May 21, 2020

Decimator D4 Quick Tour

Calian, Advanced Technologies.
18 Innovation Boulevard Saskatoon, Saskatchewan CANADA S7N 3R1
Tel: (306) 931-3425 Fax: (306) 933-1486
www.calian.co

Change Description

Revision	Description
1	Initial revision for D4.

Contents

1. Introduction

The Decimator D4 from Calian, Advanced Technologies is an L-band spectrum analyzer that comes in three different form factors as shown below.

D4 PCIe card

Multiport D4 rack-mount (4/8 port)

Portable D4

This document takes you through a tour of the main uses and features of the Decimator:

- Applications
- Setup
- Getting started
- Markers
- Overview bar
- Carrier monitoring
- Spectator
- Save and restore
- Reporting
- Cross-polarity
- Multiuser support
- Waterfall
- Signal analyzer

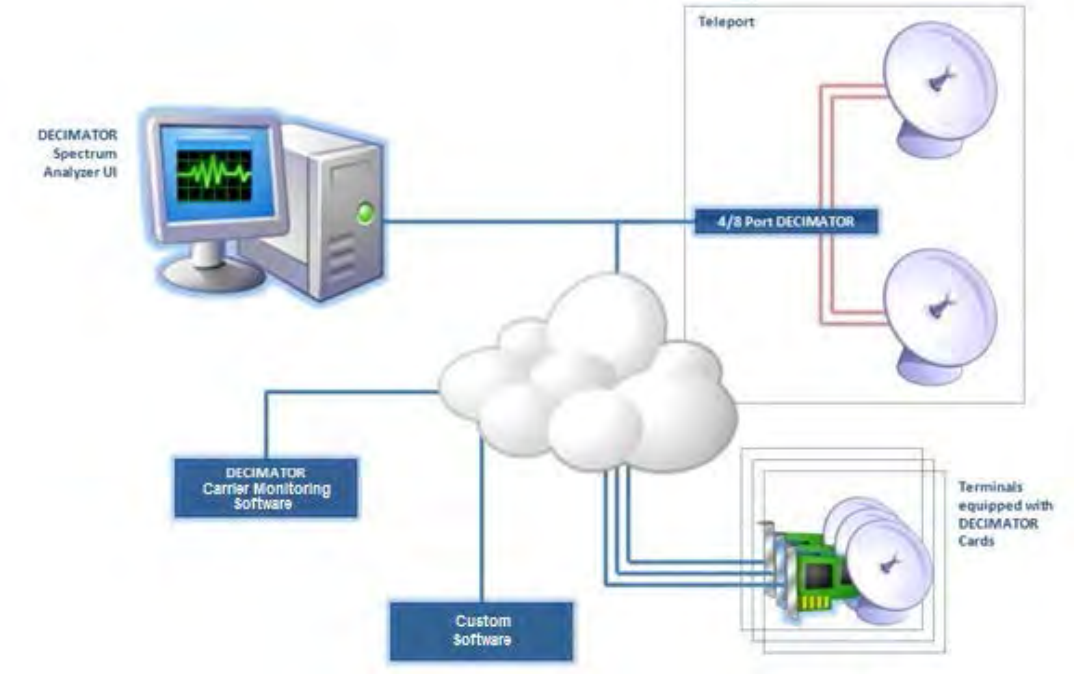
You'll be up and running very quickly and will see how easy it is to use the Decimator for your measurement and monitoring needs. As we walk you through the tour, we will keep track of the elapsed time to give you an indication of how efficient you can be using Decimator. It will take about 25 minutes to read the document, and 55 minutes if you want to follow along and perform all the operations with an actual Decimator.

2. Applications

Depending on the Decimator model you use, the setup is slightly different:

- **Decimator PCIe card**
  - This can be installed in a computer's PCIe slot or integrated into another system by mounting it on standoffs and powering it from the on-board 3-pin Molex connector.
  - 50 Ω SMA RF input.
- **Portable Decimator**
  - The Decimator card is housed in a small enclosure, making it the ideal solution when you need a portable spectrum analyzer, as it easily fits into a laptop case.
  - 50 Ω SMA RF input.
  - Powered from an external AC power source.
- **Multiport Decimator**
  - The 4/8-port Decimator is a 1U rack-mount unit that is suited to indoor installation in a ground station or broadcast facility for local or remote monitoring.
  - 50 Ω SMA or 75 Ω F-type RF inputs.
  - Powered from an external AC power source.

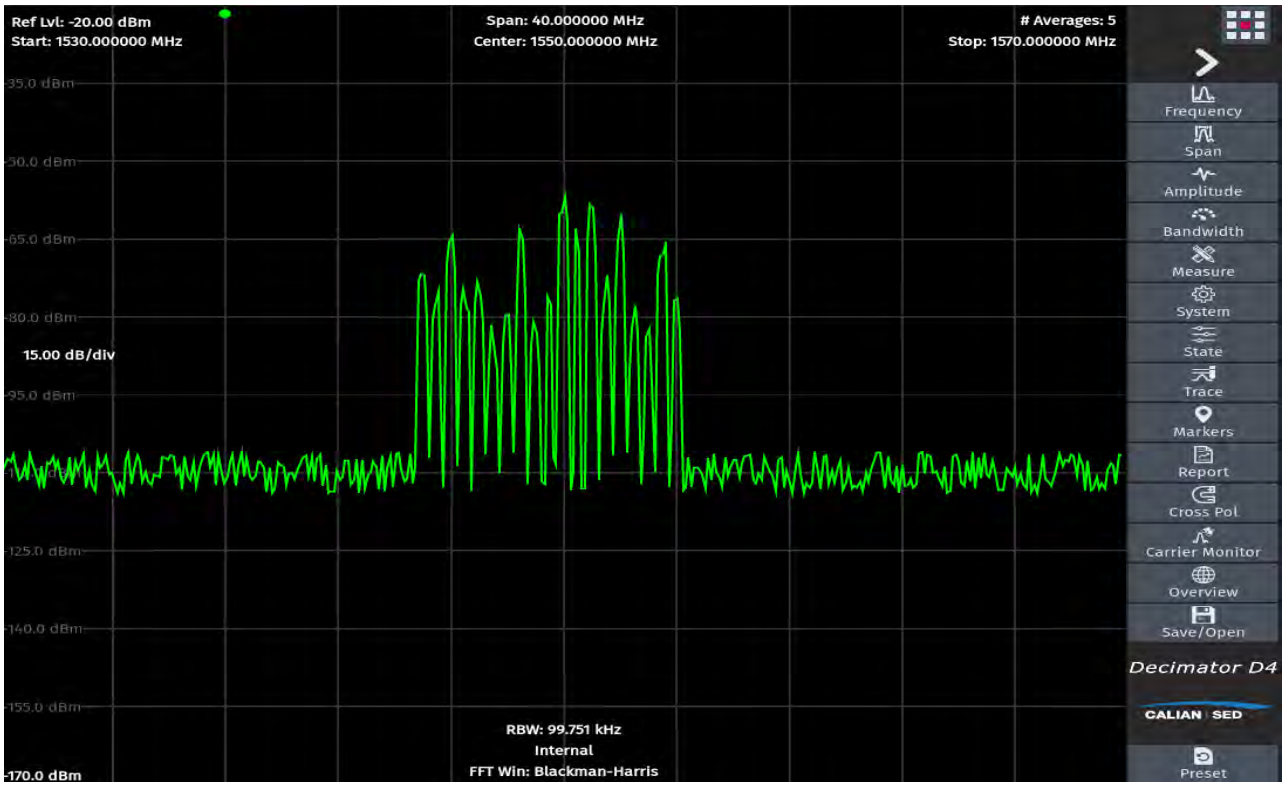
All data communications between Decimator and the controlling computer is via an Ethernet port. Some typical Decimator applications like the spectrum analyzer and carrier monitoring communicate to the Decimator card and the Multiport Decimator as shown below. You can write your own custom software to communicate with the Decimator card using the built-in application programming interface (API).



3. Setup

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

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

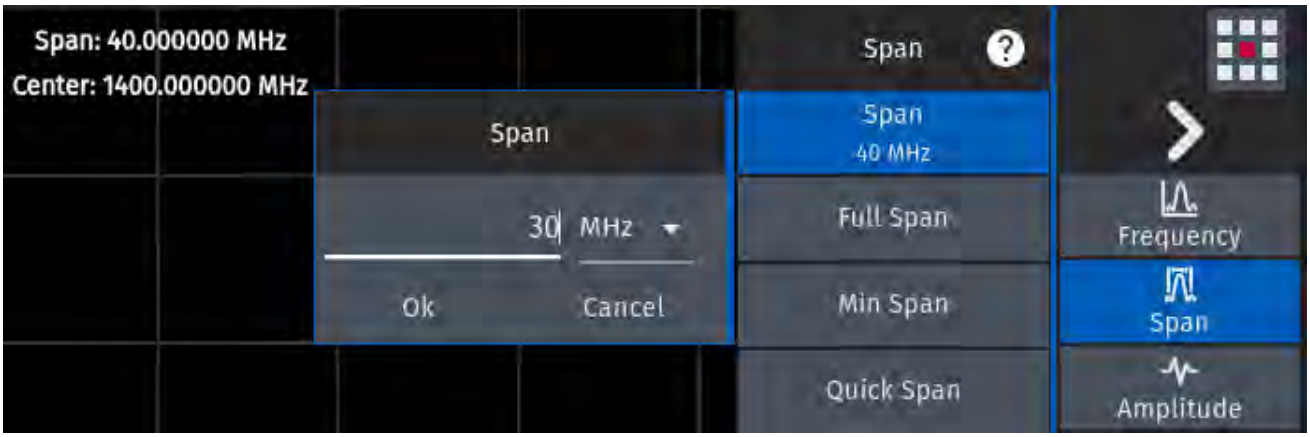


4. Getting Started

You can control your Decimator remotely using the new D4 HTTPS REST API or the legacy D3 TCP/IP ASCII-based API, allowing you to integrate it into your NMS to measure particular carrier(s) or use it interactively via the web GUI. We will focus our attention on using the web GUI to give you a tour of the rich features of the Decimator. The first thing you will notice about the GUI 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.

