TELEDYNE LECROY
Everywhereyoulook™

Spectrum Analyzer

Software Instruction Manual

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Spectrum Analyzer Software Instruction Manual

921324 Rev A

Spectrum Analyzer Overview

The Spectrum Analyzer II software simplifies the debugging of frequency-related effects, presenting a tool kit that mimics the interface of a traditional RF spectrum analyzer. You can start using the Fast Fourier Transform (FFT) with little or no concern about setting up an FFT.

Key Features

Easy FFT Setup – automatically applies the FFT to your inputs and translates scope sample rate, memory, and acquisition length settings into frequency domain relevant units. Just choose a center frequency and span or a start and stop frequency. The resolution bandwidth is automatically set to optimum resolution (or can be manually controlled).

Peaks/Markers – automatically and continually marks amplitude peaks on the spectrum trace and displays their values in an on-screen table. Or, you apply moveable markers to the trace, and the software automatically calculates relative and absolute frequencies and levels.

Spectrogram – displays a 2D or 3D rendering of spectra history.

Method of Operation

Spectrum Analyzer adds two dialogs for frequency analysis to your oscilloscope Analysis menu options:

Spectrum Analyzer – the principal setup dialog, with controls similar to a traditional RF spectrum analyzer. This is also where you control the spectrogram.

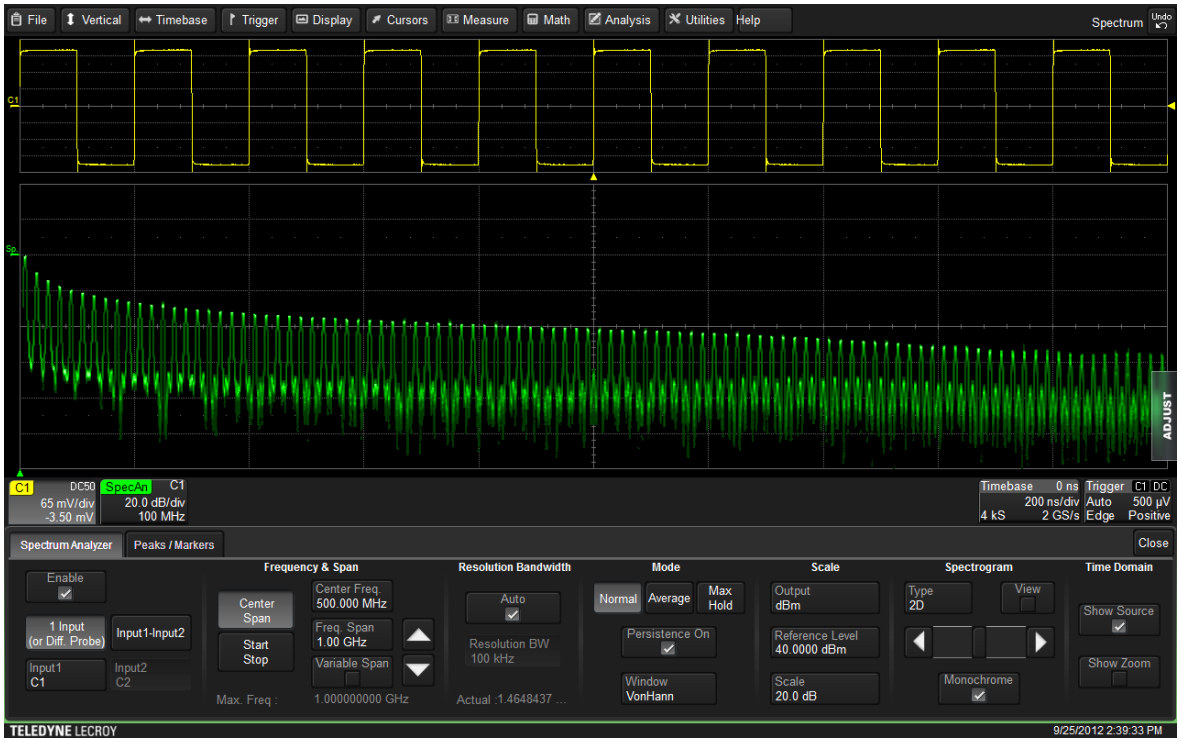
Peaks/Markers – where you control the Peaks and Markers features.

