of 0.2dB.
An interferer is now introduced. This is a 1024kb/s, QPSK, Convolutional FEC, rate ½ (1.024Msym/s) signal sharing the same carrier frequency of 123.4567MHz. In this example, a power difference of -11.3dBc between the interfering signal and the wanted modulated carrier signal. The resulting plot captured from the modem is shown below in Fig 4.

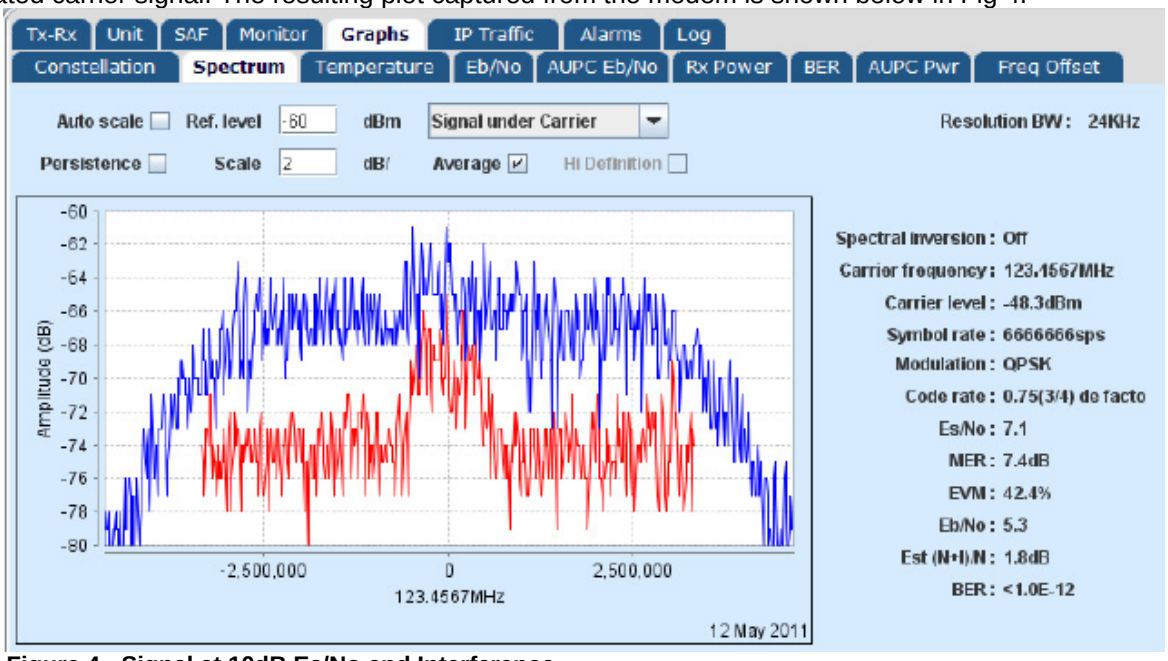

Figure 4 - Signal at 10dB Es/No and Interference

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Looking at the blue trace, representing the spectrum of the total received signal, it is not immediately obvious there is an interferer present. However the red trace shows the presence of the interferer under the carrier. There is also an increase in value of the (N+I)/N ratio. In fact, in this case, the (N+I)/N ratio exceeds the 1.8dB alarm threshold set previously in Figure 2. If the Rx alarms are quizzed, as detailed below, we can see that a warning has been raised flagging the presence of an in-band interferer.

