**Measurement Guide**

# Pulse Analyzer

## MS2090A Field Master Pro™
## MS27201A Remote Spectrum Monitor

| | |
|---|---|
| **Pulse Analyzer** | **Option 421** |

| | |
|---|---|
| **Note** | Not all instrument models offer every option or every measurement within a given option. Refer to the Technical Data Sheet of your instrument for available options and supported measurements. |

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# Table of Contents

# Chapter 1 — General Information

## 1-1 Introduction

This measurement guide gives a brief overview of the Pulse Analyzer measurement functions of the Anritsu Field Master series handheld instruments and is intended to assist you in setting up a pulse measurement. For a detailed description of how the pulse measurements are calculated, refer to Section 2-4 “Pulse Measurements” on page 2-7. After measurements are taken, refer to “File Management” section of the Instrument Overview chapter of the user guide, and Section 2-17 “Saving and Recalling Measurements” on page 2-38“for a description of saving, recalling, and managing measurement files.

### Related Manuals

For additional information and literature covering your product, visit the product page of your instrument and select the Library tab:

http://www.anritsu.com/en-US/test-measurement/products/ms2090a

http://www.anritsu.com/en-us/test-measurement/products/ms2720xa

#### Product Information, Compliance, and Safety

Read the Product Information, Compliance, and Safety Guide for important safety, legal, and regulatory notices before operating the equipment:

- Field Master Series – PN: 10100-00069
- Remote Spectrum Monitor – PN: 10100-00064

#### User Guide

For a complete overview of the instrument hardware and system functions, refer to your instrument user guide. The user guide provides information on the following topics:

- Instrument Care, maintenance and calibration.
- External Connections to the top and side panels.
- Power Requirements and Battery Information.
- System settings such as Wi-Fi, GNSS (GPS), date/time, language settings, etc.
- Other advanced settings and tools such as file management, screenshot settings, port setup, and option configuration.
- Diagnostics and software updates.
- Listing of all related documentation such as measurement guides, programming and maintenance manuals.

# 1-2 Option Description

The pulse analyzer Option 421 in Field Master series instruments provides a powerful test solution to measurement of pulsed radar signals in the field. The wide measurement bandwidth supports rise time measurements as fast as 30 ns.

| | |
|---|---|
| **Note** | Not all instrument models offer every option. Please refer to the Technical Data Sheet of your instrument for available options. |

# 1-3 Document Conventions

The following conventions are used throughout the instrument and documentation set.

## User Interface Navigation

The instrument user interface consists of menus, buttons, toolbars, and dialog boxes. Elements in navigation paths are separated as follows: MARKER > PEAK SEARCH > NEXT PEAK.

## Illustrations

Screen-captured images contained in this document are provided as examples. The chapters included in this measurement guide provide information on advanced measurement features, instrument settings and menu overviews, for a featured option. The actual displays, screen menus, and measurement details may differ based on the instrument, model, firmware version, installed options, and current instrument settings.

# 1-4 Contacting Anritsu for Sales and Service

To contact Anritsu, visit the following URL and select the services in your region:

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# Chapter 2 — Pulse Analyzer (Option 421)

## 2-1 Introduction

This chapter gives a brief overview of the Anritsu pulse analyzer and is intended to assist you in setting up a pulse measurement. This chapter describes pulse references for making pulse measurements, including selecting the analyzer and setting up frequency, bandwidth, amplitude, sweep, limit and markers.

## 2-2 Selecting the Analyzer

The instrument analyzers are selected from the 9-dot icon or the current measurement icon. To select an analyzer, press the 9-dot icon in the title bar or the current measurement icon to display the available analyzers, illustrated in Figure 2-1. Simply touch the desired icon to load the new analyzer. The analyzers available for selection depend on the options that are installed and activated on your instrument. Some measurements and views are accessed via other measurement setup menus.


**Figure 2-1.** Example Analyzers

# 2-3 Pulse Analyzer GUI Overview

This section illustrates the main graphical displays and SETUP menu presented for the Pulse Analyzer view. For a detailed description of the pulse measurement, refer to Section 2-4 "Pulse Measurements" on page 2-7.

## Pulse Trace Profile and Summary Data

The following figures show overviews of various Pulse Analyzer views:

- Figure 2-2, "Positive Pulse Trace with Measurement Summary Data (Pulse Analyzer View) (1 of 2)"shows an overview of the trace and summary data for a positive pulse type.
- Figure 2-3, "Positive Pulse Measurement Points and Reference Lines (Pulse Analyzer View) (1 of 2)" shows a full-screen trace with details of the measurement points, pulse markers, and labels for the same measurement setup.
- Figure 2-4, "Negative Pulse Trace with Measurement Summary Data (Pulse Analyzer View)"shows an overview of the trace and summary data for a negative pulse type.
- Figure 2-5, "Negative Pulse Measurement Points and Reference Lines (Pulse Analyzer View)" shows a full-screen trace with details of the measurement points and labels for the same measurement setup.

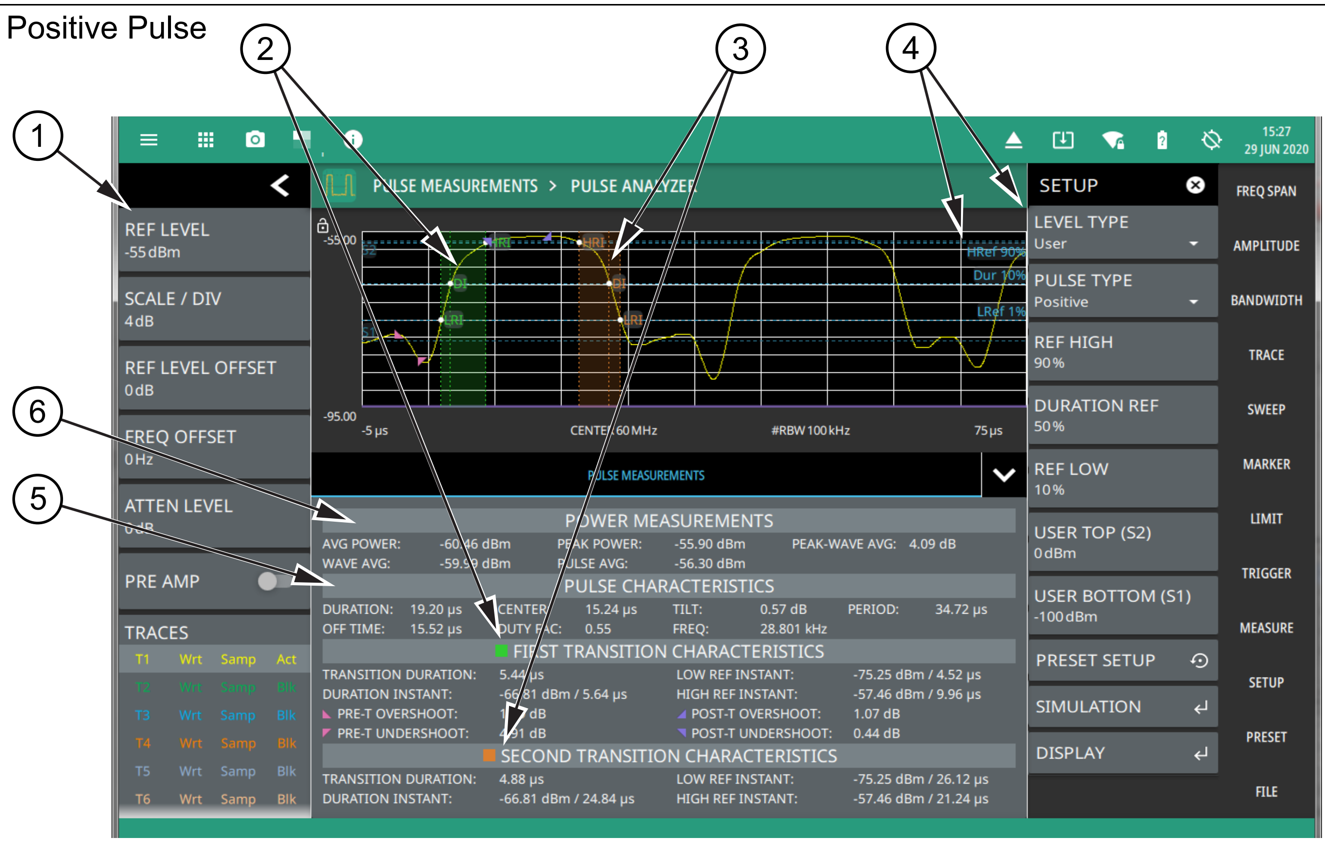



**Figure 2-2.** Positive Pulse Trace with Measurement Summary Data (Pulse Analyzer View) (1 of 2)

1. **Status Panel:** The pulse analyzer shares the spectrum analyzer status panel, displaying general settings for the current measurement. Refer to Section 2-6 “Status Panel” on page 2-14.
2. **First Transition Measurement Characteristics:** The first pulse transition is shown in a green shaded area with measurement points and labels displayed on the currently selected trace and measurement data in the corresponding summary table.
3. **Second Transition Measurement Characteristics:** The second pulse transition is shown in an orange shaded area with measurement points and labels displayed on the currently selected trace and measurement data in the corresponding summary table.
4. **Reference Level Lines:** Reference levels are shown as dashed blue lines with labels that correspond to their configuration buttons in the SETUP menu.
5. **Pulse Characteristics:** This data shows the overall pulse measurements.
6. **Power Measurements:** This data shows the signal power measurements.

