RSA6100A Series
Real-Time Spectrum Analyzers
Application Examples

Reference

071-2590-01

Tektronix

RSA6100A Series
Real-Time Spectrum Analyzers
Application Examples

Reference

www.tektronix.com
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For safety information on your spectrum analyzer, refer to its user manual.

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- Worldwide, visit www.tektronix.com to find contacts in your area.

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Preface

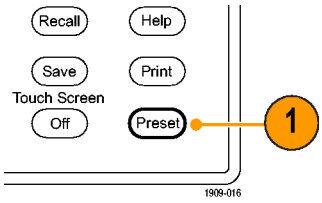
This manual provides tutorial examples of how to use the RSA6100A Series Real-Time Spectrum Analyzers to take measurements in different application areas. To work through these examples on your instrument, you can use either the sample data files provided on your hard drive or a live signal of your choice. If you use your own signal, you need to reset the instrument to match your signal's parameters.

NOTE. *You can use the mouse, keyboard, and touch screen to perform all of the tasks in this manual. Additionally, you can use the knob and buttons on the spectrum analyzer front panel as shortcuts to perform some of the tasks.*

Application 1: Making a Basic Spectrum Measurement

You can operate the RSA6100A Real-Time Spectrum analyzer like a conventional spectrum analyzer. The following example leads you through basic functions of frequency, span, and shows you how to make amplitude and frequency measurements with markers.

1. Push the front-panel **Preset** button to set the instrument to the default settings.

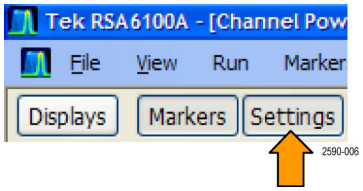


The following steps set up the appropriate measurement parameters for the sample signal.

2. Click **Freq** in the application menu bar and type in **2 GHz**.

   2 GHz is the frequency of the saved signal that you will recall in a later step. Enter the value with the front-panel keypad or an external keyboard attached through the USB port.

3. Click **Settings** in the application menu bar.

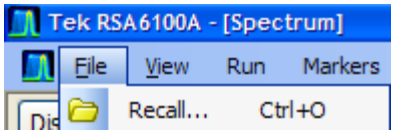


4. Set the span to **1 MHz** in the resulting **Spectrum Settings** lower screen pane.

   To locate the **Span** screen item, be sure the **Freq & Span** tab is selected.

5. Select **File** > **Recall**.

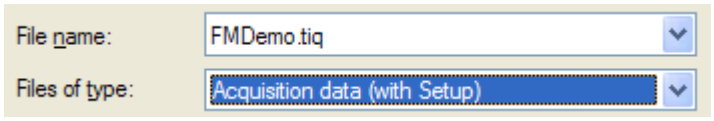
   The file that you will recall is a saved data file. It mimics a live signal for the purpose of this example application.



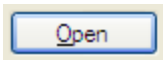
6. Go to: c:/RSA6100A Files/SampleDataRecords.

   Select **Acquisition data** in the **Files of type** field.

   Select **FMDemo.tiq** in the **File name** field.



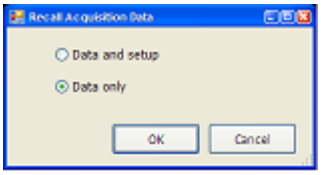
Click **Open**.



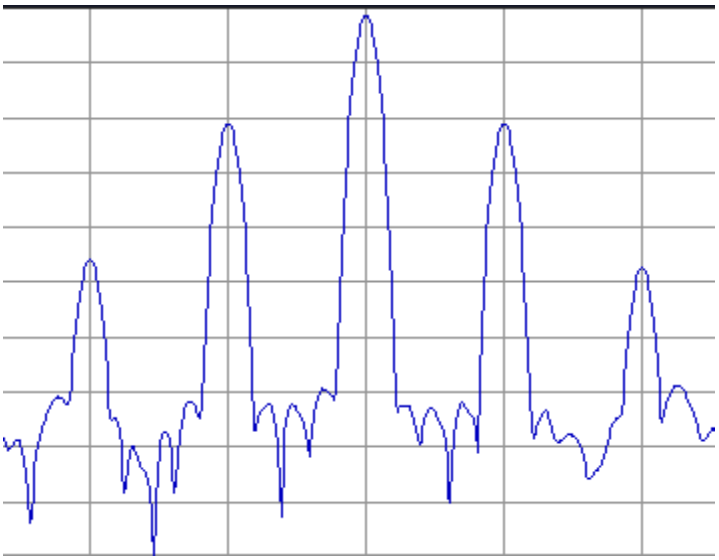
NOTE. *You can use a live signal of your own choice instead of the sample data file and reset the instrument to match your signal's parameters.*

7. Select **Data only** in the **Recall Acquisition Data** dialog box and click **OK**.

   If you had previously stored both instrument setups and your data, you could recall both items now by selecting **Data and setup**.



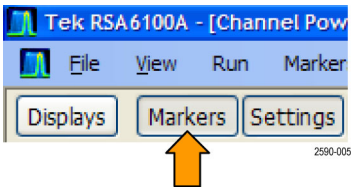
   You should see the sample waveform on the screen.



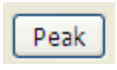
NOTE. *Markers can help you measure values like time, frequency, and power.*

8. Click **Markers** in the application bar to bring up the marker tool bar at the bottom of the screen.

   Do this with a mouse, by pressing the screen with a finger, or push the front-panel Markers **Peak** button.



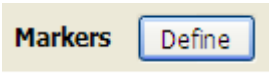
9. Click **Peak** in the resulting marker toolbar at the bottom of the display.



The instrument places a marker on the highest level peak of the spectrum. It displays the marker measurement in the upper left of the display.

The first marker is labeled **MR** to indicate that it is the reference marker.

10. Click Markers **Define** in the bottom left of the display.



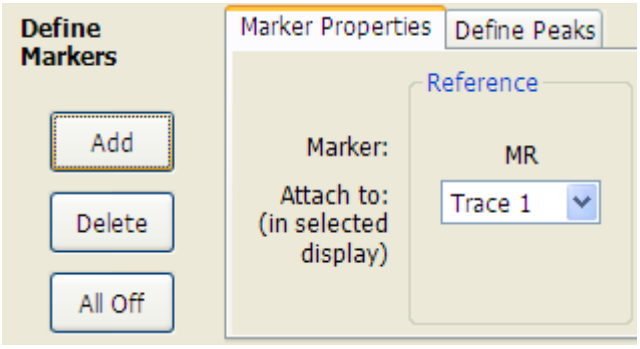
This brings up the **Define Markers** control panel.

11. Click **Add**.

A diamond shape labeled **M1** appears on top of the **MR** marker and at the center frequency. This is a delta marker.

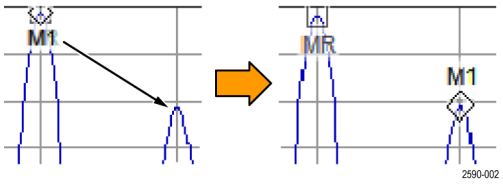
The four delta markers, **M1**, **M2**, **M3**, and **M4**, measure amplitude and frequency referenced to **MR**.

You can also assign markers to specific traces and adjust peak threshold.



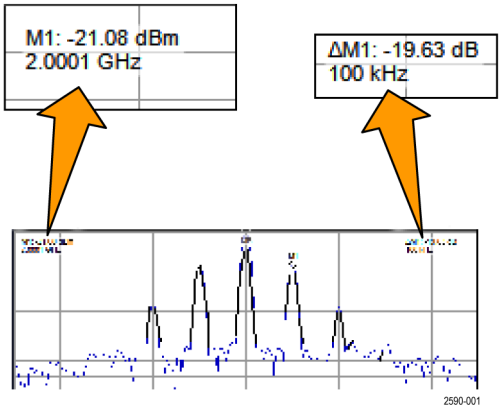
12. Use your finger or the mouse to slide the marker over to the next signal.

Alternatively, you can do the same task with the knob or arrow key on the front panel. Do this by assigning the control to the marker by touching the marker toolbar at the bottom of the screen.



The marker readout at the upper right shows the frequency and amplitude differences between the reference marker **MR** and the **M1** delta marker.

The readout to the upper left shows the absolute value of the **M1** marker.



So far, you used markers to measure two points of the same trace.

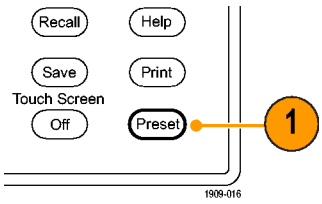
You can also use markers to measure further differences between points. You can do this by using the up, down, left, and right arrow keys. You can also drag markers with the mouse.

Alternatively, you can move markers by rotating the front-panel knob or pressing the front-panel arrow keys.

Application 2: Measuring Channel Power and Adjacent Channel Power

The RSA6100A Real-Time Spectrum Analyzer can take channel power, adjacent channel power, and multi-carrier channel power measurements. This application demonstrates the settings used for taking channel power and adjacent channel power measurements.

1. Push the front-panel **Preset** button to set the instrument to the default settings.

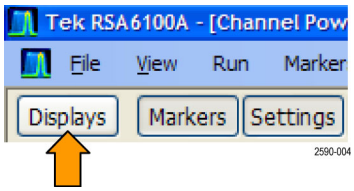


Set up the appropriate measurement parameters for the sample signal.

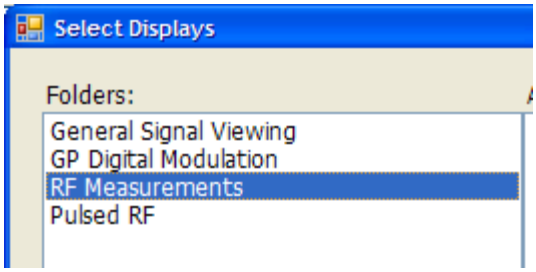
2. Ensure that **Freq** is set to **1.5 GHz**.

3. Click **Displays** in the application bar. Doing this will let you open the Channel Power and ACPR display.

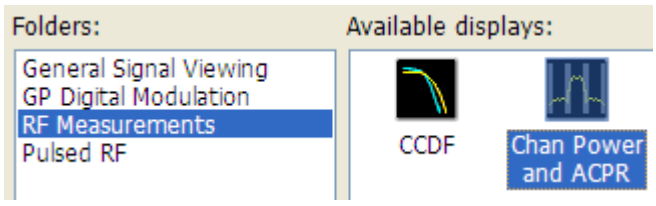
   Alternatively, push the front-panel **Displays** button.



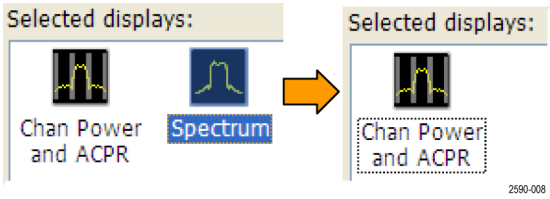
4. Select the **RF Measurements** folder.



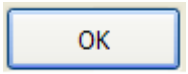
5. Double click or, alternatively, drag and drop, the **Channel Power and ACPR** icon in the **Available displays** area to move it to the **Selected displays** area.



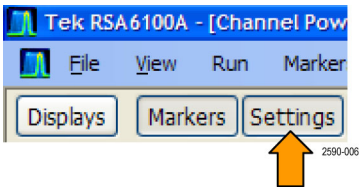
6. Double click, or drag and drop, the **Spectrum** icon to remove it from the **Selected displays** area.



