

Decimator Quick Tour

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1. Introduction

SED Systems' Decimator is an L-Band spectrum analyzer that comes in three different form factors: Decimator Card, 4/8 Port Decimator rack-mount unit and Portable Decimator, as shown in Figure 1.

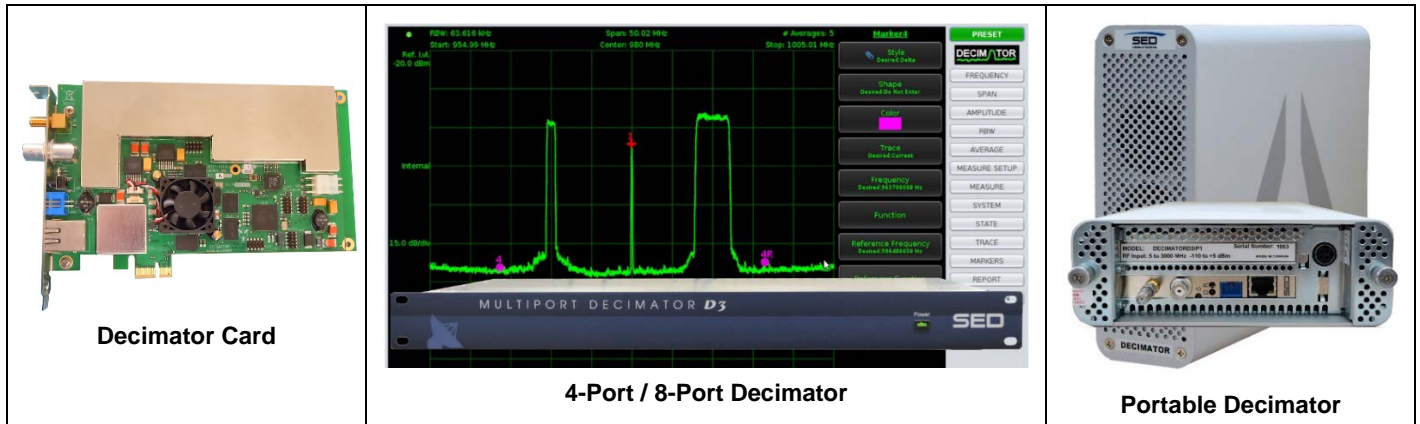


Figure 1 Decimator Form Factors

The intention of this document is to take you through a tour of the main uses and features of the Decimator:

- Applications
- Setup
- Getting Started
- Markers
- Overview
- Carrier Monitoring
- CarrierWatch
- Save and Restore
- Reporting
- Cross-Pol Isolation Testing
- Multi-user Support

You will be up and running very quickly, to see the ease of use, that provides instant productivity using a cost effective solution, resulting in great ROI. As we walk you through the tour, we will keep track of the time elapsed to give you an indication of how efficient you can be using Decimator. It will take about 20 minutes to read through the document, and 45 minutes if you want to follow along and perform all the operations with an actual Decimator.

2. Applications

Depending on which model you use, the application and setup of the Decimator is slightly different. The Decimator Card can be installed in computer's PCIe slot, or it can be integrated into another product or system by mounting it on standoffs and powering it from an on-board 3-pin Molex connector. The Portable Decimator is the Decimator Card in a small enclosure, making it an ideal solution when you need a portable spectrum analyzer, as it easily fits into a laptop case. The 4-Port or 8-Port Decimator is a 1U rack-mount unit that is well-suited to installation in a teleport, earth station or broadcast facility for either local or remote monitoring. Both the Portable and 4/8 Port Decimators are powered from an external AC power source. The Decimator card and Portable products provide an SMA RF input while for the multiport Decimator, RF signals are connected to either a 50Ω SMA or 75Ω F-Type connector. All data communications between Decimator and the controlling computer is via an Ethernet port.

Some typical applications, like the Decimator Spectrum Analyzer UI and the Decimator Carrier Monitoring Software both communicate to the Decimator Card and the 4/8-Port Decimator are shown in Figure 2. You can write your own custom Software to communicate with the Decimator Card using an API.

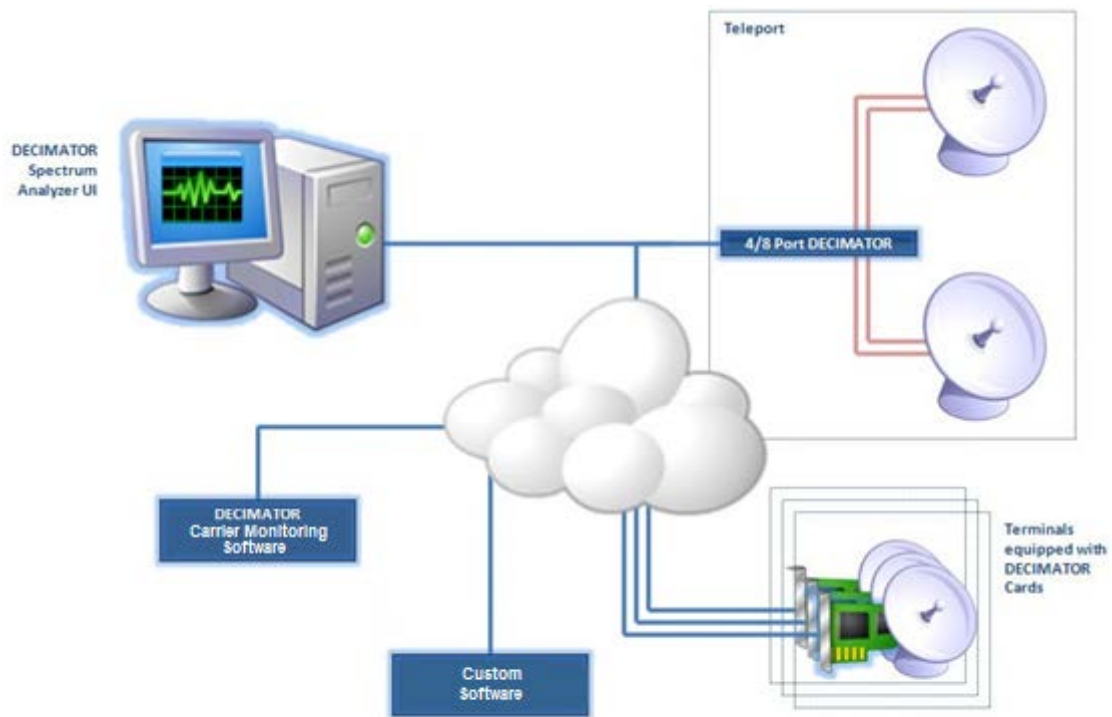


Figure 2 Decimator Applications

3. Setup

We will focus our attention on using a 4-Port Decimator for simplicity, but all Decimator products operate basically the same way. Follow these steps to setup the Decimator:

- Unpack the Decimator.
- Connect your RF feed to port 1 of the 4-Port Decimator.
- Connect a LAN cable between the Decimator and your network.
- Connect the power supply.
- Power up the Decimator and wait for a minute to let the unit boot.
- Open a browser window on a computer on the network and enter the IP Address of the Decimator.
- The main Decimator UI is displayed in the browser as shown in Figure 3 with no need to install any local software!

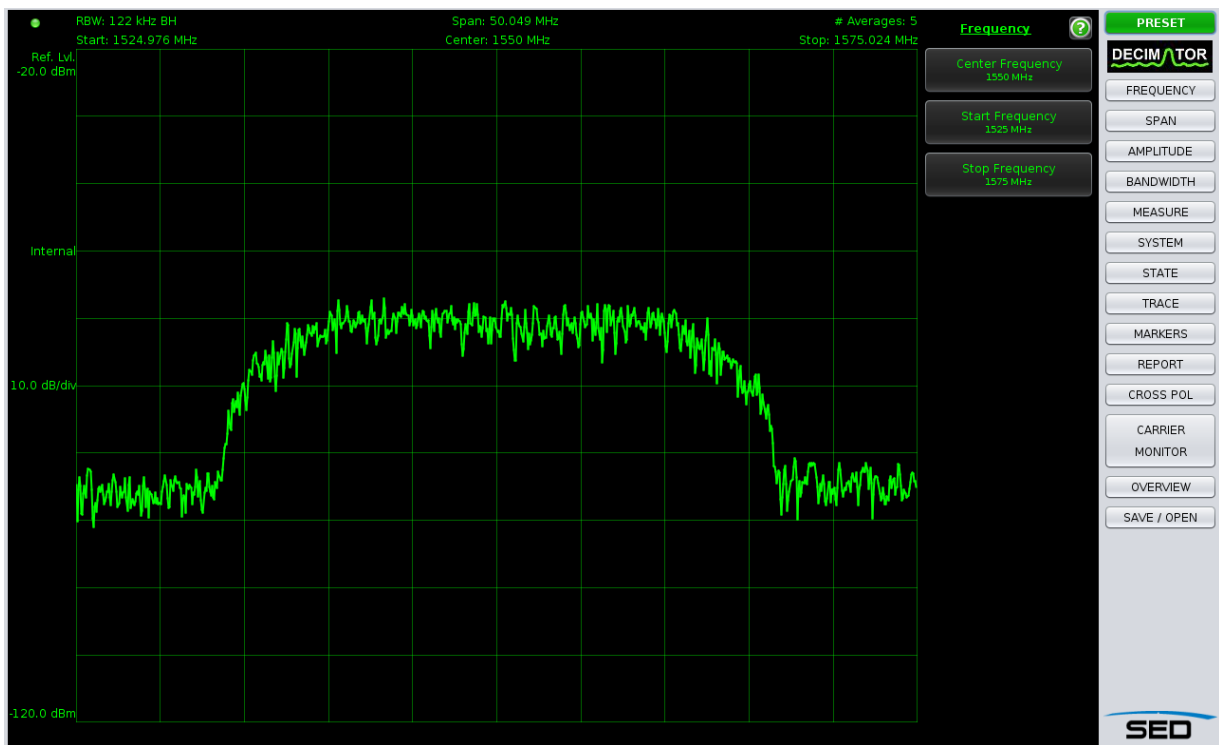


Figure 3 Main Decimator UI Screen

4. Getting Started Using the Decimator

The Decimator can be controlled remotely using the provided TCP-IP ASCII based API so that you can integrate it into your NMS to measure a particular carrier(s), or you can use it interactively via the web interface. We will focus our attention on using the web interface to give you a tour of the rich features of the Decimator. The first thing you will notice about the UI as shown in Figure 3 is that it looks like a spectrum analyzer front panel. Just wait, it feels like one too! This intuitive design allows you to use it right out of the box, without reading the manual.

By default, the Decimator is centered at 1550.0 MHz. Let's center the display on a carrier at 1400.0 MHz. Click the Center Frequency menu item and enter 1400 on the dialog. Click OK. You could also use the scroll wheel on your mouse to accomplish the same thing.

