



Spectrum Analyzer

Moku:Pro User Manual

Moku:Pro's Spectrum Analyzer allows you to observe input signals in the frequency domain between DC and 300 MHz. View four channels of data simultaneously with a resolution bandwidth as low as 2.2 Hz over a minimum span of 100 Hz. The Spectrum Analyzer also features four integrated waveform generators capable of producing sine waves at up to 500 MHz.





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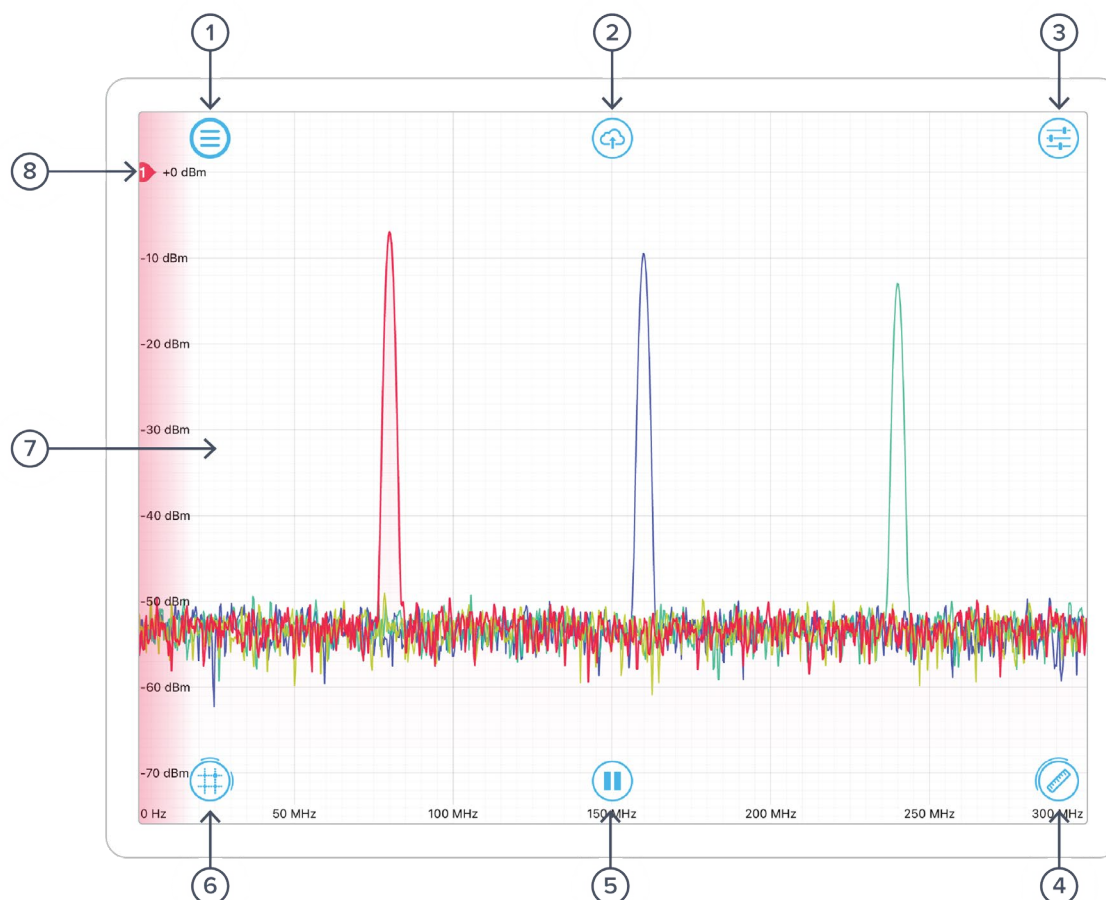


Ensure Moku:Pro is fully updated. For the latest information:

www.liquidinstruments.com



User Interface

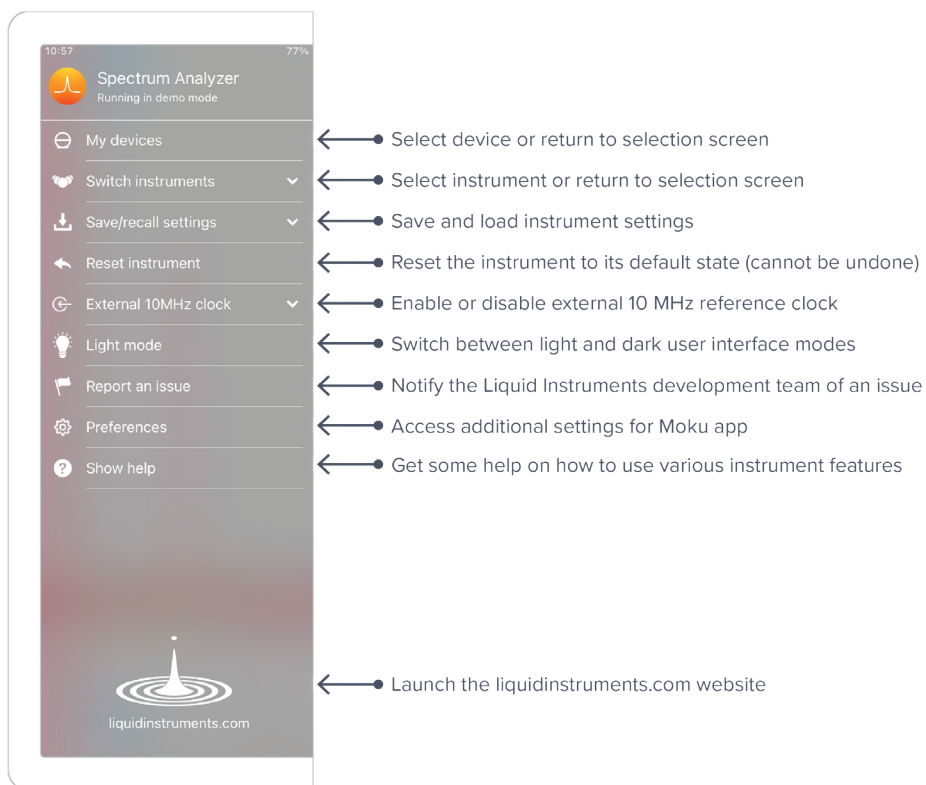


ID	Description	ID	Description
1	Main menu	5	Play/Pause
2	Save data	6	Cursors
3	Controls	7	Signal display area
4	Measurements	8	Reference position indicator