7. Click **OK**.



8. Click **Settings** in the application bar.

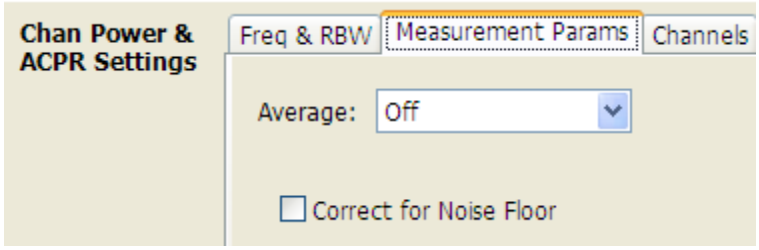


9. Click the **Measurement Params** tab.

   For the purpose of this application example, with its recalled signal, you can leave the **Average** field as Off.

   If you were using a live signal and wanted to use averaging, you want to select **Frequency Domain** in the **Average** field. That is a common setting.

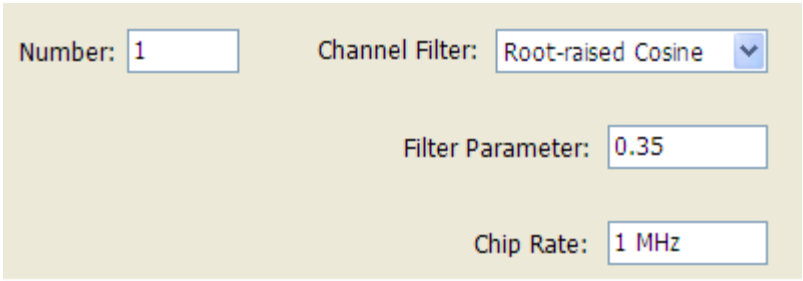
   Leave **Correct for Noise Floor** unchecked.



10. Set **Filter Parameter** to **0.35**.

11. Set **Chip Rate** to **1 MHz**.

    Chip rate is signal bandwidth.

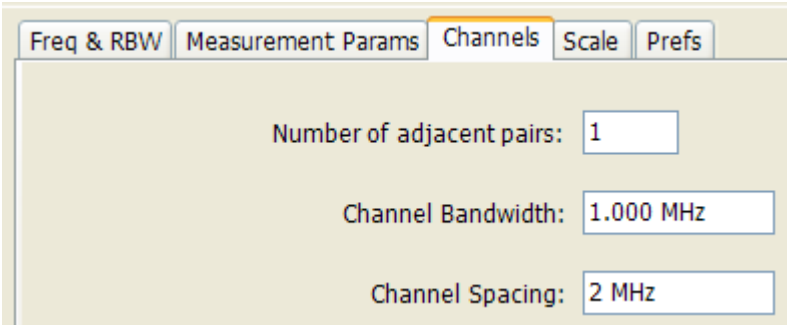


12. Click the **Channels** Tab. Use this to define the channels to measure.

13. Ensure that the **Number of adjacent pairs** is already set to **1**. This will set the instrument to measure the main channel and the one adjacent channel on each side of it.

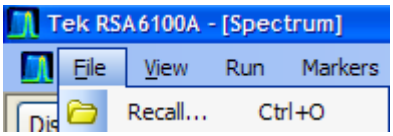
14. Set **Channel Bandwidth** to **1 MHz**.

15. Set **Channel Spacing** to **2 MHz**.



16. Select **File** > **Recall**

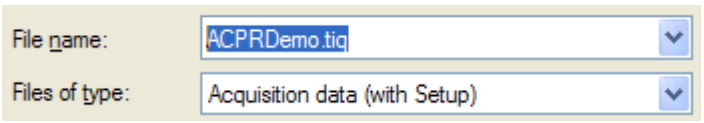
Do this to load the saved acquisition file.



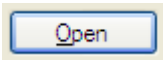
17. Go to: c:/RSA6100A Files/SampleDataRecords.

Select **Acquisition data** as the type of file to look for.

Select **ACPRDemo.tiq** as the file to recall.

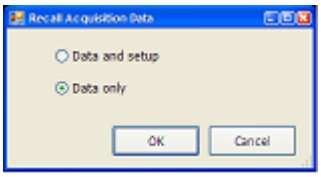


Click **Open**.



18. Select **Data only** and click **OK**.

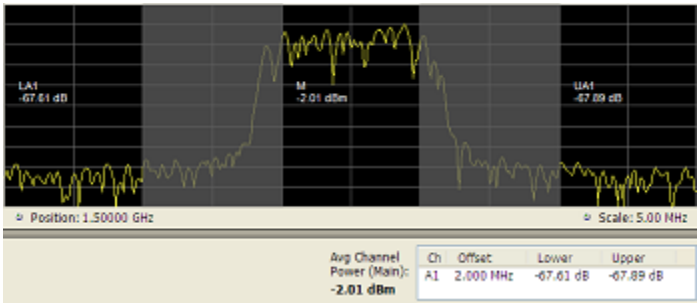
Do not select **Data and setup** because that would load control values that were saved along with the acquisition data. That would overwrite the settings you made in the previous steps of this application example.



19. View the results.

The absolute channel power value appears in the middle of the graph. The upper adjacent power ratio appears to the right, and the lower adjacent power ratio appears to the left.

The gray-shaded bands illustrate the space between channels. The RSA6100A makes ACPR power measurements within the defined channels, represented by the unshaded black areas.



Application 3: Performing Modulation Analysis

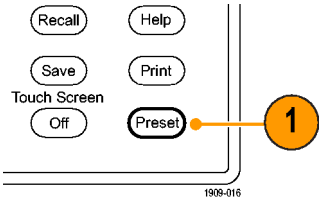
The following example shows how to use the RSA6100A Real-Time Spectrum Analyzer, with Option 21 installed, to demodulate a QPSK signal and to analyze the signal in multiple domains. You will use the instrument to do the following:

- Demodulate a QPSK signal to show its constellation diagram.
- Measure the EVM (Error Vector Magnitude) and other key indicators using the Signal Quality display.
- View the phase of the signal changing over time.
- Use markers to see how the results correlate between the Symbol Table display, Constellation display, and the Phase vs Time display.

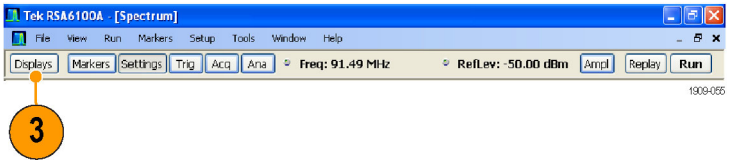
NOTE. *The following examples are based on the QPSK sample data file. If desired, you can load the QPSK sample data file (QPSKDemo.tiq) to recreate the steps used in this application. The signal settings in the following examples are based on the signal in the sample file. If you use a live signal, your settings may differ.*

Demodulate the Signal

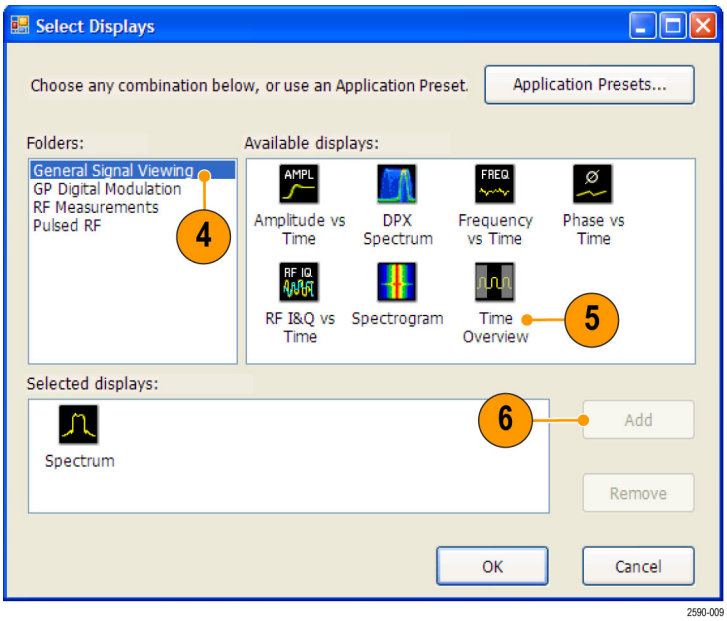
1. Push the Preset button on the front panel to set the instrument to the default settings.



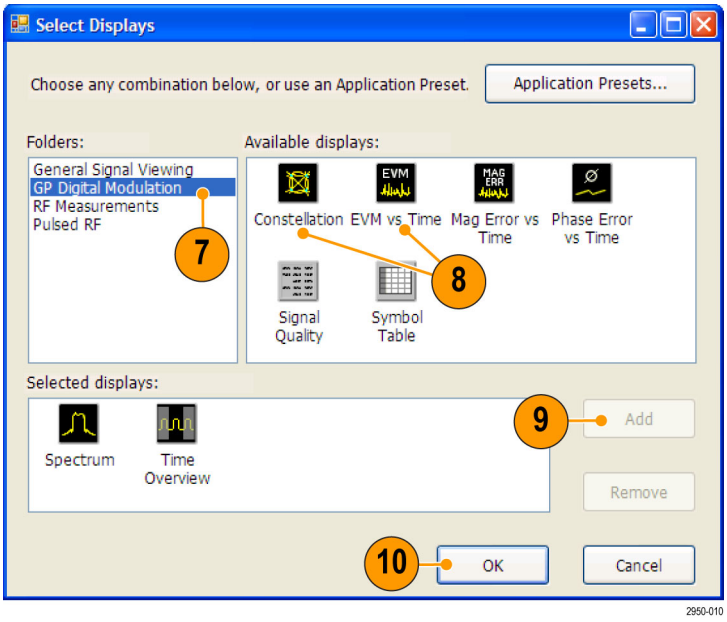
2. Tune the instrument to 2.13 GHz and set the span to **20 MHz**. These settings are appropriate for the signal that is analyzed in this example.
3. Click **Displays** to open the Select Displays dialog box.



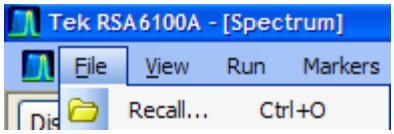
4. Select the General Signal Viewing folder.
5. Select the **Time Overview** icon.
6. Click **Add** to add the Time Overview icon to the Selected Displays list.



7. Select the **GP Digital Modulation** folder.
8. Select the **EVM vs Time** icon.
9. Click **Add** to add the icon to the Selected Displays list.
10. Repeat steps 8 and 9 for the **Constellation** icon, and then close the dialog box.



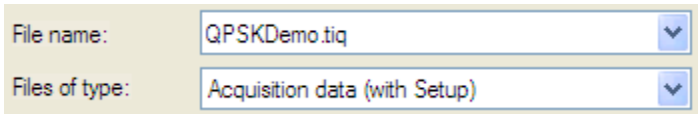
11. Select **File** > **Recall**.



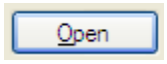
12. Go to: c:/RSA6100A Files/SampleDataRecords.

    Select **Acquisition data** in the **Files of type** field.

    Select **QPSKDemo.tiq** in the **File name** field.



    Click **Open**. Select **Data only** in the Recall Acquisition Data dialog and click **OK**.

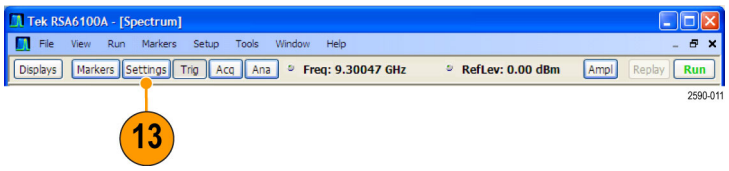


You might see a message on the display that states *Data acquired from data simulator*. This means that the sample data file was generated, not captured from a live acquisition.