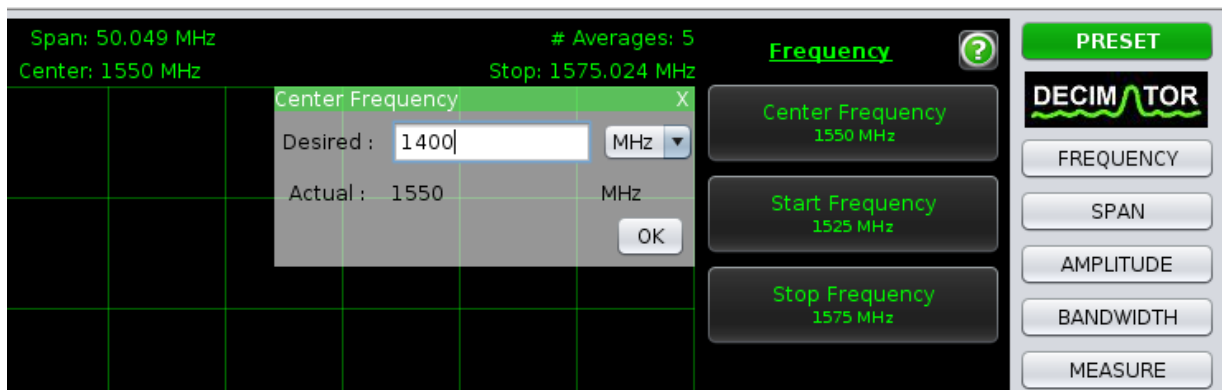


Figure 4 Setting Center Frequency

Let's change the Span to zoom out to a better carrier width by setting the Span to 30 MHz. Click the SPAN button, then the Span menu item, enter 30, keeping the units MHz and click OK.

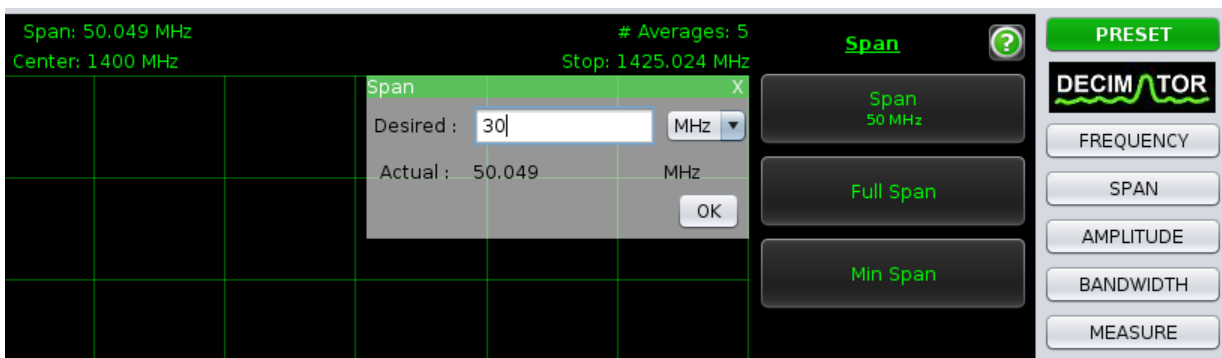


Figure 5 Setting Span

You have now locked the display into the carrier of interest by setting the Center Frequency and Span. There are many other settings that can be tuned, such as Number of Averages, RBW and more. In this case, the Number of Averages was increased from 5 to 20, to produce a display for the given modulated carrier, like that in Figure 6.

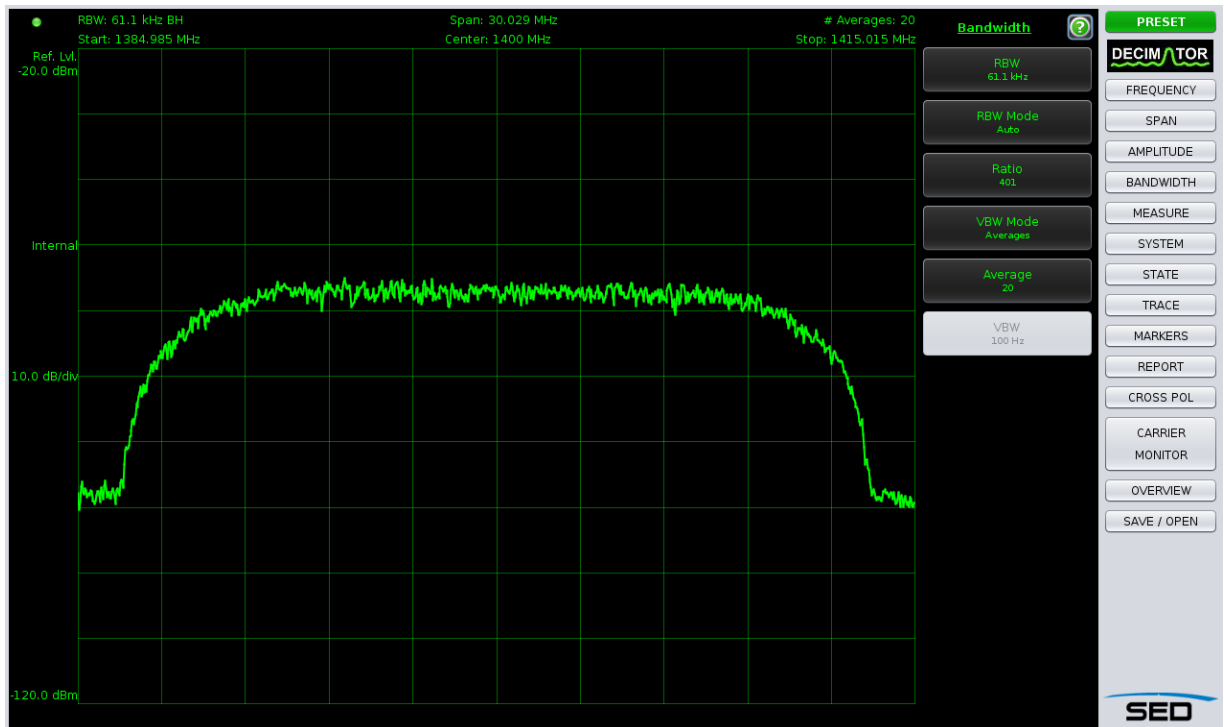


Figure 6 Modulated Carrier

Total Elapsed Time: 7 minutes

5. Markers

Of course we need to see more information about the carrier. Let's add a marker. Click the **MARKERS** button and then the Marker 1 menu item. A single marker is added at mid span with the frequency and power shown in the Marker Legend at the bottom. Let's move the marker to the peak. Click the **Function** menu item and select **Peak Search**. The peak power value is shown in Figure 7 in the Marker Legend at -57.51 dBm.

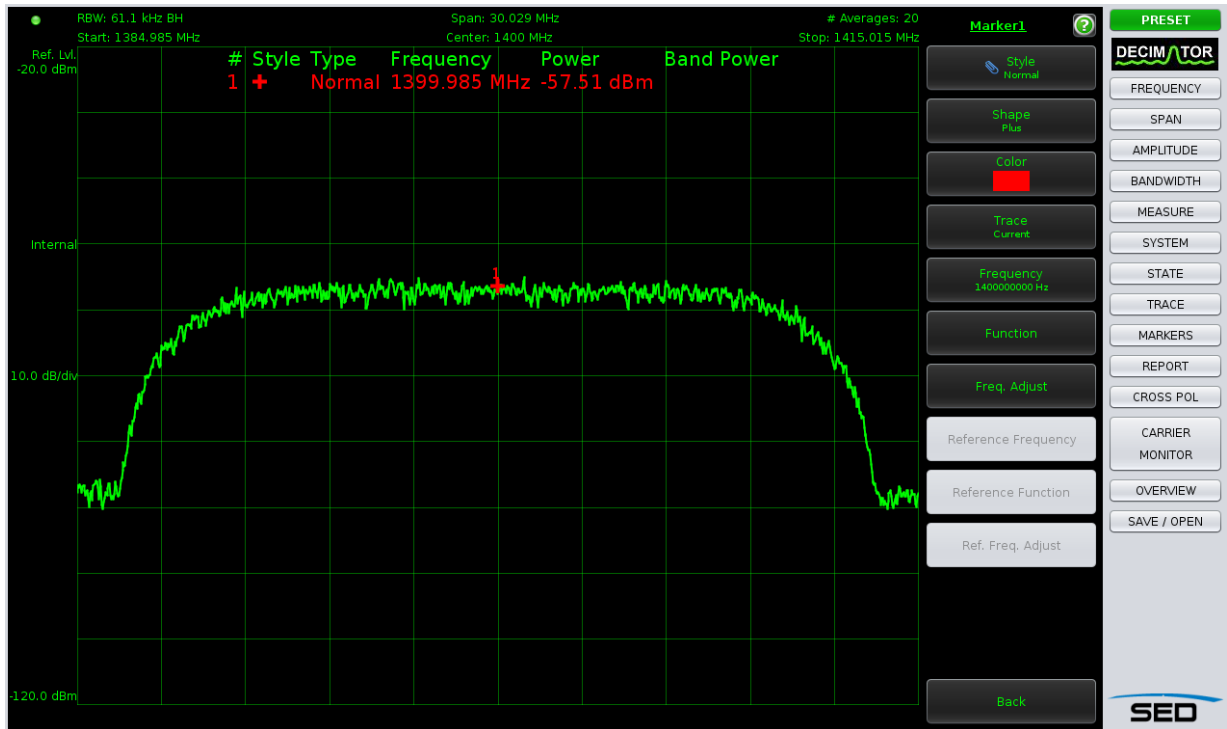


Figure 7 Normal Markers

This example showed use of individual markers, but the markers can also be used in delta mode, which will allow you to determine the total power in a modulated carrier, by placing one marker on either side of the carrier. This is explained in more detail in the Carrier Monitoring section.

Total Elapsed Time: 9 minutes

6. Overview

Setting the Center Frequency and Span using the menu buttons above is the traditional way to view carriers. Let's turn on the Overview Bar, which shows a trace of the full span to help navigate around our spectrum. Click the OVERVIEW button, and turn the Overview Mode on by toggling it "On" in the first menu item. The Overview Bar is shown at the bottom of Figure 8.