Main Menu

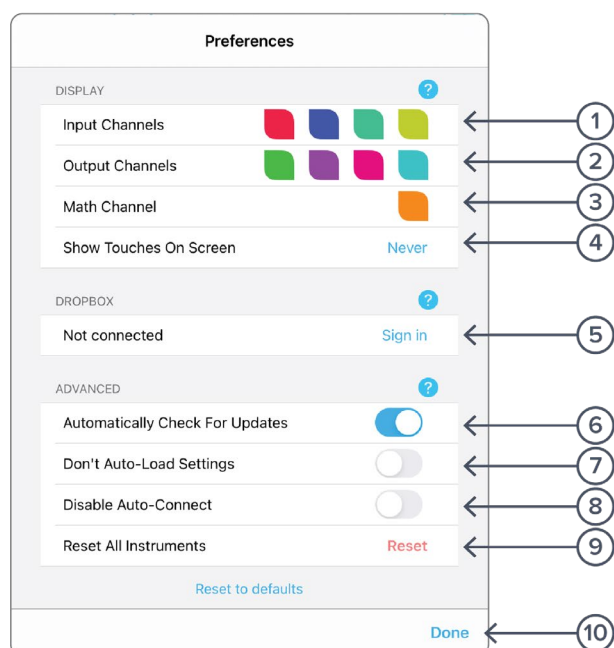
The **main menu** can be accessed by pressing the  icon, allowing you to:





Preferences

The preferences pane can be accessed via the main menu. In here, you can reassign the color representations for each channel, connect to Dropbox, etc. Throughout the manual, the default colors (shown in the figure below) are used to present instrument features.



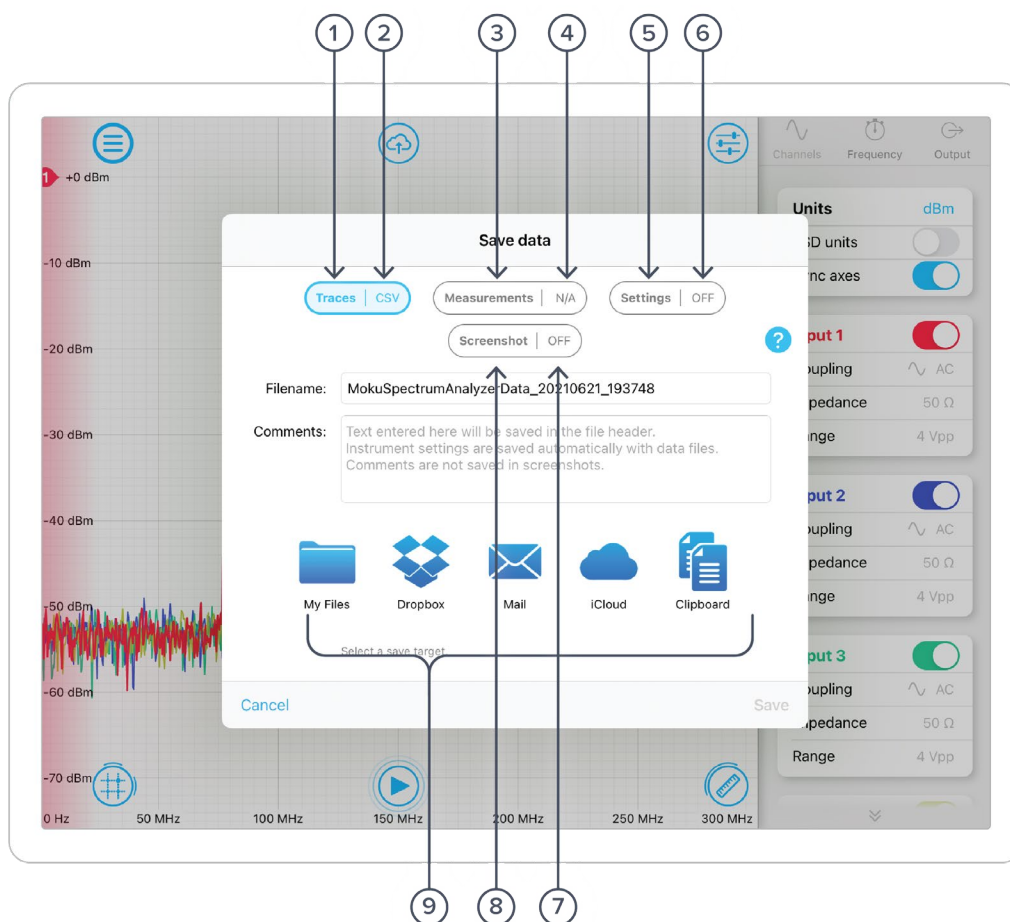
ID Description

1	Tap to change the color associated with input channels.
2	Tap to change the color associated with output channels.
3	Tap to change the color associated with math channel.
4	Indicate touch points on the screen with circles. This can be useful for demonstrations.
5	Change the currently linked Dropbox account to which data can be uploaded.
6	Notify when a new version of the app is available.
7	Moku:Pro automatically saves instrument settings when exiting the app, and restores them again at launch. When disabled, all settings will be reset to defaults on launch.
8	Moku:Pro can remember the last used instrument and automatically reconnect to it at launch. When disabled, you will need to manually connect every time.
9	Reset all instruments to their default state.
10	Save and apply settings.