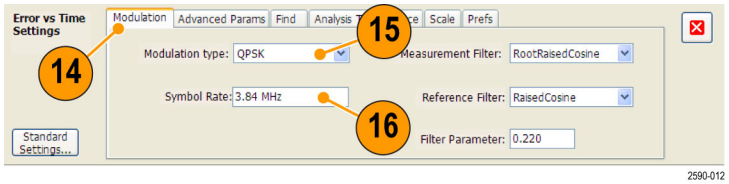
Alternatively, you can use a live signal of your own choice and reset the instrument to match your signal's parameters.

The General Purpose Digital Demodulation displays share the same modulation and advanced parameter controls. These controls are available in the Settings control panel for each display.

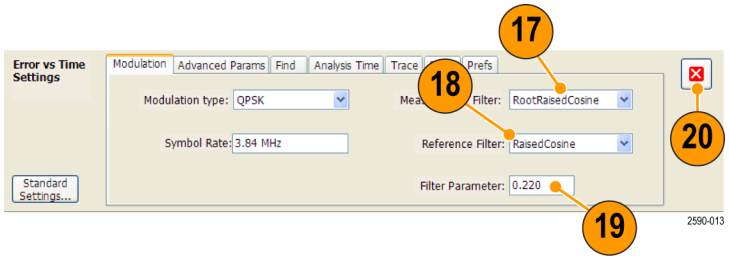
13. Select the EVM vs Time display, and then click **Settings**.



14. Select the Modulation tab.
15. Set the Modulation Type to **QPSK**.
16. Set the Symbol Rate to 3.84 MHz.



17. Set the Measurement Filter to **RootRaisedCosine**.
18. Set the Reference Filter to **RaisedCosine**.
19. Set the Filter Parameter to **0.220**.
20. Close the control panel.

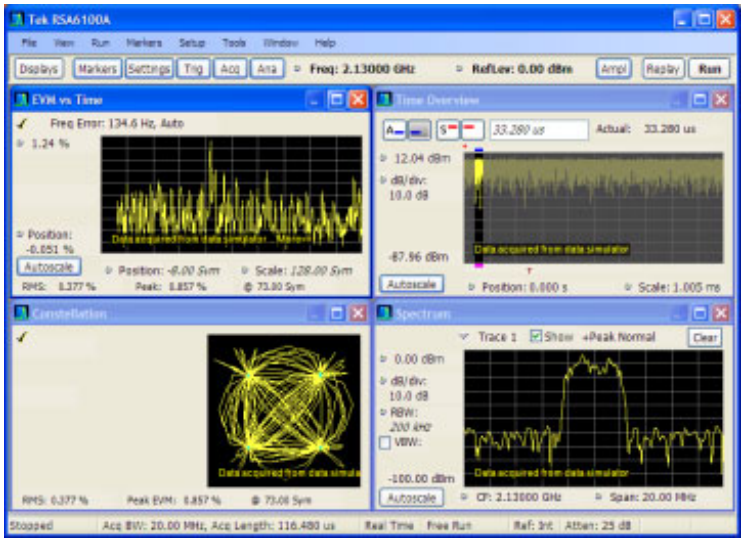


Analyze the Signal

You can analyze the signal using both qualitative and quantitative methods.

The Constellation display should look similar to the illustration. You might need to click the Autoscale button on the EVM vs Time display to properly scale the graph display. For a QPSK signal, the points should be located in four tight clusters. If they are not, check your settings for Frequency, Modulation Type, Symbol Rate, and Filters.

Look at the trace in the EVM vs. Time display. The graph shows the EVM value in percent at each trace point in time. The RMS value for EVM during the entire analysis period is shown at the bottom of the display window, along with the peak EVM value and the time (or symbol) at which it was detected.



Manually Adjust the Analysis Length

The Time Overview display shows the entire acquisition record, illustrating the length and offset for Spectrum Time and Analysis Time. The spectrum length is the period of time within the acquisition record for which the spectrum is calculated. The analysis length is the period of time within the acquisition record where other measurements are made. The analysis length can be automatically determined by measurement parameters such as symbol rate, or you can manually adjust the analysis length.

NOTE. *The Spectrum Length and Spectrum Offset cannot be set independently unless the Spectrum Time Mode is set to Independent. You can change the Spectrum Time Mode on the Analysis > Spectrum Time control panel tab. The red line that represents the Spectrum Time settings in the Time Overview display is only shown when the Spectrum Time Mode is set to Independent.*

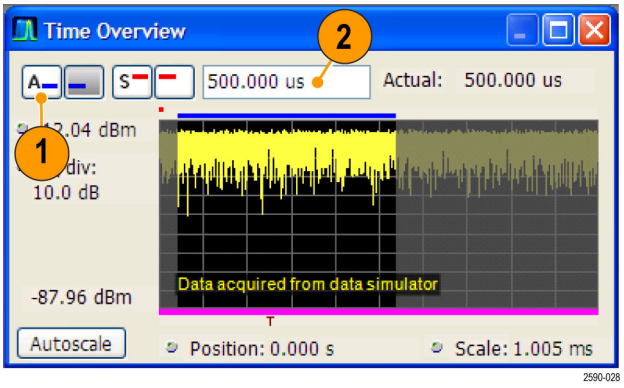
1. In the Time Overview display, select the Analysis Length button.

   The analysis length is indicated by the blue bar above the graph.

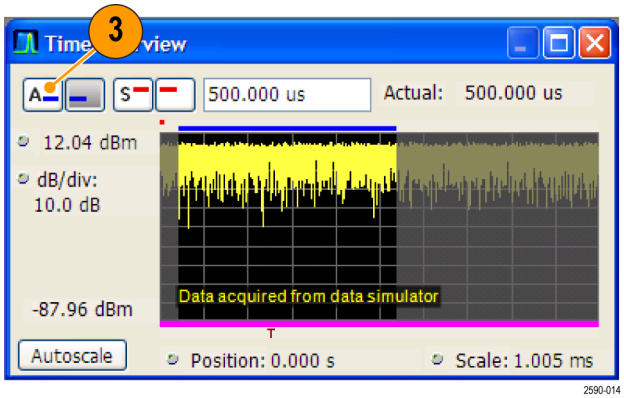
2. Increase the analysis length to 500 us. You can do this two ways: by changing the value in the number entry box or by dragging the right edge of the unshaded area. Click **Replay** to rerun the analysis using this new Analysis Length setting.

   Changing the Analysis Length setting changes the amount of data used for computing the measurements in the displays. The shading in the display shows the extent of the analysis period.

   The increased analysis length causes the instrument to automatically increase the acquisition length setting to collect enough samples to satisfy the new analysis settings. By default, the automatically determined acquisition length is equal to or slightly greater than the analysis length.



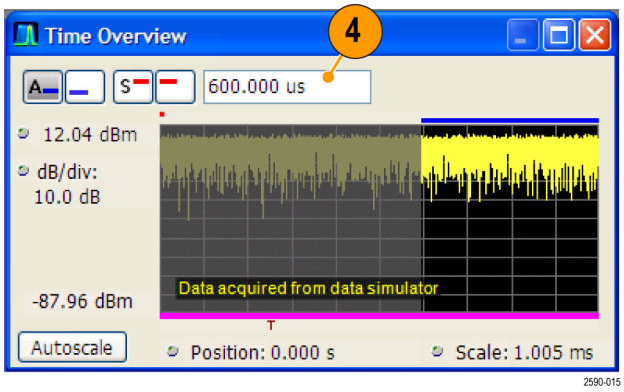
3. Select the Analysis Offset button.



4. Increase the Analysis Offset setting to **600 µs**.

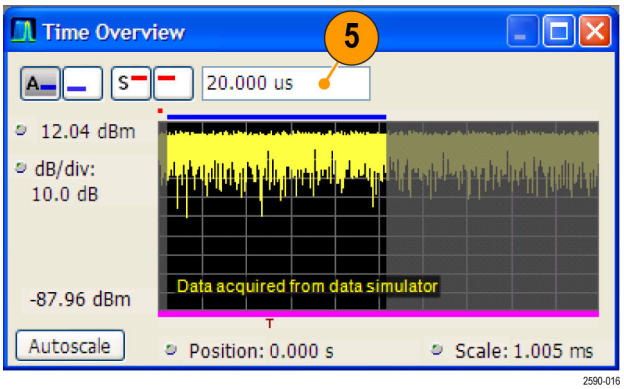
   If the analysis offset is increased such that the analysis period extends past the end of the acquisition record, the instrument will increase the acquisition length to provide the additional data.

For a recalled signal, if you increase the Analysis Length or Analysis Offset beyond the end of the available data, the instrument will analyze only the data that exists within the set analysis period. To let you know about the discrepancy, the instrument adds a text readout to the right of the numeric value readout stating *actual: xx.x. usec*.



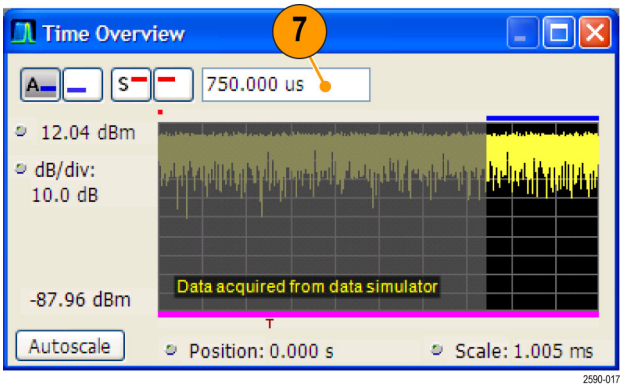
5. Change the Analysis Offset setting to **20µs**.

6. Click **Replay** to update the measurement results (you need to do this each time you make a change in Analysis Offset or Length when viewing recalled data).



7. Increase the analysis offset again.

   Because the instrument is stopped, it cannot run a new acquisition to capture a longer data record. When the requested analysis period extends past the end of the data record, the actual analysis length is reduced.



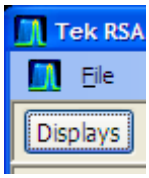
Application 4: Performing Time and Frequency Analysis

The following example shows how to use the RSA6100A Real-Time Spectrum Analyzer to measure frequency hops. You will use the instrument to do the following:

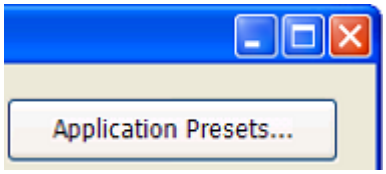
- Measure the transition time.
- Measure the hop to hop frequency difference.
- Measure the frequency overshoot.
- View the spectrogram to see more detail in the frequency transitions versus time.

NOTE. *The following examples were based on the TimeFrequency.tiq demonstration data file. If desired, you can load this file to recreate the steps used in this application. The signal settings in the following examples were based on the signal in the demonstration file. If you use a live signal, your settings may differ.*

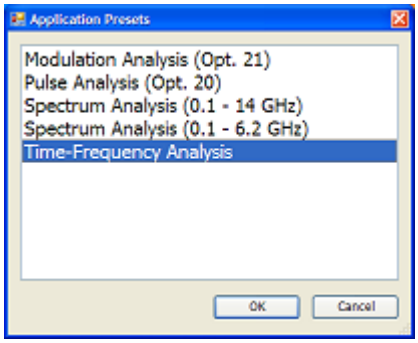
1. Click **Displays**.
   This opens the *Select Displays* window.