**Figure 2-2.** Positive Pulse Trace with Measurement Summary Data (Pulse Analyzer View) (1 of 2)

Positive Pulse

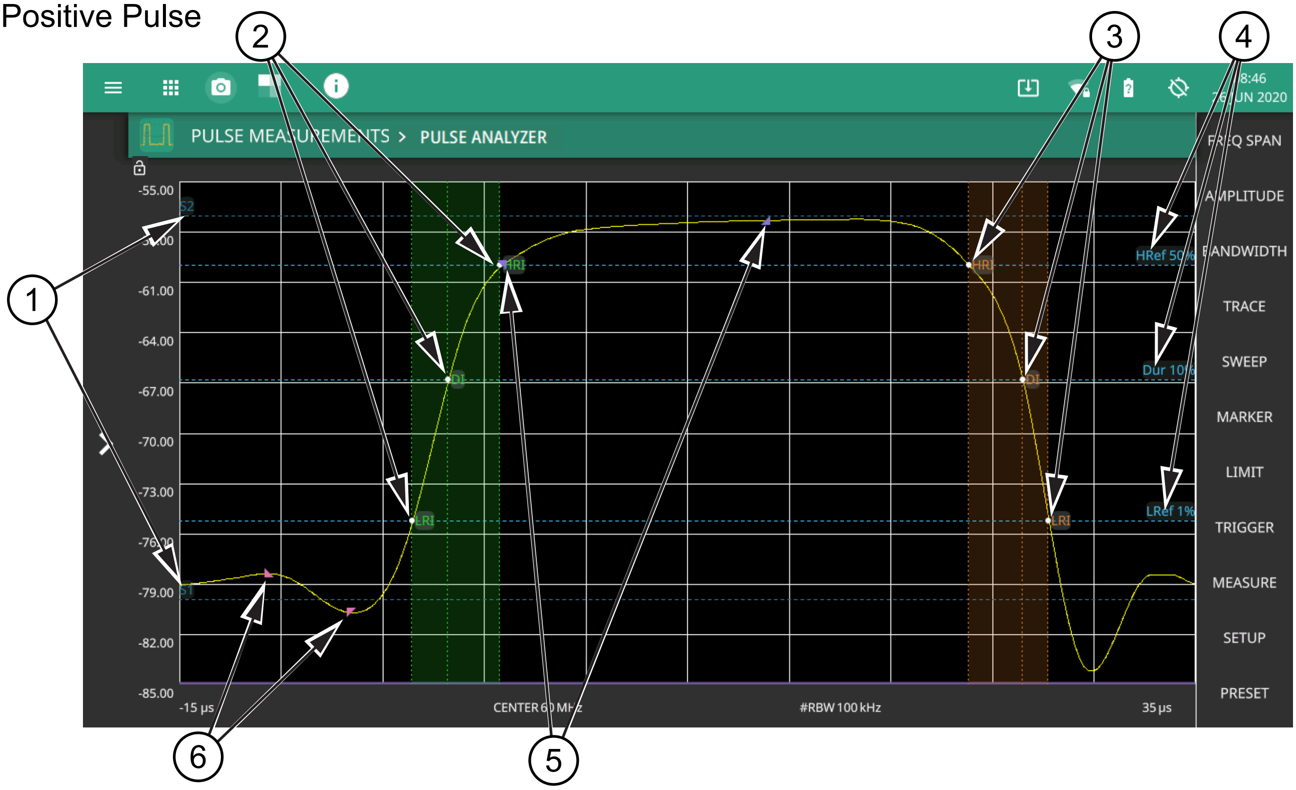
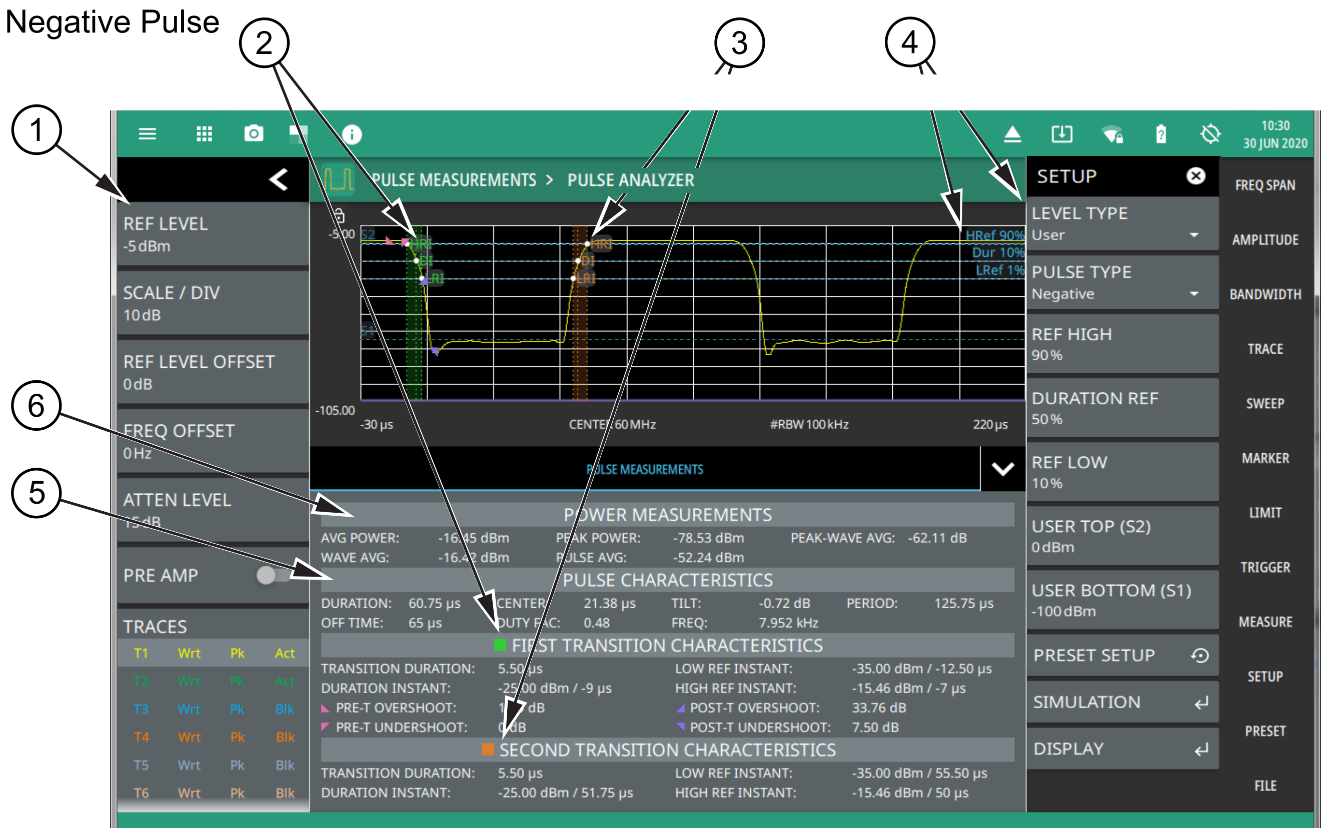



**Figure 2-3.** Positive Pulse Measurement Points and Reference Lines (Pulse Analyzer View) (1 of 2)

1. **Level Reference:** Top and bottom level references are used as a basis for all other references. These can be set to Auto or User. When set to User, the dashed blue lines (S1 and S2) are in use.
   - S2: USER TOP (S2)
   - S1: USER BOTTOM (S1)
2. **First Transition Measurement Points:** The first pulse transition is shown in a green shaded area with measurement points and labels displayed on the currently selected trace. Green labels indicate the first transition measurement points at instants shown at the intersection of the dashed green and blue line crossings.
   - LRI: Low Reference Instant
   - HRI: High Reference Instant
   - DI: Duration Instant
3. **Second Transition Measurement Points:** The second pulse transition is shown in an orange shaded area with measurement points and labels displayed on the currently selected trace. Orange labels indicate the second transition measurement points at instants shown at the intersection of the dashed orange and blue line crossings.
   - LRI: Low Reference Instant
   - HRI: High Reference Instant
   - DI: Duration Instant
4. **Reference Level Lines:** Reference levels are shown as dashed blue lines with labels that correspond to their configuration buttons in the SETUP menu.
   - HRef: REF HIGH (High Reference Level)
   - LRef: REF LOW (Low Reference Level)
   - Dur: DURATION REF (Pulse Duration Reference Level)
5. **Post Transition Markers:** Blue triangle markers indicate the post-transition overshoot and undershoot.
6. **Pre Transition Markers:** Magenta triangle markers indicate the pre-transition overshoot and undershoot.