Save data

The **save data** options can be accessed by pressing the  icon, allowing you to:




ID Description

- | | |
|---|---|
| 1 | Tap to save data from all visible traces. |
| 2 | Tap to change the save format (CSV or MAT). |
| 3 | Tap to save measurement trends when the measurement tile is visible and at least one measurement is active. |
| 4 | Tap to change the save format (CSV or MAT). |
| 5 | Tap to save the current instrument's settings to a text file. Note that settings are saved automatically in the header of data files. |
| 6 | Tap to change the save format (TXT only). |
| 7 | Tap to change the save format (PNG or JPG). |
| 8 | Tap to save the iPad screen as an image. |
| 9 | Tap on any of these options for saving your files. |

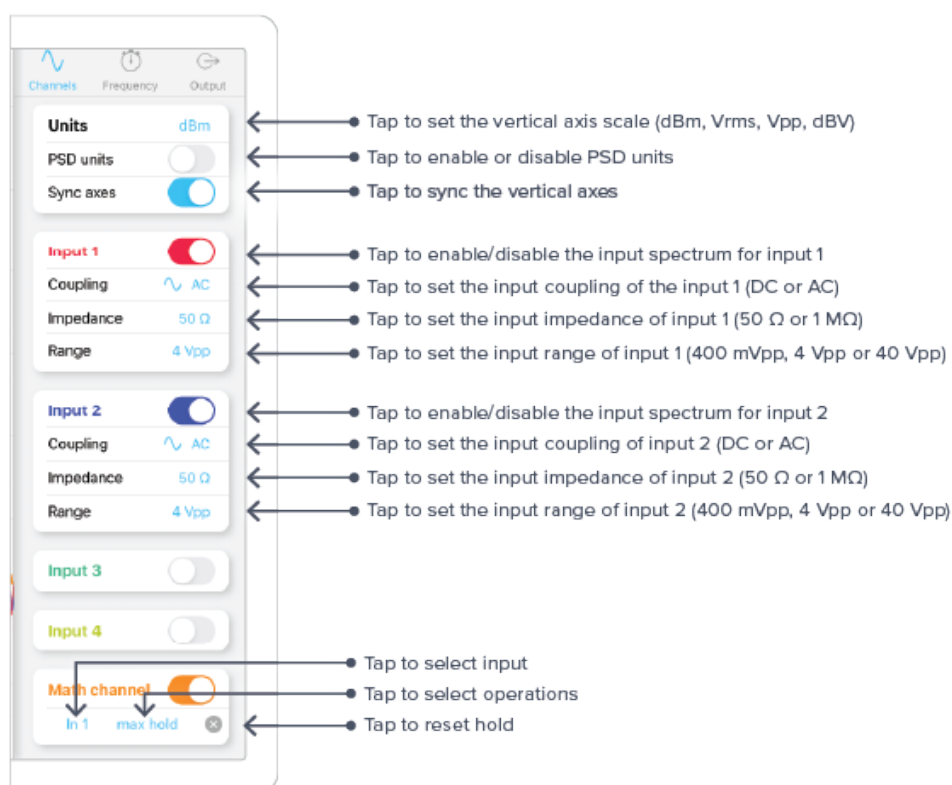


Controls

The **controls** options can be accessed by pressing the  icon, allowing you to reveal or hide the control drawer, giving you access to all instrument settings. This menu is also available by swiping in from the right-hand side of the screen. The controls drawer gives you access to channels, frequency, and output settings.

Channels

The **channels** pane allows you to change the input settings for each input channel, adjust the input range, impedance, and coupling, and enable/disable the math channel. Additional settings are available when math channel is enabled.

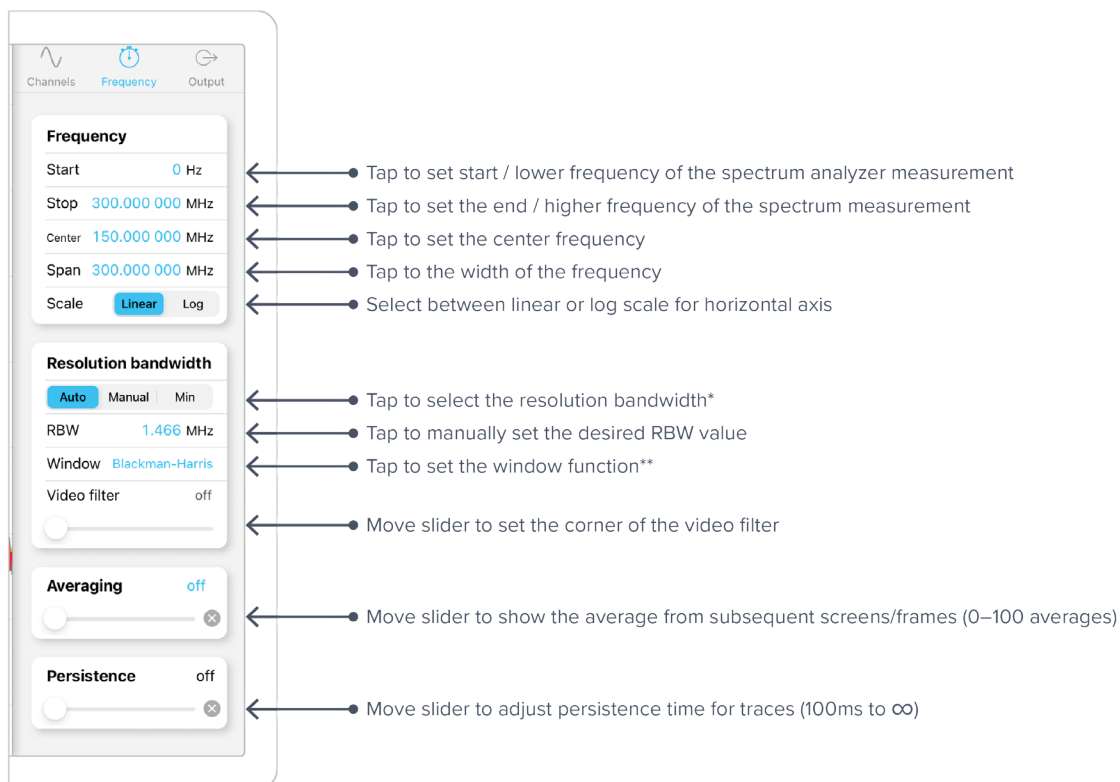


Four operations are currently supported by Moku:Pro's Spectrum Analyzer: +, \times , min hold, and max hold.



Frequency

The **frequency** pane allows you to change parameters related to the frequency domain (horizontal axis), including frequency span, resolution bandwidth, and video bandwidth.



Note that [Start, Stop] and [Center, Span] in the frequency panel are equivalent representations of the measured frequency range. Moku:Pro will automatically update the other pair if one is changed.