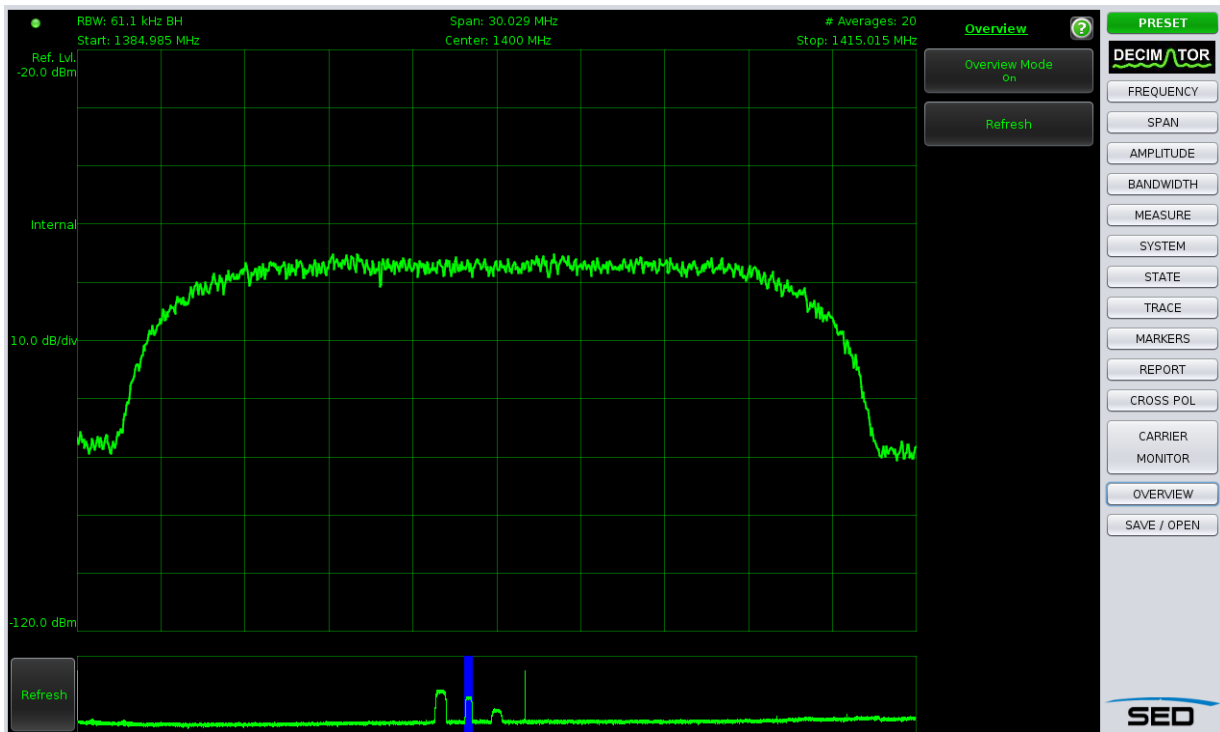


Figure 8 Overview Bar

Notice that our modulated carrier is selected with the blue background at 1400 MHz. There appears to be 3 other carriers present that we will have a look at in the next section, Carrier Monitoring. The Overview Bar full span trace can be refreshed on demand at any time by clicking the Refresh button to the left of the Overview Bar or in the OVERVIEW menu.

Mouse input changes to the Overview Bar will drive changes to the Center Frequency and possibly Span in the plot area above. Left clicking anywhere in the Overview Bar specifies a new Center Frequency, or if you like, dragging the blue selection bar, as shown in Figure 9, does the same thing.

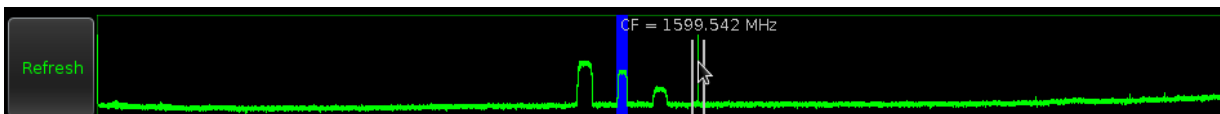


Figure 9 Overview Bar Drag Selected Span

The Center Frequency preview value is shown while dragging so you know where you will end up after you complete the operation. The 2 new span boundary line previews are also displayed while dragging.

You can reposition one of the edge frequencies by dragging it to the left or right, which will specify a new Center Frequency and Span. In this case, both the Center Frequency and Edge Frequency are depicted while dragging along with the span boundary line previews. This is shown in Figure 10.

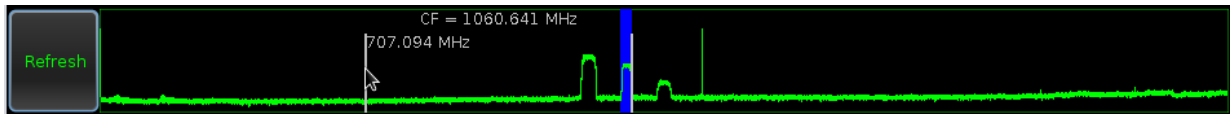


Figure 10 Overview Bar Drag Left Edge of Span

Spectrum navigation has never been easier. That's like putting on your Spectrum Analysis glasses when you didn't know you need them!

Total Elapsed Time: 10 minutes

7. Carrier Monitoring

Now that you have configured the Decimator UI to view a carrier, you are 90% of the way to performing Carrier Monitoring. Yes, really! In this tour, we will have 4 carriers to measure. The first one is already configured. A measurement consists conceptually of a list of settings (or a state) to lock into an area of spectrum to monitor. Each measurement results in a trace that is passed to one or more analyses, producing a pass/fail result. The overall measurement status result for a particular carrier is a summary of all the analyses included for that carrier.

- Before adding our first measurement, let's get some help computing the Band Power for the modulated carrier. We will use a Delta marker to help us do this. Click the **MARKERS** button, then **Marker 2**, click the **Style** menu item and select **Delta**. Drag the markers around with the mouse to separate them, one on each edge of the carrier. The Band Power shown in Figure 11 in the Marker Legend is the total power in the carrier. We can use -32.00 dBm for our Nominal Power in this case.

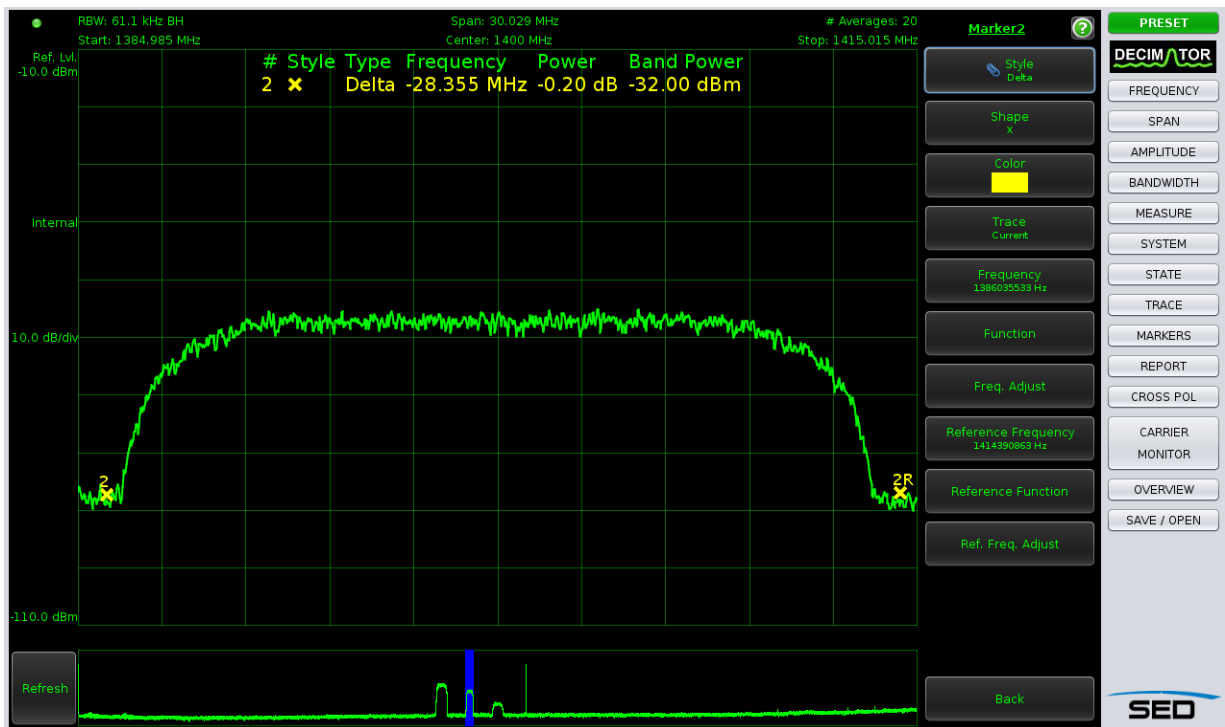


Figure 11 Modulated Carrier with Delta Markers

- Let's capture the existing carrier as a measurement named "Mod-1400"
 - Click the **CARRIER MONITOR** button
 - Click **New Measurement**
 - Name the measurement "Mod-1400"
 - Check the **Band Power Analysis** and override the default values for **Nominal Power** = -32 dBm and **Tolerance Power** 10 dB. This provides an operational threshold limit from -22 dBm to -42 dBm. You should see something like shown in Figure 12. Click **OK**.