Set up your spectrum trace on the Spectrum Analyzer dialog by choosing your inputs (one or more channel, zoom, math, or memory traces) and the frequency range of interest, just as with an RF analyzer. Then, choose various analysis features, such as Show Peaks or Spectrogram, to optimize your display.

Set Up Spectrum Trace

This procedure explains how to use the Spectrum Analyzer software option to display a spectrum trace, an FFT of your input trace.

1. Choose **Analysis > Spectrum Analyzer**; the Spectrum Analyzer dialog appears. Be sure **Enabled** is checked so the spectrum trace is displayed.



2. To use **1 Input** or a differential probe connected to a single channel (the default), touch **Input1** and choose any channel, zoom, math, or memory source.

   OR

   To input the difference between two sources, select **Input 1-Input 2**, then touch **Input1** and choose the first source. Repeat for **Input2**.

   Example: You can input the difference between two probes connected to two different channels. This option eliminates the need to first set up a math trace to calculate the difference.

3. Position the spectrum trace in either of the following ways:

   Select **Center Span**, then enter the **Center Freq.** and the **Freq. Span**, the total range of frequencies that appear on the grid. Use the Up/Down Arrow buttons to quickly step through the frequency span.

   Tip: To change the frequency span in finer increments than the default 1, 2, 5 steps, check Variable.

   OR

   Select **Start Stop**, then enter the absolute **Start Freq.** and **Stop Freq**. of the frequency span.

   Tip: Start by viewing a large range of Start Stop frequencies to see where frequencies of interest occur in the spectrum trace. Then, Center Span around a frequency for a smaller span.

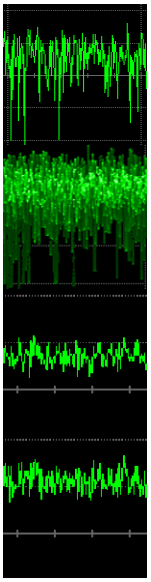
   Note: The spectrum Analyzer always sets the sample rate equal to or higher than twice the frequency span selected.

The remainder of the steps are optional.

4. Adjust the resolution by unchecking Auto (the default) and entering a new **Resolution BW**.

   Note: Changing Resolution Bandwidth is equivalent to changing the Timebase to increase or decrease memory in FFT mode. Reducing the bandwidth will increase the available memory, enabling a faster update rate, but will decrease the resolution of the trace.

5. Change the operating **Mode** of the trace:



Normal (default) – displays the power spectrum of the source trace. You can enable or disable Persistence in this mode.

Persistence – in Normal mode with Persistence on, you will see a history of multiple spectra similar to the display on an RF spectrum analyzer.

Average – choose a number of spectra to average. This effectively reduces noise and displays more of the harmonic carrier detail.

Max Hold – is useful for swept frequency measurements. It shows the history of peak values across the frequency axis.

6. Choose a weighting **Window** to be used for the FFT.

7. Change **Scale** to alter the spectrum trace based on your reference signal. Enter new values for any of the following:

   - **Output** units of measure:
     - **dBm**
     - **dBV**
     - **dBmV**
     - **dBµV**
     - **V rms**
     - **Arms**
   - **Reference Level –** Lowering/raising this value moves the trace up/down on the grid.
   - **Scale –** Amplitude/div. Lowering/raising this value has the effect of "zooming" in/out on the trace. (This alters the appearance of the spectrum trace; it does not open a separate zoom trace.)

   Tip: An easy way to rescale the trace is to touch-and-drag: a) the trace or the Center Frequency indicator left or right, which changes the Center Frequency setting; b) the Zero Point indicator up or down, which changes the Reference Level setting.