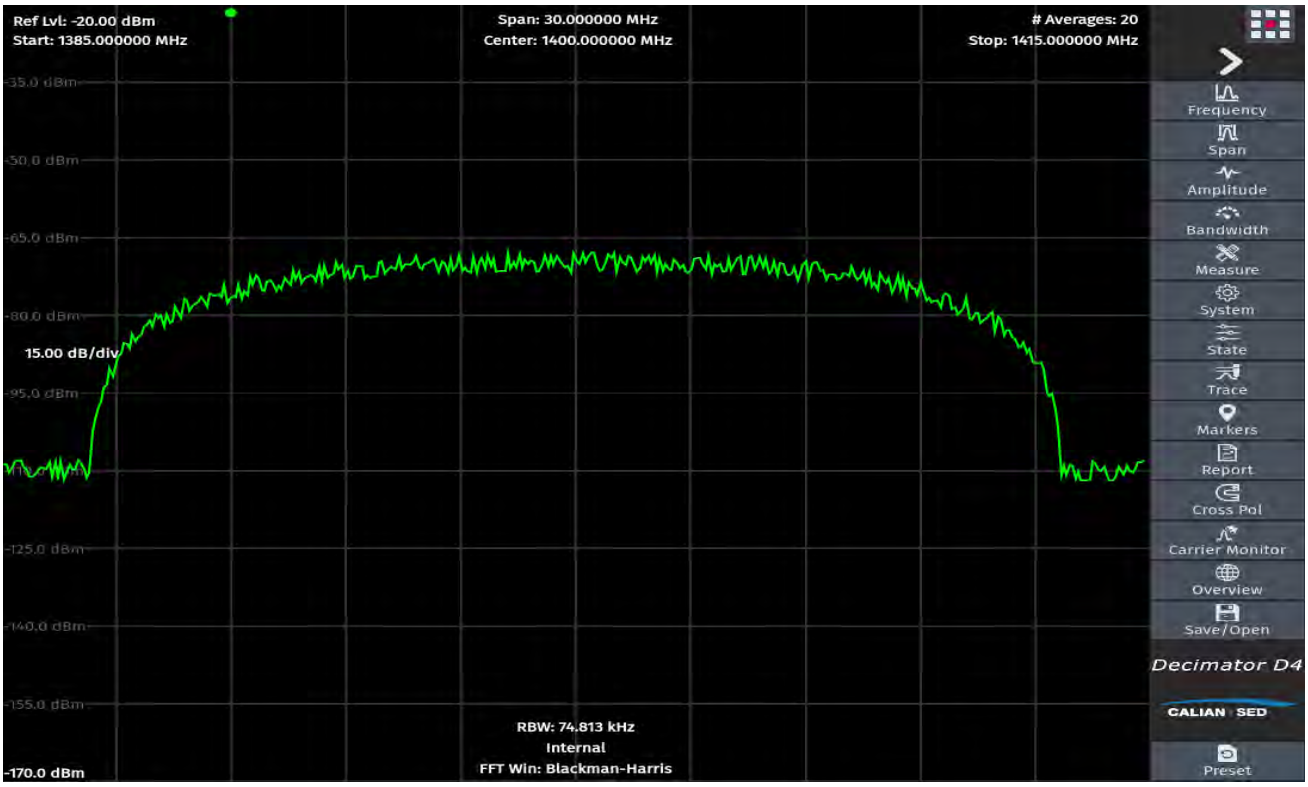
Let's center the spectrum display on a carrier at 1400 MHz. Click the *Center Frequency* menu item and enter 1400 in the dialog box as shown below. Click *Ok*.

Let's change the span to zoom out to a more suitable carrier width by setting it to 30 MHz. Click the *Span* button, then the *Span* menu item, enter 30 (keeping the units as MHz), and click *Ok*.



You have now locked the display into the carrier of interest by setting the center frequency and span. You can tune many other settings such as the number of averages, resolution bandwidth (RBW), and more.

In this case, the number of averages was increased from 5 to 20, resulting in the modulated carrier display shown below.

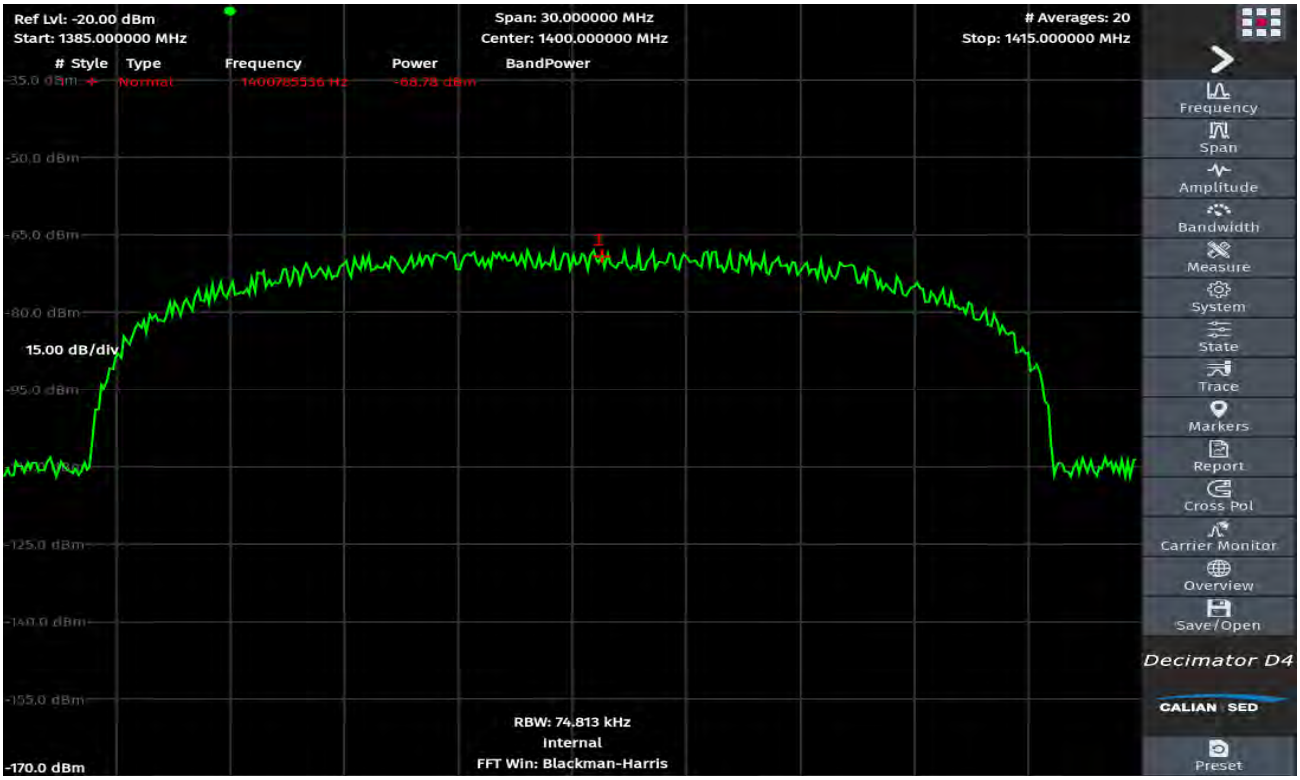


Total Elapsed Time: 7 minutes

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 table.

Let's move the marker to the peak. Click the *Function* menu item and select *Peak Search*. The peak power value is shown below in the marker table at -68.78 dBm.



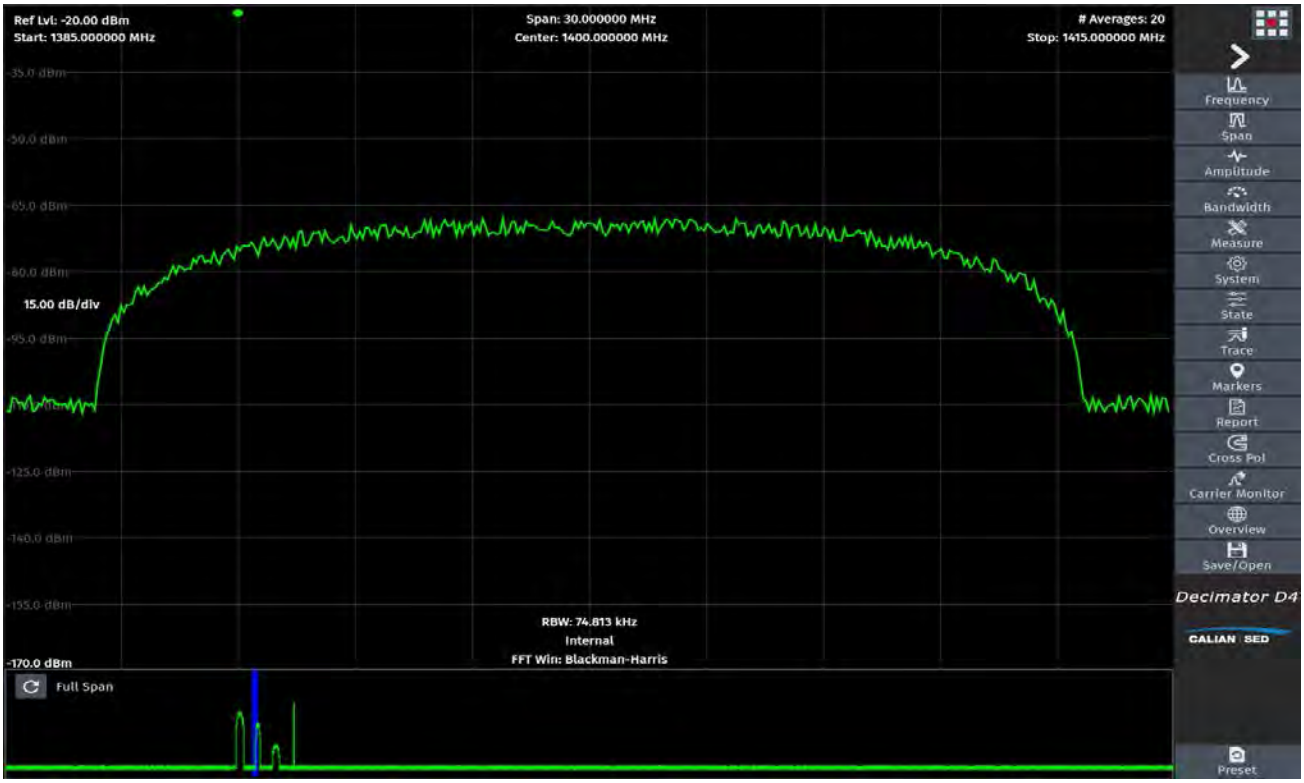
You can collapse the marker table by clicking the white header row, and open it by clicking the row again. You can also drag the table to wherever you want on the spectrum display area!

This example showed the use of individual markers, but the markers can also be used in delta mode, which allows you to determine the total band 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 Bar

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 to show a trace of the full span to help navigate around our spectrum. Click the *Overview* button and turn overview mode on by selecting the *On Full Span* option in the menu. The overview bar is shown at the bottom of the screen as shown below.



Notice that our modulated carrier is selected with a blue background at 1400 MHz. There appears to be three other carriers present that we will have a look at in the Carrier Monitoring section. You can refresh the overview bar full span trace at any time by clicking the refresh button at the top left of the overview bar or clicking *Refresh* 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. You can left-click anywhere in the overview bar to specify a new center frequency or if you like, drag the blue selection bar, as shown below, to do the same thing.

The center frequency preview value is shown while dragging so you know where you will end up after you complete the operation. The two 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 displayed while dragging, along with the span boundary line previews as shown below.