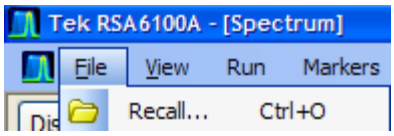
2. Click **Application Presets...**



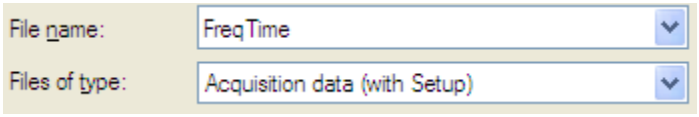
3. Click **Time-Frequency Analysis** and **OK** from the resulting window.
   By using an application preset, you direct the instrument to automatically do much of the setup work for you.



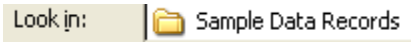
4. Click **File** and, from the resulting pull-down menu, click **Recall...**.
   Recalling a data file stops the instrument from running new acquisitions so that you can analyze the recalled data.



5. In the *Open* window, use the pull-down **Files of type** control to select **Acquisition data (with Setup)**.

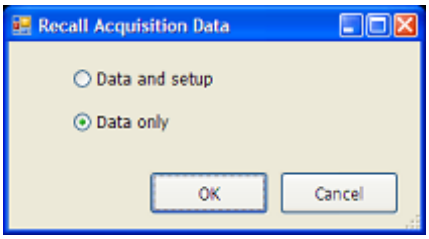


6. In the **Look in** field, maneuver to the path named *c:/RSA6100A Files/Sample Data Records*.and click the file named **TimeFrequency.tiq**.

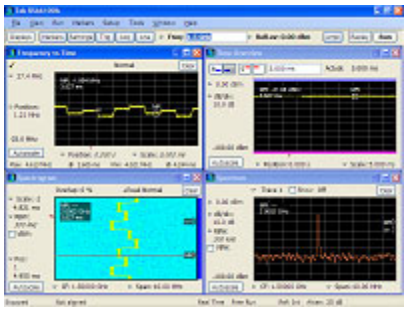


7. Click **Open**.

8. Click **Data only** in the *Recall Acquisition Data* dialog and click **OK**.

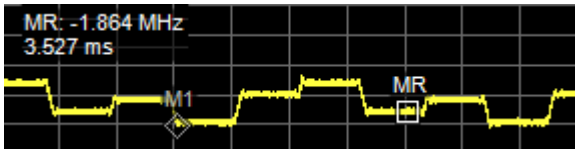


This application opens four displays titled *Frequency vs. Time*, *Time Overview*, *Spectrogram*, and *Spectrum*.

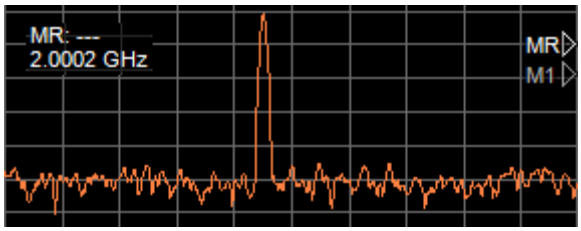


These displays allow you to see both time- and frequency- domain representations of hopping signals. They include a reference marker (MR) and a delta marker (M1) to help measure the hops.

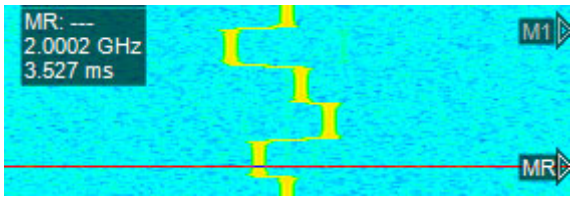
The *Frequency vs Time* display shows the deviation from the center frequency value on the vertical axis and time on the horizontal axis.



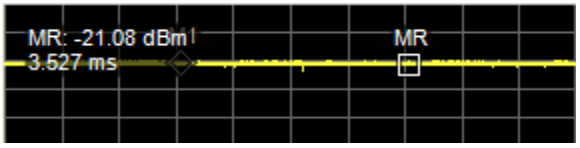
The *Spectrum* display shows log power on the vertical axis and frequency on the horizontal axis.



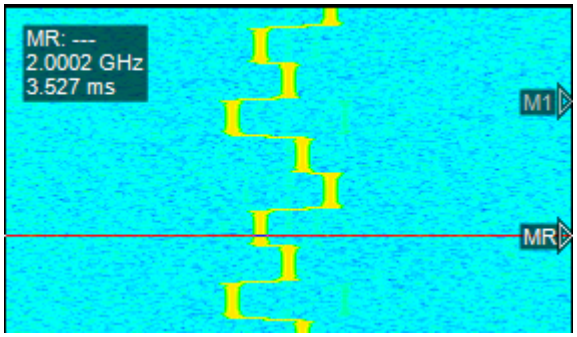
The *Spectrogram* display shows time on the vertical axis and frequency on the horizontal axis. The color at each point represents the amplitude at a particular frequency at a particular time.



The *Time Overview* display shows log power on the vertical axis and time on the horizontal axis.

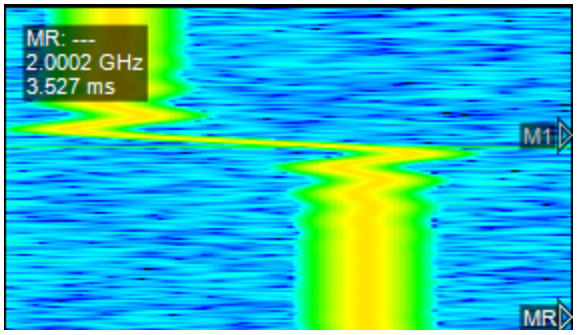


9. Move the mouse to the *Spectrogram* display.



10. Right click the mouse and select **Zoom** from the resulting menu. Pull the mouse vertically and horizontally to zoom in on one or two hops of the spectrogram signal.

One way to understand the spectrogram graph is to think of it as a stack of spectrum traces turned on edge.



11. Use the mouse to move the MR marker in the *Spectrogram* display to a point of interest. As you move the marker up and down, look at the corresponding changes in the marker in the *Spectrum* display. The *Time-Frequency Analysis* application preset configured the *Spectrum* display to show the selected spectrogram line.

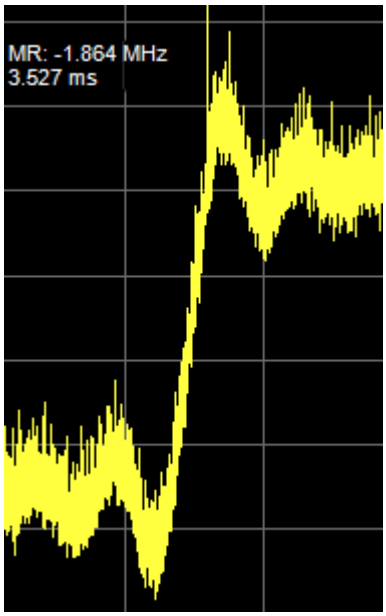
As you continue to move the marker, observe that the power remains constant over time in the *Time Overview* display even though you can see the frequency change over time in the *Frequency vs Time* display.

The marker frequency is correlated between the *Spectrum* and *Spectrogram* displays. The marker time is correlated across the*Spectrogram*, *Frequency vs. Time*, and *Time Overview* displays.

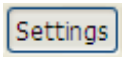
12. Show the full screen view of the *Frequency vs Time* display. This will help you more carefully analyze the signal.

13. Click the right mouse button and select **Zoom** from the mouse menu. Click and hold the left mouse button and move the mouse to pull the displayed waveform out horizontally and vertically until you have isolated one or two hops on the screen.

Zooming in will help you see a more detailed view of the signal and thus more accurately measure the overshoot. Now that you can see the signal and the overshoot better, you can also see that the signal contains a lot of noise, which will impair your ability to measure the overshoot. So the next step is to clear up the noise in the signal. One way to do that is to minimize the span setting as far as you can.



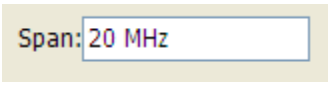
14. Click **Settings** in the menu bar.



15. Click **Span** in the resulting *Frequency vs Time Settings* pane.

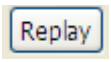
The span is the measurement bandwidth control for all the measurements in the *General Signal Viewing* folder, including Frequency vs. Time. Changing it in any of these displays will also change it in the other displays.

16. Click the down arrow and see the setting change to 20 MHz.



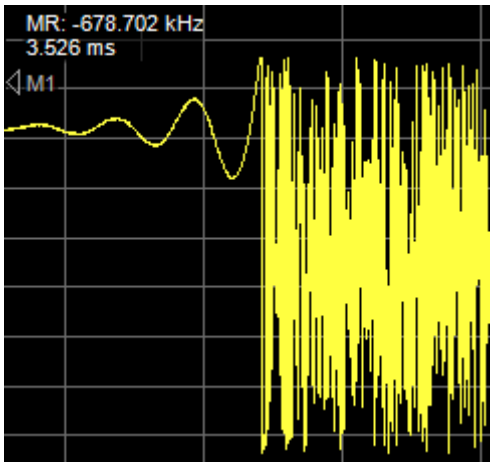
Reducing the span decreases the measurement bandwidth. Reducing the measurement bandwidth reduces the amount of noise present on the frequency vs. time waveform, allowing for better resolution of the frequency transitions.

17. Click **Replay**.



Continue clicking **Span**, pushing the down arrow and clicking **Replay** to clean up the signal more and more until the waveform breaks down.

Change the span settings to 10, 5, and 2 MHz. At 2 MHz, the waveform clearly breaks down and looks wrong, as shown at the right. It no longer includes the hop that you want to measure.

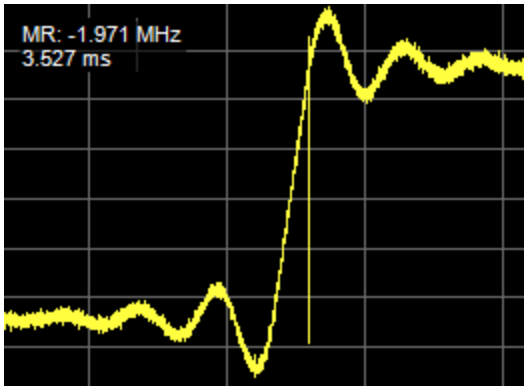


When you set span too small, you reduced the measurement bandwidth too far. You invalidated the measurement result because you not only eliminated unwanted noise but also eliminated much of the signal that you wanted to measure.

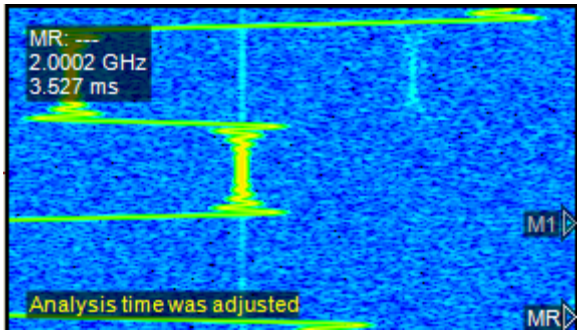
18. Push the up arrow key twice to get the span setting back to 10 MHz.

19. Click **Replay** to restore the good waveform. You can see your desired signal once again, and it appears much cleaner than it did at the original 40 MHz setting.

Notice in the screen shot to the right that now that you have cleaned up the signal, you can clearly see a transient in it.