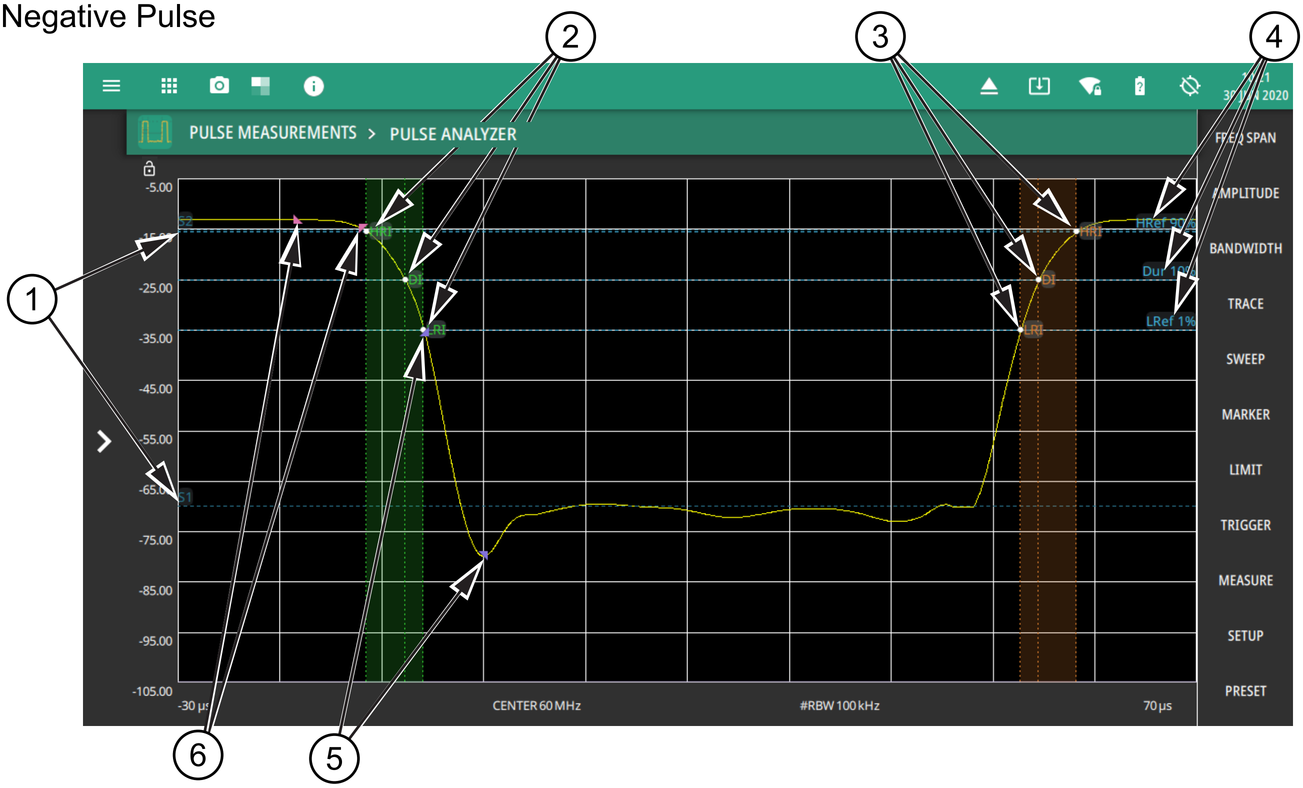
**Figure 2-3.** Positive Pulse Measurement Points and Reference Lines (Pulse Analyzer View) (1 of 2)




1. **Status Panel:** The pulse analyzer shares the spectrum analyzer status panel, displaying general settings for the current measurement. Refer to Section 2-6 “Status Panel” on page 2-14.
2. **First Transition Measurement Characteristics:** The first pulse transition is shown in a green shaded area with measurement points and labels displayed on the currently selected trace and measurement data in the corresponding summary table.
3. **Second Transition Measurement Characteristics:** The second pulse transition is shown in an orange shaded area with measurement points and labels displayed on the currently selected trace and measurement data in the corresponding summary table.
4. **Reference Level Lines:** Reference levels are shown as dashed blue lines with labels that correspond to their configuration buttons in the SETUP menu.
5. **Pulse Characteristics:** This data shows the overall pulse measurements.
6. **Power Measurements:** This data shows the signal power measurements.

**Figure 2-4.** Negative Pulse Trace with Measurement Summary Data (Pulse Analyzer View)

Negative Pulse




1. **Level Reference:** Top and bottom level references are used as a basis for all other references. These can be set to Auto or User. When set to User, the dashed blue lines (S1 and S2) are in use.
   - S2: USER TOP (S2)
   - S1: USER BOTTOM (S1)
2. **First Transition Measurement Points:** The first pulse transition is shown in a green shaded area with measurement points and labels displayed on the currently selected trace. Green labels indicate the first transition measurement points at instants shown at the intersection of the dashed green and blue line crossings.
   - LRI: Low Reference Instant
   - HRI: High Reference Instant
   - DI: Duration Instant
3. **Second Transition Measurement Points:** The second pulse transition is shown in an orange shaded area with measurement points and labels displayed on the currently selected trace. Orange labels indicate the second transition measurement points at instants shown at the intersection of the dashed orange and blue line crossings.
   - LRI: Low Reference Instant
   - HRI: High Reference Instant
   - DI: Duration Instant
4. **Reference Level Lines:** Reference levels are shown as dashed blue lines with labels that correspond to their configuration buttons in the SETUP menu.
   - HRef: REF HIGH (High Reference Level)
   - LRef: REF LOW (Low Reference Level)
   - Dur: DURATION REF (Pulse Duration Reference Level)
5. **Post-Transition Markers:** Blue triangle markers indicate the post-transition overshoot and undershoot.
6. **Pre-Transition Markers:** Magenta triangle markers indicate the pre-transition overshoot and undershoot.

**Figure 2-5.** Negative Pulse Measurement Points and Reference Lines (Pulse Analyzer View)

## 2-4 Pulse Measurements

### Finding the High/Low Reference Levels Using the Histogram Algorithm

When the pulse level type is set to AUTO a histogram algorithm method is used for determining the high and low state levels as described in the *IEEE Standard for Pulses, Transitions, and Related Waveforms* (181-2011), Section 5.2.1. The trace data is taken as input and the amplitudes are operated on in terms of dBm units. The trace data is converted into a histogram where the number of bins is determined by a fixed bin width of 0.01 across the total range of values in the trace data (trace max to trace min). In other words, each trace point amplitude results in an incremented "count" in the histogram bin that corresponds to the amplitude range in which that amplitude falls. To find the high and low state levels, the resulting histogram is split into an "upper" and "lower" histogram where the former consists of all the bins that correspond to the upper 50% range of amplitudes, and the latter the lower 50% range. Then the high state is determined to be the mode of the upper histogram, i.e. the amplitude corresponding to the histogram bin with the highest count. The low state is similarly determined to be the mode of the lower histogram.

If the count of either mode is not greater than at least 1% of the total number of points in the trace data input, then the histogram is recreated using a bin width that is ten times larger. This process of regenerating the histogram with larger a bin width is repeated until the mode of the histogram is at least 1% of the total number of points. This means that the best case resolution of the resulting high state and low state is 0.01 dBm (the starting bin width), and depending on how much the state levels fluctuate, the resolution can fall back to 0.1 dBm, 1 dBm, and so on.

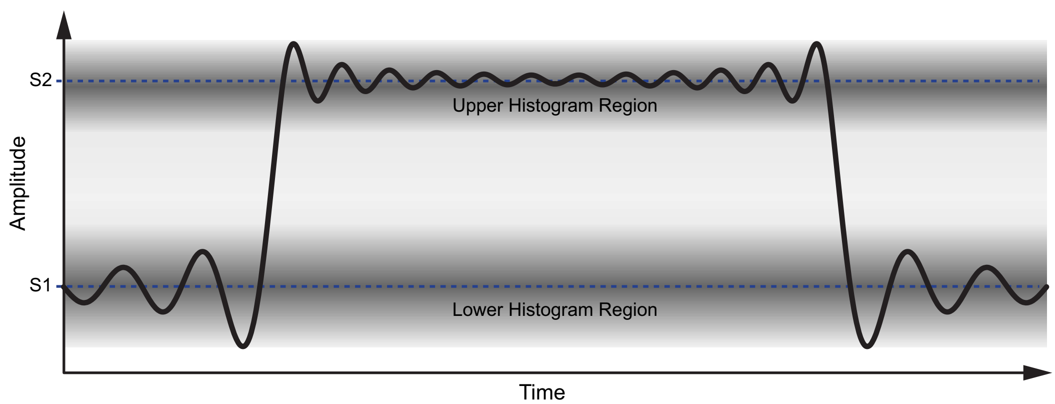



**Figure 2-6.** Finding High and Low Reference Levels

When the pulse level type is set to USER, the user determines the high and low state levels and enters the level using the USER TOP (S2) and USER BOTTOM (S1) settings.

## Finding the Reference Level Instants

Instants are a specific time value within a waveform time duration. They are typically referenced relative to the initial instant of the waveform. The following sections describe how the pulse measurements are determined (see Figure 2-7 and Figure 2-8).