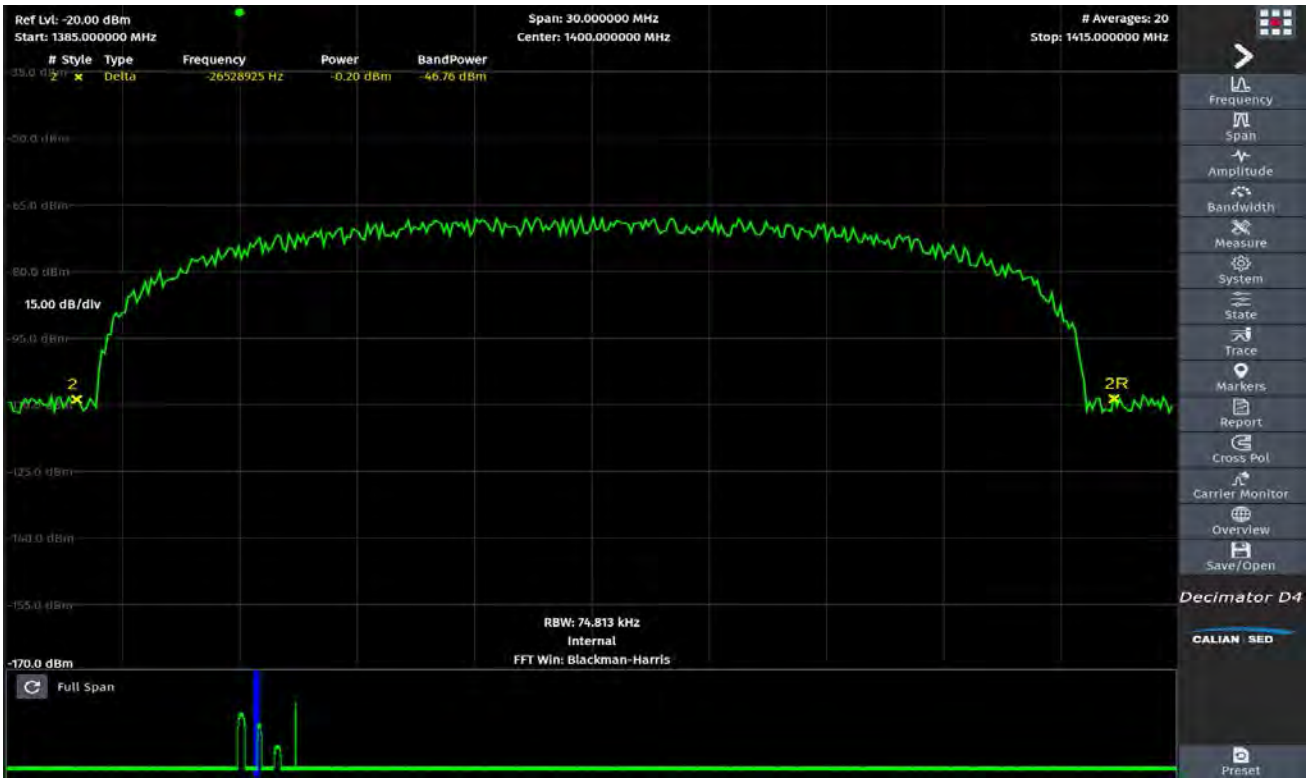
Spectrum navigation has never been easier. That’s like putting on your spectrum analysis glasses when you didn’t know you need them!

Total Elapsed Time: 10 minutes

7. Carrier Monitoring

Now that you have configured the Decimator GUI to view a carrier, you are 90% of the way to performing carrier monitoring. Yes, really! In this tour, we will have four carriers to measure. We have already configured the first one. Conceptually, a measurement consists of a list of settings (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.

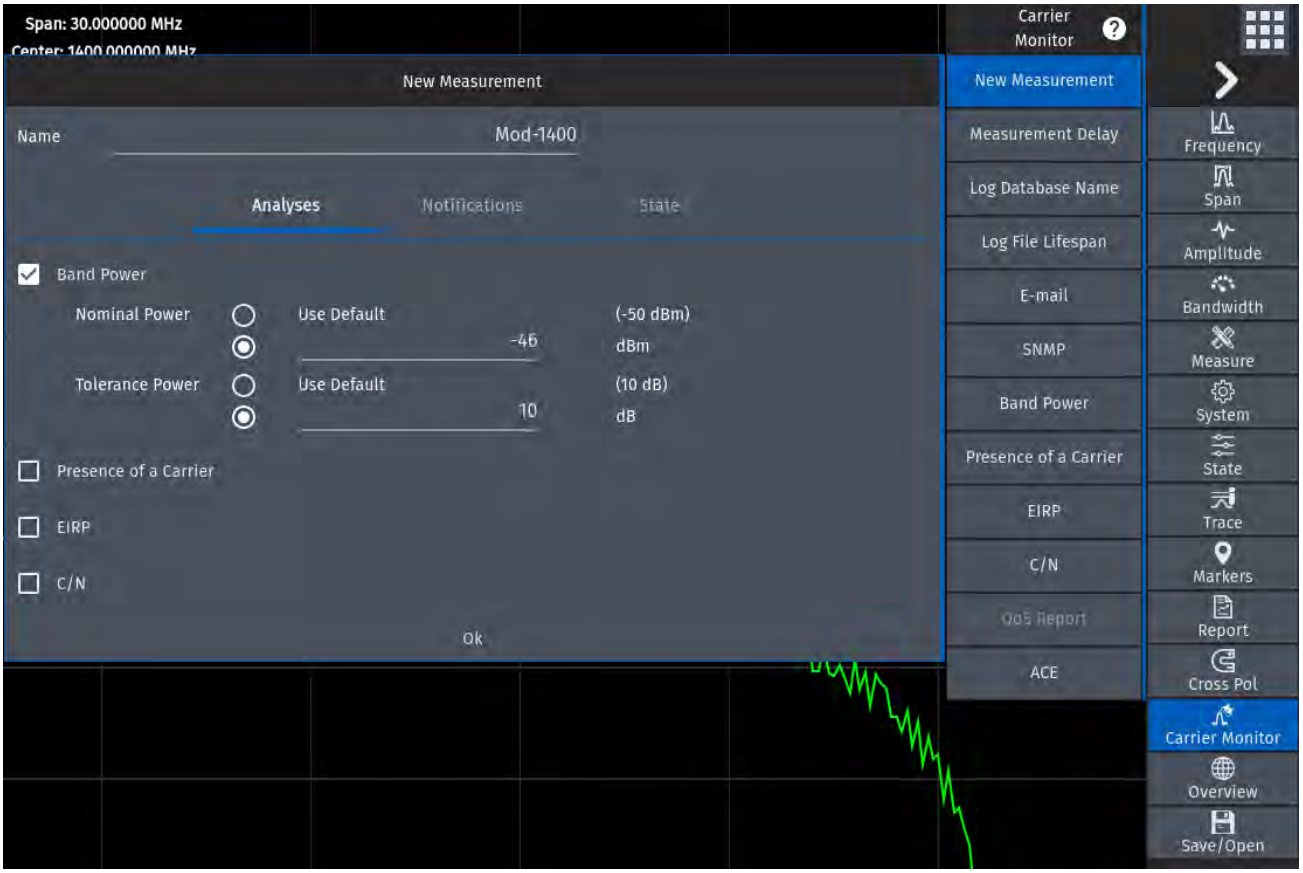
Before adding our first measurement, let's get some help computing the band power for the modulated carrier. We will use a delta marker to help us do this. Click the *Markers* button, then *Marker 2*, click the *Style* menu item, and select *Delta*. Drag the markers around with the mouse to separate them, one on each edge of the carrier. The band power shown below in the marker legend is the total power in the carrier. We can use -46 dBm for our nominal power in this case.



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 set the values of *Nominal Power* to -46 dBm and *Tolerance Power* to 10 dB. This provides operational threshold limits from -36 dBm to -56 dBm.

- You should see something like the screen shown below. Click *Ok.*



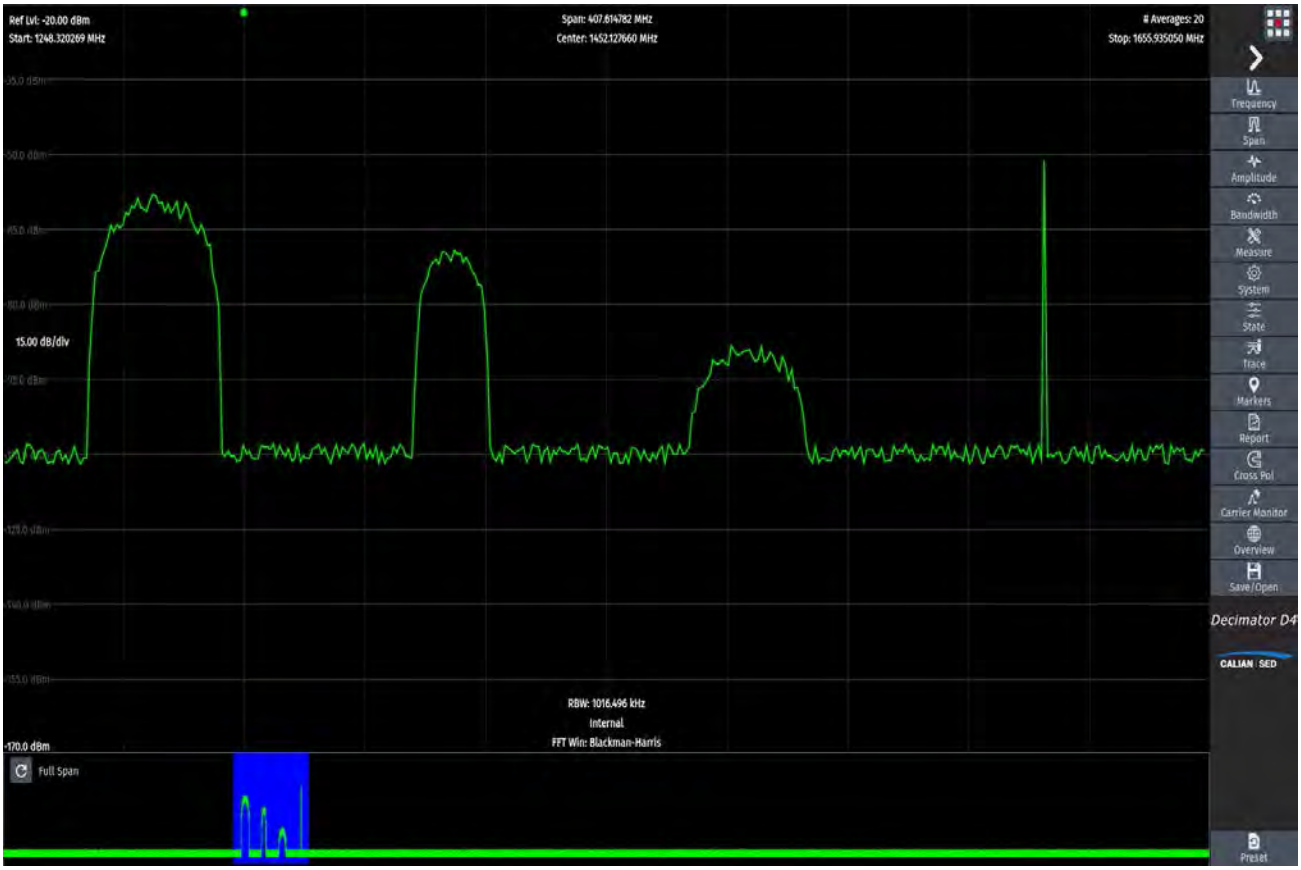
- Notice a carrier monitoring toolbar was added to the left of the display. More on this later.
- We could connect more RF feeds to other switch ports on the Decimator and bring in other carriers from those feeds, but for this example, all four carriers will be on switch port 1. If you need to change the switch port, click the *System* button and set the switch port as needed.
- We will go ahead and repeat the above steps for the other three carriers with the settings specified in the table below to create a total of four measurements. Configure these settings using the *Frequency* and *Span* buttons as before, or lock them in using the overview bar – your choice.