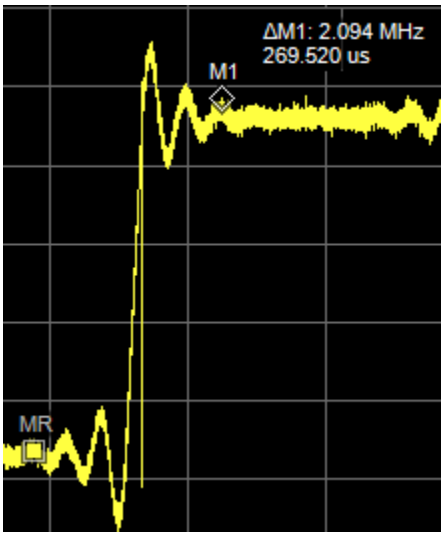
NOTE. *To optimize the measurement even further, you can go back to step 9 and use the right-button, mouse-controlled* ***Span Zoom*** *and* ***CF Pan*** *features of the Spectrogram display instead of the* ***Zoom*** *and* ***Pan*** *features. Then use* ***Replay*** *and* ***Autoscale****. Such an approach might yield a further reduction of the span setting and thus an even cleaner signal on which to make your measurement.*



20. Close the *Frequency vs Time Settings* pane.

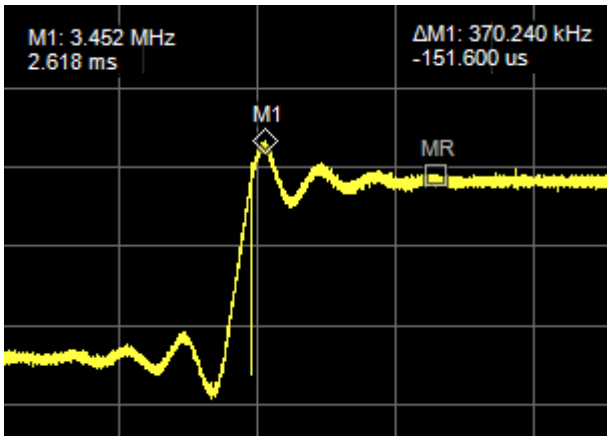
21. Place the MR and M1 markers in the *Frequency vs Time* pane to enclose just one hop and measure hop frequency.

In the example to the right, the hop-to-hop frequency is 2.094 MHz. Marker MR is in the bottom plateau of the waveform, and M1 is in the top plateau of the waveform.



22. Move the markers to measure overshoot.

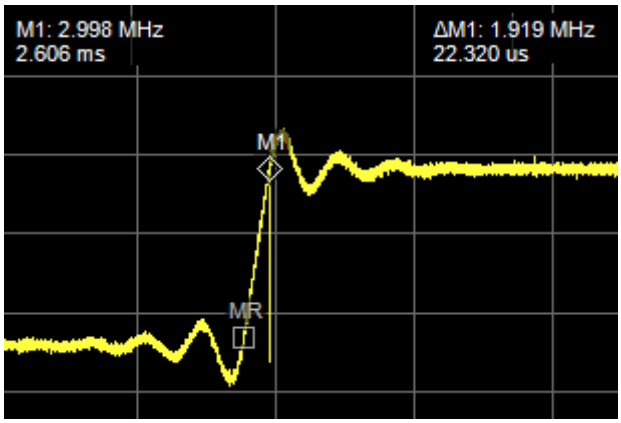
The M1 marker is at the peak of the overshoot, the MR marker is at the middle of the hop frequency, and the overshoot is 370.240 kHz. The overshoot occurs 151.600 µs before reference marker MR.



23. Move the markers to measure transition time. If you have trouble fine-tuning the location of the markers, try using the general purpose knob.

The transition time shown starts as the signal is about to make a hop and ends at about the settled time of the new frequency. Transition time measurements for your own application might use other methods, such as starting when some other signal occurs or ending when the frequency has settled to within some tolerance of a specified frequency.

The readout shows a 22.320 µs transition time for a 1.919 MHz hop.



Application 5: Capturing Transient Signals

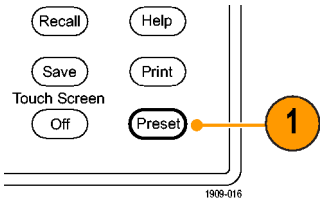
With the DPX Spectrum display, the RSA6100A Series Spectrum Analyzer can identify infrequently occurring transient signals and low-power signals that may be obscured by stronger signals. After you find that these signals exist, you can use some of the following tools to capture and examine the signal details to determine their cause:

- Use the Max Hold function to verify the presence of signals other than the CW signal.
- Use the DPX Spectrum display to view transient signals.
- Create a frequency mask and the use the Frequency Mask trigger to capture any signal that violates the mask.
- Use the Spectrogram with Frequency Mask Trigger to view the mask violations in the Time and Frequency domains.

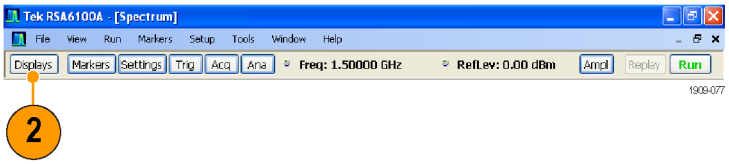
Detecting Transient Signals Using the DPX Spectrum Display

The DPX Spectrum display uses a bitmap image in addition to line traces to view signals. Bitmaps can represent multi-value signals so that you can see low-level and higher power signals that occur at the same frequency, but at different times.

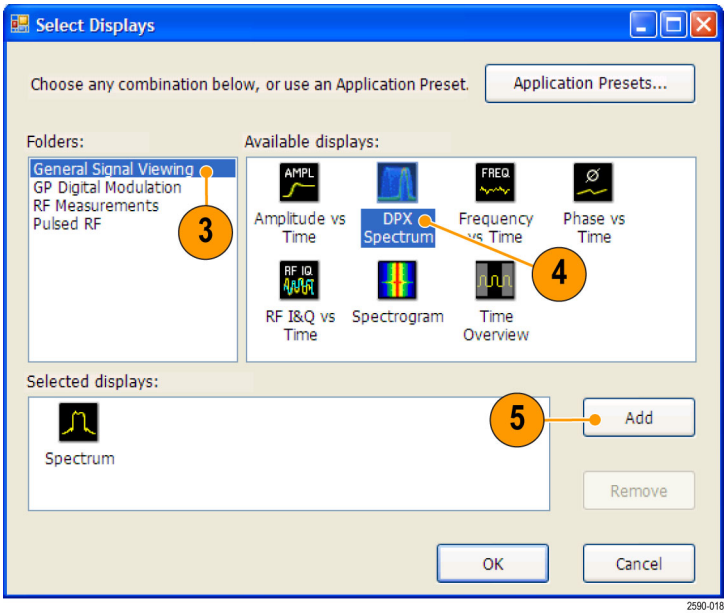
1. Push the Preset button on the front panel to set the instrument to the default settings.



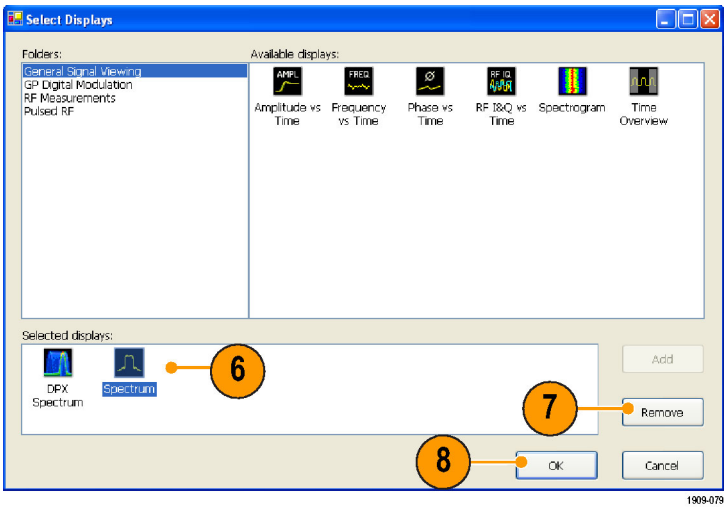
2. Click **Displays**.



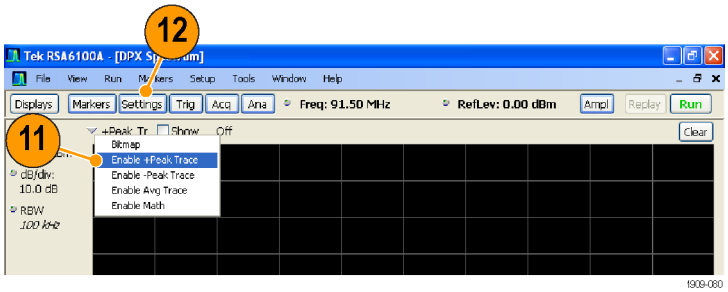
3. Select the General Signal Viewing folder.
4. Select the DPX Spectrum icon.
5. Click **Add** to add the application to the Selected Displays list.



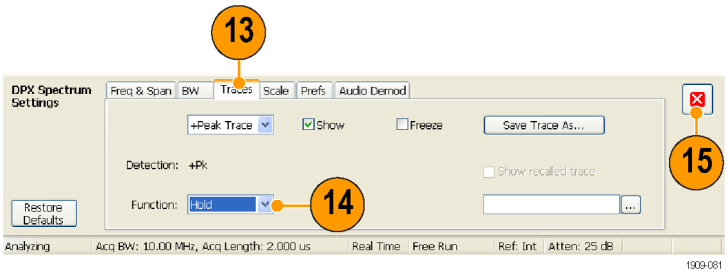
6. Select the Spectrum icon in the Selected Displays list.
7. Click **Remove** to clear the icon from the list.
8. Close the dialog box.



9. Tune the instrument to the signal.
10. Adjust the span.
11. Select **+Peak Trace** from the drop down menu. This new trace detects the highest peaks in each DPX frame.
12. Click **Settings** to open the DPX Spectrum Settings control panel.



13. Click the **Traces** tab.
14. Select **Hold** from the Function list to hold the peaks from all acquisitions.
15. Close the control panel.



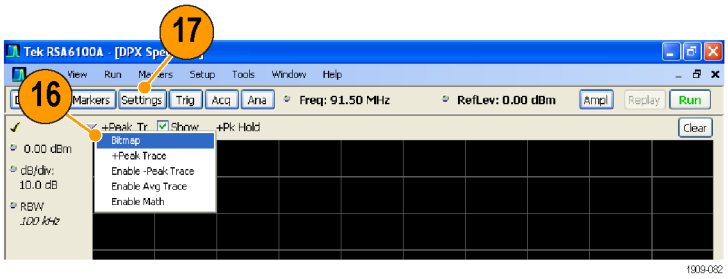
Quick Tip

- Click **Clear** located just above the graph to clear the display and start collecting points again.

The Hold function shows the highest points collected over continuing updates. Although the Hold trace shows the highest points, it doesn't show signals that are below the maximum value at any frequency. However, this is possible with the DPX bitmap trace.

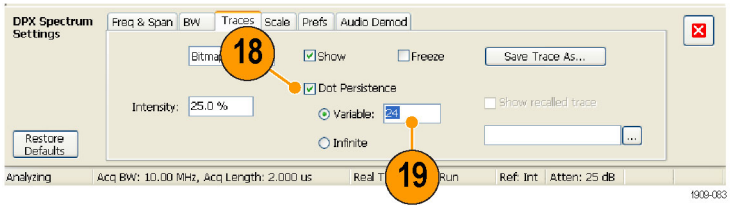
16. Select **Bitmap** from the drop-down list.