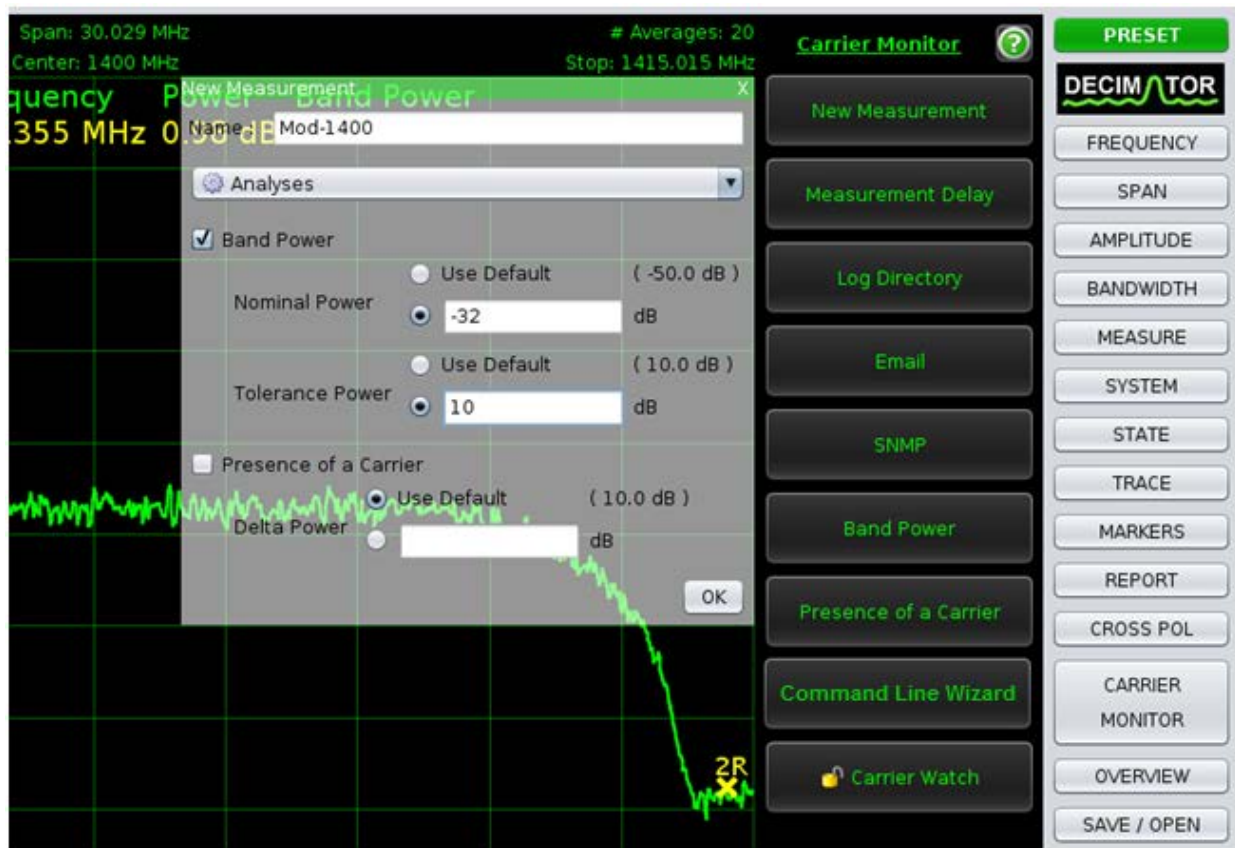


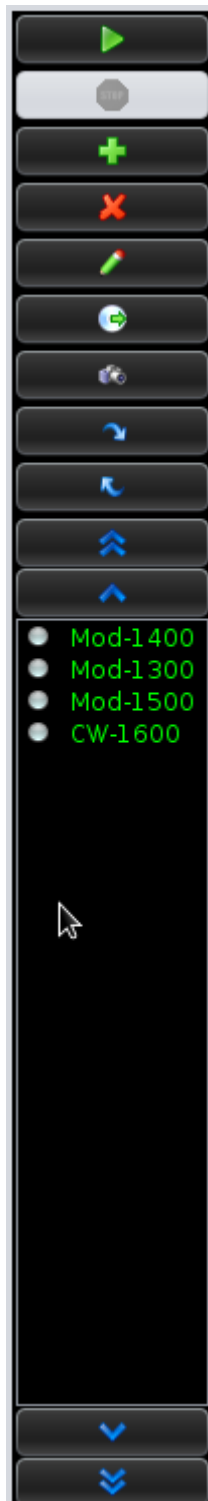
Figure 12 New Measurement

- You will notice a Carrier Monitoring Toolbar added to the left of the display. More on this later.
- We could connect another RF feed to other switch port(s) on the Decimator and bring in other carriers from different feeds, but for this example, all 4 carriers will be on Switch Port 1. If you need to change the switch port, click the SYSTEM button and set the Switch Port to 2.
- We will go ahead and repeat the above bulleted steps for the other 3 carriers with the adjustments in settings specified in Table 1 to create a total of 4 measurements. Configure these settings using the FREQUENCY and SPAN buttons as before or lock them in using the Overview Bar. Your choice.

Table 1 Measurement Settings

Measurement Name	Center Frequency (MHz)	Span (MHz)	Nominal Power (dBm)
Mod-1400	1400	30	-32
Mod-1300	1300	50	-22
Mod-1500	1500	50	-46
CW-1600	1600	1	-16

- You will notice 4 icons in the Carrier Monitoring toolbar, one for each measurement.



- Green arrow – Start carrier monitoring
- Stop – Stop carrier monitoring
- Plus sign – Add a new measurement
- X sign – Delete selected measurement
- Pencil – Modify selected measurement
- Circle with Right Arrow – Recall state from measurement
- Camera – Capture existing state into currently selected measurement
- Down arrow – Move selected measurement down
- Up arrow – Move selected measurement up
- Double arrow up – Scroll to top
- Single arrow up – Scroll up
- List of selectable measurements
- Single arrow down – Scroll down
- Double arrow down - Scroll to bottom

Figure 13 Carrier Monitoring Toolbar

- Let's enable Carrier Monitoring logging. This logs all the Trace data and results of any analysis in CSV format, which is great for off line viewing and file sharing! The CarrierWatch functionality will need it later too. Click the CARRIER MONITOR button, click the Log Directory, click the "..." button to browse and specify a logging directory
- Start the measurement process by clicking the green arrow on the Toolbar.
- Note the historical and new values being overlaid on screen, with your specified limits for the analysis indicated by red lines. The measurement result status is reflected in green on the overlay caption and in the Toolbar icon. The current measurement is now selected in the Toolbar and Overview Bar. In this case, the current Band Power is -32 dBm, which matches the Marker measurement we made.

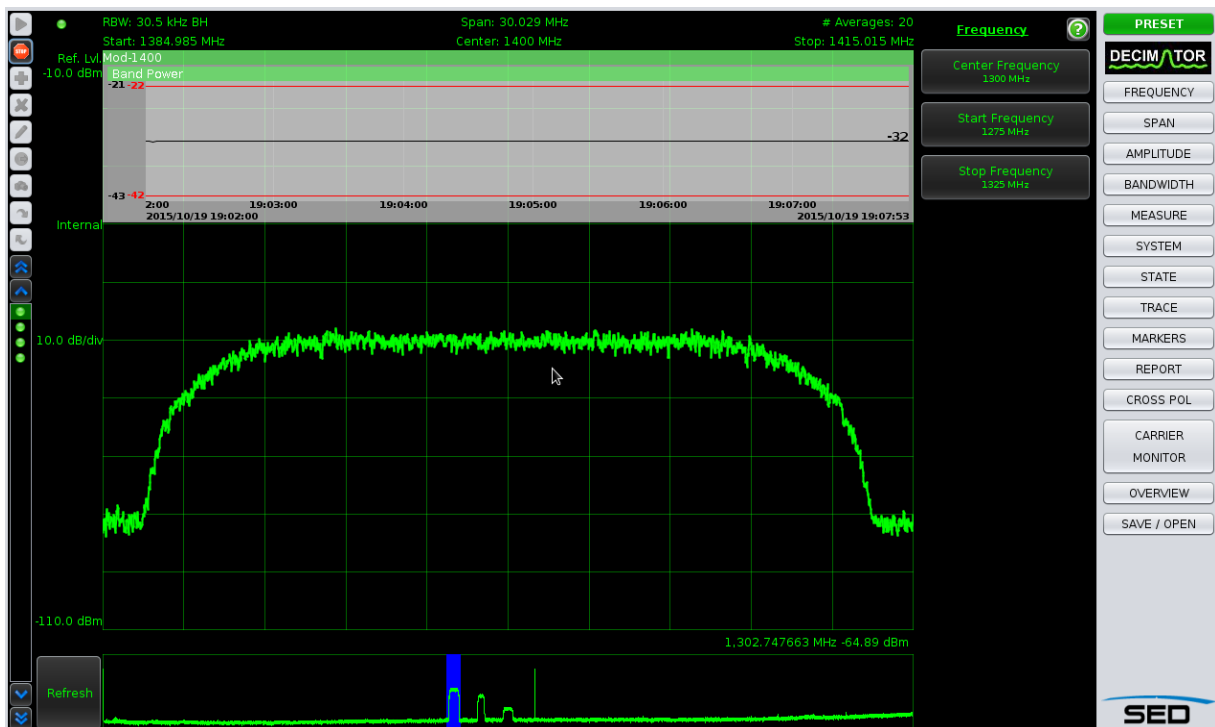


Figure 14 CM Running

- Mouse over the “CW-1600” icon in the left Toolbar. Notice the historical charts for any measurement while the Carrier Monitoring system is running. In this case one of the Modulated carriers is currently being measured with the callout showing the results of the CW-1600 measurement.

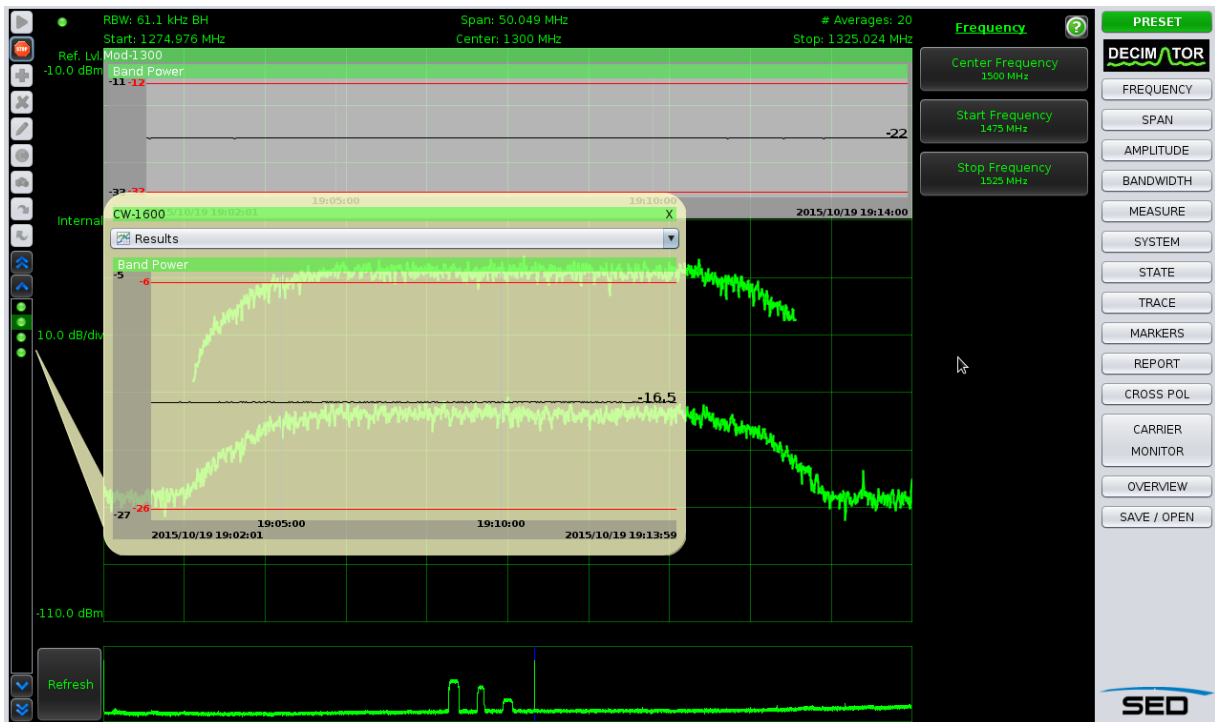


Figure 15 CM Measurement Callouts

- Stop the Carrier Monitoring system using the stop button.
- Mouse over the “Mod-1600” icon.
- Select the State item in the combo box. Notice the settings captured in the measurement. Click Recall to establish the settings from “Mod-1600” measurement as the current settings in the Decimator.