Measurement Name	Center Frequency (MHz)	Span (MHz)	Nominal Power (dBm)
Mod-1400	1400	30	-46
Mod-1300	1300	50	-36
Mod-1500	1500	50	-66
Mod-1600	1600	1	-26

Automatic Carrier Extraction

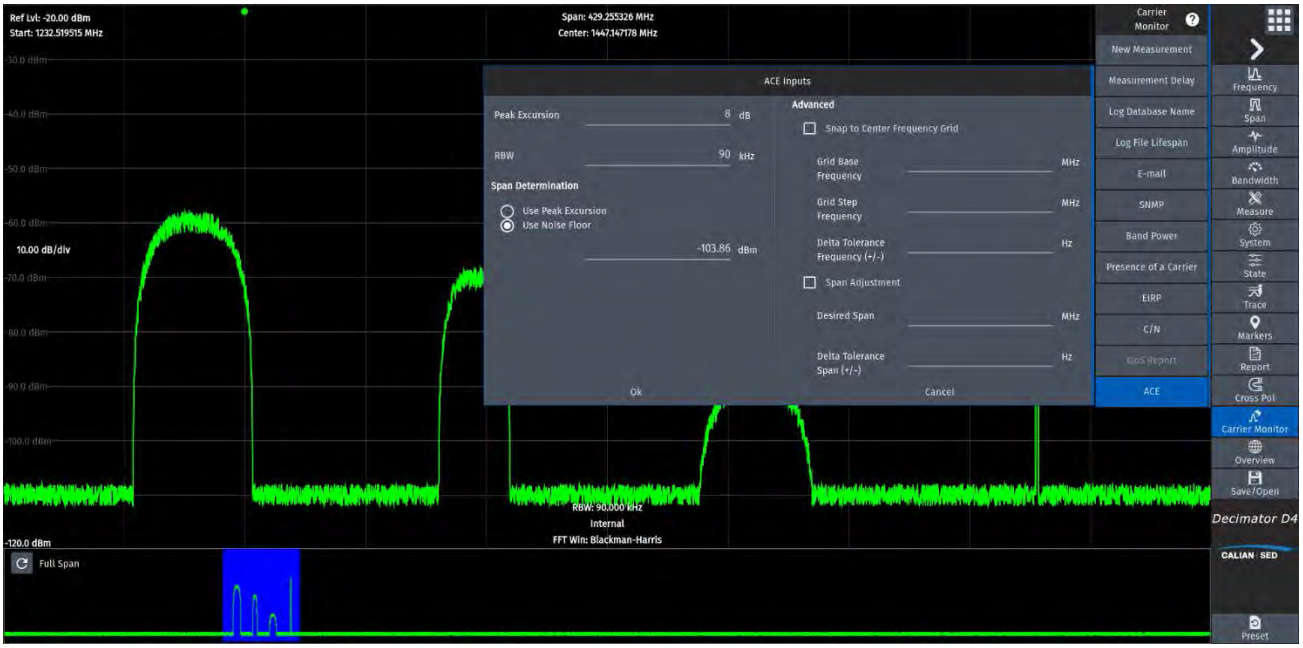
You can also add carriers manually using the Automatic Carrier Extraction (ACE) feature. This is new to the D4 and helps extract carriers in significantly less time, allowing you to begin monitoring even faster!

- To begin, we will assume none of the carriers mentioned above have been added – simply select and delete them with the measurement toolbar if needed!
- Using the overview bar shown below, change the span to encompass all of the desired carriers.

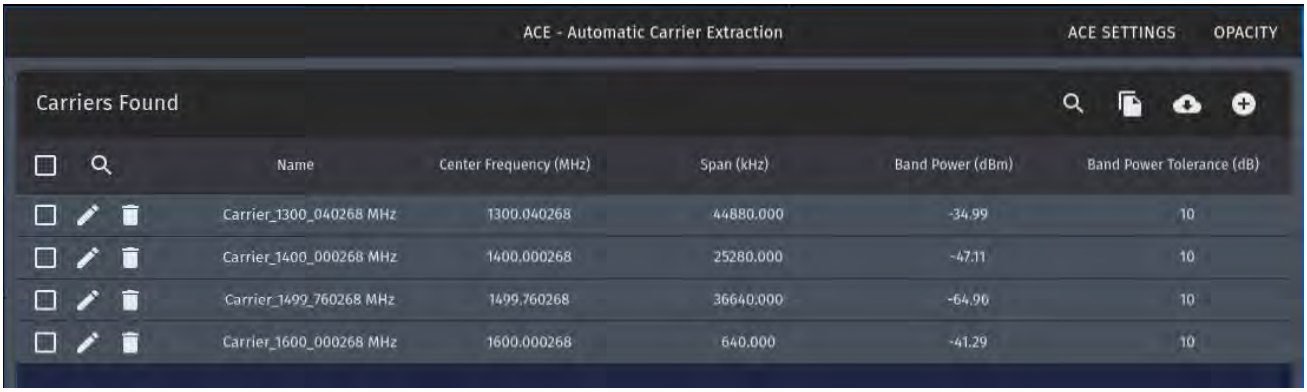


- Click the *Carrier Monitor* button then click the *ACE* button.
- The *Peak Excursion* value is the amount in dB that the signal needs to rise and fall before a carrier is identified.

- For simplicity, we will set the RBW at a low value – this allows for more accurate measurements of the nominal band power – and change the *Span Determination* radio buttons to *Use Noise Floor*, as shown below.

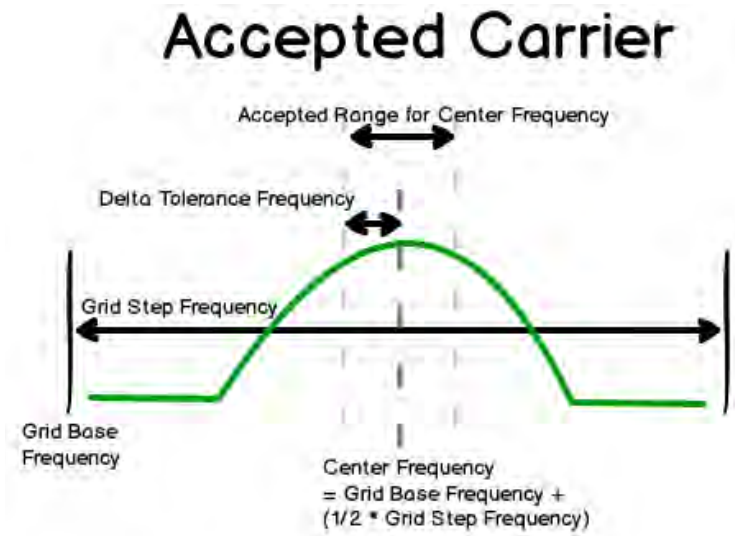


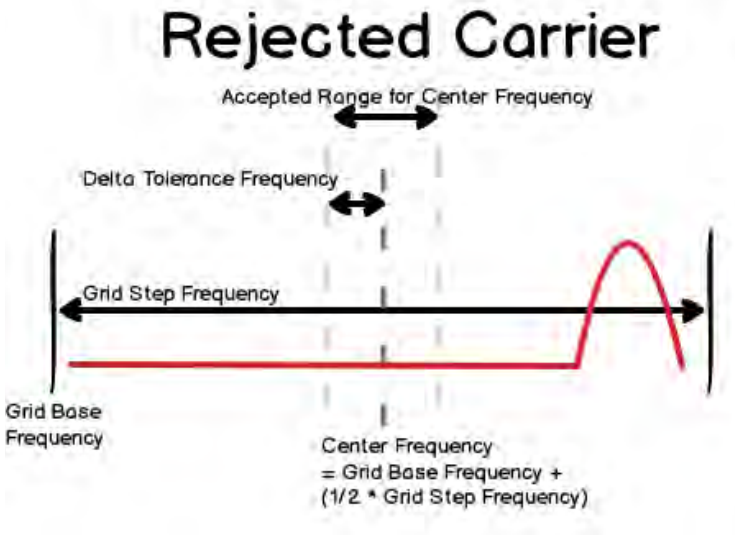
- Click *Ok* to see the *Carriers Found* table as shown below.



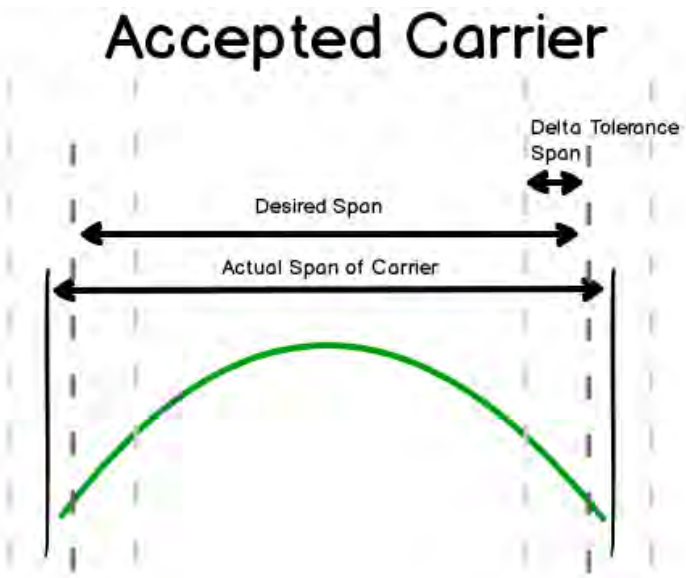
- You can now rename the found carriers, edit their center frequencies, spans, band powers, and the tolerance if desired.
- Notice that while the first three carriers have a close approximation to the band power and span we set in the table above, the last does not. To get an accurate reading on the final CW carrier, you can enter a smaller RBW to increase the resolution.
- Simply select the rows to add to carrier monitoring and click *Ok*!
- More advanced settings can be achieved by enabling settings on the right panel and filling in the required fields.

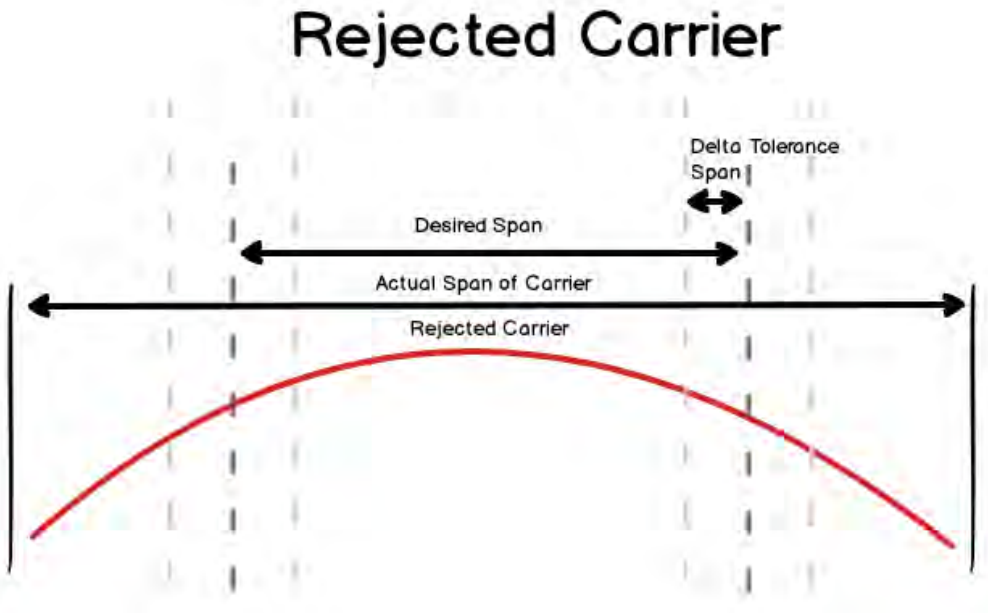
- *Snap to Center Frequency Grid* ensures the center frequency of any found carriers is within a specified slotted range, where carriers outside of that range are ignored. This is depicted below.