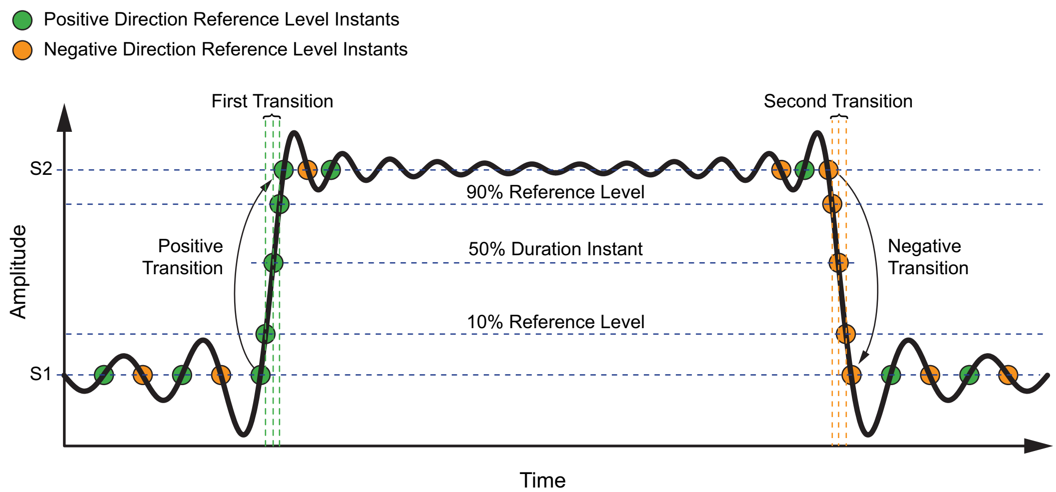



**Figure 2-7.** Positive Pulse Waveform Instants and Transitions

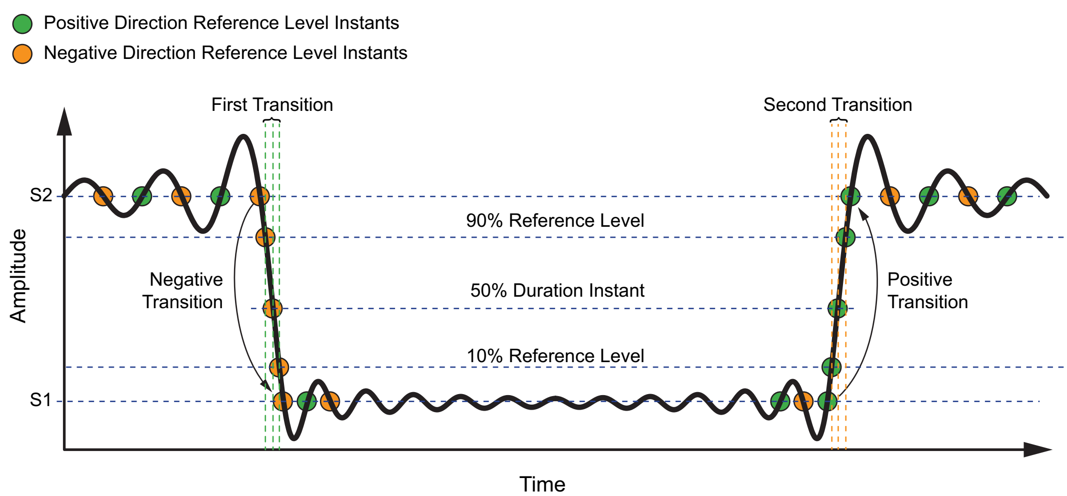



**Figure 2-8.** Negative Pulse Waveform Instants and Transitions

### Finding the Transitions

Transitions are contiguous regions of a waveform that connect, either directly or via intervening transients, two state occurrences that are consecutive in time but are occurrences of different states. To find the transition, begin with a filtered list of reference level instants that contain only those that cross the low or high reference levels. Each reference level instant in the list has a corresponding index and direction (e.g. the trace index immediately before the amplitude crossing the reference level, and direction indicating whether the trace crosses from above to below the reference level or vice versa).

This filtered list of instants is sorted in ascending index order. Then all positive and negative transitions (between the high/low reference levels) are found by searching for consecutive instants in the filtered list that both have the same direction. The waveform is defined to be in the "high state" if it exceeds the 90% reference level and in the "low state" if it drops below the 10% reference level. This is the chosen alternative rather than using the state upper/lower boundaries (which the IEEE standard says is optional).

### Finding Pulse Duration and Period

The pulse duration is determined by using the positive and negative transitions as describe above to check if it is a valid pulse. If so, then any pulse duration reference levels (50%) are verified to exist within the positive/negative transition. This reference level determines the starting and ending period of the pulse. The duration is just the difference between the ending point and the starting point.

The pulse period also first determines that we have a valid pulse from the positive and negative transitions. Unlike the pulse duration measurement, the pulse period must have the pulse repeat, or a pulse train, to have a measurement. There should be at least 3 transitions in the 50% reference level to produce a valid measurement. The period is the distance between the starting level of the first pulse and the starting level for the second pulse.

### Finding the Wave Average

The wave average is determined by averaging the power levels of all points within all complete periods that are available on the trace. To determine where to start and stop, the number of transitions is used to determine if there is at least one full period. The system returns "nan" if there is not a full period. Otherwise, the starting point for this measurement is the beginning of the first transition and the end point is the beginning of the transition of the last full period.

For instance, a trace with six transitions has some quantity of points before the first transition followed by two full periods, then followed by less than one full period. Once the start and end of all the complete periods have been found, all points between them are summed together and divided by the total number of points used in the measurement.

### Finding Trace Average

The trace average is the exponential average of all the points in the trace. Unlike the wave average, it is not constrained to full pulses.

### Finding the Pulse Average

The pulse average is the average of the points in the high state of the pulse (typically those points above the 90% reference line). This only applies to positive pulses. If there is no positive pulse, then no measurement is returned.

### Finding the Pulse Center Instant and Repetition Frequency

The Pulse repetition frequency is determined from the inverse of the pulse period (1/pulse period) as a frequency value. The pulse center instant is determine by taking the pulse duration (50%) start time and adding the pulse duration midpoint, which is one-half of the pulse duration (pulse duration/2).

### Finding the Pulse Peak

The pulse peak is the maximum value in a waveform after a positive transition. If there is no positive transition, the peak amplitude of the overall waveform is returned.

### Finding the Pulse Tilt

The pulse tilt measures the distortion of a waveform state where the overall slope of the state is essentially constant and other than zero. The slope may be of either polarity and is calculated for either negative or positive pulses. A complete pulse (with at least two transitions) is needed to ensure that there is a waveform state for which tilt can be measured. If there is enough trace data within the waveform state, the first and last 25% of samples where overshoot distortion is most likely to occur is removed. The slope of the remaining 50% of state trace data is then calculated using the *least squares* method, and the tilt is calculated by multiplying the slope by the number of trace points in the state.

### Finding the Wave Amplitude

The wave amplitude is found by subtracting the amplitude of the lower state level from the amplitude of the upper state level in dB units.

### Finding the Peak to Wave Average

The peak to wave average is found by subtracting the wave average from the pulse peak in terms of dB. This requires the wave average to have a valid value, so there must be at least one full period for a measurement.

### Finding the Pre- and Post-Transition Aberration Region

The pre-transition aberration region is determined to be the region of the trace before the last state crossing before the first transition, and with a width equal to three times the duration of the first transition. It is upper bounded by the available trace data before the transition. The post-transition aberration region is the region beginning at the first state crossing past the first transition, and ending at three times the transition duration or at the beginning of the next transition, whichever comes first.

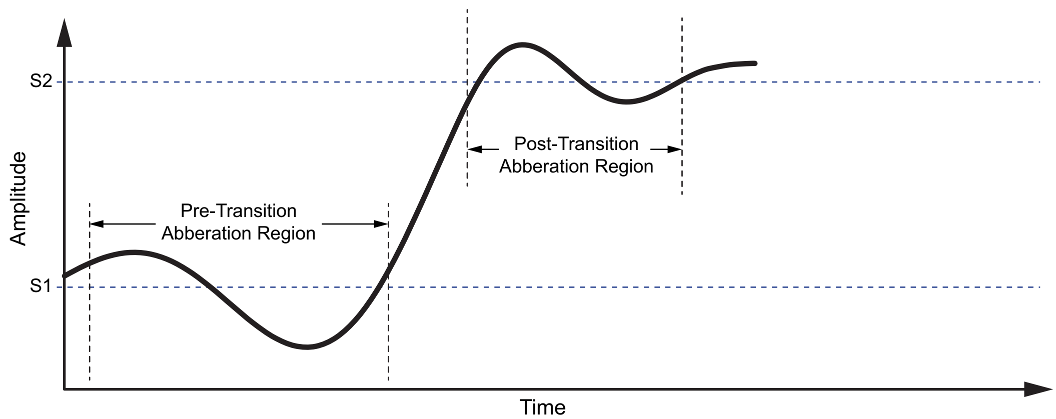



**Figure 2-9.** Positive Pulse Aberration Regions

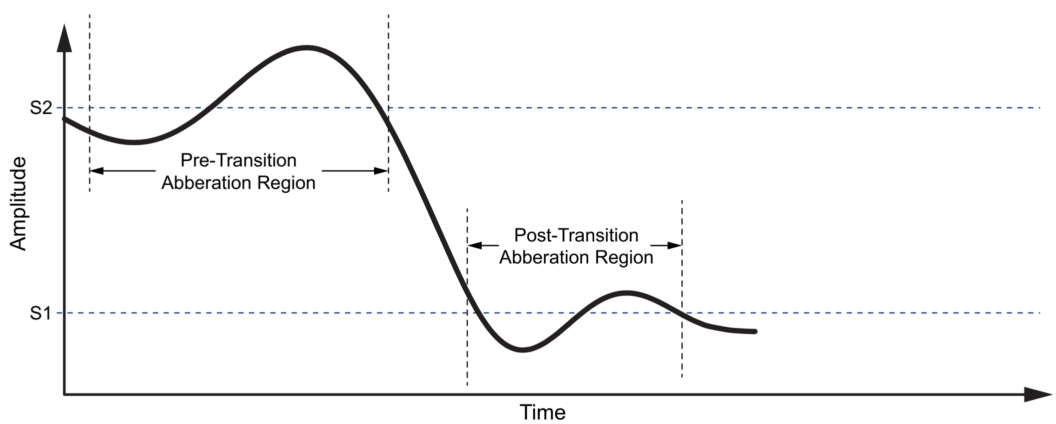



**Figure 2-10.** Negative Pulse Aberration Regions

### Finding the Overshoot and Undershoot of Each Aberration Region

The overshoot and undershoot of each region are calculated by taking the difference between the maximum and minimum trace value of each aberration region and the local state level. Local state level being (Low = pre-transition → High = post-transition) in a positive transition, and (High = pre-transition → Low = post-transition) in a negative transition.