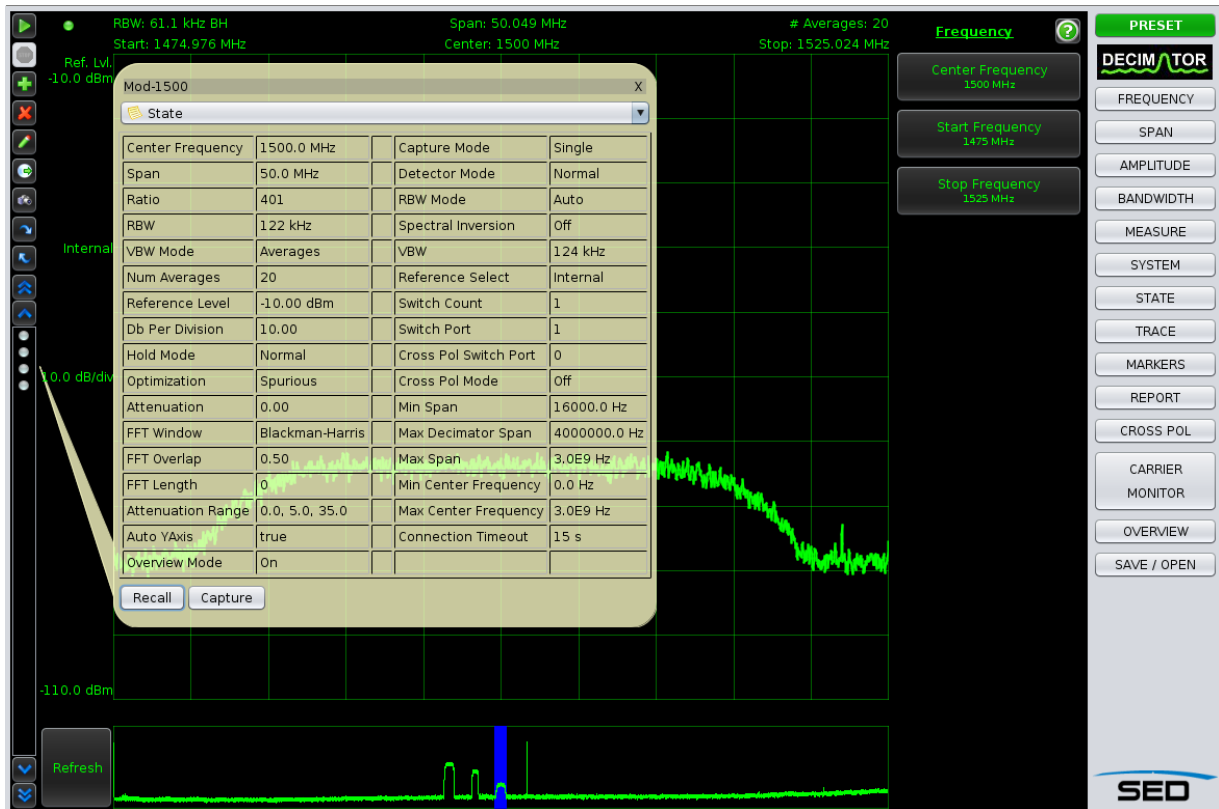


Figure 16 Modify a Measurement

- Change the Span from 50 kHz to 60 kHz. Then click the Capture button on the callout to save the updated span value back to the measurement. You just modified a measurement. That was easy!
- Now let's configure the Email so that there is a recipient to be notified when a measurement changes result status: either from pass to fail or fail to pass. We will specify a Rich HTML format to include a screen shot of the display in the email. The default, Simple Text is ideal for notifications on smart phones. Click the CARRIER MONITOR button, then the Email menu item. Enable Emailing by checking the Master Switch, and fill it out in a similar manner. You will need unblocked access to a local mail server to send out email notifications. You can also send email with SSL and TLS authentication.

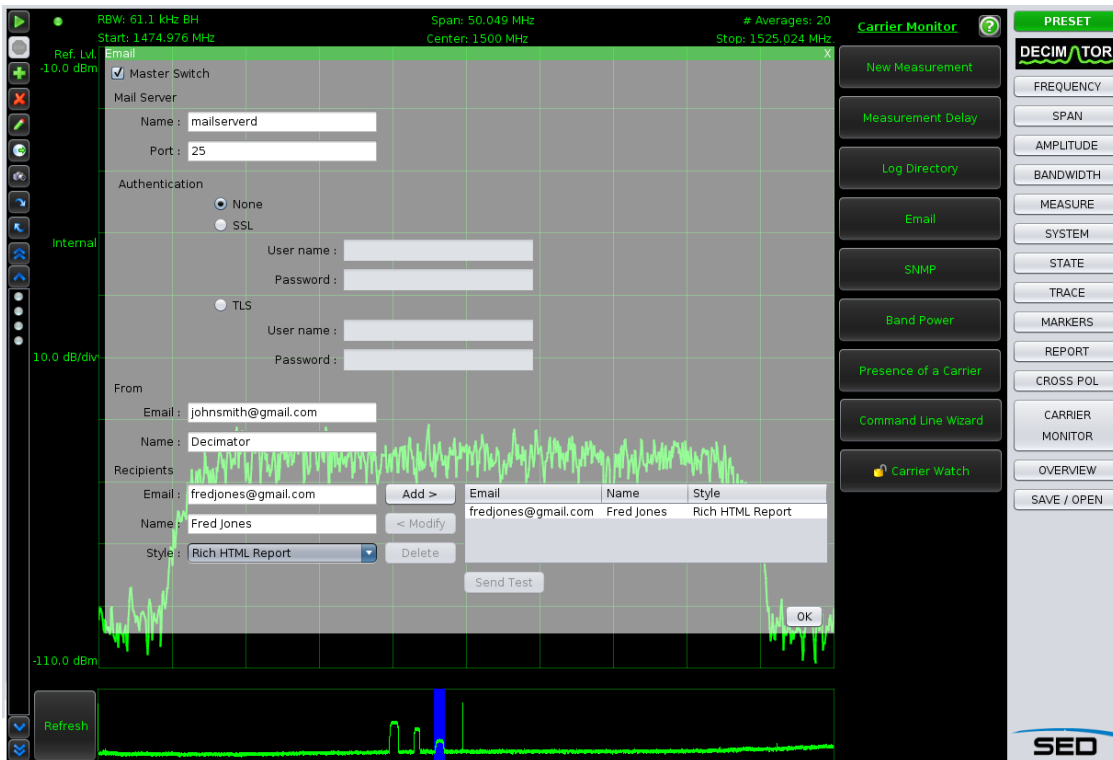


Figure 17 Email Configuration

- Send a test email to verify Email is configured correctly by clicking the Send Test button.
- Verify the test email was received.

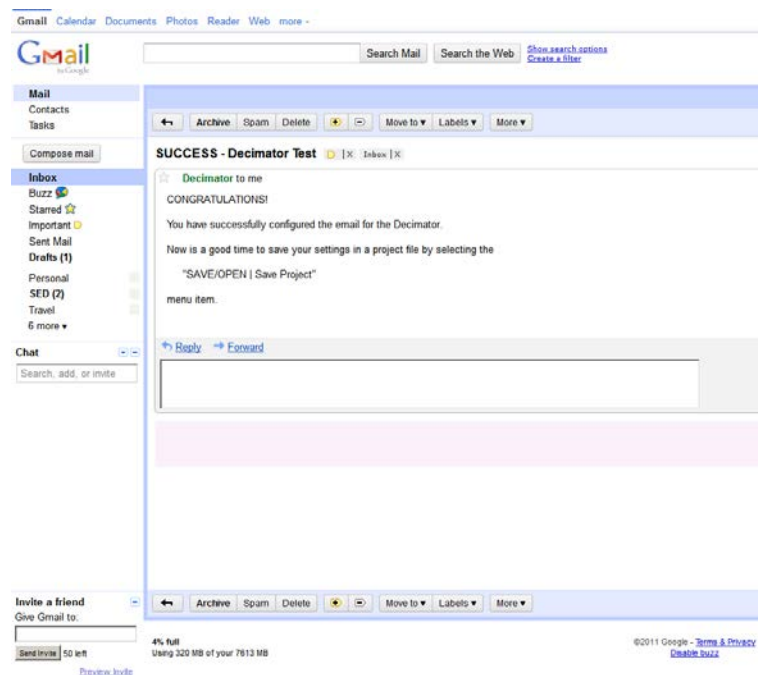


Figure 18 Test Email Received

- Re-start the carrier monitoring.
- Since all measurements have a passing result status, no email is sent out. Let's trigger a failure by shutting down the input feed to carrier Mod-1400, eliminating the carrier altogether. Notice the alarm condition on the "Mod-1400" measurement as it turns red. The Trace shows noise only, so the alarm makes sense visually.