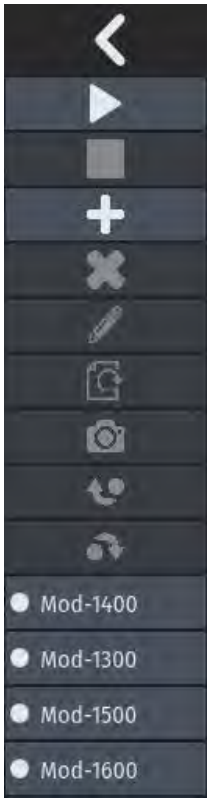


- *Span Adjustment* ensures the span is within a desired range, where any carriers with a span outside of this range are ignored. This is depicted below.





You will notice four icons at the bottom of the carrier monitoring toolbar, one for each measurement.



Back button

Start carrier monitoring

Stop carrier monitoring

Add a new measurement

Delete selected measurement

Modify selected measurement

Recall state from measurement

Capture existing state into currently selected measurement

Move selected measurement up

Move selected measurement down

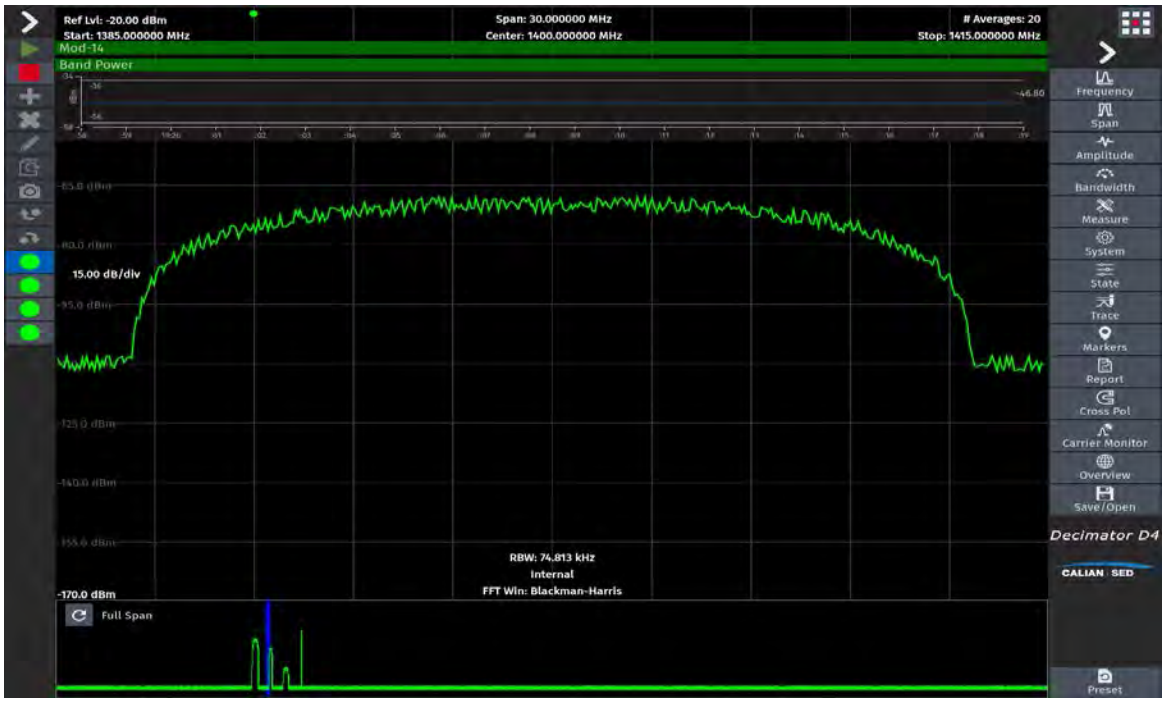
List of selectable measurements

These additional symbols only appear when there are too many measurements to fit the screen without scrolling:

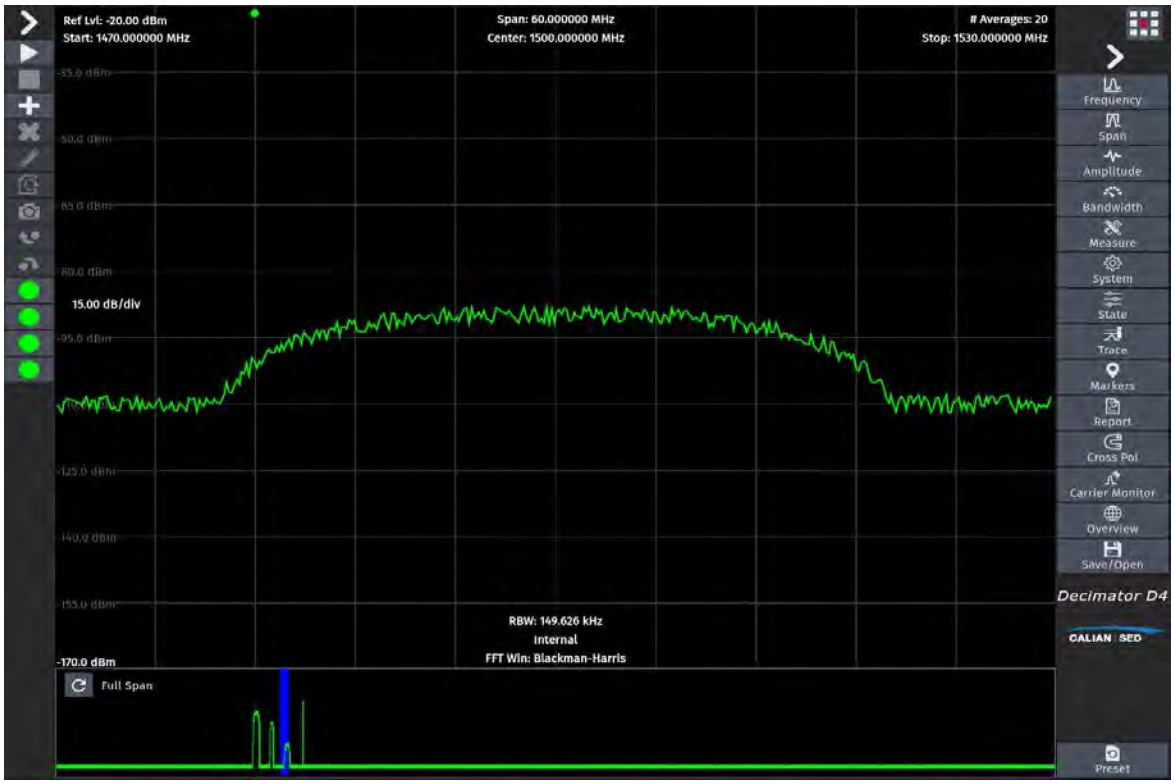
- Double arrow up: Scroll to top
- Single arrow up: Scroll up
- Single arrow down: Scroll down
- Double arrow down: Scroll to bottom

Let's enable carrier monitoring logging. This logs all the Trace data and results of any analysis to the browser's cookies. The Spectator functionality will need it later too. Click the *Carrier Monitor* button, click *Log Database Name*, specify a database name, and click *Ok*.

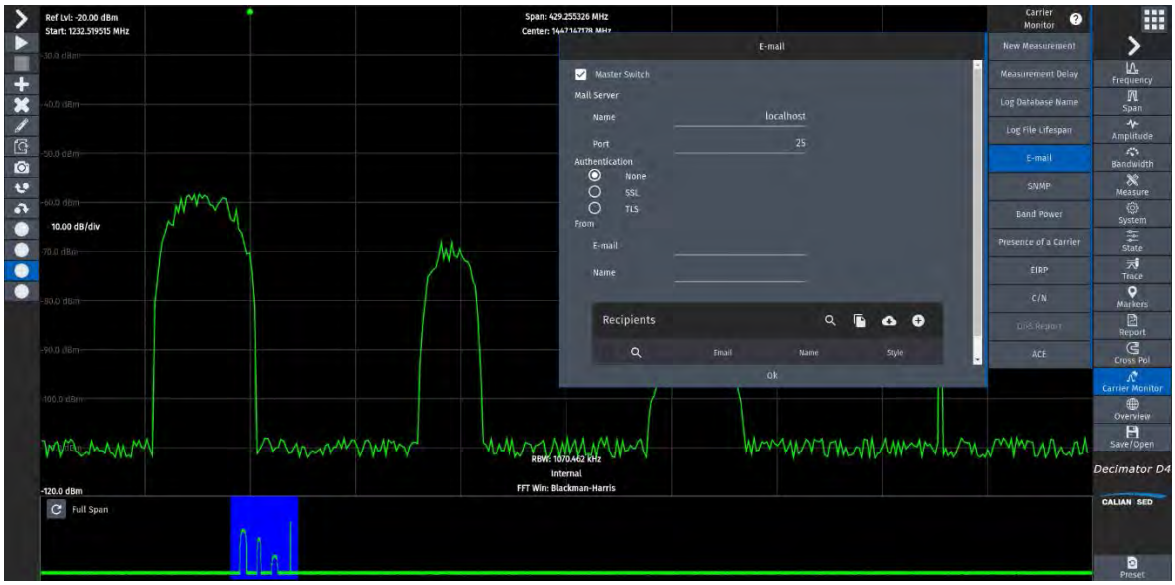
- Start the measurement process by clicking the play button on the toolbar.
- Note the historical and new values being overlaid on screen after a measurement has had been analyzed three times, with your specified limits for the analysis indicated by white lines.
- The measurement result status is reflected 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 -46 dBm, which matches the marker measurement we made.