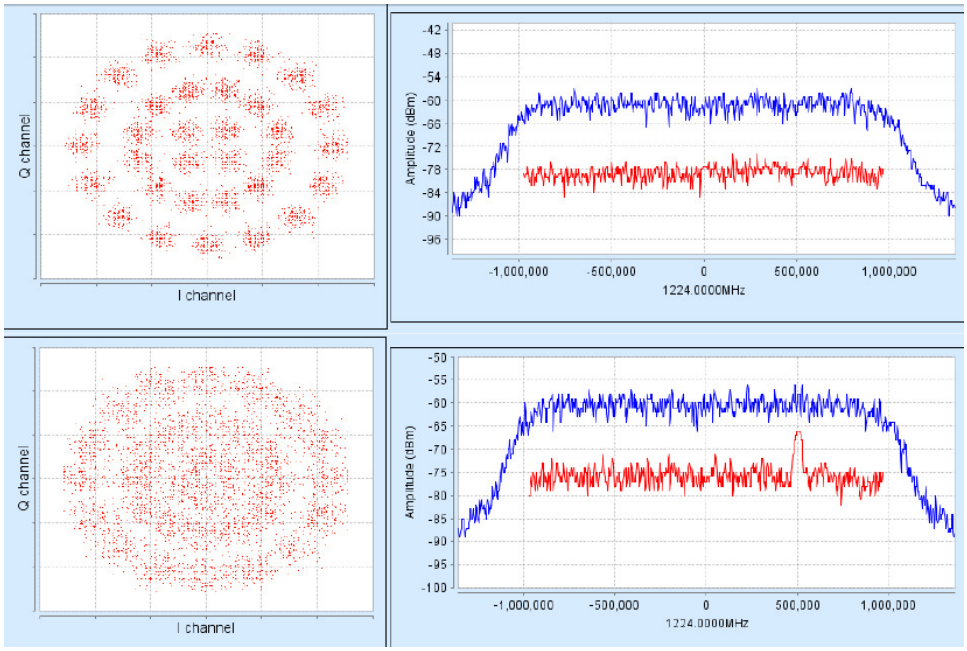

Figure 5 - Built-in Spectrum Analyser showing Signal-Under-Carrier Interference Detection without/with Interferer Present for 32APSK

Figure 6 - Built-in Time-based Graph showing Signal-Under-Carrier Interference Es/No Level (Minimum, Maximum and Average) over time.

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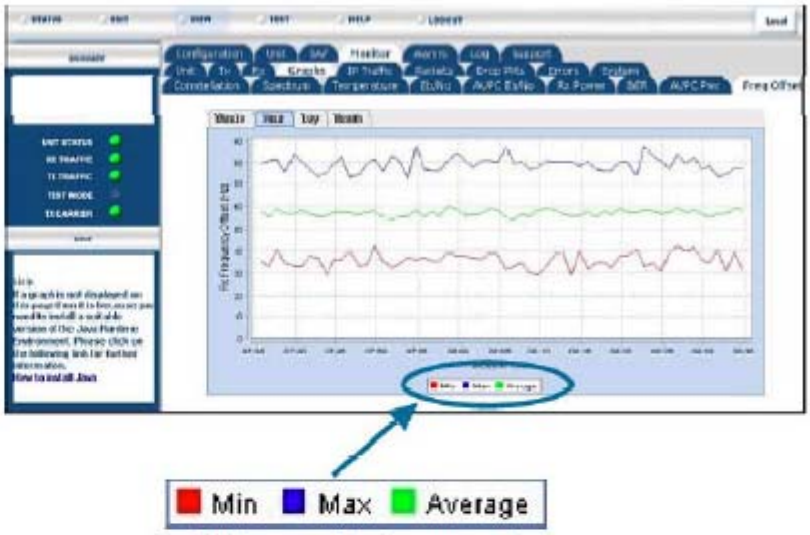
Performance Graph

- *Eb/No vs time*
- *Receive Signal Power vs time*
- *BER vs time*
- *Real time Receive Spectrum Analyser*
- *Real time Receive Constellation Monitor*
- *Receive IF Offset frequency vs time*
- *Modem Internal Temperature vs time*
- *AUPC Eb/No (Distant End) vs time*
- *AUPC Power (Delta Power) vs time*
- *Numerous IP Statistics vs time*
- *Modem CPU Usage & Memory Usage*