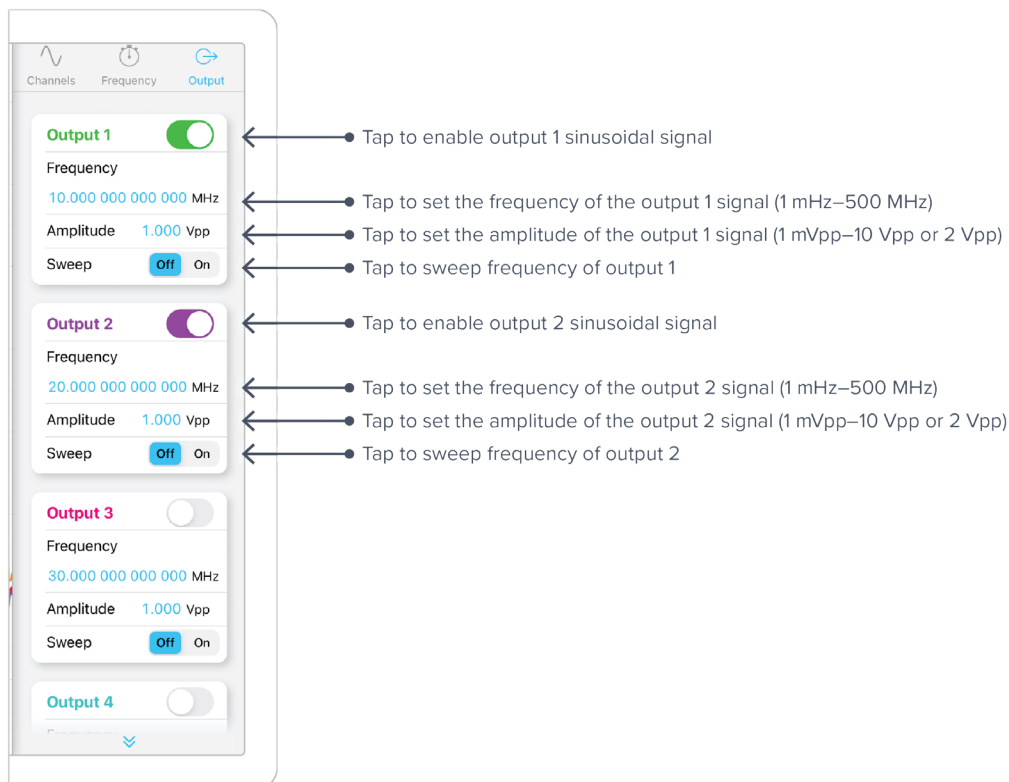
* Auto: determines the best resolution based on the span; Manual: manually set the resolution bandwidth of the spectrum analyzer; Min: uses the smallest RBW available.

** Available options: Blackman-Harris, Flat top, Hanning, and None.



Output

The **output** pane allows you to configure the integrated sine wave generator for the Spectrum Analyzer.



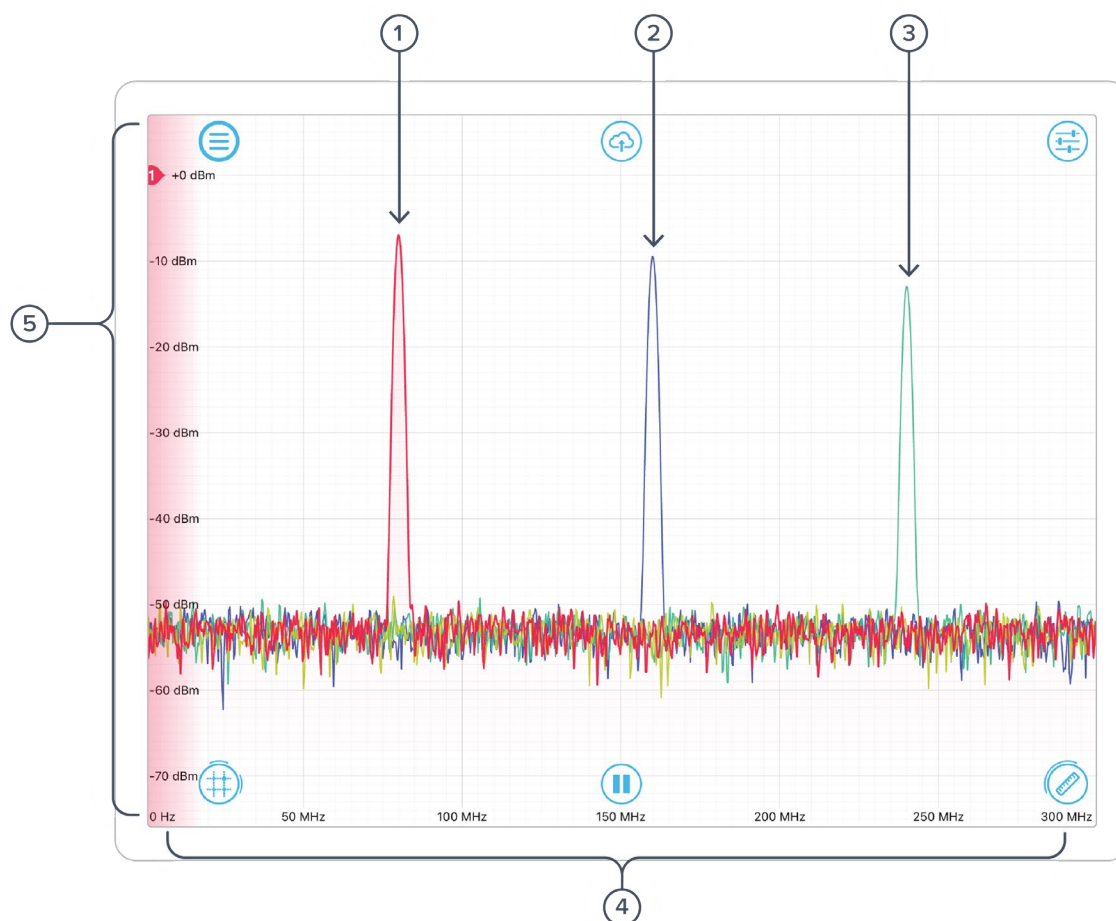
The maximum output amplitude depends on the output frequency. It is 10 Vpp for 100 MHz and below, and 2 Vpp for 100 MHz to 500 MHz.