17. Click **Settings** to open the DPX Spectrum Settings control panel.



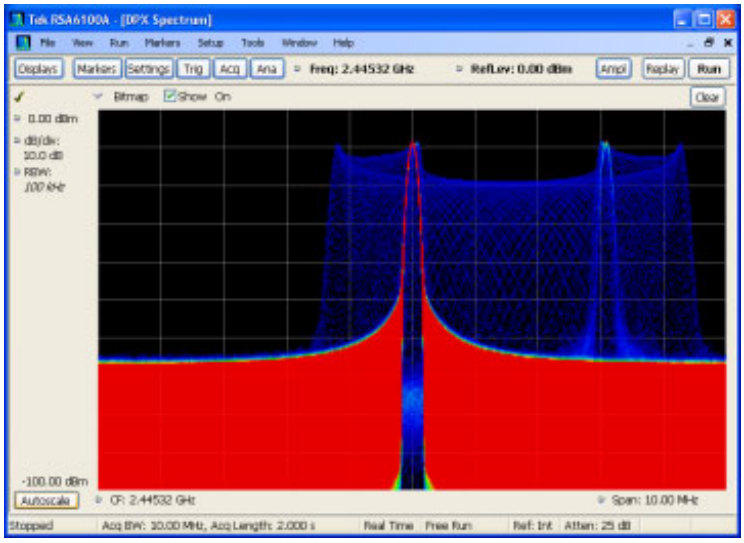
18. Enable **Dot Persistence** by checking its box.

19. Increase the Variable Persistence setting.



The more you increase the Persistence setting, the more quickly you will see infrequent signal events. In this example, the more frequent signals appear in red; infrequent signals will appear in blue.

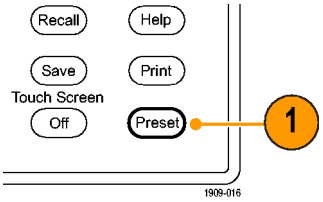
These settings can also be used to display signals below the maximum signal level. For example, a low-level signal in the presence of a pulsed signal might require a lower Persistence and Intensity setting.



Frequency Mask Triggering

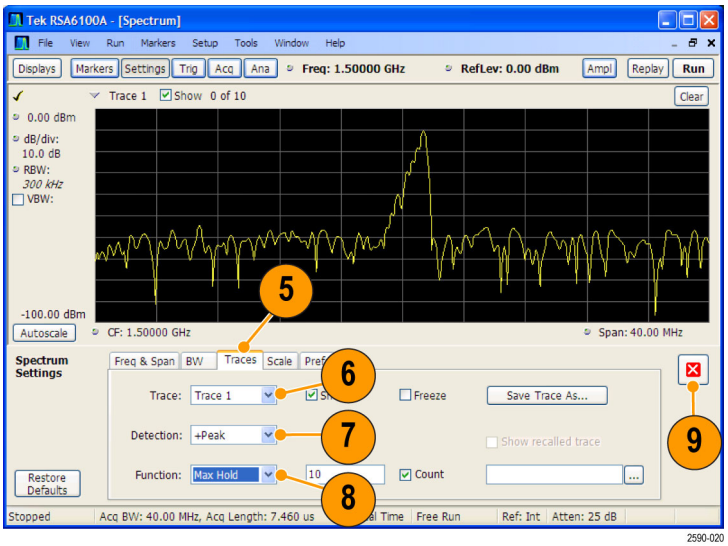
If your instrument has Option 05 installed, you can use the Mask Editor to create a frequency mask for triggering on transient signals. Complete the following steps to get a good visual reference that you can use to build the frequency mask.

1. Push the Preset button on the front panel to set the instrument to the default settings.

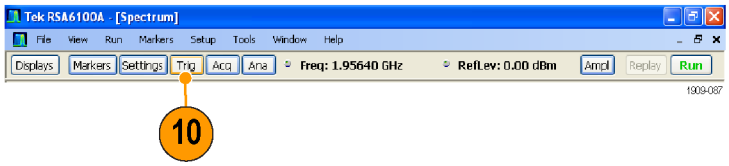


2. Tune the instrument to the frequency of your signal.
3. Adjust the span.
4. Click **Settings** to open the Settings control panel.

5. Select the Traces tab.
6. Select **Trace 1** (make sure the Show check box is checked).
7. Set the Detection to **+Peak**.
8. Set the Function to **Max Hold**.
9. Close the control panel.

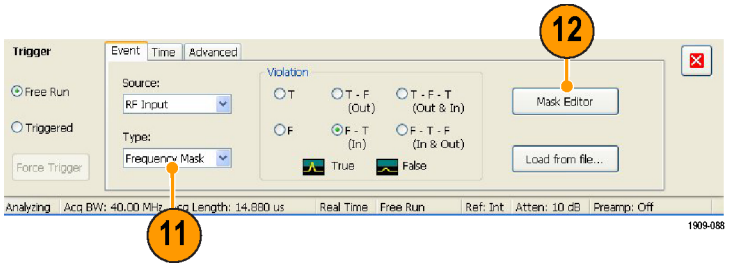


10. Click **Trig** to open the Trigger control panel.



11. Set the Type to **Frequency Mask**.

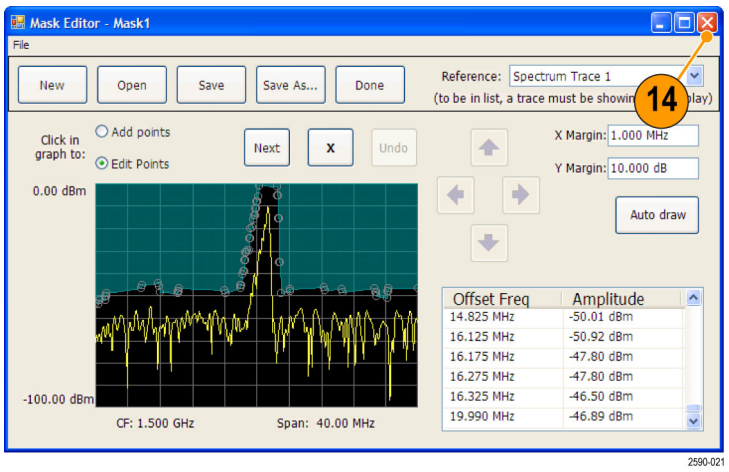
12. Click **Mask Editor** to open the Mask Editor.



13. Use the Mask Editor to create a mask for your signal. Start by using the **Auto draw** function and adjust if necessary.

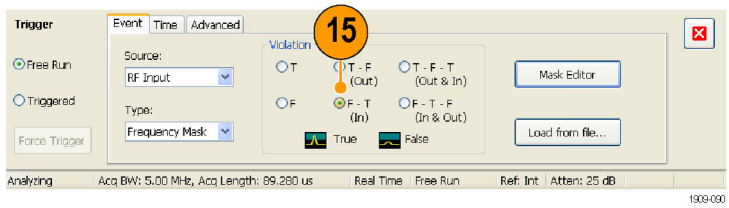
    Traces that you selected in the Spectrum Analyzer display are used as references in the Mask Editor. All trace detections and functions are available.

14. Close the Mask Editor.



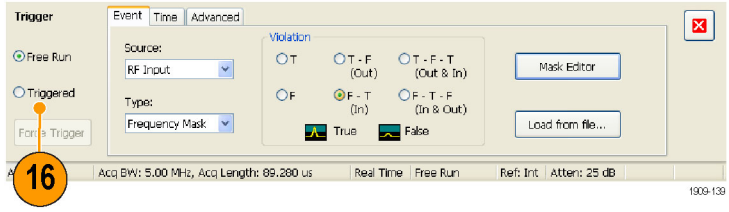
15. Select the condition that you are interested in.

    For example, if you want the instrument to trigger when it detects the first violation after seeing at least one acquisition with no violations, select the F > T violation. (A violation is when any point is within the shaded mask area.)



16. Click **Triggered**.

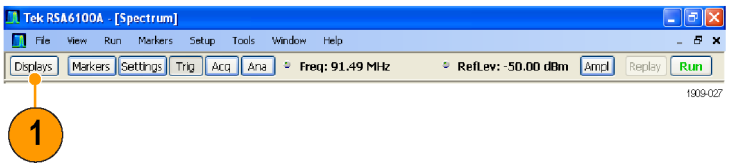
    The instrument should trigger when a violation occurs. If you believe that the instrument might have triggered prematurely (on noise instead of a real violation), then you might need to adjust your mask to leave a wider margin between the mask and your signal.



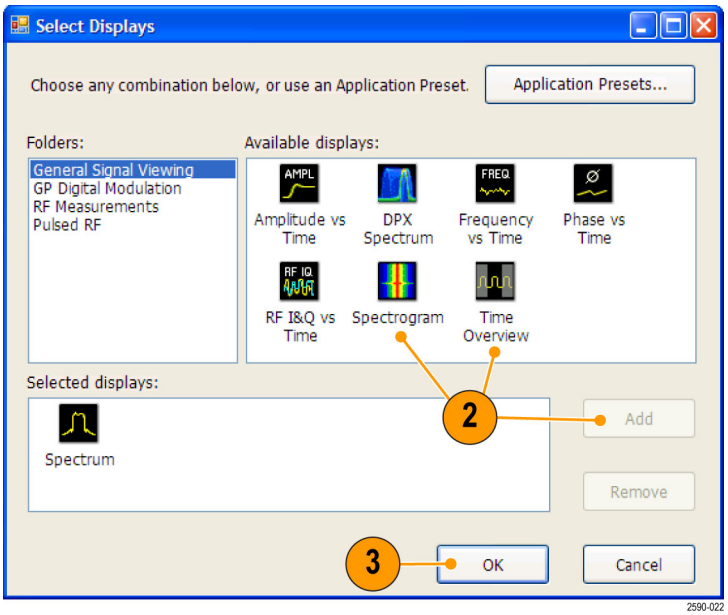
Viewing Transient Signals in Time and Frequency Domains

Spectrograms allow you to see how signals change over time. You can use the Spectrogram display to examine the transient signals that violated the mask. Combining the Spectrogram display with the Frequency Mask Trigger allows you to see how often the violations occur and to troubleshoot the cause of the problem.

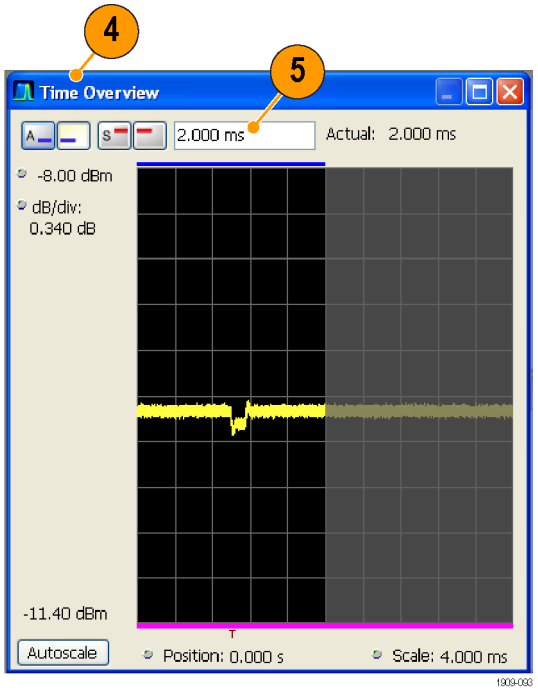
1. Click **Displays** to open the Select Displays dialog box.