Minimum, Maximum and Average values displayed

- Full Status Monitoring of Alarms and Warnings
- Traffic Log records all changes of status with time and date stamp
- Time based performance data is graphed with a user-selectable timebase up to 1 month
- Graphs show minimum, maximum and average values for most parameters
- Can print or save all graphs with just a mouse click
- Field proven capabilities - offers full visibility of link performance

- IP Statistics include Transmit and Receive performance data, categorised by IP port (Traffic, M&C and Satellite Traffic) as follows:
  IP Traffic *IP Packets*
  Dropped Packets *Errored Packets*
- All graphical content (CSV format) can be emailed ***by the Modem*** to chosen recipients, either on alarm detection, or on a regular schedule - this is easily converted to an Excel graph with just 4 mouse clicks
- Performance tools can be used to monitor remote sites from another location ***without sending an Engineer to site and with no additional test equipment***

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The Web User Interface (WUI) is accessed via a Web Browser such as Internet Explorer V.6 or above, Firefox or Netscape V7 or above. Enter the Modem IP Address in the address bar of the Browser and log on when prompted. The Modem supports two levels of access:

Username:	**user**	*Allows monitor-only access*
default password:	**raditek**	
Username:	**admin**	*Allows full monitor & control access*
default password:	**raditek**	

We recommend that the password is changed for security reasons. Only Administrators (**admin** login) have authority to change passwords.

Buttons and tabs are logically organised in categories, using the same layout as the Modem front panel menus. Simple point and click selection of parameters.

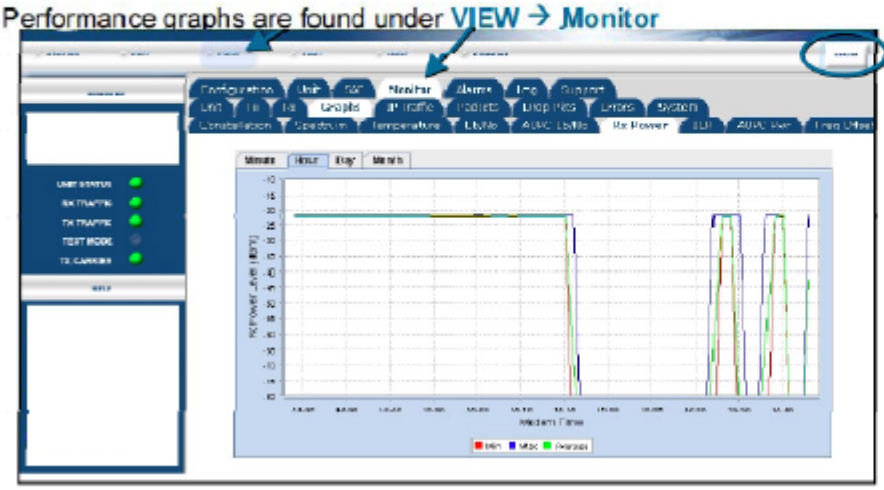
Modem alarm status can be viewed by selecting **STATUS → Traffic**

Modem link status can be viewed by selecting **STATUS → Demodulator**

Link status information includes:

Rx Eb/No	*Rx power level*	*Rx frequency offset*
Final BER	*Rx buffer fill status*	*Buffer slips*

Performance graphs are found under **VIEW → Monitor**



In a *point to point link*, this button selects M&C content from the far-end Modem. Button displays **Local** for the Local connection and **Remote** for Remote (far) End connection via the ESC channel (if the ESC is used).