Display

User Interface

This area is intended to display the spectrum of input and math channels, where the horizontal axis is the measured frequency range and the vertical axis is the power or power spectral density (PSD) in linear or log scales.



ID Description

- | ID | Description |
|----|---|
| 1 | Spectrum for input channel 1. |
| 2 | Spectrum for input channel 2. |
| 3 | Spectrum for input channel 3. |
| 4 | Frequency axis: shows the frequency scale for all channels. |
| 5 | Power axis: shows the power scale for the active channel. * |

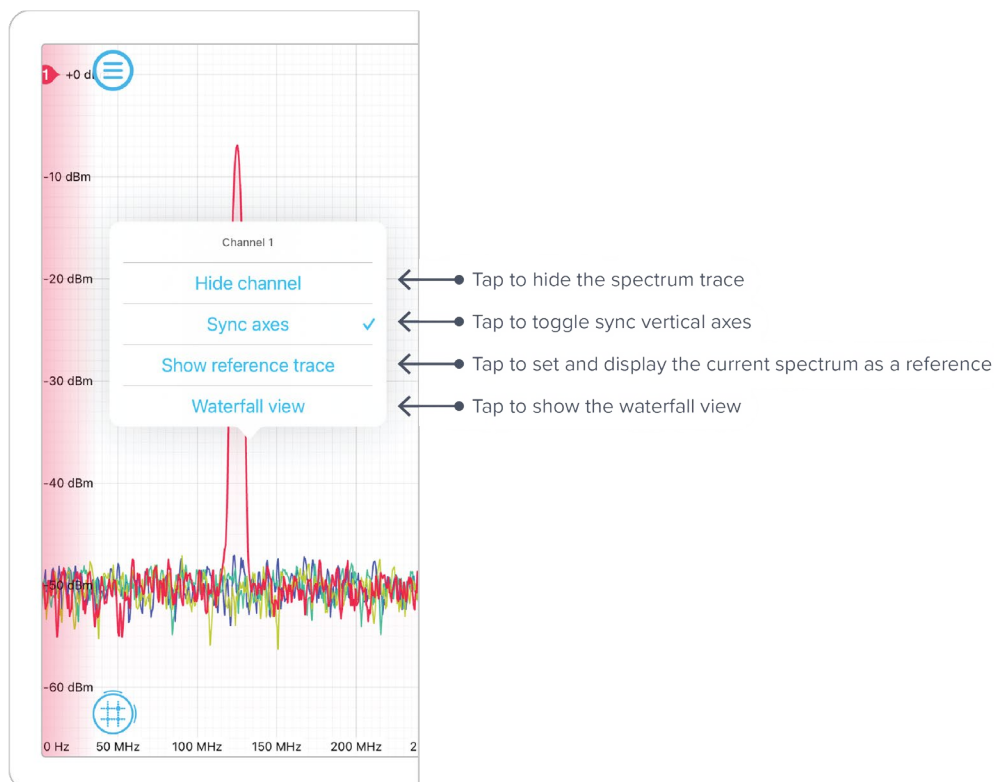
The scales of both axes can be adjusted with pinching gestures.

* The shaded color near the vertical axis indicates the active channel. By default, red represents channel 1, blue represents channel 2, teal represents channel 3, yellow green represents channel 4, and orange represents the math channel.



Spectrum Trace

Press and hold the spectrum trace to reveal additional viewing options:





The screenshot shows the 3D visualization interface. Callout 1 points to the close button (X) in the top right corner. Callout 2a points to the color scale for the first layer (red) on the left. Callout 3a points to the color scale for the second layer (blue) on the left. Callout 4a points to the color scale for the third layer (green) on the left. Callout 5a points to the color scale for the fourth layer (yellow) on the left. Callout 2 points to the first layer (red) in the 3D plot. Callout 4 points to the second layer (blue) in the 3D plot. Callout 3 points to the third layer (green) in the 3D plot. Callout 5 points to the fourth layer (yellow) in the 3D plot.

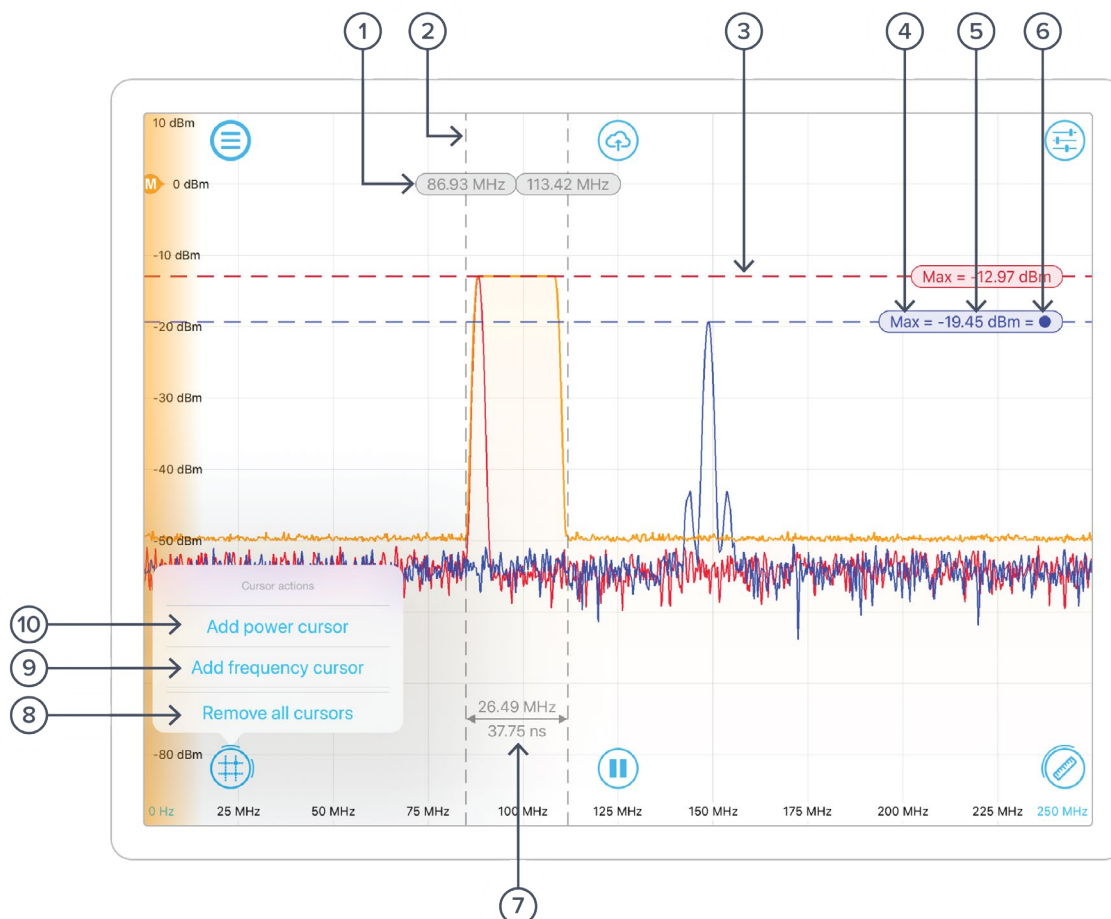
1	Tap to close the waterfall view.
2	Waterfall view for input 1.
2a	Color scale for input 1.
3	Waterfall view for input 2.
3a	Color scale for input 2.
4	Waterfall view for input 3.
4a	Color scale for input 3.
5	Waterfall view for input 4.
5a	Color scale for input 4.