2. Add the Spectrogram and Time Overview displays.
3. Close the dialog box.

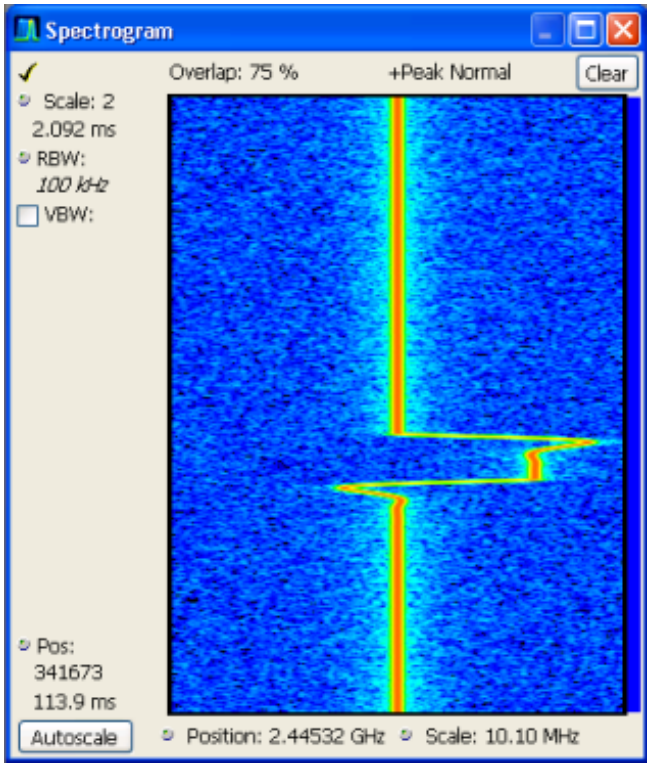


4. Select the Time Overview display.
5. Increase the Analysis Length setting until the Time Overview display covers the transient signal.



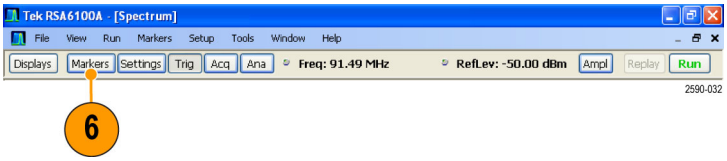
The Spectrogram display shows an example of a transient signal. As you increase the Analysis Length setting, the number of spectrogram lines within each acquisition also increases.

The marks along the right side of the Spectrogram display show the beginning of each acquisition record.

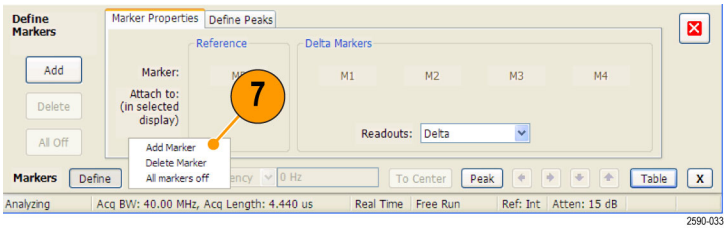


The Spectrogram display shows both time and frequency domains in a single display. The vertical axis is time, with newer data at the bottom. The horizontal axis is frequency, covering the same span as the Spectrum display.

6. Click **Markers** to open the Marker toolbar.

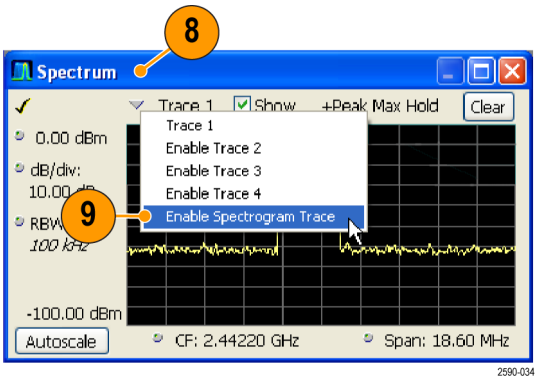


7. Select **Add Marker** to add one marker to the display.



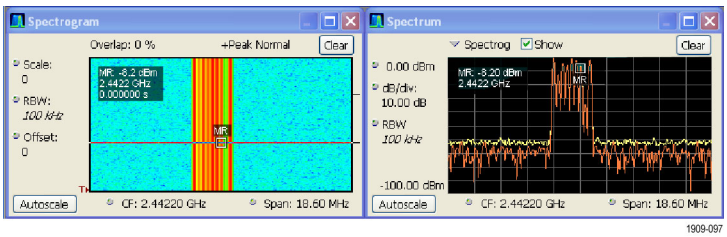
8. Select the Spectrum display by clicking the title bar.

9. Make sure the check box for Spectrogram Trace in the Spectrum display is checked.



The Spectrogram trace in the Spectrum display corresponds to the line selected in the Spectrogram display by the active marker.

NOTE. *If there is no active marker, the Spectrogram trace in the Spectrum display shows first line from the analysis period in the current acquisition data record.*



Quick Tip

- Spectrum traces 1, 2, 3, and 4 show the spectrum for the *Spectrum Time* selected in the Time Overview display or in the Spectrum Time tab of the Analysis control panel. The Spectrogram, by comparison, covers the *Analysis Time* selected in the Time Overview display or in the Analysis Time tab of the Analysis control panel.

Application 6: Taking Pulse Measurements

Pulsed RF measurements have historically been difficult to perform. Some measurements required custom-built and dedicated test tools. These custom-built tools required trained experts to properly use the tools to achieve accuracy and repeatability. Tektronix real-time spectrum analyzers have revolutionized pulse measurements through automation. An RSA6100A Series Spectrum Analyzer, with Option 20 installed, can replace specialized test equipment formerly required for pulsed RF measurements.

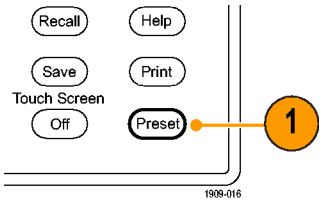
This application shows how to accomplish the following pulsed RF measurement tasks:

- Capture a series of RF pulses in a single acquisition record.
- Select measurements to display in the Pulse Table.
- Examine the pulse shape and measure reference points with the Pulse Trace display.
- View Trend and FFT analysis on the measurement results with the Pulse Statistics display.

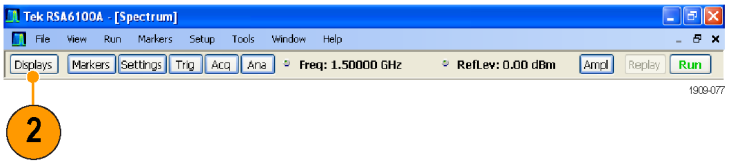
NOTE. *To complete the following example, you will need a pulsed signal or an appropriate saved data record. This example uses the PulseDemo.tiq file, which is located in the folder C:\RSA6100A Files\Sample Data Records.*

Capture the Pulses

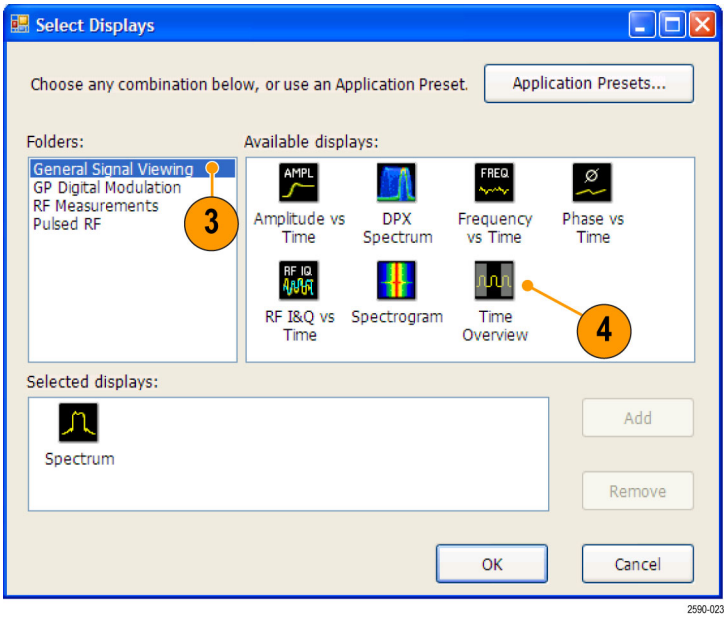
1. Push the Preset button on the front panel to set the instrument to the default settings.



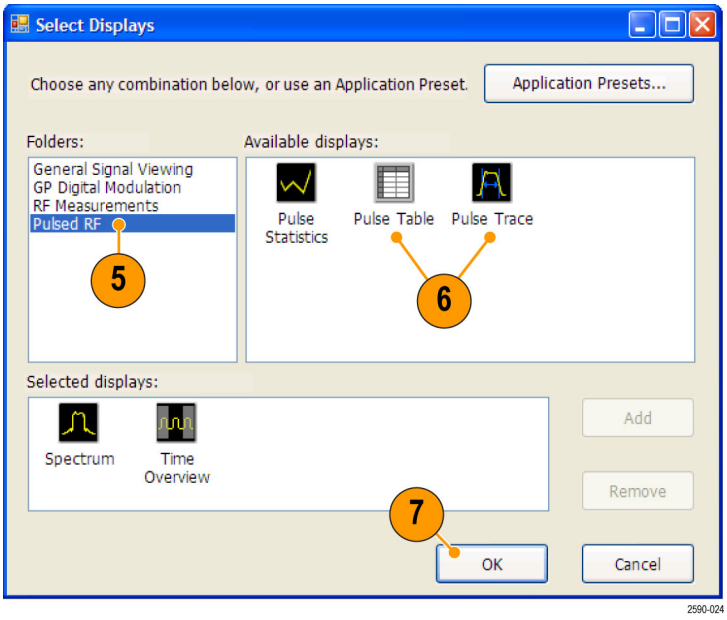
2. Click **Displays** to open the Select Displays dialog box.



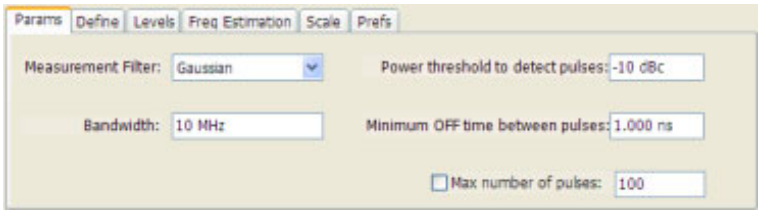
3. Select the General Signal Viewing folder.
4. Select the Time Overview icon and add the application to the Selected Displays list.



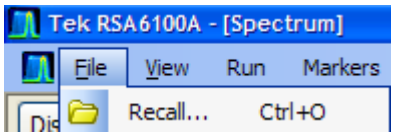
5. Select the Pulsed RF folder.
6. Add the Pulse Table and Pulse Trace displays to the Selected Displays list.
7. Click **OK** to close the dialog box.
8. Set the Frequency to 2.7 GHz.



9. Select the **Pulse Trace** display and click **Settings**.
10. Set the **Bandwidth** value to 10 MHz. Close the Settings control panel.



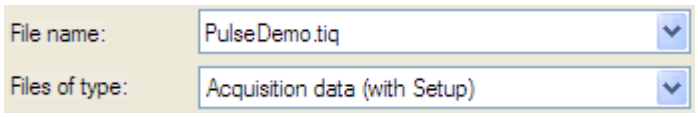
11. Select **File** > **Recall**.



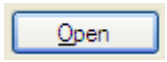
12. Go to: c:/RSA6100A Files/SampleDataRecords.

Select **Acquisition data** in the **Files of type** field.

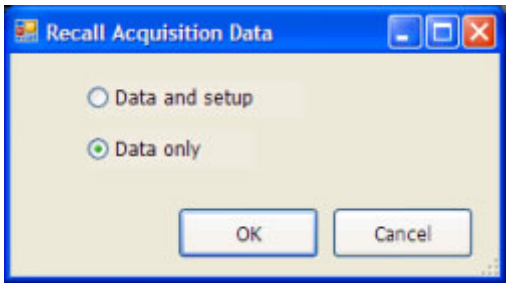
Select **PulseDemo.tiq** in the **File name** field.