8. Select to display additional traces:

   - **Show Source** displays the pre-transform source trace.
   - **Show Zoom** displays a zoom of the source trace.

   Each trace opens in a separate grid from the spectrum trace, and a new descriptor box appears on screen. Touch the descriptor box to open the trace setup dialog and make further adjustments.

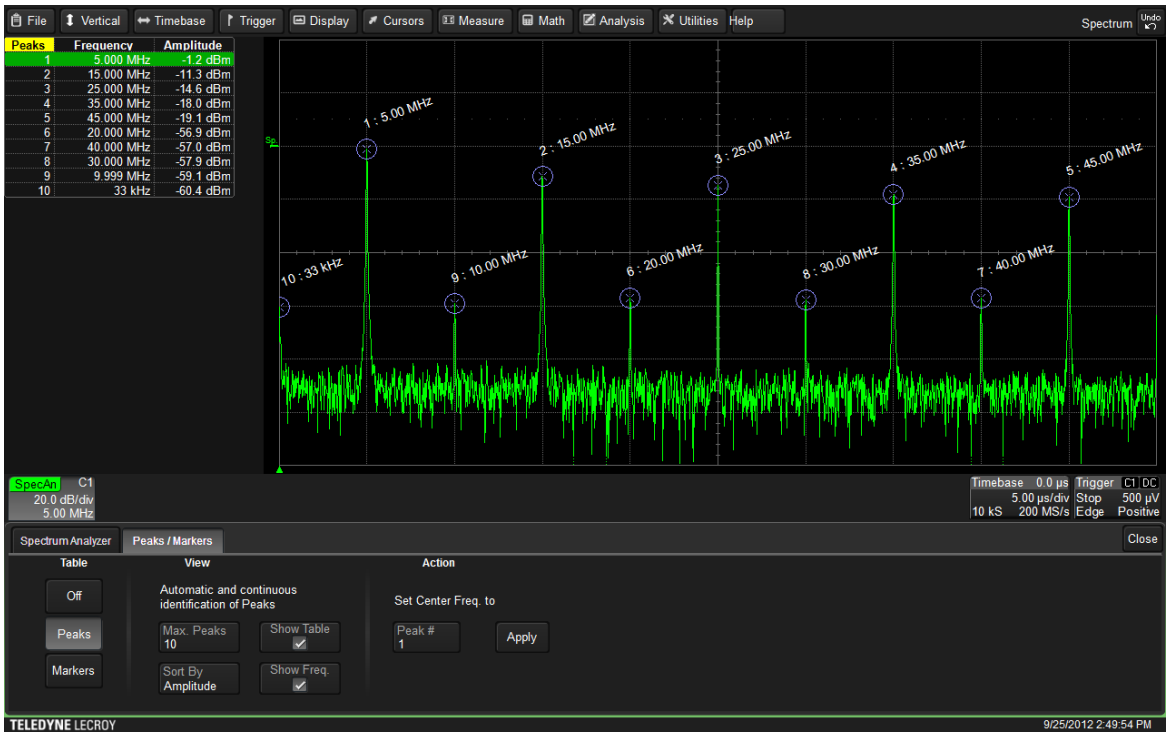
Show Peaks

This procedure explains how to use the Show Peaks feature. Show Peaks marks a desired number of peak amplitudes in the spectrum trace and displays their values in tabular form.

Show Peaks is an automatic and continuous identification of peaks. As the range of frequencies measured changes, peak values are recalculated and markers are moved. The values tabulated are always absolute values for the marked peak.