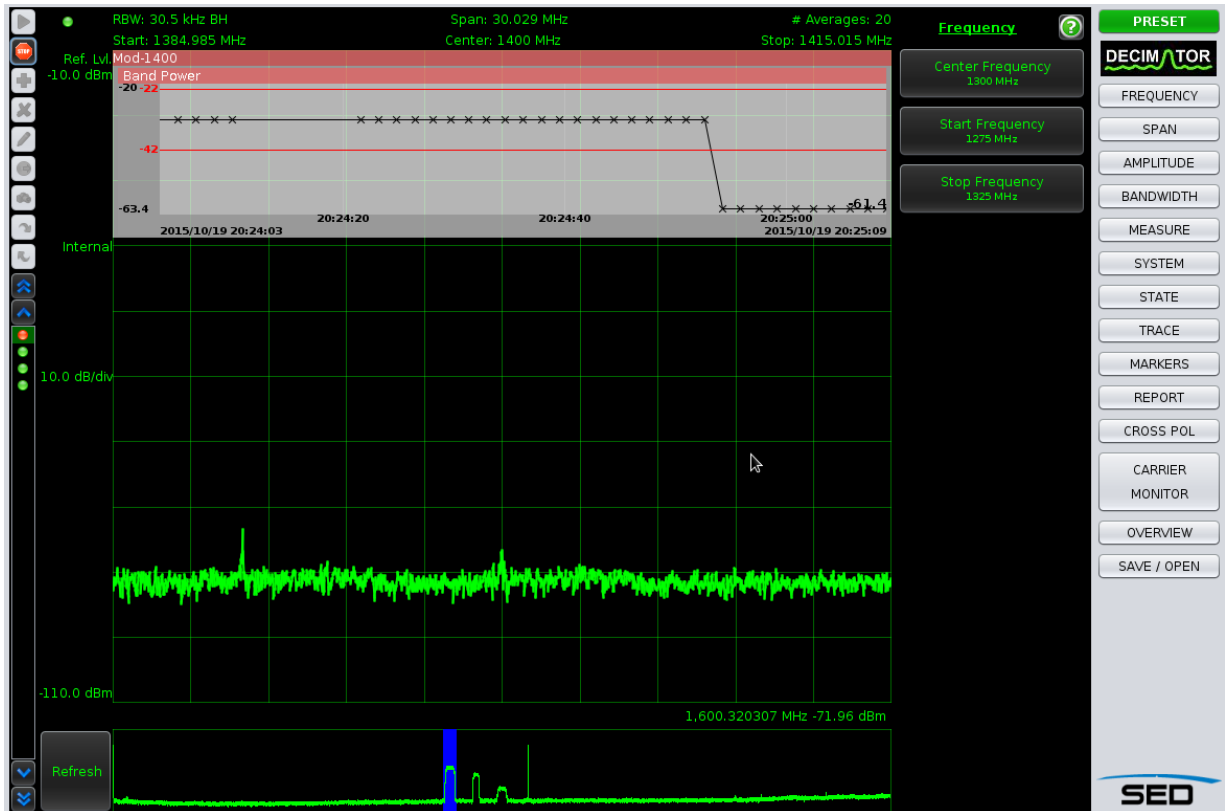


Figure 19 "Mod-1400" Measurement in Alarm Condition

- Notice the alarm email with the screen shot embedded

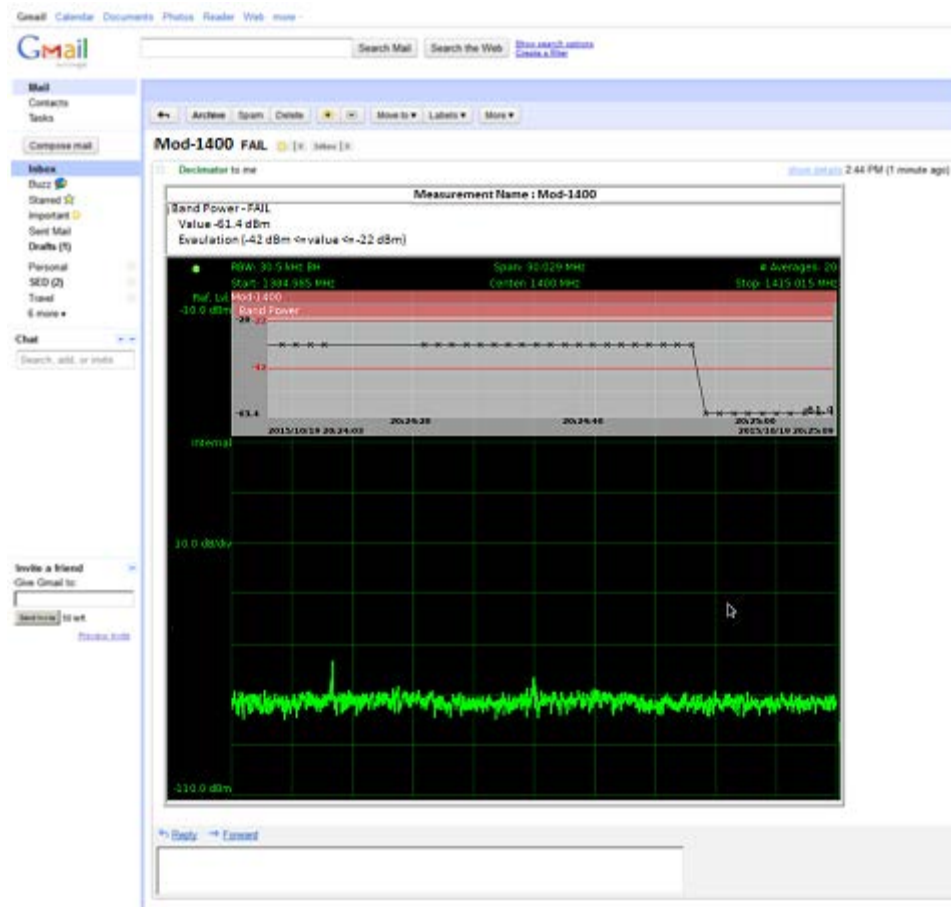


Figure 20 Email Received for “Modulated” Measurement in Alarm Condition

- Re-enabling the input feed to measurement, moves the “Mod-1400” measurement back into a success result status triggering another email. On a multi-port Decimator, you can monitor one or more carriers on each of the Switch Ports. The carrier monitoring system automatically switches the ports for you to acquire the Trace.
- The Decimator Carrier Monitoring system also can be configured to send SNMP V2 traps of the resulting Power and/or Presence of a Carrier Analyses. This is ideal for integration into an existing NMS.
- All you have to do now is locate the rest of your carriers using the Decimator UI interactively and add them in as measurements. Turn it on, forward your email to a smart phone or any Internet device, go home and get notified if there are any problems!
- After setting up the measurements for carrier monitoring and running and testing within the browser UI, you may prefer to run the carrier monitoring from a command line task. This allows you to integrate Carrier Monitoring into your stack of applications. We have added the “Command Line Wizard” menu button to export all the files you need to a local directory so you can run from the command line.

Total Elapsed Time: 25 minutes

8. CarrierWatch

The CarrierWatch feature is an extension to the Carrier Monitoring System. It provides a tiled display of measurement traces, state and much more. It is a feature that requires an additional license.

Click the CARRIER MONITOR button, then the CarrierWatch menu item. The CarrierWatch Dashboard window appears. For simplicity, let's add all our 4 carriers on the CarrierWatch dashboard display. We can do this by clicking the "Add All" button on the toolbar in User Defined Mode as in Figure 21.

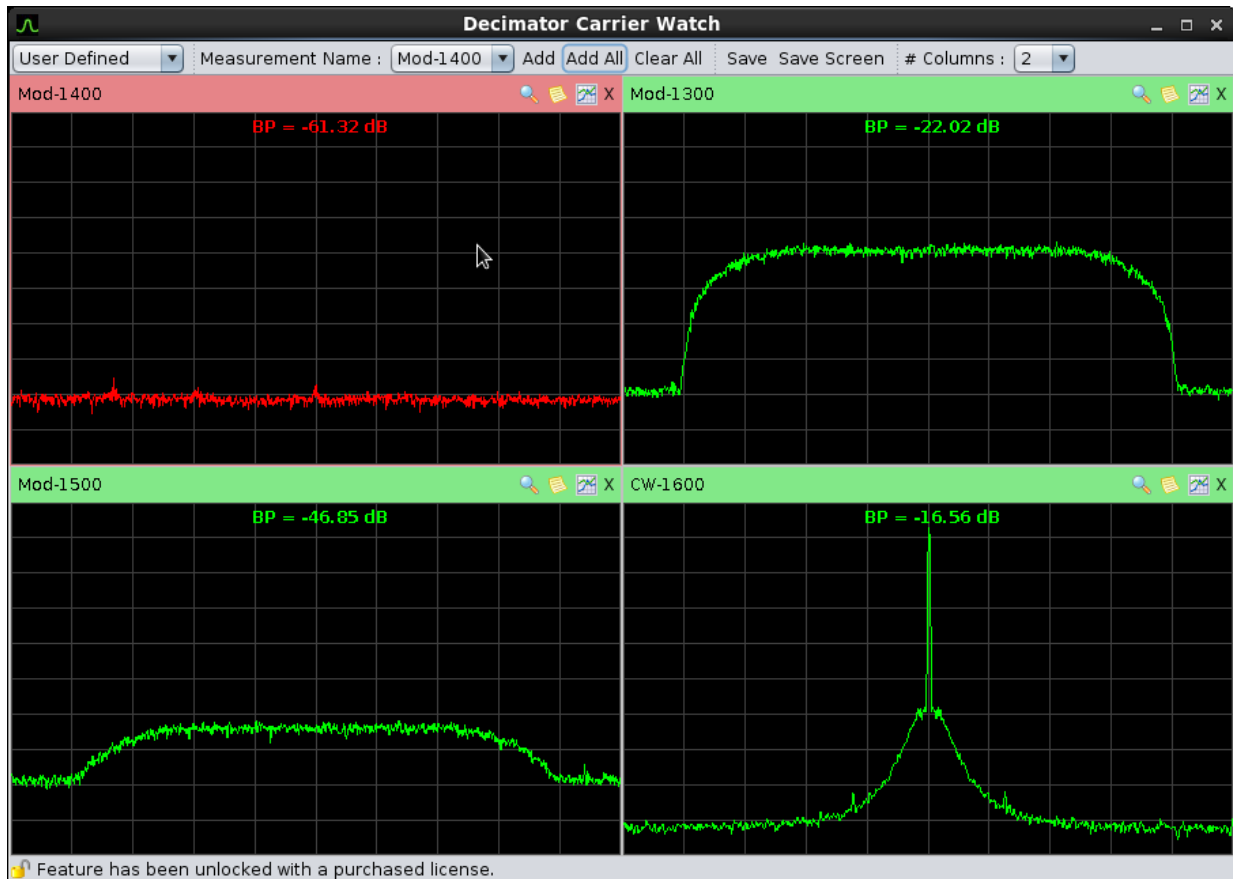





Figure 21 CarrierWatch Dashboard

Each measurement appears in the tiled display. You can control the layout by adjusting the # of Columns. You can add one or more carriers here, maybe just your important ones, or you can add them all like we have done above. This display can be configured effectively to show up to 100 Measurements.

Click the Play button on the Carrier Monitoring Toolbar to start Carrier Monitoring again.

You will see the trace for each measurement update and the state evaluated. Each Measurement Tile has the following information:

- Measurement name and its state depicted in colour
- A Zoom button.  Clicking this button displays the CarrierWatch Zoom Window. More on this in a bit.
- A Settings  tooltip to show the settings such as Center Frequency, Span, etc.
- An Analysis History  tooltip to show you the band power and other analysis results as a function of time

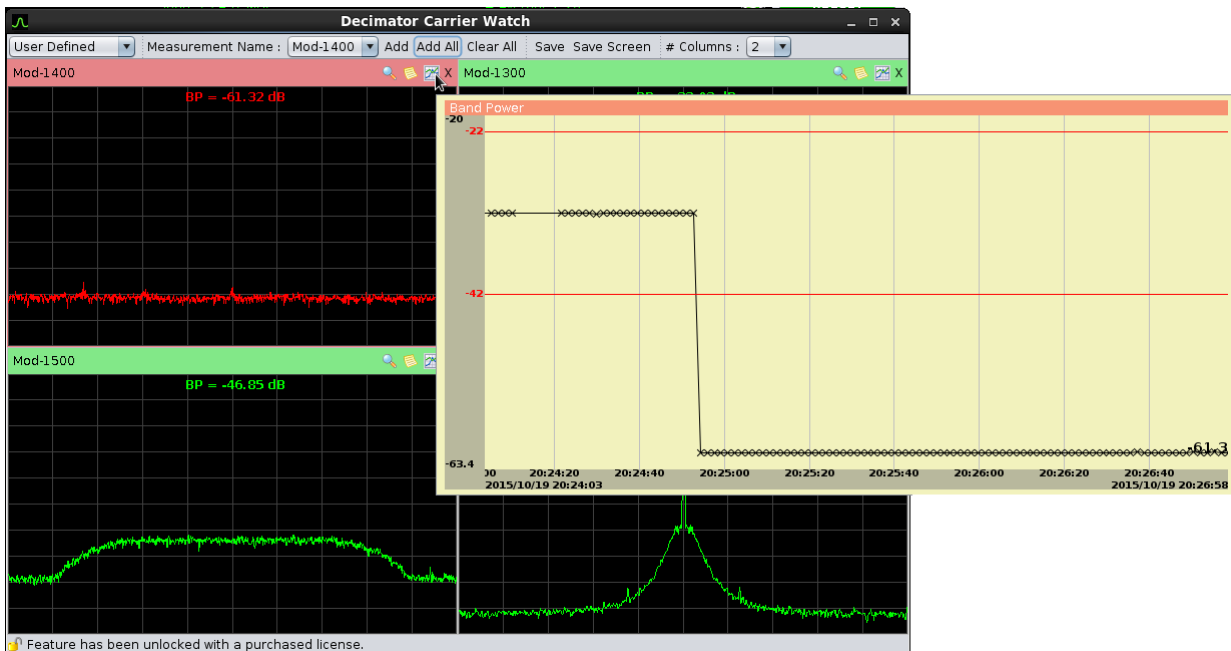


Figure 22 CarrierWatch Dashboard – Analysis History

- An “X” button to remove the measurement from the CarrierWatch Dashboard

The CarrierWatch Dashboard has 3 modes: User Defined, Active Alarm and Historical Alarm. You have seen the User Defined mode above. The Active Alarm mode only shows the Measurements presently in alarm condition with the most recently raised alarm in the top left of the screen as shown in Figure 23.