Cursors

The **cursors** can be accessed by pressing the  icon, allowing you to add power or frequency cursors on the display.

User Interface



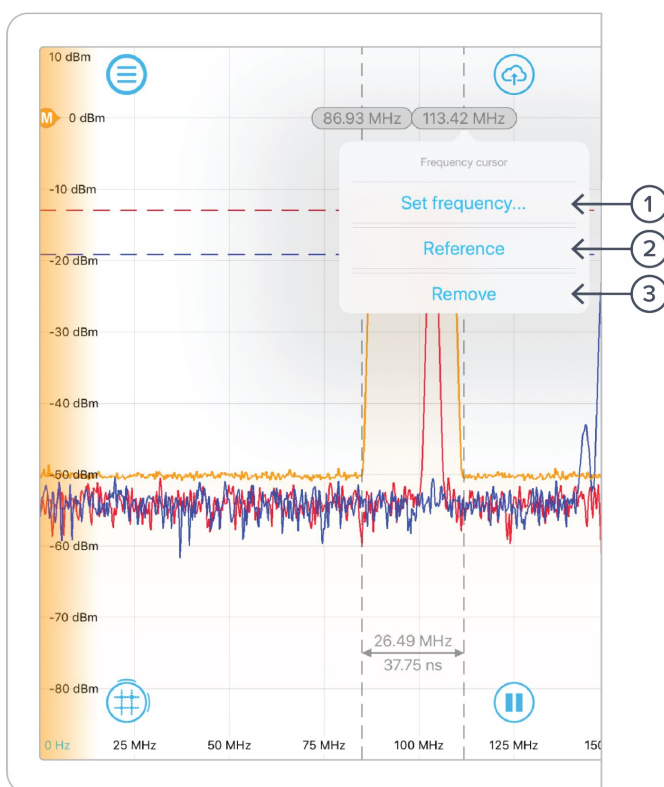
ID	Parameter	Description
1	Frequency reading	Tap to reveal frequency cursor options.
2	Frequency cursor	Drag left or right to set positions.
3	Power cursor	Drag up or down to set positions. Color represents the channel of the measurement.
4	Cursor function	Indicates the current cursor function (max, min, max hold, etc).
5	Amplitude reading	Tap to reveal amplitude cursor options.
6	Reference indicator	Indicates the cursor is set as reference.
7	Frequency difference	Represents the frequency difference between two cursors. This will show up automatically when you have two frequency cursors placed.



ID	Parameter	Description
8	Remove all cursors	Tap to remove all power and frequency cursors.
9	Add frequency cursor	Tap to add a cursor measuring horizontal position.
10	Add power cursor	Tap to add a cursor measuring vertical position.

Frequency Cursor

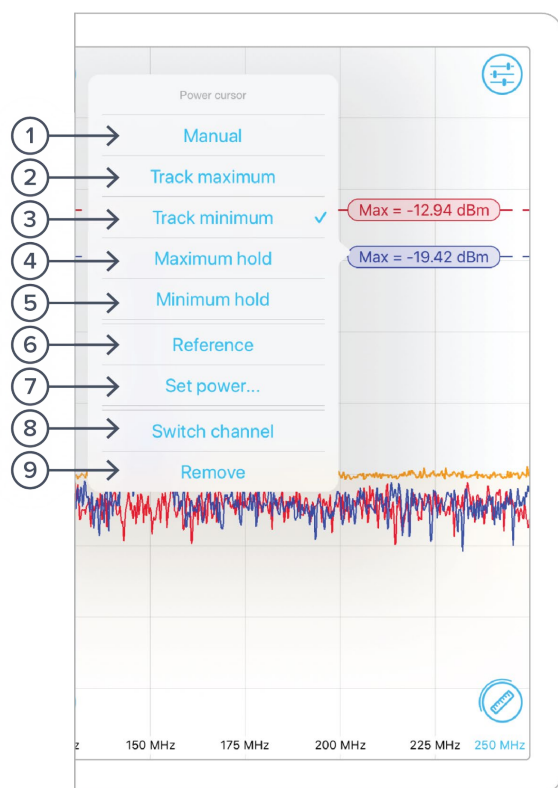
Tap the cursor reading to reveal additional frequency cursor options:



ID	Parameter	Description
1	Set frequency	Tap to position the cursor at the frequency selected.
2	Reference	Tap to set the cursor to act as a horizontal reference value. When this option is selected all other cursors will display the difference between the cursor and the reference cursor's value.
3	Remove	Tap to remove the cursor from display.