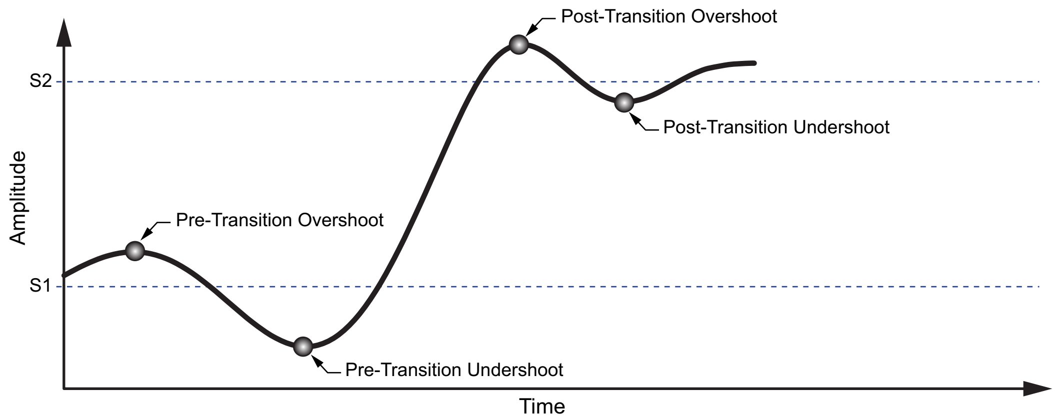



**Figure 2-11.** Positive Pulse Overshoot and Undershoot

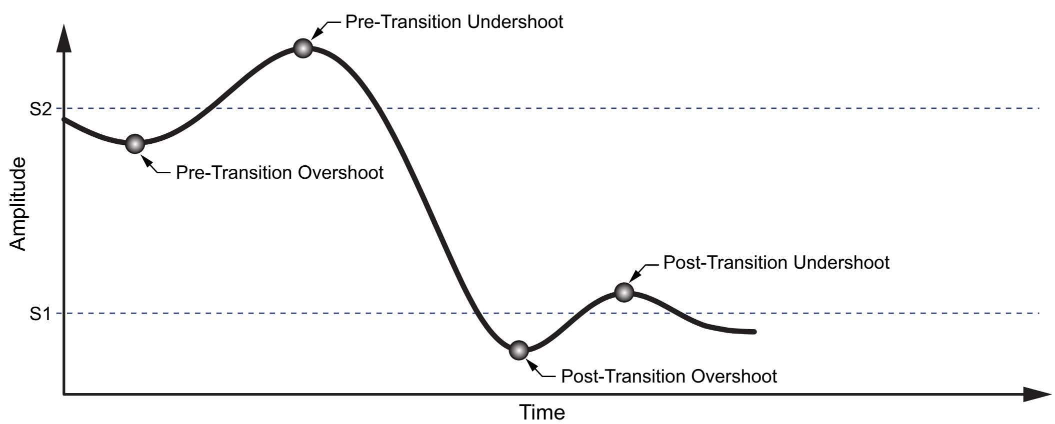


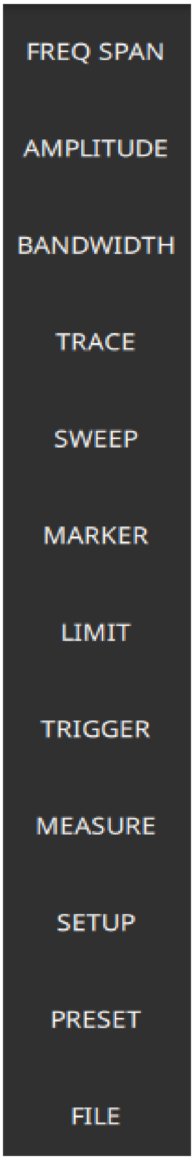

**Figure 2-12.** Negative Pulse Overshoot and Undershoot

## Tips for Improving Pulse Measurement Results

- Set the reference level as close to the top of the trace as possible.
- Use trace averaging.
- For custom or irregular pulses, use a user defined top reference level (S2) instead of auto detection.
- Use single sweep and sweep once buttons to take measurements one at a time.

## 2-5 Main Menu

The main menu is the primary access point for all instrument controls and measurement selections. The main function for each main menu button is described below.




**FREQ SPAN:** Contains all frequency control settings such as center frequency, start and stop frequency, span, frequency offset, and frequency step. Refer to Section 2-8 "Setting Frequency Parameters".

**AMPLITUDE:** Provides access to all amplitude-related settings including reference level, graticule scale, and attenuator/preamp settings. Refer to Section 2-9 "Setting Amplitude Parameters".

**BANDWIDTH:** Provides access to resolution and video bandwidth settings and Auto ratios, and sets the bandwidth filter types. Refer to Section 2-10 "Setting Bandwidth Parameters".

**TRACE:** Provides trace- and detection-related controls to set trace behaviors, presets, and access to the trace/detector settings table. When in Spectrogram view, also provides spectrogram cursor controls. Refer to Section 2-11 "Setting Trace Parameters".

**SWEEP:** Provides controls for sweep behaviors, number of measurement points, and gated sweep settings (with Option 90). Refer to Section 2-12 "Setting Sweep Parameters".

**MARKER:** Traditional markers are not available in Pulse Analyzer.

**LIMIT:** Limit is not available in Pulse Analyzer.

**TRIGGER:** Controls the trigger source, delay and holdoff, and trigger slope settings. Refer to Section 2-14 "Setting Up Triggering".

**MEASURE:** Used to select measurements such as spectrum, channel power, occupied bandwidth, adjacent channel power, spectral emissions mask, and opens the spectrogram. Refer to Section 2-15 "Measurement Setup".

**SETUP:** Measurement controls for setting up advanced measurements. This menu always displays setting options for the current active measurement (refer to "SETUP Menu" on page 2-33).

**PRESET:** Opens the PRESET menu with selective trace, marker, and setup preset commands, or an all inclusive analyzer preset command. Refer to Section 2-16 "Presetting the Analyzer".

**FILE:** Used to save and recall instrument setups and measurements, and screen images. Also provides access to save on event controls. Refer to "FILE Menu" on page 2-40 and "File Management" section of the instrument's user guide.

**Figure 2-13.** Main Menu

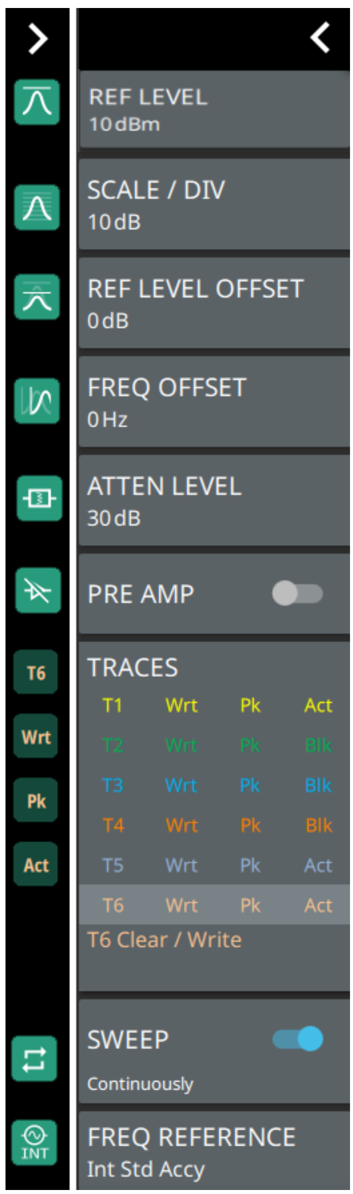
## Using Menus

Instrument setup, control, and measurement functions are performed through the use of menus. Menu behaviors are summarized below:

- Pressing a main menu button opens an associated menu.
- The name of the button pressed in the main menu is reflected in the title bar of the resulting menu.
- Menu buttons can change for various measurement settings, instrument setup parameters, and measurement views.
- Pressing the corresponding main menu button for a menu closes the menu.
- Touching status data, a parameter field, or label in the display area opens the corresponding menu and the associated keypad for editing that parameter setting.
- Pressing Accept, Cancel, or the X in the upper right corner closes the menu or keypad.