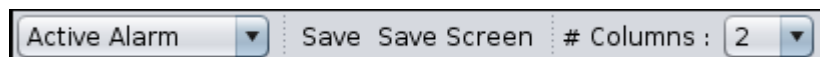


Figure 23 CarrierWatch Dashboard – Active Alarm Mode Toolbar

The Historical Alarm Mode is similar to the Active Alarm mode, but it provides an additional time range back from the present time to search for measurements in alarm condition or have been in alarm condition. Again the most recently raised measurement alarms appear first, followed by corrected measurements.



Figure 24 CarrierWatch Dashboard – Historical Alarm Mode Toolbar

Let's drill down on the measurement in alarm state for more detailed analysis. Click on the Zoom button for measurement "Mod-1400" to display the CarrierWatch Zoom window as shown in Figure 25.

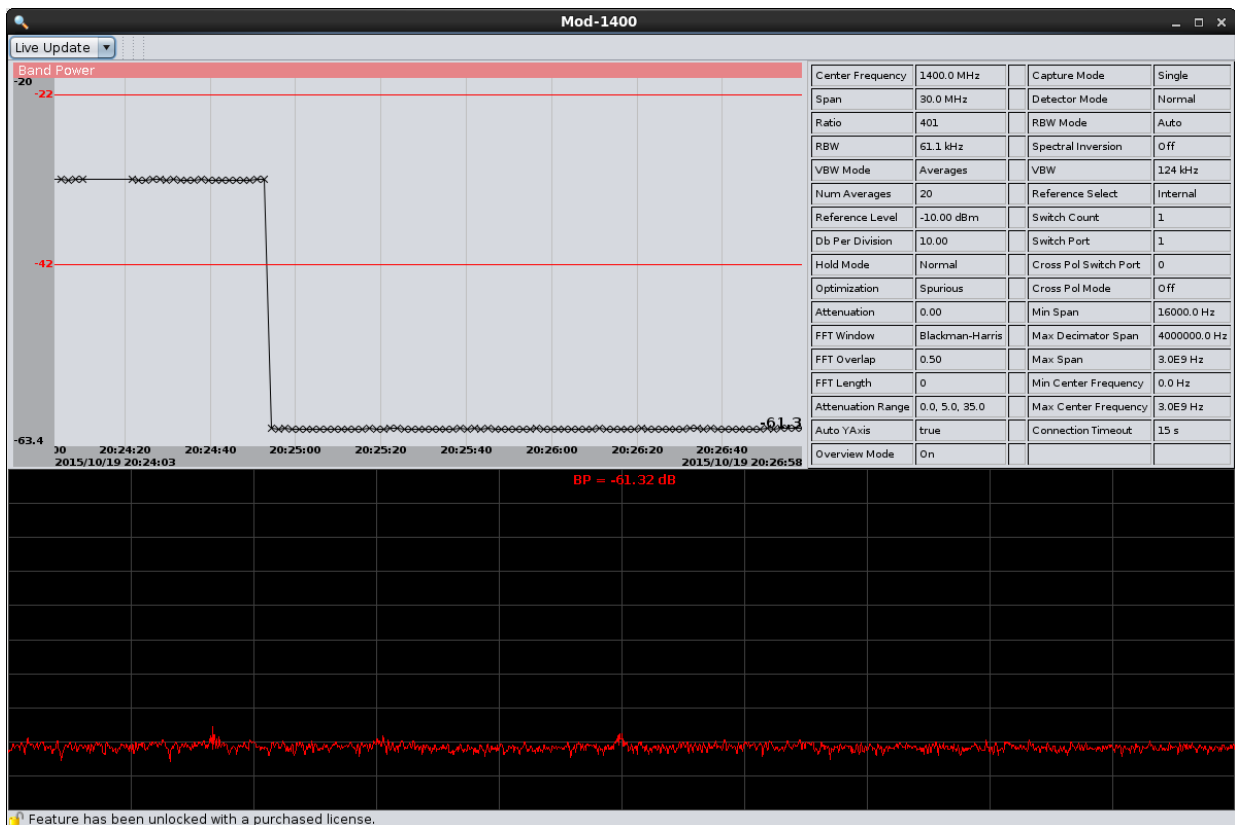


Figure 25 CarrierWatch Zoom Window

By default the "Live Update" mode is turned on, which shows you the latest trace in the bottom of the screen.

Let's toggle over to "Inspection" mode. You will notice the toolbar changes to allow you to run a playback simulation and/or to navigate to any trace in the history (as long as you turned logging on). The selected time is shown with the vertical blue bar in the Band Power plot and is altered by a mouse left click. The CarrierWatch Zoom window in "Inspection" mode is shown in Figure 26.

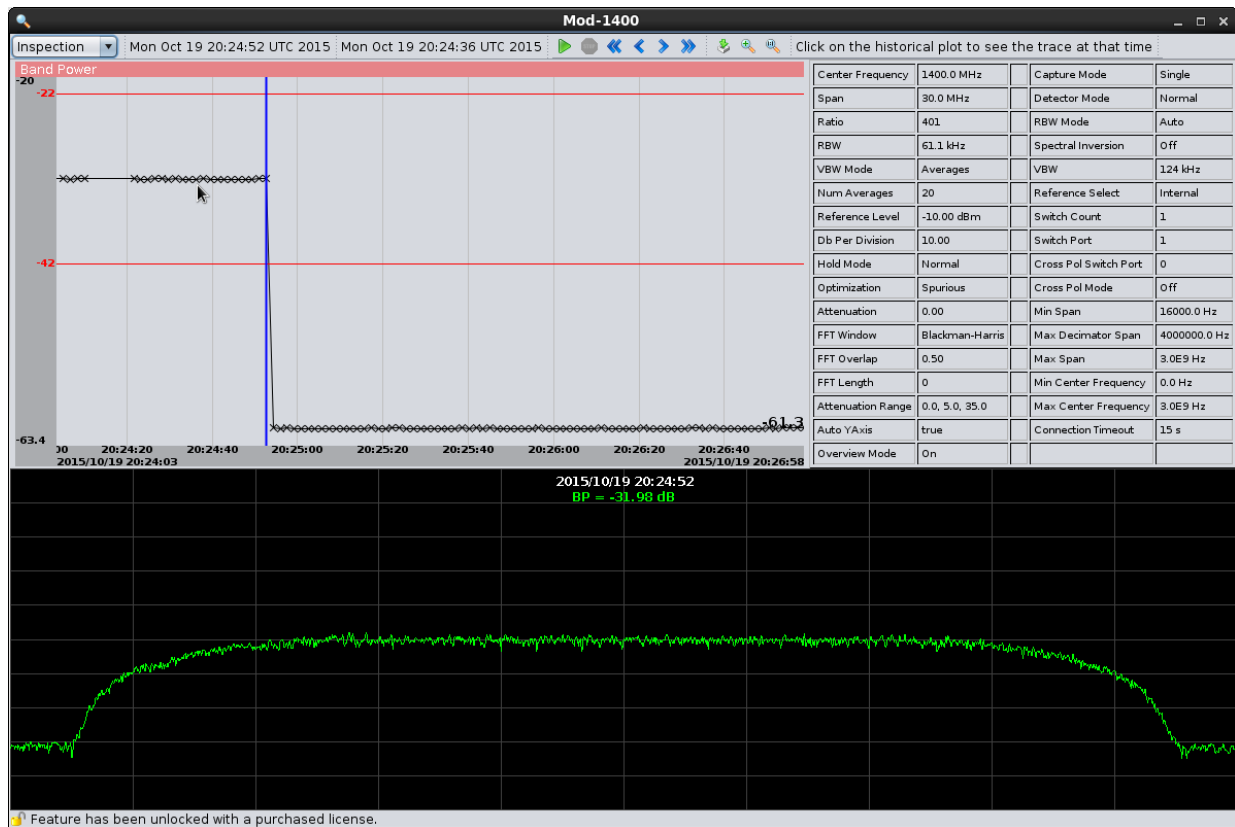


Figure 26 CarrierWatch Zoom Window – Inspection Mode

The CarrierWatch Zoom Window Inspection Mode toolbar is shown in Figure 27.



Figure 27 CarrierWatch Zoom Window Inspection Mode Toolbar

The first item is the "mode" combo box, followed by the selected date and time. The second date and time corresponds to the date and time at the mouse location in the Band Power plot.

The rest of the items are as follows:

- Green arrow – Start a play-back of traces from the current selected time
- Stop button – Stop the play-back
- Double arrow left – Select the first time in the Band Power plot
- Single arrow left – Select the next time in the Band Power plot

- Single arrow right – Select the previous time in the Band Power plot
- Double arrow right – Select the last time in the Band Power plot
- Load the previous day – Load one more day back in time up to a maximum of 7 days
- Zoom in – Zoom in to see half the time range of data
- Zoom extents – Zoom to see all the time range of data loaded

Total Elapsed Time: 35 minutes

9. Save and Restore

Now that you have done all this work, it is a good idea to save the configuration to a project XML file locally on disk. This saves your settings, markers, memory traces, states, and measurements. Note, that the saving does not save the data on the Decimator card, but to a local file. Use this project file to recall your configuration in the case of a power outage or send it to a colleague with the same set of carriers at a different location. Click the SAVE/OPEN button then the Save Project menu item. Enter a file name and click Save.