1. Set up the spectrum trace.

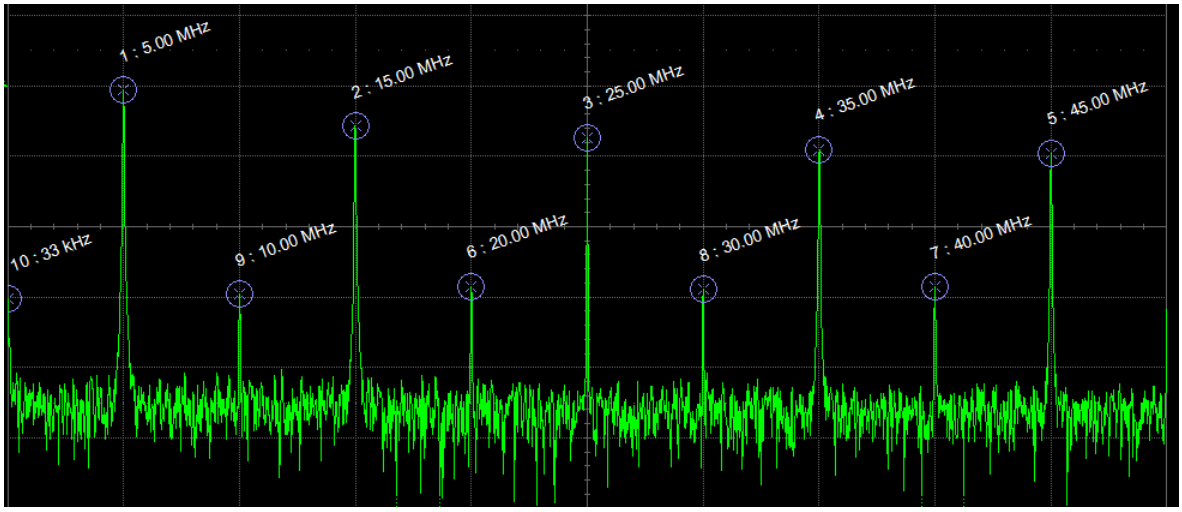
2. Touch the **Peaks/Markers tab**; the Peaks/Markers dialog opens.



3. Select **Peaks**.

4. Enter a **Max.** (number of) **Peaks** up to 100.

Circular markers appear over the trace, representing the *x* peak amplitude measurements.



5. Choose to **Sort By** amplitude or frequency on the measurements table.

   The table is reordered to show the marker with highest amplitude or frequency value on top. The marker number assignment does not change.

6. Optionally, reposition the trace by choosing a peak to **Set Center Freq. to**. Select the desired marker from the table or enter the marker number in **Peak #**. Touch **Apply**.

   The trace shifts, and the new *x* peak amplitudes in that span of frequencies are marked and tabulated.

   Tip: If you do not want the peaks to be renumbered after changing the center frequency, use the Markers feature instead and choose to Set Markers on Peaks.