## 2-6 Status Panel

The status panels and features illustrated in this section are unique to the spectrum analyzer and to the particular measurement and view that is selected. Below is the pulse analyzer status panel that covers pulse analyzer and pulse viewer measurements (selected via MEASURE > VIEW menu).




Pressing any of these parameters opens the associated menu with a keypad that allows you to conveniently change the parameter value. These are the same settings found in the right side menus.

**REF LEVEL:** Sets the reference level of the top graticule line. If the reference level offset is not zero, OFFSET REF LEVEL is displayed at this location.

**SCALE/DIV:** Sets the graticule scale/division.

**REF LEVEL OFFSET:** Compensates for the presence of external input attenuation or gain.

Refer to Section 2-9 “Setting Amplitude Parameters” on page 2-17.

**FREQ OFFSET:** Accounts for frequency conversions outside of the analyzer. Refer to Section 2-8 “Setting Frequency Parameters” on page 2-15.

**ATTEN LEVEL:** When auto attenuation is off, sets input attenuation.

**PRE AMP:** Toggles the low-noise front-end preamplifier on or off. Refer to Section 2-9 “Setting Amplitude Parameters” on page 2-17.

**TRACES:** Displays the current status of up to six traces in a quick-view summary.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) will show you the settings of the trace used to fill the spectrogram. The reference trace settings are applied to all traces and cursors while in Spectrogram view. Pressing a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu. It allows you to select and set up an individual trace or cursor as desired. Refer to Section 2-11 “Setting Trace Parameters” on page 2-22.

**SWEEP:** Toggles the current sweep setting between continuously or sweep once. Refer to Section 2-12 “Setting Sweep Parameters” on page 2-25.

**FREQ REFERENCE:** Indicates the current frequency reference source of Internal High Accuracy (used after GNSS (GPS) has lost sync, but while the internal clock still has good GNSS (GPS) reference), Internal Standard Accuracy, External, or GNSS (GPS) Hi Accuracy (requires GNSS (GPS)). The instrument automatically selects the frequency reference in the following order of priority: external, GNSS (GPS), then the internal time base.

**Figure 2-14.** Pulse Analyzer Status Panel with Minimized Status Panel Icons

## 2-7 Connecting a Signal Source

The basic setup starts with connecting a signal source to the RF In port of the instrument. For over-the-air measurements, connect an antenna that is appropriate for the frequency range to be measured. For direct conducted measurements, ensure the RF source does not over power the input of the analyzer.

| | |
|---|---|
| **Note** | For connector panels descriptions and torque specifications, refer to the product user guide. For RF input power limitations, refer to the product technical data sheet. |

After an RF source is connected to the input connector, follow the sections below for setting up the measurement parameters.

## 2-8 Setting Frequency Parameters

Frequency-related parameters are set using the "FREQ SPAN Menu" on page 2-16. Pulse measurements are conducted in zero span so only the center frequency needs to be entered. Additionally, a frequency offset can be used, depending on what makes the most sense, either for the user or for the measurement.

### Entering a Center Frequency

1. Press FREQ SPAN on the main menu.
2. Press CENTER FREQUENCY to open the center frequency parameter entry keypad.
3. Enter the desired center frequency. When entering a frequency with the keypad, available frequency units (GHz, MHz, kHz, and Hz) will be displayed along the left and right edge of the menu.
4. Press the appropriate frequency unit to terminate the entry or press ACCEPT to terminate the entry with the current frequency unit.

| | |
|---|---|
| **Note** | To quickly move the center frequency value up or down, press the + or - slider controls to increment the center frequency by the set FREQUENCY STEP. You can also drag the center frequency using the slider or by dragging the trace directly. |

The current settings are shown along the bottom of the pulse graph (see Figure 2-6 on page 2-7).

### Using Offset Frequency

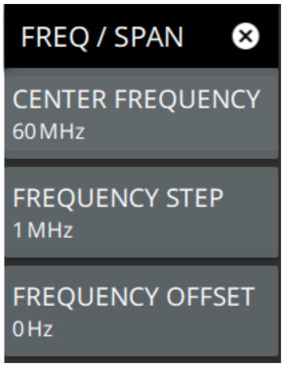
A user-defined frequency offset can be entered to adjust the frequency that is displayed on the instrument from the actual swept frequency. For example, if the DUT is an antenna system receiving signals in the 10 GHz range and offsetting the signals to the 1 GHz range, you can set a frequency offset in the spectrum analyzer in order to display the actual received antenna frequency in the sweep window.

Both positive and negative offset values are allowed. Negative offsets can be useful for seeing differences from expected values. Enter a negative offset of the expected value, and the received antenna frequency should display in the 0 Hz range.

When enabled, the offset value is displayed at the left of the screen in the status panel (see Section 2-6 "Status Panel"). To remove a frequency offset, open the FREQ SPAN menu and set FREQUENCY OFFSET to 0 Hz. You can also access this parameter directly from the left side status panel.

| | |
|---|---|
| **Note** | Offset frequency apply to start, stop, center, and marker frequencies. |

## FREQ SPAN Menu




**CENTER FREQUENCY:** Sets the center frequency of the sweep range.

**FREQUENCY STEP:** Sets the frequency step value used for the plus (+) or minus (–) control.

**FREQUENCY OFFSET:** The frequency offset value accounts for frequency conversions outside of the analyzer. The offset frequency value is added to the start, stop, center, fixed marker, and normal marker frequencies. Pressing the plus (+) or minus (–) control moves the offset frequency in steps defined by the FREQUENCY STEP value.

**Figure 2-15.** FREQ / SPAN Menu

## 2-9 Setting Amplitude Parameters

Amplitude-related parameters are set using the “AMPLITUDE Menu” on page 2-19.

### Setting Amplitude Reference Level

The amplitude reference level is typically an absolute reference level set at the top of the graticule for the power level being measured. Signal levels above this set value will be outside of the display range and may overdrive and saturate the input circuit (refer to “Indications of Excessive Signal Level” on page 2-18). To set the current amplitude reference level:

1. To automatically set an optimum reference level, press AMPLITUDE > AUTO REF LEVEL.
2. To manually set the reference level, press AMPLITUDE > REF LEVEL, then enter the desired reference level in dBm.

| | |
|---|---|
| **Note** | Select AUTO ATTEN coupling of the attenuator setting and AUTO REF LEVEL to help ensure that harmonics and spurs are not introduced into the measurements. |

### Setting Amplitude Range and Scale

This setting applies to most analyzer modes of instrument operation and allows you to set the y-axis graticule scale.

1. Press AMPLITUDE > SCALE/DIV and enter the desired number of units per division (dB/division).
2. Set the desired y-axis amplitude units. Currently, dBm is the only available selection.

### Reference Level Offset for External Loss or External Gain

To obtain accurate measurements, you can compensate for any external attenuation or gain by using a reference level offset. The compensation factor is in dB. External attenuation can be created by using an external cable or an external high power attenuator. External gain is typically from an amplifier.

To adjust the reference or amplitude level for either gain or loss:

1. Press AMPLITUDE > REF LEVEL OFFSET.
2. Enter a positive dB value to account for gain or enter a negative dB value to account for loss.
3. The new reference level offset value will be displayed on the instrument and the y-axis and trace amplitude is adjusted accordingly.

### Attenuator Functions

The spectrum analyzer includes a step attenuator at the RF input. This attenuator is used to reduce large signals to levels that make best use of the analyzer’s dynamic range. By default, the auto attenuation automatically adjusts the attenuator as a function of the reference level. In the AMPLITUDE menu, the ATTEN LEVEL allows manual adjustment of the input attenuation. When auto attenuation is selected, both the reference level and the attenuation are increased. The following actions, listed in decreasing order of effectiveness, can facilitate the detection of low-level CW signals:

- Decrease the reference level and attenuation. Refer to “AMPLITUDE Menu” on page 2-19.
- Turn on the preamplifier.
- Reduce RBW and or VBW (RBW/VBW = 10 is often optimal for this purpose). Refer to “Setting Bandwidth Parameters” on page 2-20.
- Use trace averaging if VBW is already set to 1 Hz. Refer to “Setting Trace Parameters” on page 2-22

## Preamplifier

The preamplifier can be turned on and off by toggling PRE AMP via the status panel or the AMPLITUDE menu. Figure 2-16 shows the noise floor with the preamplifier off (1) and on (2). Note that when the preamplifier is turned on, the noise floor drops significantly and a low-level signal is exposed. In order to use the preamplifier, the attenuation must be lower than 20 dB. If the preamplifier is turned on when the attenuation is greater than or equal to 20 dB, the attenuation will automatically drop to 10 dB. When AUTO ATTEN is toggled on, the REF LEVEL must be set to –40 dBm or lower to enable the preamplifier. The below image shows the effect of the preamplifier in a frequency sweep to illustrate how a signal can be exposed from the analyzer noise.