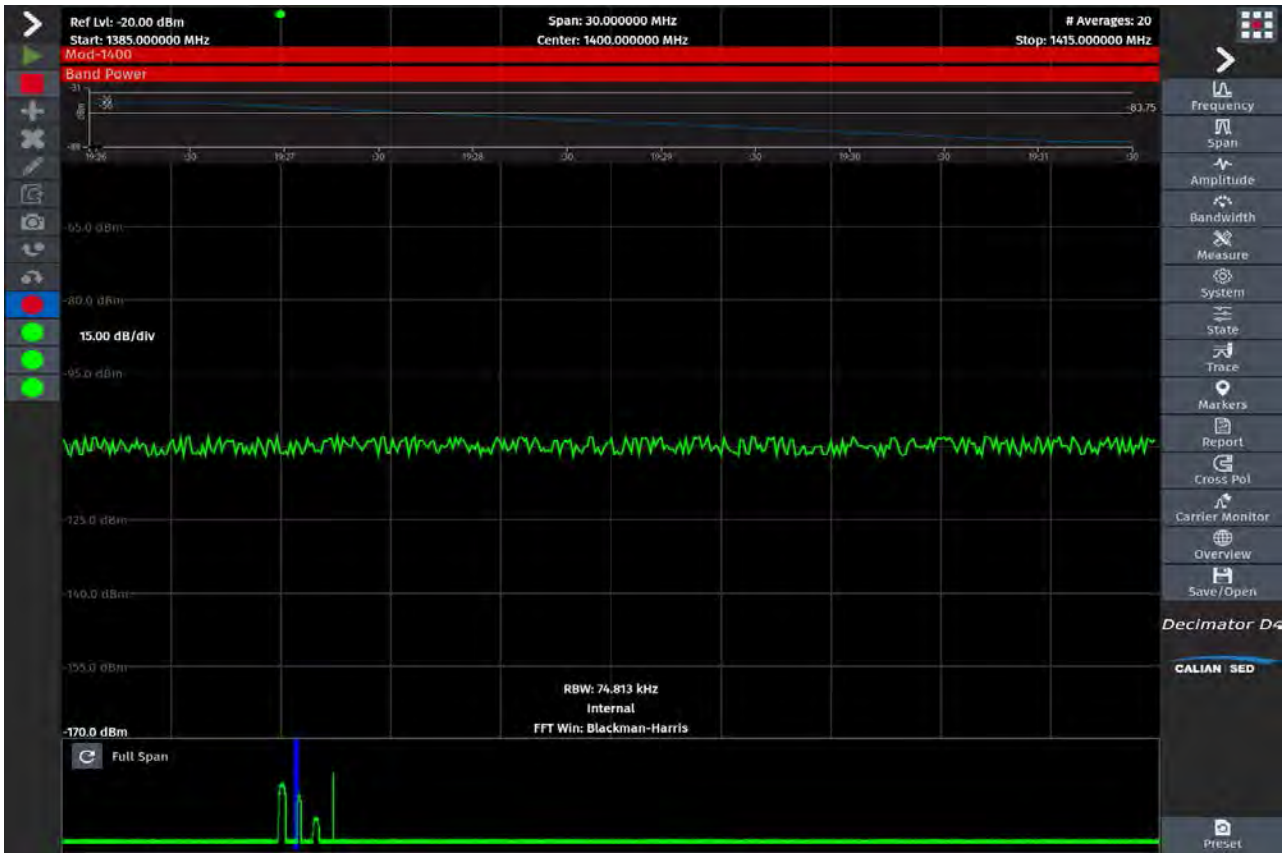
- Stop carrier monitoring using the stop button.
- Mouse over the *Mod-1500* icon.
- Click *Recall* to establish the settings from the *Mod-1500* measurement as the current settings in the Decimator.



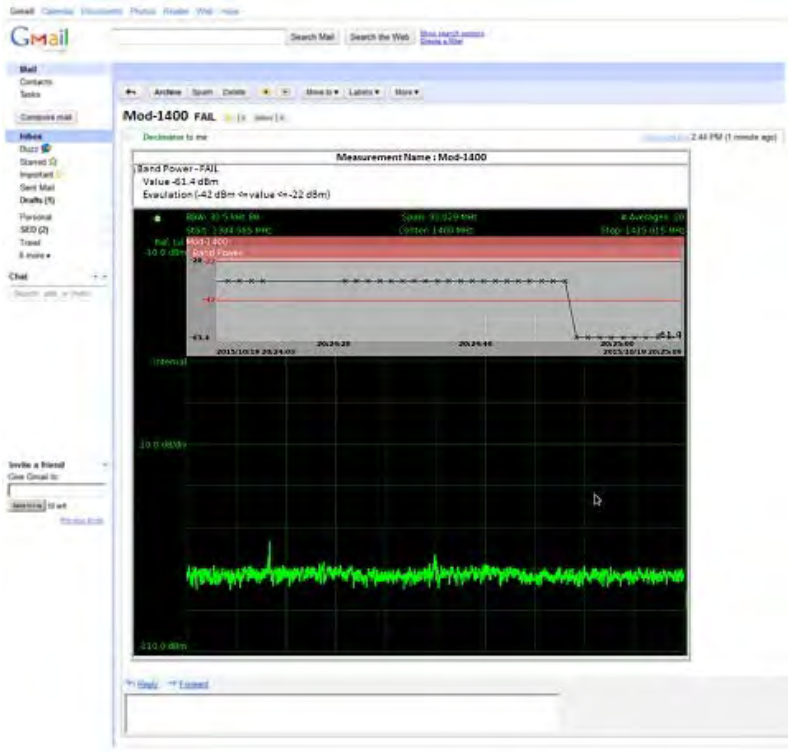
- Change the span from 50 MHz to 60 MHz. Then click the capture (camera) button on the toolbar to save the updated span value back to the measurement. You just modified a measurement. That was easy!
- Now let's configure email notifications so there is a recipient when a measurement changes result status, 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 better for notifications on smart phones. Click the *Carrier Monitor* button, then the *Email* menu item. Enable emailing by checking the *Master Switch*, and fill out the options. You need unblocked access to a local mail server to send out email notifications. You can also send email with SSL and TLS authentication.



- Restart 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.



- Notice the alarm email with the screenshot embedded



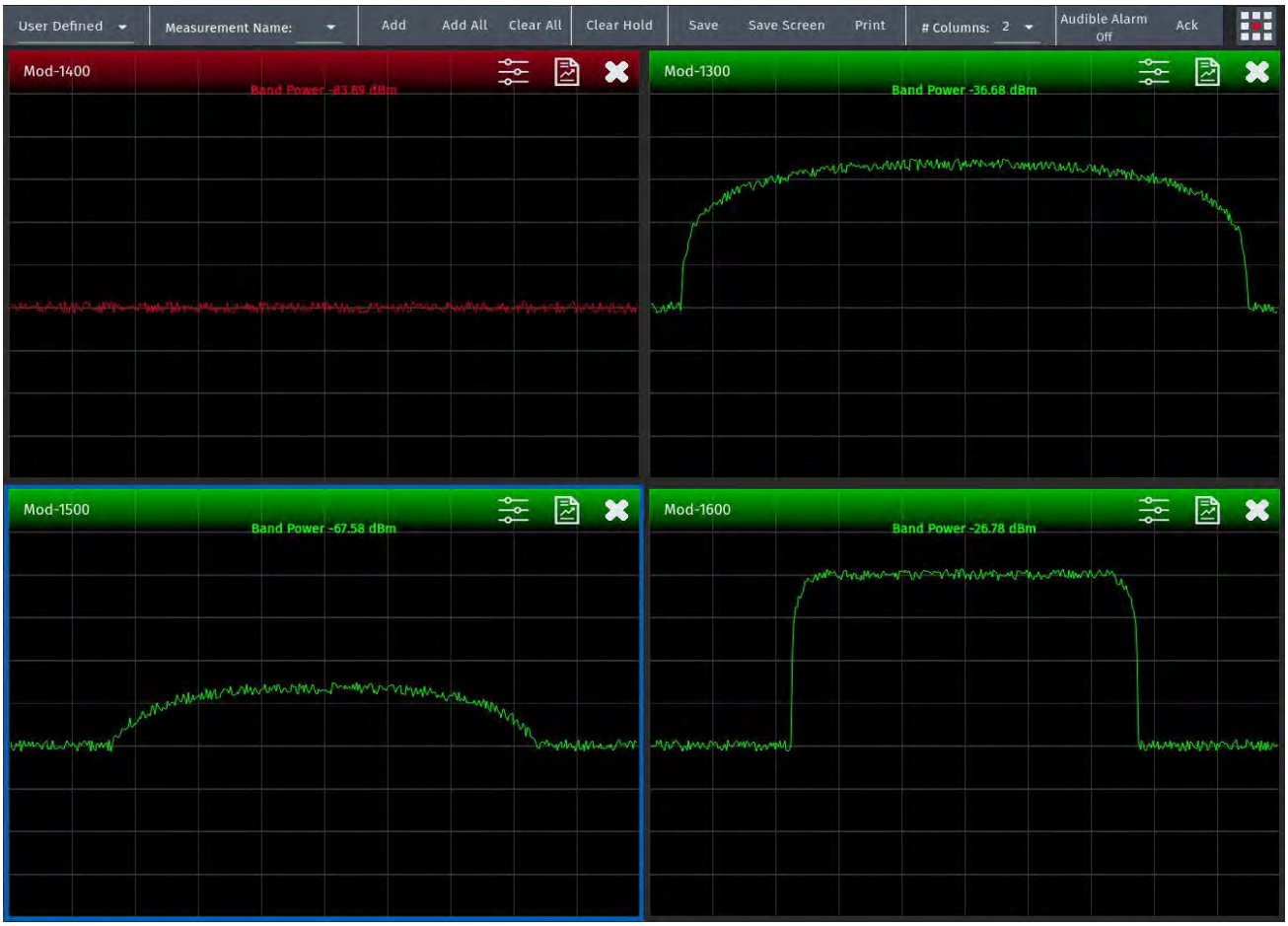
- Re-enabling the input feed moves the *Mod-1400* measurement back into success status, triggering another email. On a Multiport Decimator, you can monitor one or more carriers on each of the switch ports. Carrier monitoring automatically switches the ports for you to acquire the trace.
- Carrier monitoring can also be configured to send SNMPv2 traps of the resulting analyses: C/N, EIRP, band power, or presence of a carrier. 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 GUI 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!

Total Elapsed Time: 25 minutes

8. Spectator

The *Spectator* feature is an extension to carrier monitoring that requires an additional license. It provides a tiled display of measurement traces, state, and much more.

Click the apps button, found in the top right corner of the screen, and then click the *Spectator* button. The *Spectator* dashboard window appears. For simplicity, let's add all our four carriers to the tiled display. We can do this by clicking the *Add All* button on the toolbar in *User-Defined* mode as shown below.



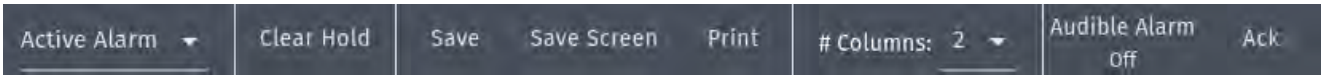
Each measurement appears in the tiled display. You can control the layout by adjusting *# Columns*. You can add one or more carriers here, maybe just your important ones, or you can add them all as we have done above. This display can be configured to show up to 100 measurements.

Click the play button on the carrier monitoring toolbar to start carrier monitoring again.

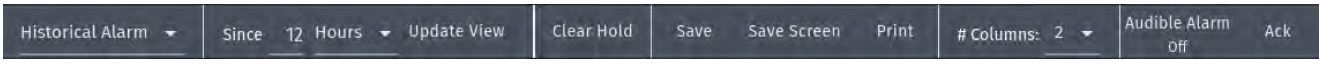
You will see the trace for each measurement update and the state evaluated. Each measurement tile has the following information:

- Measurement name and its state depicted in color.
- A trend button to display the *Spectator* historic view window. More on this in a bit.
- A settings dialog to show the settings such as center frequency, span, etc.
- A delete button to remove the measurement from the *User-Defined* dashboard.

The *Spectator* dashboard has three modes: *User-Defined*, *Active Alarm*, and *Historical Alarm*. You saw 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 below.



The *Historical Alarm* mode is similar to the *Active Alarm* mode, but it provides an additional time range in the past to search for measurements that are/have been in an alarm condition. Again, the most recently raised measurement alarms appear first, followed by corrected measurements.