Power Cursor



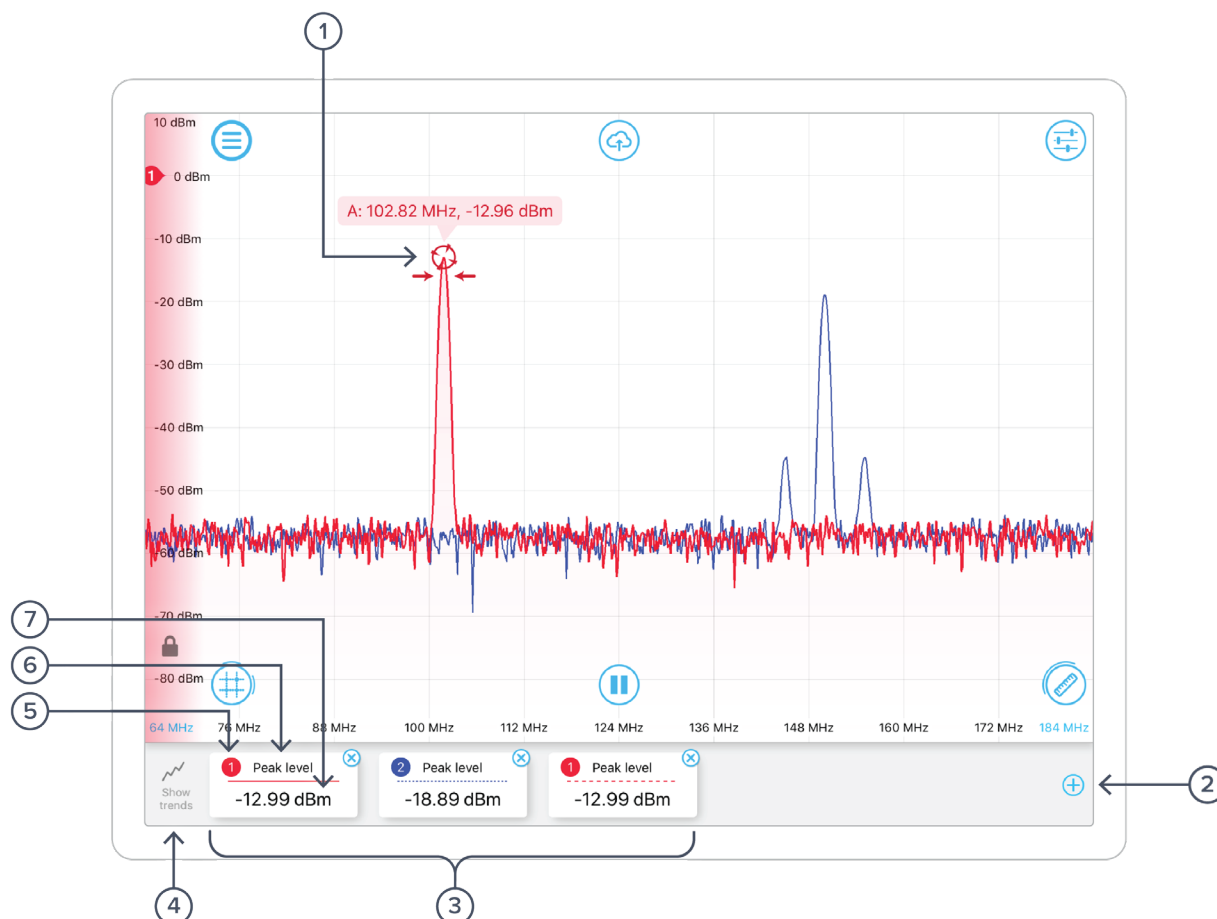
ID	Parameter	Description
1	Manual	Tap to manually set the vertical position of the cursor.
2	Track maximum	Tap to set the cursor to track the maximum power/amplitude.
3	Track minimum	Tap to set the cursor to track the minimum power/amplitude.
4	Maximum hold	Tap to set the cursor to the maximum power/amplitude of previous traces.
5	Minimum hold	Tap to set the cursor to the minimum power/amplitude of previous traces.
6	Reference	Tap to set the cursor to act as a vertical reference value. When this option is selected, all other cursors will display the difference between the cursor and the reference cursor's value.
7	Set power	Tap to set amplitude cursor at specific amplitude.
8	Switch channel	Tap to change the channel that the cursor measures.
9	Remove	Tap to remove the selected cursor.



Measurements

The **measurements** can be accessed by pressing the  icon, allowing you to add/remove measurements to probe a spectra's peak level, peak frequency, power, etc. The measurement function operates on a per channel or per markers basis.


User Interface

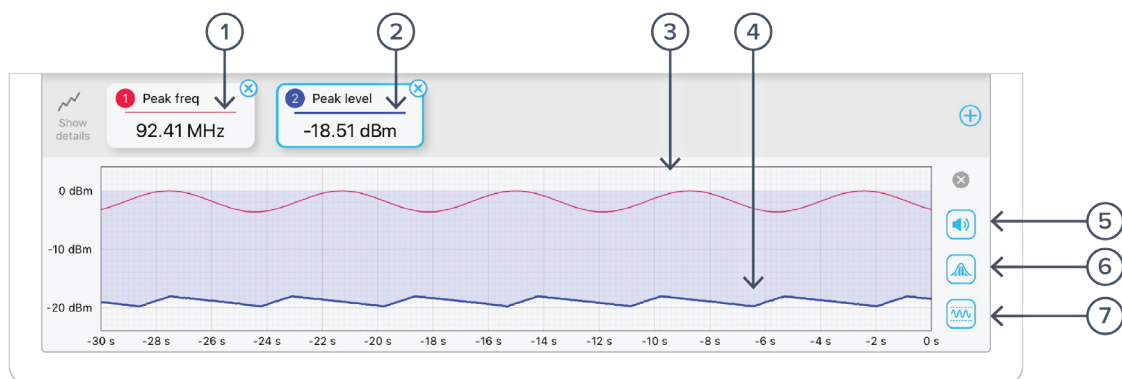


ID Description

- | ID | Description |
|----|--|
| 1 | Measurement marker, tap to reveal additional options. |
| 2 | Tap to add measurements. |
| 3 | List of current measurement cards, tap to reveal additional options. |
| 4 | Tap to show measurements trends. |
| 5 | Source channel. |
| 6 | Measurement type. |
| 7 | Measurement reading. |



Note that measurement markers can be added by dragging the measurement icon  to snap on the input signal. In addition, a plot of measurements vs. time can be accessed by tapping the “show trends” button.