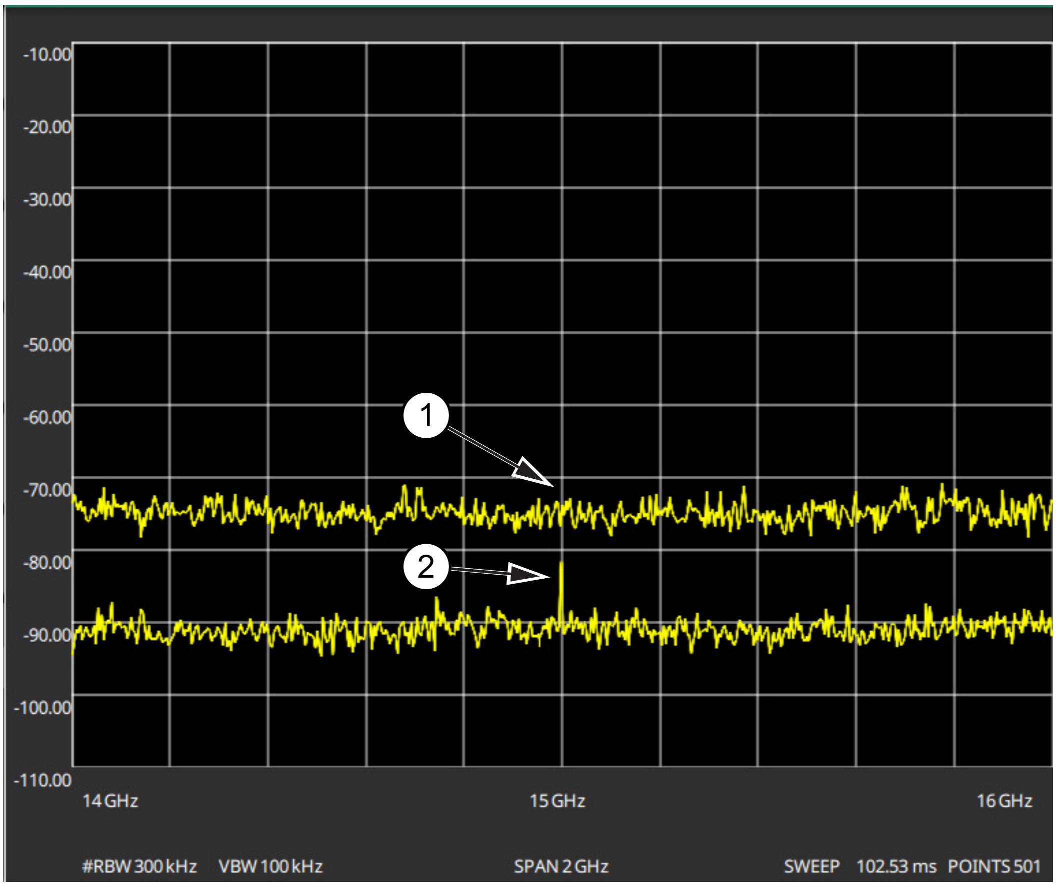



**Figure 2-16.** 1. Preamplifier Off
2. Preamplifier On

## Indications of Excessive Signal Level

The instrument has built-in features to help prevent input overload. These include auto attenuation and reference level. The instrument will also indicate when a received signal is too high for the current setup by displaying an "ADC Overrange" notification in the title bar (Figure 2-17). Before proceeding with the measurements, adjust the reference level, the attenuation level, and disable the preamplifier if necessary. Adjusting the resolution bandwidth and frequency range may also help when measuring small signals that are near large signals.


**Figure 2-17.** ADC Overrange

## AMPLITUDE Menu


**REF LEVEL:** The reference level is the top graticule line on the measurement display. If the reference level offset is not zero, the offset reference level is displayed at this location. Pressing the plus (+) or minus (–) control increments the value by 10. The plus/minus (+/-) button on the keypad toggles between positive and negative values.

**AUTO REF LEVEL:** Auto reference level automatically adjusts the reference level to place the highest signal amplitude at about two graticule lines from the top based on the position of the trace at the time the button is pressed.

**SCALE/DIV:** The scale can be set from 1 dB per division to 15 dB per division. The default setting is 10 dB. Pressing the plus (+) or minus (–) control changes the value by 1.

**Y AXIS UNIT:** Selects the y-axis amplitude units of dBm, dBW dBV, dBmV, dBμV or dBA.

**REF LEVEL OFFSET:** Reference level offset compensates for the presence of external input attenuation or gain. The offset is applied to all amplitude related parameters and to measurements such as the y-axis scale and marker measurements. The default offset value is 0 dB. Pressing the plus (+) or minus (–) control increments the value by 10. The plus/minus (+/-) button on the keypad toggles between positive and negative values. Refer to “Reference Level Offset for External Loss or External Gain” on page 2-17.

**PRE AMP:** Turns the low-noise front-end preamplifier on or off. To ensure accurate measurement results, the largest signal into the instrument input when the preamplifier is turned on should be less than –40 dBm. The preamplifier cannot be turned on if auto attenuation is on and the reference level is above –40 dBm. Refer to “Preamplifier” on page 2-18.

**AUTO ATTEN:** Input attenuation can be either tied to the reference level (on) or manually selected (off). When input attenuation is tied to the reference level, attenuation is increased as higher reference levels are selected to make sure the instrument input circuits are not saturated by large signals that are likely to be present when high reference levels are required.

**ATTEN LEVEL:** When auto attenuation is off, the attenuation value can be set manually to a resolution of 5 dB. Pressing the plus (+) or minus (–) control increments the value by 10.

**IMPEDANCE:** Select either 50 ohm, 75 ohm, or Other impedance value. Selecting 75 ohm selects the 7.5 dB loss of the Anritsu 12N50-75B adapter. For other adapters, select Other and enter the appropriate loss (0 dB is the default loss). Note that loss values are also applied to the relevant units.

**CUSTOM IMP LOSS:** Sets a user-defined impedance loss value, if option “other” is selected for impedance.

**Figure 2-18.** AMPLITUDE Menu

# 2-10 Setting Bandwidth Parameters

Bandwidth parameters are set using the "BANDWIDTH Menu" on page 2-21.

## Resolution Bandwidth

Resolution Bandwidth (RBW) determines frequency selectivity. The spectrum analyzer traces the shape of the RBW filter as it tunes past a signal. The choice of resolution bandwidth depends on several factors. Filters take time to settle. The output of the filter will take some time to settle to the correct value so that it can be measured. The narrower the filter bandwidth (resolution bandwidth), the longer the settling time needs to be, and therefore, the slower the pulse transition.

There is always some amount of noise present in a measurement. Noise is often broadband in nature; that is, it exists at a broad range of frequencies. If the noise is included in the measurement, the measured value could be in error (too large) depending upon the noise level. With a wide bandwidth, more noise is included in the measurement. With a narrow bandwidth, less noise enters the resolution bandwidth filter and the measurement is more accurate. If the resolution bandwidth is narrower, the noise floor will drop on the spectrum analyzer display. As the measured noise level drops, smaller signals that were previously obscured by the noise might now be measurable. Zero span is used for noise and noise-like measurements that are usually wider than the RBW. The RBW is ideally set to be as wide as the bandwidth of the signal you are measuring.

## Video Bandwidth

Spectrum analyzers typically use another type of filtering after the detector that is called video filtering. This filter also affects the noise on the display, but in a different manner than the resolution bandwidth. In video filtering, the average level of the noise remains the same, but the variation in the noise is reduced. Therefore, the effect of video filtering is a "smoothing" of the signal noise. The resultant effect on the analyzer's display is that the noise floor compresses into a thinner trace, while the average position of the trace remains the same.

Changing the video bandwidth (VBW) does not improve sensitivity, but it does improve discernibility and repeatability when making low-level measurements. To avoid any smoothing, the video bandwidth must be set equal to or wider than the resolution bandwidth.

## Setting Resolution Bandwidth

1. Press BANDWIDTH on the main menu.
2. Toggle AUTO RBW or AUTO VBW (or both) off to manually change values. If using Auto, refer to the following sections.
3. Set the RBW and VBW to achieve the desired resolution and sweep characteristics. Lower values increase resolution and reduce noise, but at the expense of measurement (sweep) speed.
4. Set the VBW TYPE to Logarithmic (geometric mean) or Linear (arithmetic mean).

## Setting Bandwidth Auto Coupling

Both resolution bandwidth and video bandwidth can be coupled to the frequency span automatically, or set manually. When set to Auto RBW, the instrument automatically adjusts the RBW in proportion to the frequency span. The default ratio of the span width to the resolution bandwidth is 100:1 and can be changed as follows:

1. Press BANDWIDTH on the main menu.
2. Press SPAN:RBW and change the coupling value, and then press ACCEPT to enter the value.

When auto-coupling between the span and RBW is selected (AUTO RBW is toggled on), the bandwidth parameter is displayed normally at the bottom of the graph. If manual RBW is selected (AUTO RBW is toggled off), the bandwidth label at the bottom of the graph is prefixed with the '#' symbol, and resolution bandwidth is set independently of the span.

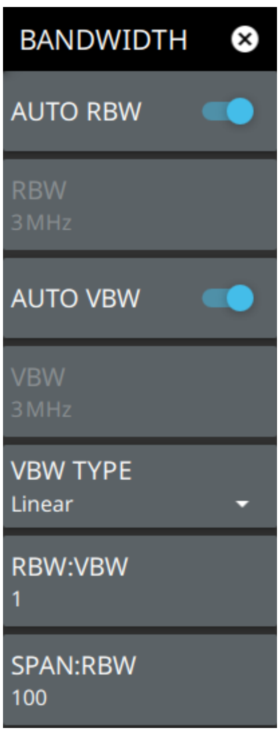
Auto coupling VBW links the video bandwidth to the resolution bandwidth so that VBW varies in proportion to RBW. If manual VBW coupling is selected, the VBW label at the bottom of the graph is prefixed with the "#" symbol and video bandwidth is set independently of resolution bandwidth.