Click **Open**.



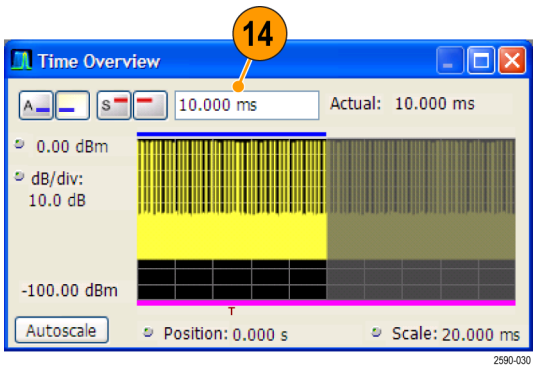
13. When the **Recall Acquisition Data** window appears, select **Data Only** and click **OK**.



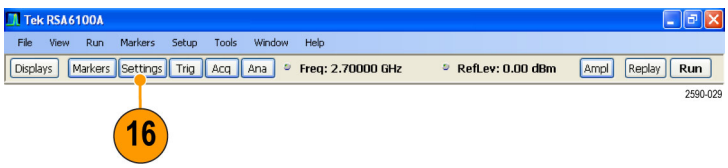
Alternatively, you can use a live signal of your own choice and reset the instrument to match your signal's parameters.

14. In the Time Overview display, set the Analysis Length to include several pulses. Decrease the horizontal scale to about 10 ms so you can see the first pulse in detail. Adjust the Spectrum Offset so the Spectrum Time covers the on time of this pulse.

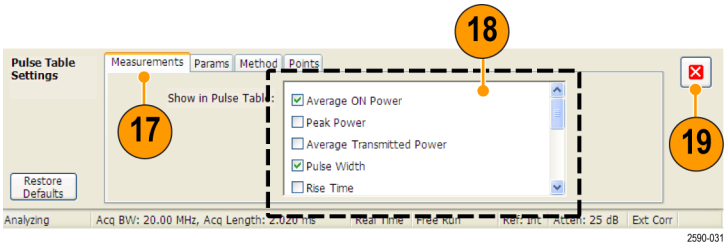
15. Click Replay to run the measurements over these new analysis and spectrum time periods.



16. Select the Pulse Table display and then select **Settings**.



17. Select the **Measurements** tab.
18. Select the measurements that you are interested in. (For this example, select **Average ON Power**, **Pulse Width**, and **Rise Time**).
19. Close the control panel.
20. When you see the data in the Pulse Table display, click **Replay** to recalculate the Pulse Table measurements.



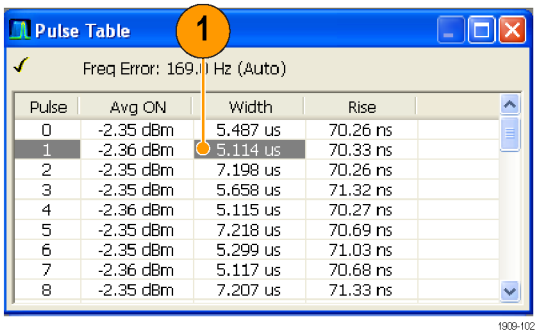
Quick Tip

- You can take measurements while the instrument is running or while it is stopped. Stopping the instrument may make it easier to read the measurements from captured data.

Measure the Parameters of the Captured Pulses

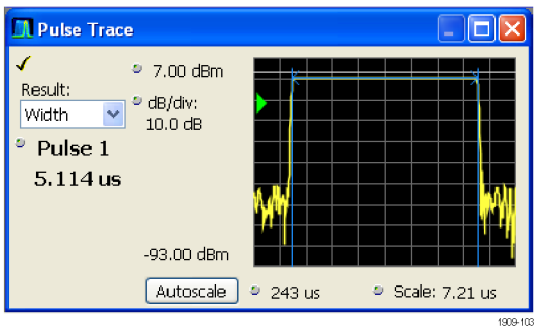
After you have captured the pulses, you can use the Pulse Trace display to view the details of specific measurements.

1. Select one of the measurement results in the Pulse Table display. For example, click the cell for the Width measurement of Pulse 1.



The Pulse Trace display shows an amplitude versus time trace for the selected result on the selected pulse. Blue lines and arrows show how the measurement was made.

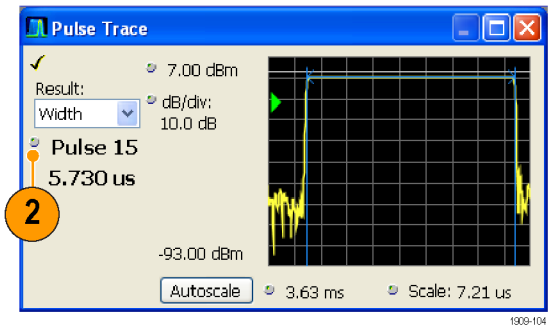
The green arrow in the display shows the power threshold used to detect pulses. If this threshold is set too high or too low, no pulses will be detected. You can set the power threshold on the Settings > Params tab.



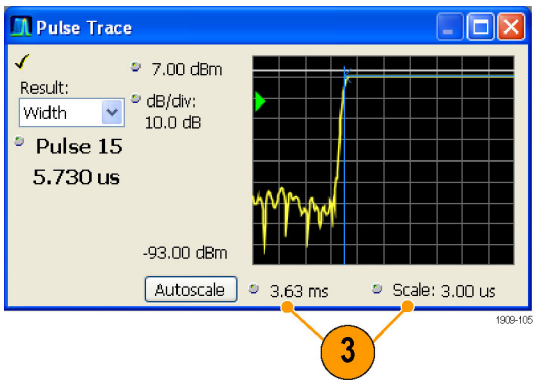
2. Click the Pulse control in the Pulse Trace display and enter a different pulse number.

   The new pulse appears in the Pulse Trace display and is selected in the Pulse Table display. You can use the Pulse Trace display and the Pulse Table display together to view and analyze pulse measurements.

   You can select a different result in the Pulse Trace display and it will also be selected in the Pulse Table display.



3. Use the Scale and Offset controls to zoom in on details of the selected pulse. For example, you can adjust the controls to get a close look at the details of the Rise Time measurement as shown.



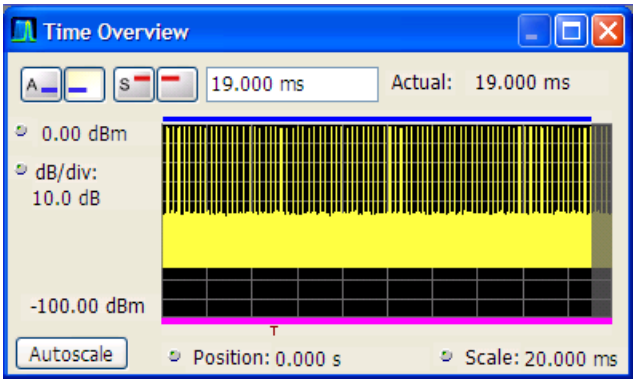
Quick Tip

- Click **Autoscale** to optimize the vertical and horizontal offset and scale settings.
- When using scale or offset, adjust the offset control to move the area of interest to the far left side of the screen, and then adjust the scale to expand the area of interest. Another way to change scaling is to right-click in the graph and select Pan or Zoom, then use the mouse or the touchscreen to drag in the graph.

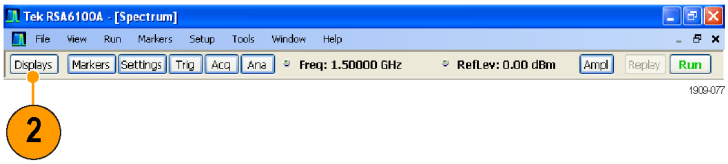
Review Measurement Statistics Across All Measured Pulses

You can use the Pulse Statistics display to show the trend or an FFT across all measured pulses. To get the best frequency resolution and dynamic range in the display, you need to include many pulses in the analysis period.

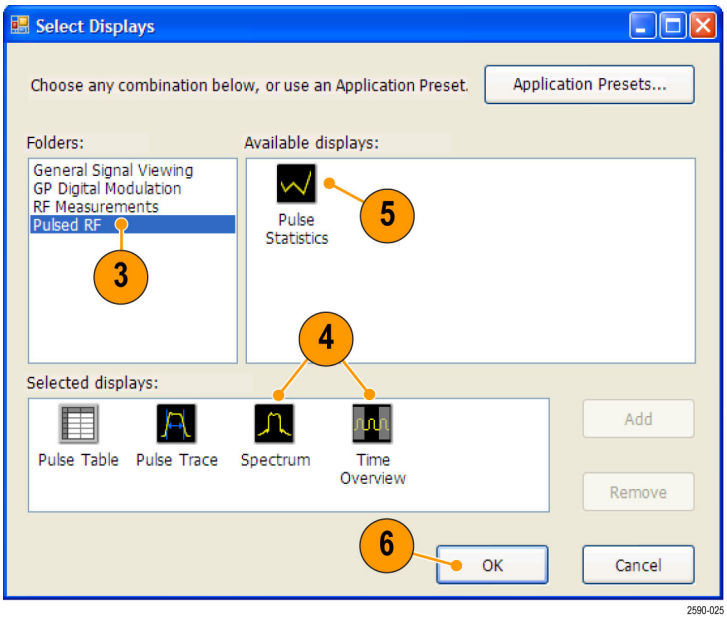
1. Set the Analysis Length in the Time Overview display to 19 ms.



2. Click **Displays** to open the Select Displays dialog box.



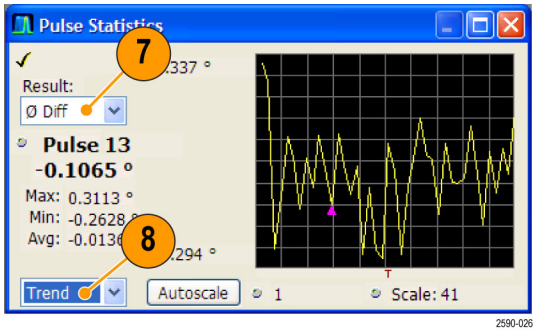
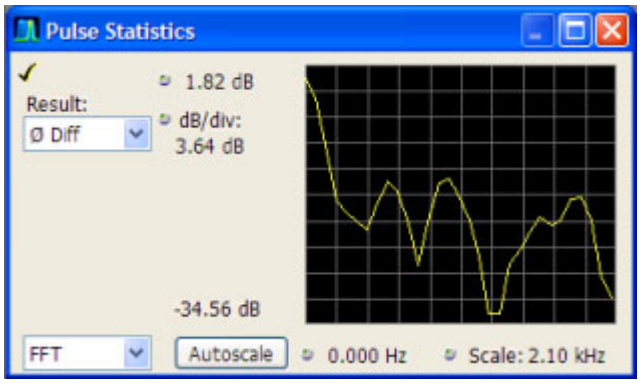
3. Select the Pulsed RF folder.
4. Remove the Spectrum icon and the Time Overview icon from the Selected Displays list.
5. Add the Pulse Statistics icon to the Selected Displays list.
6. Close the dialog box.



When Trend is the selected plot, the Pulse Statistics display plots the results of the selected measurement for every measured pulse.

7. Select the Φ Diff measurement. Pulse-to-pulse phase measurements are good examples to show the trend and FFT statistics.

8. Change the Statistics trace to **FFT**.



FFT shows a spectrum-like trace of the amplitude (in dB relative to the highest result in the set) versus frequency. This can be useful for identifying interference in the pulsed signal. For example, if a spike appears around 60 Hz, it might indicate coupling from the AC power supply.