Example of the Receive Power Monitor via a Web Browser

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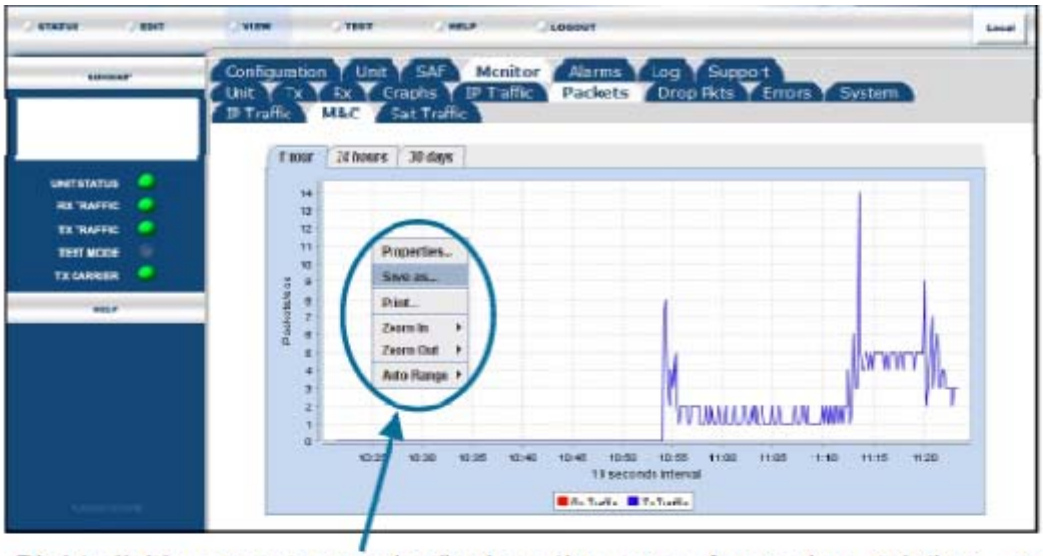
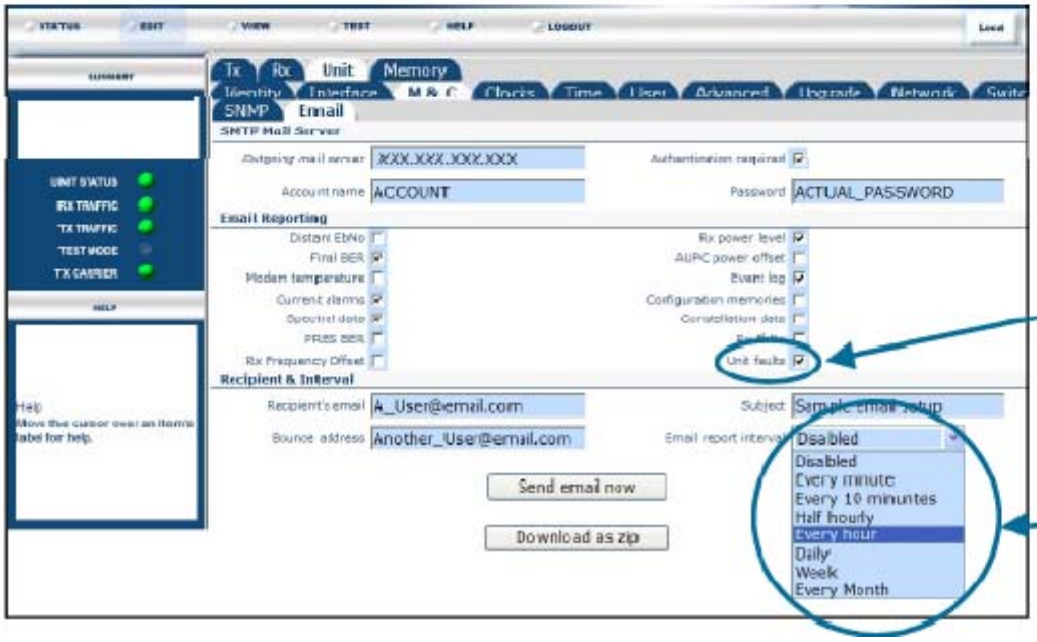


Example of the IP Packet Monitor via a Web Browser

Right-clicking on any graph displays the menu for saving, printing, zooming or autoranging the graph display.

The Modem may be configured to email particular information on a regular schedule, or to email Unit Faults should alarms occur. To configure the email facility, log on as Administrator and select **EDIT → Unit → M&C → Email** then complete the form. Graph data is sent in CSV format.



Unit faults are emailed immediately if this box is ticked

Select the required email reporting interval

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