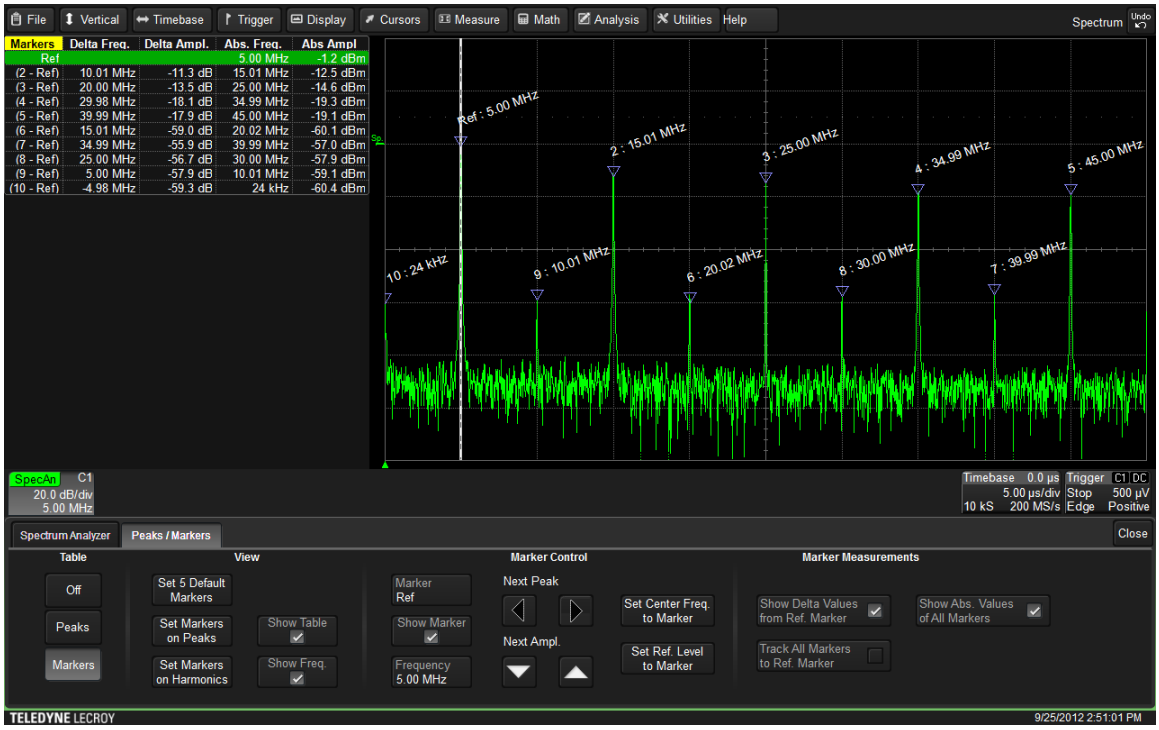
7. To maximize the grid area, uncheck **Show Table**. To remove the frequency readout from the markers, uncheck **Show Freq**.

Apply Markers

This procedure explains how to apply up-to-20 markers to frequencies of interest. Unlike peak markers, these markers remain in place unless you manually re-assign them to a different frequency. However, you can associate different measurements with the markers, and values are automatically calculated and added to the tabular display.

1. Set up the spectrum trace.
2. Touch the **Peaks/Markers tab**; the Peaks/Markers dialog opens.
3. Select **Markers**.
4. Choose which set of markers to **View**:
   - **Set 5 Default Markers** marks five frequencies spread evenly over the spectrum.
   - **Set Markers on Peaks** marks the peak amplitudes in the spectrum.
   - **Set Markers on Harmonics** marks the fundamental frequency and its harmonic content.

   Blue, triangular markers appear over the trace. Marker 1 is always the Reference Marker, also indicated by a thick, white cursor line. The default measurement is absolute amplitude and frequency.



The remainder of the steps are optional.

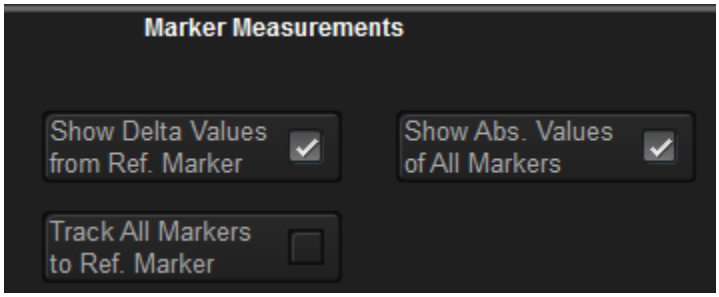
5. Use the **Marker Controls** to re-assign a marker to a new frequency:
   - Select the marker from the table or from the **Marker** popup menu. This is now the Active Marker, indicated by a thin, dashed cursor line, and all Marker Controls apply to this marker.
   - To move it to the Next Peak in either direction, touch the **Left/Right Arrow** button.
   - To move it to the peak with the Next (highest or lowest) Amplitude, touch the **Up/Down Arrow** buttons.
   - To move it to a specific **Frequency**, enter the new value.
   - To remove it from the display, deselect **Show Marker**.

   Tip: A quick way to re-assign any marker is to touch-and-drag the cursor line or the blue triangle to a new frequency. The tabular values are recalculated as the marker moves.