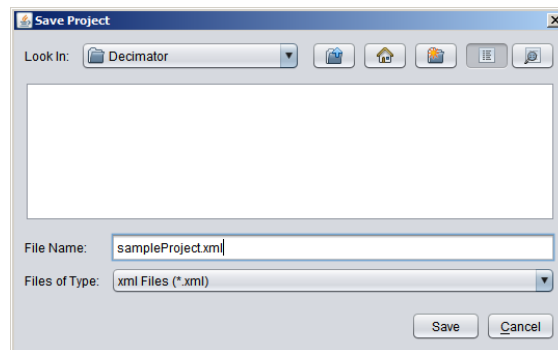


Figure 28 Save a Project

Close the Decimator UI to allow us to start over from scratch. Open a new Decimator UI session by entering the IP Address in the browser. Click the SAVE/OPEN button and click the Open Project menu item. Browse to the project file just saved and click Open.

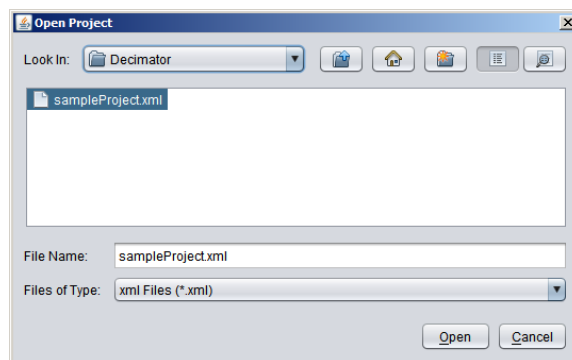


Figure 29 Open a Project

The previous Decimator configuration is restored, including the Carrier Monitoring measurements.

Total Elapsed Time: 36 minutes

10. Reporting

We can create an HTML report for the active Trace and saved Traces or export the Trace data to a CSV file format. Up to 4 additional Traces can be saved. Markers and a screenshot are included.

We will show an example of an HTML report. Close the Decimator UI and restart a new session. Select the REPORT button and click the Export the HTML menu item. Enter a new subdirectory, click Save and when prompted “Do you want to display the report?”, click OK. The contents of the report are shown in a browser window as shown in Figure 30.

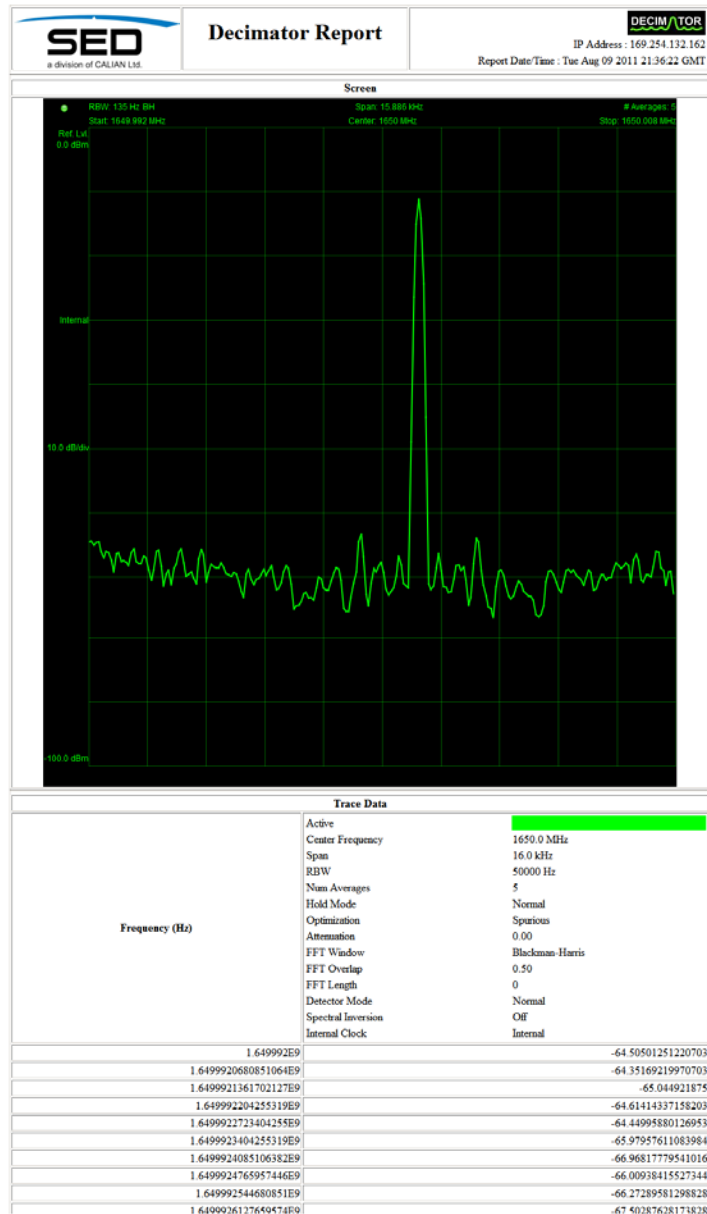


Figure 30 HTML Report

Total Elapsed Time: 38 minutes

11. Cross-Pol Isolation Performance Testing

The 4 and 8 Port Decimators are capable of Cross-Pol Isolation Performance testing. To conduct this test, perform the following:

- Connect one polarization RF feed (the Co-Pol) to switch port 1.
- Connect the opposite polarization RF feed (the Cross-Pol) to switch port 2.
- Run the Decimator UI in the browser.
- Click the CROSS POL button.
- Verify Switch Port is set to 1, if not adjust it to make it so.
- Verify Cross-Pol Switch Port is set to 2, if not adjust it to make it so.
- Set the Cross-Pol Mode to On

The Decimator UI captures a trace from each port, toggling back and forth. Cross-Pol style markers are automatically added to both trace, with one at the peak of the trace and the reference marker to the noise floor. This frequency is determined at the first trace acquisition on the minimum point in the trace. Subsequent trace acquisitions will leave the marker at the same frequency. Users can drag the reference noise floor marker to the desired frequency for analysis.

The system computes the C / No value for each pair of markers and renders this in the legend. This is simply the difference between the 2 marker values on the same trace.

A summary of the delta between these 2 C / No values is provided at the bottom of the legend for convenience. This is the value you have to optimize as you adjust the orientation of the antenna and observe the changes to the delta C / No summary value. Figure 31 shows the result of a recently configured Cross-Pol testing on an 8 Port Decimator with Switch Port 1 and Cross-Pol Switch Port 2 being used.

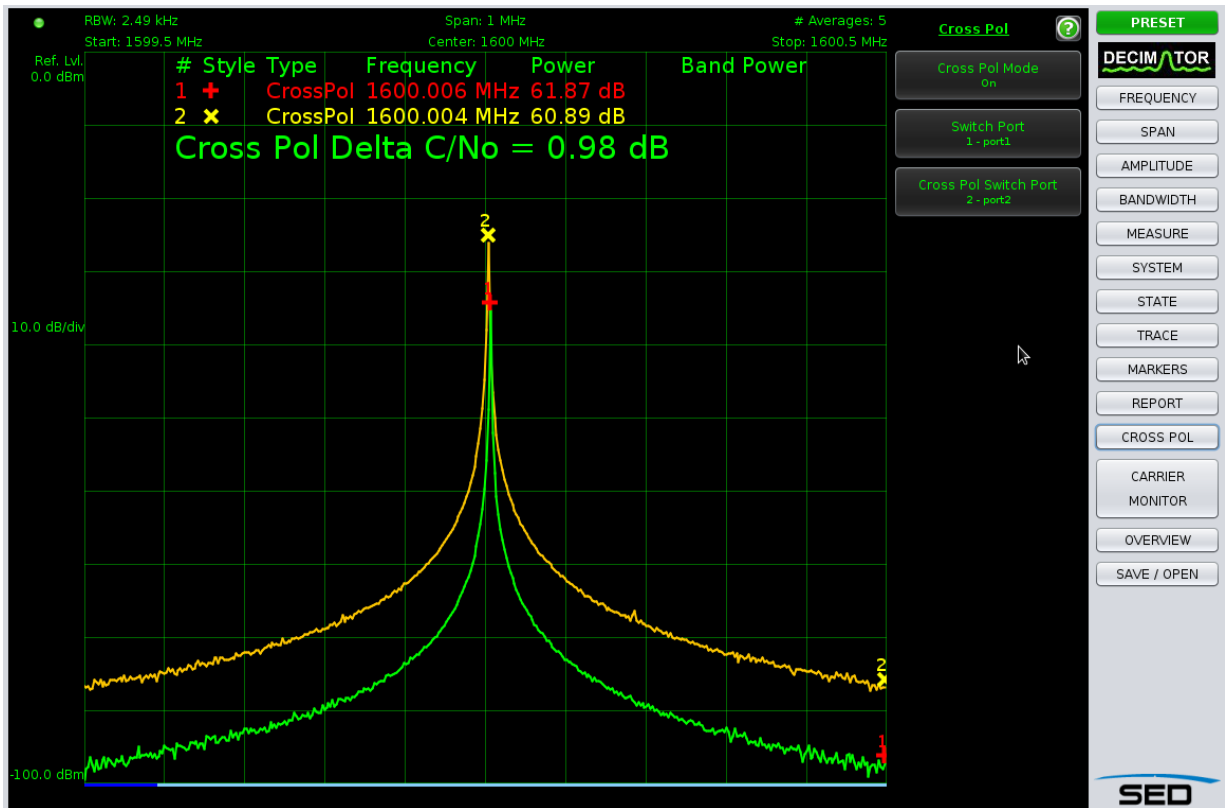


Figure 31 Cross-Pol Mode

Total Elapsed Time: 42 minutes

12. Multiuser Support


Multiuser access to the Decimator is directly built into the hardware. This allows you to connect the UI to the Decimator to perform ad-hoc measurements while having a separate independent connection from your NMS that is performing background measurements with no extra running software. Up to 10 concurrent users can be serviced in a round robin fashion. Really nice!

Total Elapsed Time: 43 minutes

13. Conclusion and Contact

The Decimator is an extremely powerful, cost effective and intuitive product for viewing your spectrum, performing simple Carrier Monitoring and testing Cross-Pol Isolation. There are other features of the Decimator not discussed here, such as saving Traces and setting and recalling States. We continue to add features that you want. Upon request, we can provide User's Manuals and the API Specification for any of the Decimator products.

Total Elapsed Time: 44 minutes, giving you another minute to get your hands on one today, or ask further questions by contacting:

 SED a division of CALIAN Ltd.	Contact Information
Name	Jim Shedden (SED Sales Representative)
Phone	1 (306) 933-1541
Email	shedden@sedsystems.ca
Website	http://www.sedsystems.ca/decimator_spectrum_analyzer
Interactive Online Demo Use IE browser, Firefox ESR or older Chrome and Firefox versions	http://www.sedsystems.ca/decimator_live_demo.html