ID Description

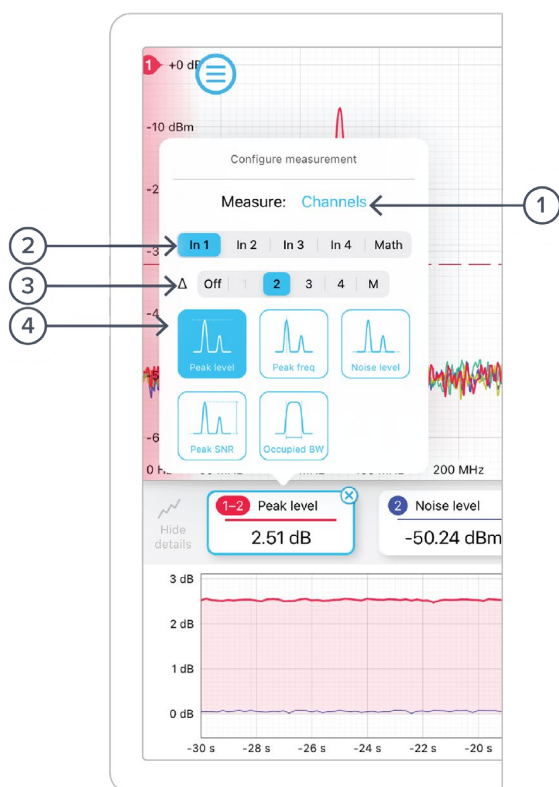
- | | |
|---|--|
| 1 | Trend line style for tile 1. |
| 2 | Trend line style for tile 2. |
| 3 | Trend line for tile 1. |
| 4 | Trend line for tile 2. |
| 5 | Tap to enable/disable audio. |
| 6 | Tap to enable/disable statistics. |
| 7 | Tap to enable/disable adjusted Y-axis scale. |



Measurement Tile Options

Measurement tile options can be revealed by simply tapping the tile. Users can select to measure peak level, peak frequency, noise level, peak signal-to-noise ratio (peak SNR), and occupied bandwidth (occupied BW) of a selected channel/marker.

Options for measurements from channels

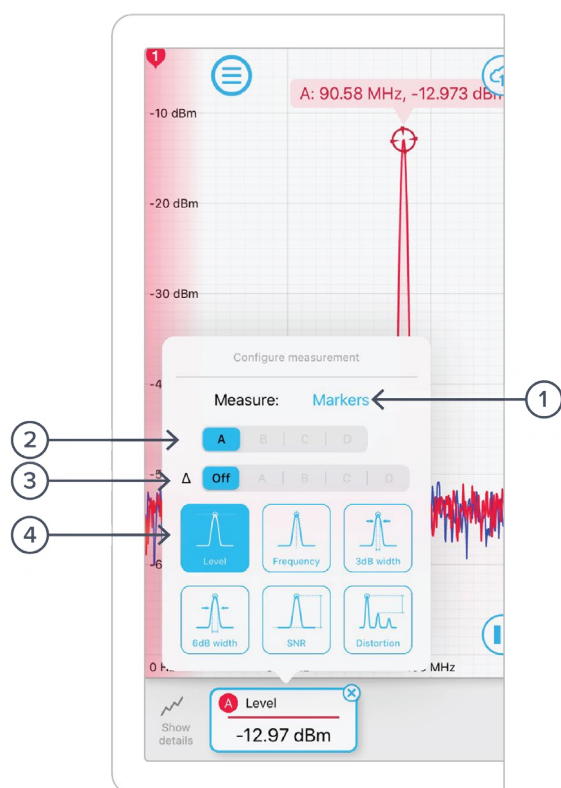


ID Description

- | ID | Description |
|----|---|
| 1 | Tap to switch to measurements from markers. |
| 2 | Tap to select measurement source. |
| 3 | Tap to measure the difference channels |
| 4 | Tap to select measurement type. |



Options for measurements from markers



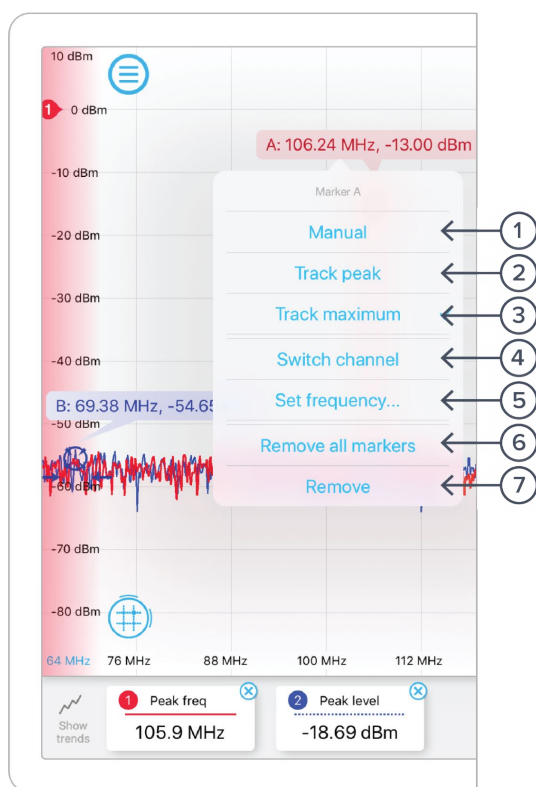
ID Description

- | | |
|---|--|
| 1 | Tap to switch to measurements from channel. |
| 2 | Tap to select measurement source. |
| 3 | Tap to measure the difference between markers. |
| 4 | Tap to select measurement type. |



Measurement Marker Options

Measurement marker options can be revealed by simply tapping the markers. Users can select to set the marker to track the peak, track the maximum, and other options.



ID	Parameter	Description
1	Manual	Tap to set marker position manually.
2	Track peak	Tap to set marker to the frequency of the closest peak / spur.
3	Track maximum	Tap to set marker to the frequency of the maximum power. The marker is updated in real-time.
4	Switch channel	Tap to switch the channel that the marker measures.
5	Set frequency	Tap to set the marker to measure the amplitude of a particular frequency.
6	Remove all markers	Tap to remove all active markers.
7	Remove	Tap to remove currently selected marker.



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