6. To **Set Center Freq. to Marker** or **Set Ref. Level to Marker,** activate the desired marker then touch the button.

   Those settings now take the value of the Active Marker, and the trace is shifted accordingly, although the marker itself remains on the same frequency.

7. Change the **Marker Measurements** by selecting or deselecting options.



   Note: The **Track All Markers to Ref. Marker** option locks all markers at their current delta from the Reference Marker. The markers are moved as the Reference Marker is moved. This is useful for finding interesting harmonics in the spectrum.

The measurements table expands or collapses depending on how many measurements you have selected.

Markers	Delta Freq.	Delta Ampl.	Abs. Freq.	Abs Ampl
Ref			5.00 MHz	-1.2 dBm
(2 - Ref)	10.01 MHz	-11.3 dB	15.01 MHz	-12.5 dBm
(3 - Ref)	20.00 MHz	-13.5 dB	25.00 MHz	-14.6 dBm
(4 - Ref)	29.98 MHz	-18.1 dB	34.99 MHz	-19.3 dBm
(5 - Ref)	39.99 MHz	-17.9 dB	45.00 MHz	-19.1 dBm
(6 - Ref)	15.01 MHz	-59.0 dB	20.02 MHz	-60.1 dBm
(7 - Ref)	34.99 MHz	-55.9 dB	39.99 MHz	-57.0 dBm
(8 - Ref)	25.00 MHz	-56.7 dB	30.00 MHz	-57.9 dBm
(9 - Ref)	5.00 MHz	-57.9 dB	10.01 MHz	-59.1 dBm
(10 - Ref)	-4.98 MHz	-59.3 dB	24 kHz	-60.4 dBm

8. To maximize the grid area, uncheck **Show Table**. To remove the frequency readout from the markers, uncheck **Show Freq**.

Display Spectrogram

This procedure explains how to display a spectrogram of a spectrum trace. The spectrogram is a 2D or 3D rendering of the historical data, up-to-256 spectra displayed in a vertically stacked display. The spectrogram can be shifted/rotated on any of its two or three axes and can be generated in colorized or monochrome versions to more easily visualize high-occurrence samples.

1. Set up the spectrum trace.

2. Choose **Type 2D** or **3D** and check **View**.

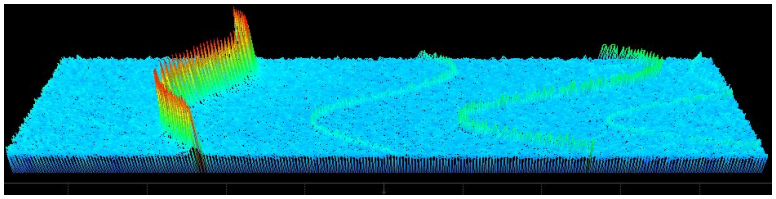
   The spectrogram is drawn in a new grid above the spectrum trace.

3. Move the Spectrogram **slider** or touch the **Right/Left Arrow** buttons to increase or decrease saturation level.

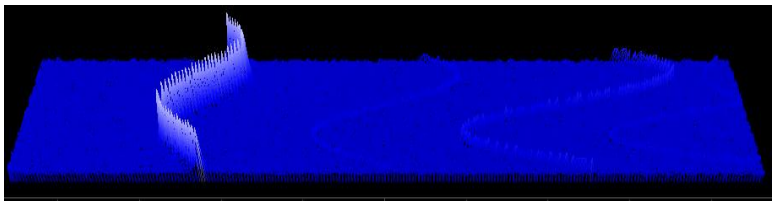
   Saturation corresponds to how often a frequency occurs in a spectrum. The greater the saturation, the more variation you will see in the spectrogram.

4. Optionally, uncheck **Monochrome** to colorize the spectrogram.

   Variations in hue correspond to the occurrence of a frequency in the spectrum. Hotter hues indicate more frequent events, cooler hues indicate less frequent events.



Colorized 3D Spectrogram



Monochrome 3D Spectrogram

5. Grab (touch-and-hold) any point in the spectrogram to move it.

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