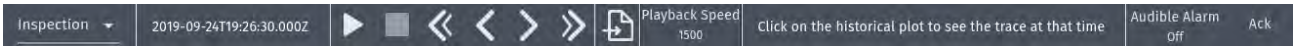


Let's drill down on the alarmed measurement for more detailed analysis. Click the trend button or double-click the tile for *Mod-1400* to display the historical view window as shown below.

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

Let's try *Inspection* mode as shown below. The toolbar now allows 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 *Spectator* historical view *Inspection* mode toolbar is shown below.



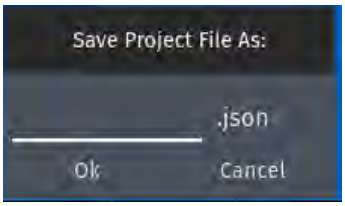
The toolbar items are, from left to right:

- Selected mode
- Date and time selected in the plot
- White arrow: Start playback of traces from the current selected time
- White square: Stop playback
- Left double arrow: Select the first time in the plot
- Left single arrow: Select the next time in the plot
- Right single arrow: Select the previous time in the plot
- Right double arrow: Select the last time in the plot
- Load previous day: Load one more day in the past, up to a maximum of 7 days

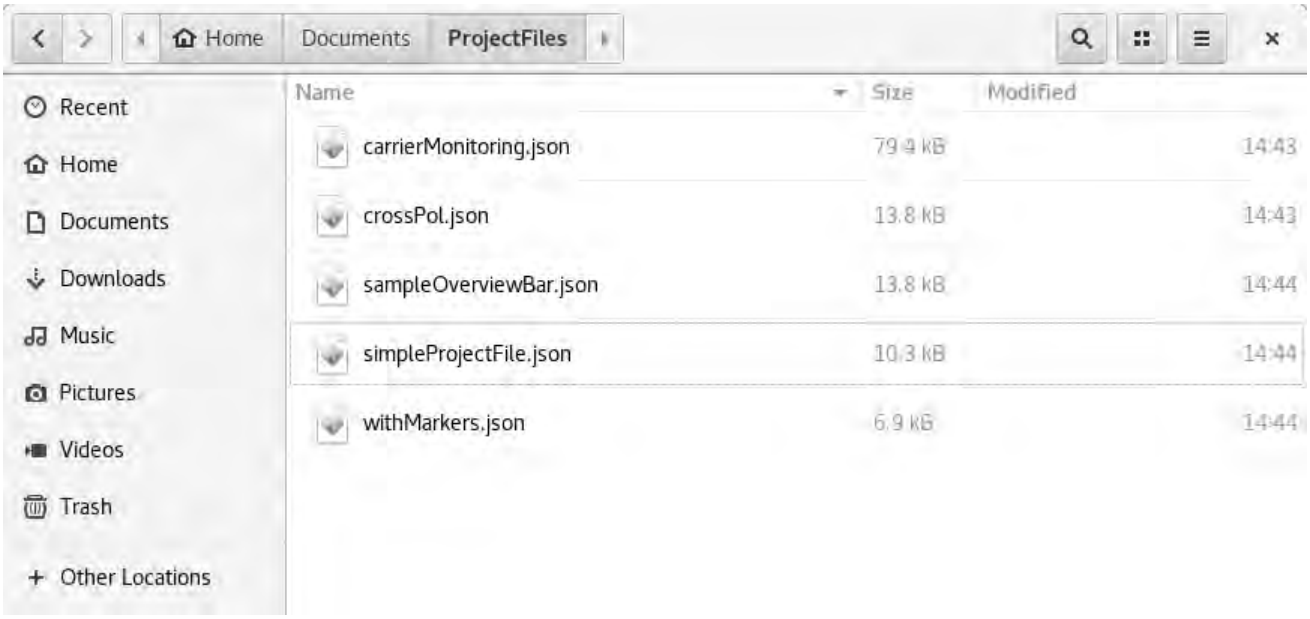
Total Elapsed Time: 35 minutes

9. Save and Restore

Now that you have done all this work, it's a good idea to save the configuration to a project JSON file locally on disk. This saves your settings, markers, memory traces, states, and measurements. Note that this 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*.



Close the Decimator GUI to allow us to start over from scratch. Open a new Decimator GUI session by entering the IP address in the browser. Click the *Save/Open* button and then click the *Open Project* menu item. Browse to the project file you just saved and click *Open*.



The previous Decimator configuration is restored, including the carrier monitoring measurements.

Files can also be saved to the browser's local storage in the same way by clicking *Save/Open* and then *Save Local Storage*. These local storage files can be opened using the *Open Local Storage* button. Select a file and then click *Ok* to restore that file's configuration.

The following table summarizes the storage operations for the Decimator D3 and D4.

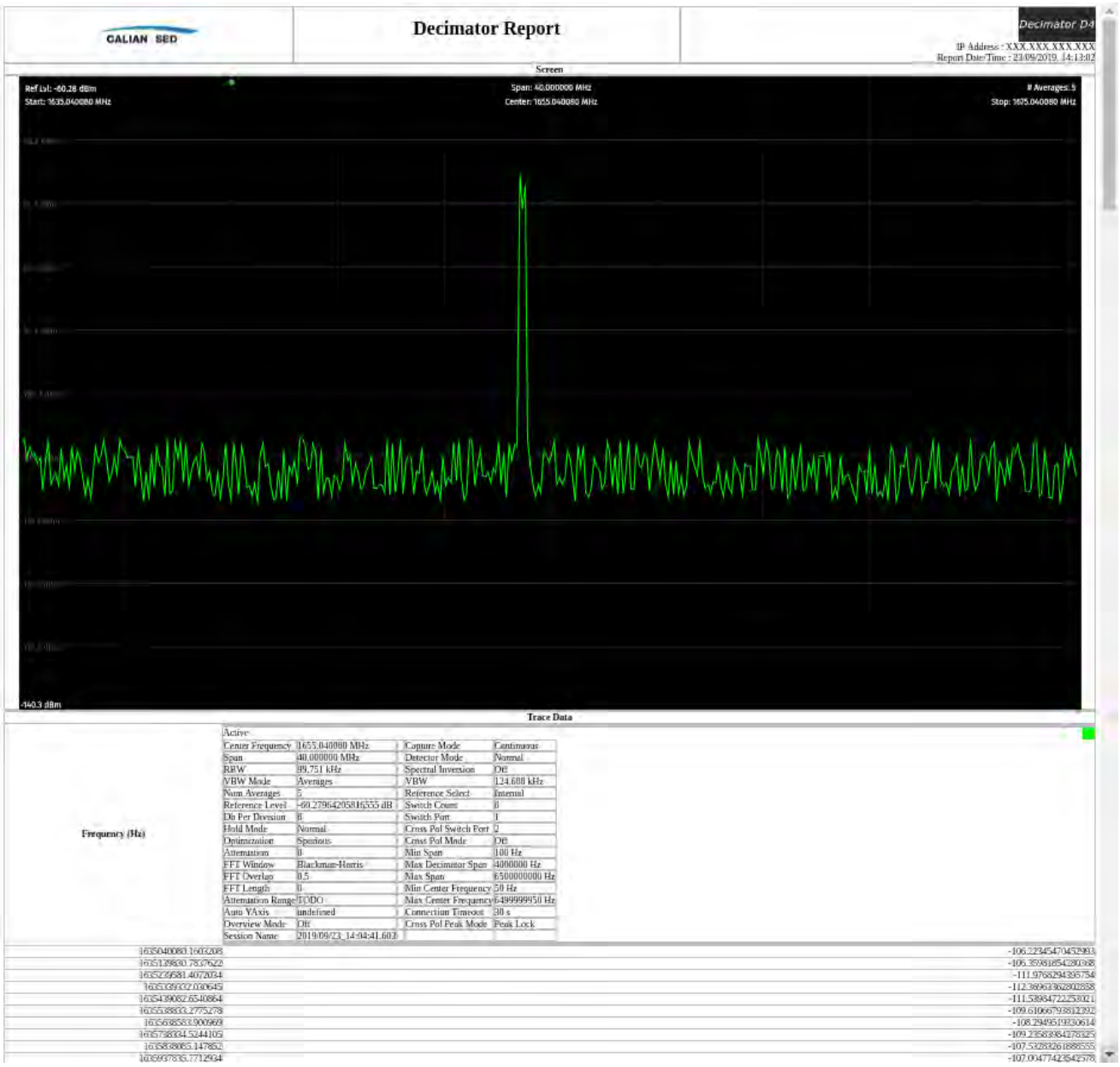
Operation	Decimator D3	Decimator D4
Open	Project file in XML format on disk opened either interactively within the GUI, or at startup from a command line parameter.	• Project file in XML format converted interactively on open (this allows D3 project files to be imported into D4). • Project file in JSON format on disk opened interactively. • Project file JSON in the browser's local storage keyed by name and referenced in the startup URL.
Save	Project file in XML format saved to disk interactively.	• Project file in JSON format saved to disk. • Project file in JSON format saved in the browser's local storage under a key name.

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 as a CSV file. Up to four additional traces can be saved. Markers and a screenshot are included.

We'll look at an example of an HTML report. Close the Decimator GUI and start a new session. Select the *Report* button and then click the *Export to HTML* menu item. Enter a new file name, click *Save*, and the HTML report will be downloaded. Open the file once it has been downloaded. The contents of the report are displayed in a browser window as shown below.



Total Elapsed Time: 38 minutes

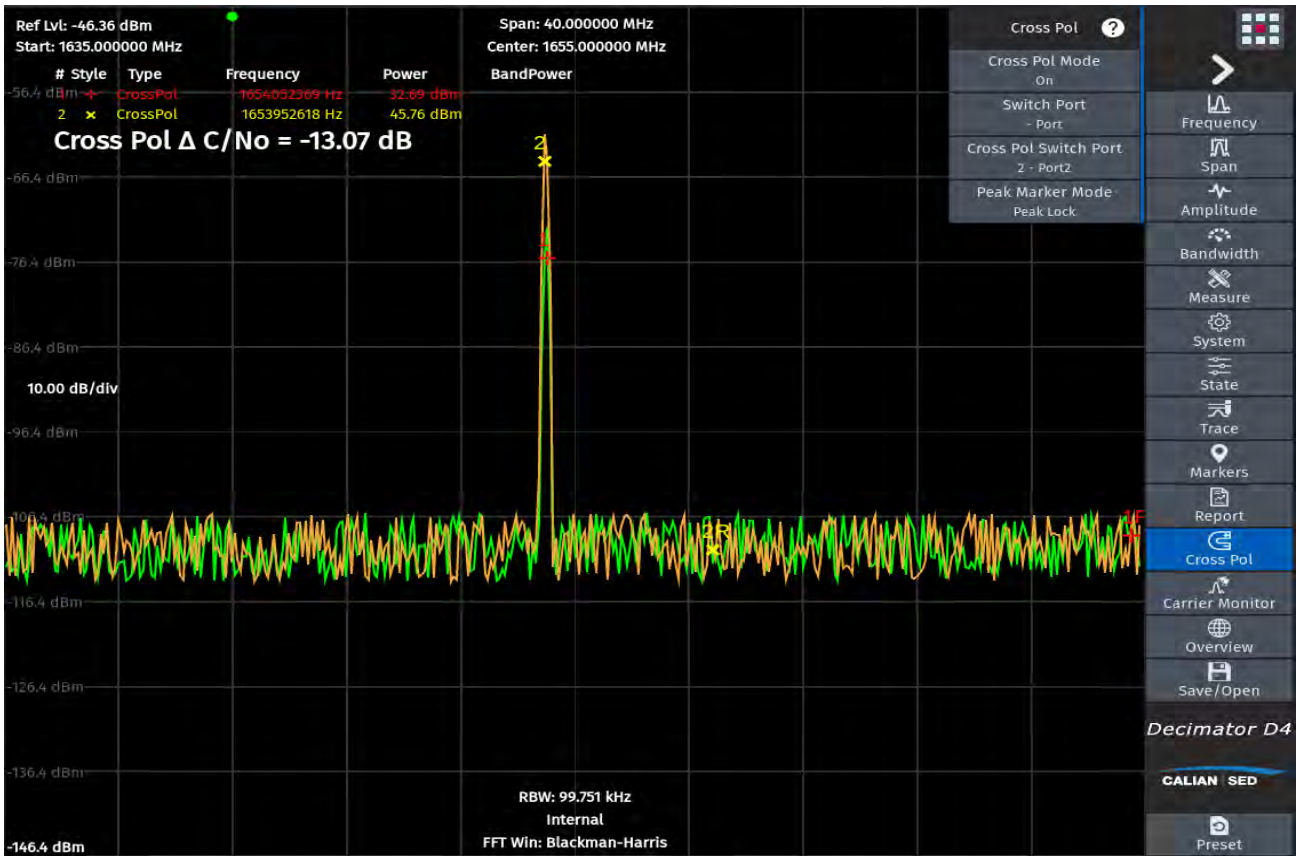
11. Cross-Polarity

The Multiport Decimators are capable of cross-polarity isolation performance testing, as follows:

- Connect one polarization RF feed (the CoPol) to switch port 1.
- Connect the opposite polarization RF feed (the CrossPol) to switch port 2.
- Click the *CrossPol* button.
- Ensure *Switch Port* is set to 1.
- Ensure *CrossPol Switch Port* is set to 2.
- Set the *CrossPol Mode* to *On*.

A trace is displayed from each port, toggling back and forth. Markers are added to both traces, with one at the trace peak and the reference marker at the noise floor. This frequency is determined at the first trace acquisition on the minimum point in the trace, and subsequent trace acquisitions will leave the marker at that frequency. Drag the reference marker to the desired frequency for analysis.

C/N_0 is computed for each pair of markers and displayed in the table – this is simply the difference between the two marker values on the same trace. The delta between the two C/N_0 values is provided under the table, which is the value to optimize as you adjust the orientation of the antenna and observe the changes to the delta C/N_0 summary value. The screenshot below shows the result of CrossPol testing on an 8-port Decimator with switch port 1 and CrossPol switch port 2 being used.



Total Elapsed Time: 42 minutes

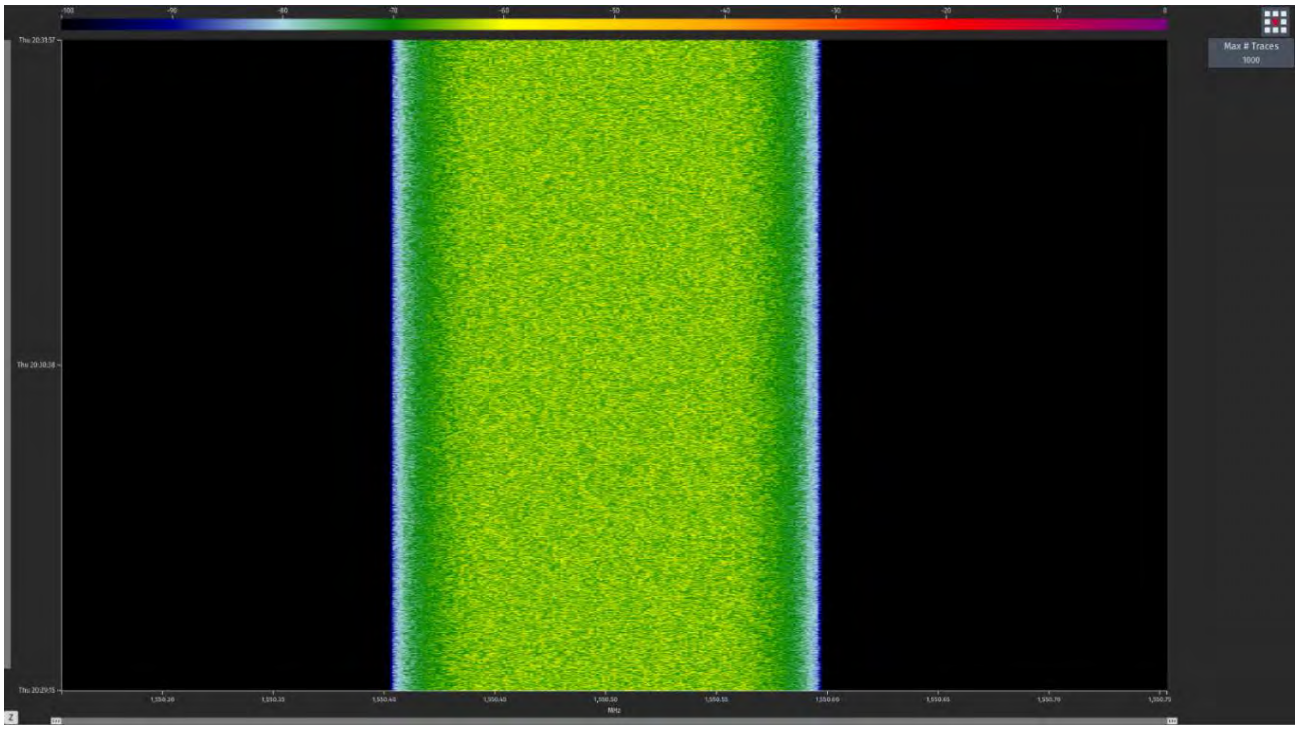
12. Multiuser Support

Multiuser access to the Decimator is directly built into the hardware. This allows you to connect the GUI 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. Waterfall

The Waterfall display provides a heat map representing the latest and historical signal powers.



Click apps button and select *Waterfall*. All the current settings from the spectrum view are loaded into the *Waterfall* view such as center frequency, span, and RBW.

The horizontal axis represents frequency and the vertical axis represents time, with the latest time at the top and the oldest time at the bottom.

Each signal capture is represented with one pixel high row of color in the heat map. Each power value in the signal capture is represented in a colored block, one pixel high by one or more pixels in width depending on the number of power points received in the signal capture. The power value for a trace point is mapped to a color using the legend at the top of the screen to create the colors of the waterfall. As new signal captures arrive, they are displayed at the top of the heat map and the existing rows are pushed down by one pixel, creating the waterfall effect.

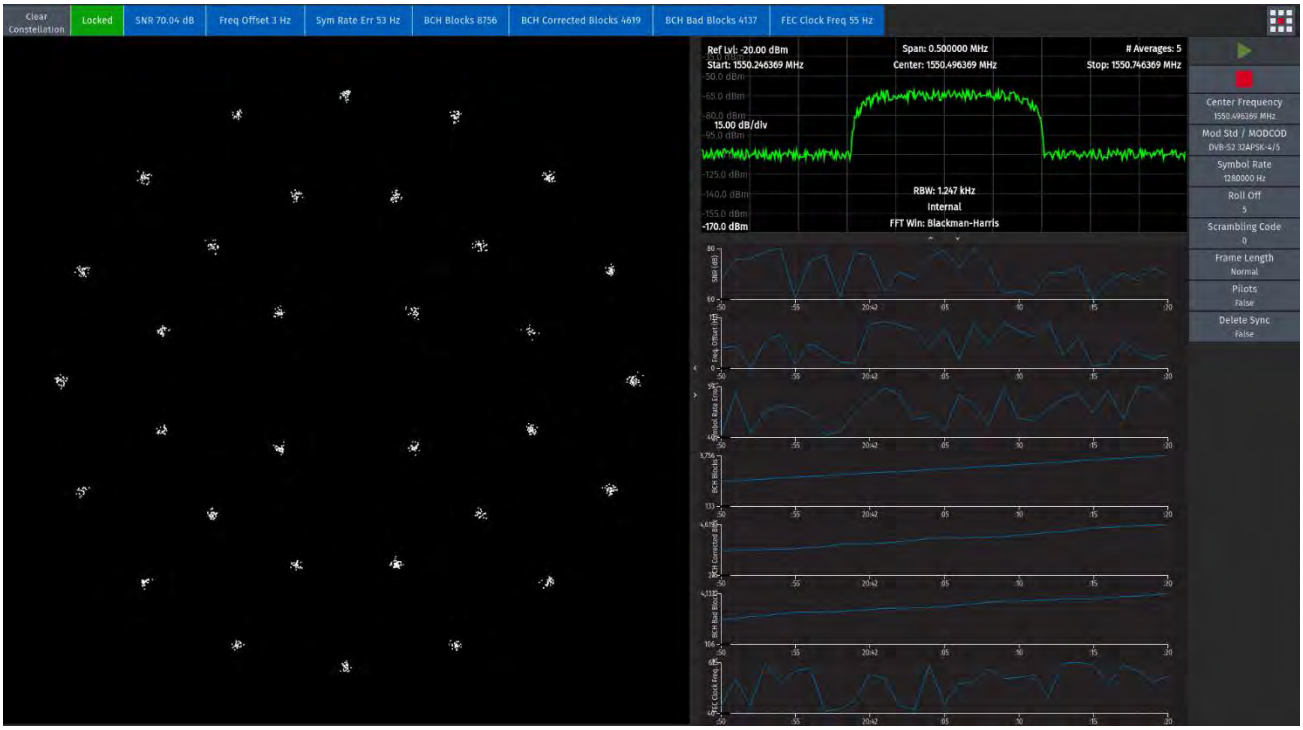
When you navigate back to the *Spectrum* view and change a setting such as center frequency or span, and then navigate back to the *Waterfall* view, you will see the previous historical data was cleared and a new history of signal power being accumulated in the waterfall.

A colorful way to see power variation due to bursty signals!

Total Elapsed Time: 46 minutes

14. Signal Analyzer

The *Signal Analyzer* constellation display (I/Q plot) is a graphical representation of the demodulated digital symbols received over a period of time.



You can specify the *Center Frequency* and *MODCOD* (modulation and coding) along with other signal parameters and start acquiring data. The view shows the constellation plot on the left, the spectrum plot on the top right, and under that a series of historical statistical values. The latest value for each statistic is also displayed in the top toolbar. Clicking on a toolbar statistic turns the button blue and toggles the historical statistic plot on or off.

Grouping all that information together provides a lot of detail about your DVB-S2 signal!

Total Elapsed Time: 52 minutes

15. Your Decimator

Your Decimator is an extremely powerful, cost effective and intuitive product for viewing your signals and spectrum, performing carrier monitoring, and testing cross-polarity isolation.

There are other Decimator features not discussed here, such as saving traces and setting/recalling states. We continue to add the features that you want!

Upon request, we can provide the user manual and the API specification for all Decimator products.

Total Elapsed Time: 54 minutes

This gives you extra minute to get your hands on a Decimator today, or you can ask further questions by contacting Calian as shown below.

CALIAN | SED	Contact Information
Name	Jim Shedden, Sales Manager
Phone	(306) 933-1541
Email	decimator@calian.com
Website	https://www.calian.com