By default, the RBW/VBW ratio is set to 3 and can be changed as follows:

1. Press BANDWIDTH on the main menu.
2. Press RBW/VBW and enter the desired value.

The RBW range varies with instrument features. Refer to "BANDWIDTH Menu" on page 2-21 and check your technical data sheet for the bandwidth range of your instrument.

## BANDWIDTH Menu




**AUTO RBW:** When toggled on, the instrument selects the resolution bandwidth based on the current span width. The ratio of span width to RBW can be specified using the SPAN:RBW button. When toggled off (manual), the RBW label at the left edge of the x-axis will be preceded by the "#" symbol.

**RBW:** The current resolution bandwidth is displayed under the RBW button. Once auto RBW is toggled off, the RBW can be changed using the keypad or the slider controls. Bandwidth values increment in a 1:3:10 sequence, from 1 Hz to 3 Hz to 10 Hz or from 10 Hz to 30 Hz to 100 Hz, for example. Refer to your instrument technical data sheet for the resolution bandwidth range.

**AUTO VBW:** When toggled on, the instrument selects the video bandwidth based on the resolution bandwidth. The ratio of video bandwidth to resolution bandwidth can be set using the RBW:VBW button. When toggled off (manual), the VBW label at the left edge of the X-axis will be preceded by the "#" symbol.

**VBW:** The current video bandwidth is displayed under the VBW button. Once auto VBW is toggled off, the VBW can be changed using the keypad or slider controls. Bandwidth values increment in a 1:3:10 sequence, from 1 Hz to 3 Hz to 10 Hz or from 10 Hz to 30 Hz to 100 Hz, for example. Refer to your instrument technical data sheet for the video bandwidth range.

**VBW TYPE:** Toggles between linear averaging (arithmetic mean) and logarithmic averaging (geometric mean).

**RBW:VBW:** This parameter displays the ratio between resolution bandwidth and video bandwidth. To change the ratio, press this button and use the keypad or the slider controls.

**SPAN:RBW:** Displays the ratio between the span and the resolution bandwidth. The default value is 100, meaning that the span will be 100 times the resolution bandwidth. To change the ratio, press this button and use the keypad or slider controls.

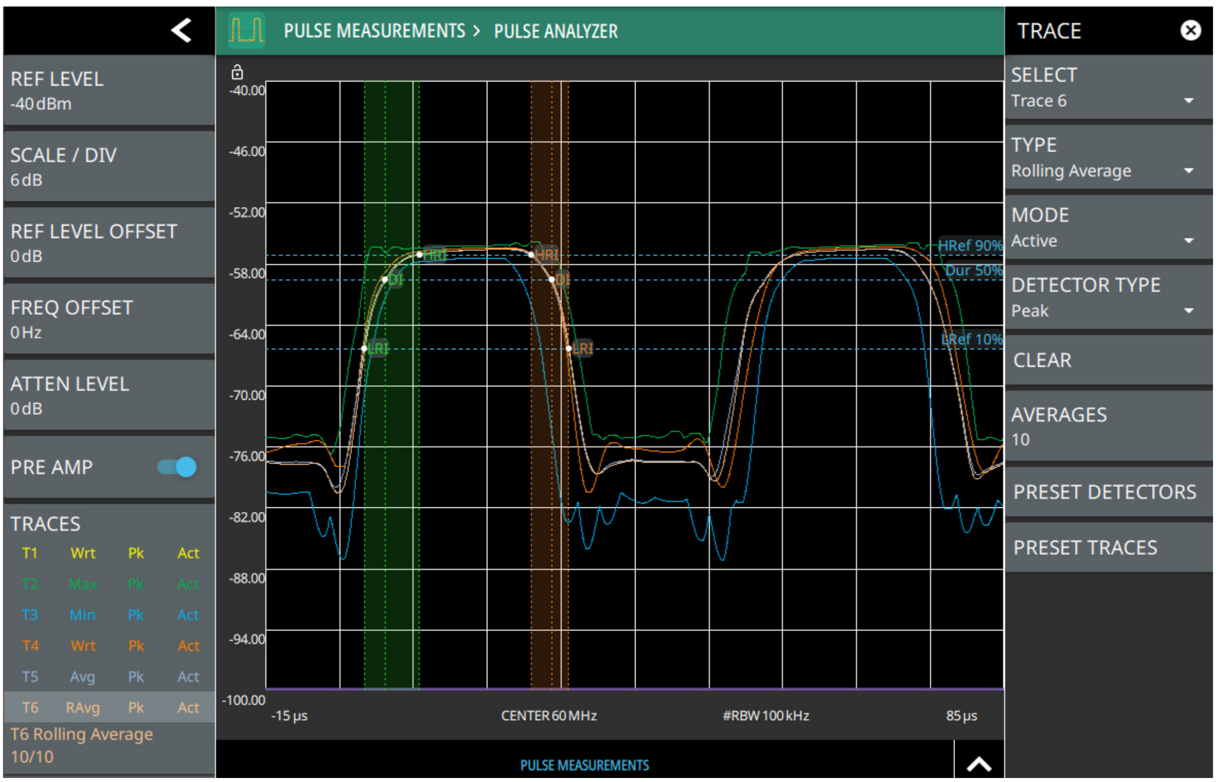
**Figure 2-19.** BANDWIDTH Menu

## 2-11 Setting Trace Parameters

Field Master Series instrument can display up to six traces simultaneously. Traces can be enabled from the TRACE menu by selecting the trace from the available selections, or you can select a trace in the Status panel to make it active. Each trace can have a separate trace type, mode, and detector. When working with traces, refer to "TRACE Menu" on page 2-23.

### Traces in Pulse Mode (Pulse Analyzer View)

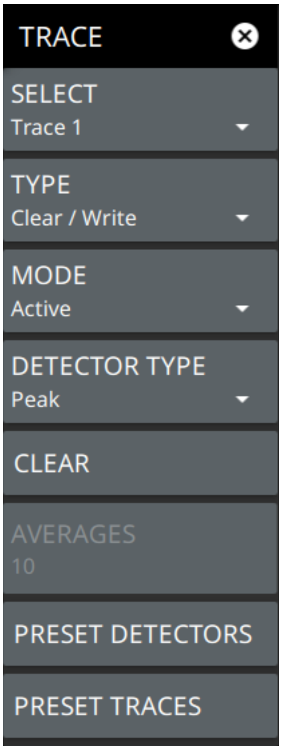
The screenshot below shows the Pulse Analyzer view with all six traces enabled on a signal, each with a different trace or detector type setting. The left side status panel shows a trace setup summary table. Touching one of the trace rows in the table will enable the trace and open the TRACE menu. In Pulse Viewer mode, the pulse instant and transition indicators are not shown.




1. Clear/Write and Peak Detection: This is the default trace setting. The trace is cleared during each sweep and the largest measurement point is used for each display point.
2. Max Hold and Peak Detection: Each trace point retains its maximum value and the largest measurement point is used for each display point.
3. Min Hold and Negative Detection: Each trace point retains its minimum value and the smallest measurement point is used for each display point.
4. Clear/Write and Negative Detection: Trace points are cleared during each sweep and the smallest measurement point is used for each display point.
5. Average and Sample Detection: The trace points are an average of the previous N sweeps, where N is the AVERAGES setting. RMS/Average detection depends on the video bandwidth type setting (BANDWIDTH > VBW TYPE): When VBW/AVERAGE type is set to Linear, this method detects the average power of measurement points that go into the display point. When VBW/AVERAGE type is set to Logarithmic, the traditional average of log (power) is displayed.
6. Rolling Average: The rolling average of the last N traces, where N is the AVERAGES setting.

**Figure 2-20.** Traces in Pulse View (Pulse Analyzer View)

## TRACE Menu




**SELECT:** Selects traces 1 through 6. Selecting a trace that is off turns the trace on. The trace type will be Clear/Write, the trace mode will be Active, and the detector type will be Peak. Selecting a trace will draw the trace on top of all other traces. This feature is not available in the spectrogram measurement view because all spectrogram data is created from a single trace.

**TYPE:** Selects one of the following types of traces:

- **Clear/Write:** Clears the trace after each sweep is complete and writes a new trace.
- **Average:** The exponential average of all N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- **Max Hold:** Represents the maximum value since sweeping began. The number of sweeps is displayed in the status panel TRACES table.
- **Min Hold:** Represents the minimum value since sweeping began. The number of sweeps is displayed in the status panel TRACES table.
- **Rolling Average:** Is the rolling average of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- **Rolling Max Hold:** Is the maximum rolling average value of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- **Rolling Min Hold:** Is the minimum value of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.

**TRACE MODE:** Selects one of the following trace modes:

- **Active:** Displays the selected trace as it is updating.
- **Hold/View:** Displays the trace and it is not updating. It displays the last sweep from when the trace mode was set to hold/view. If the frequency or bandwidth settings are changed while a trace is in hold/view mode, the data will be blanked from the screen. In order to see data again, set the trace mode to active.

**Blank**: Does not display the trace and is not updating. It is the same as if the trace was off.**DETECTOR TYPE:** Selects one of the available detector types. Several detection methods tailor the function of the instrument to meet specific measurement requirements. There are often more measurement points across the screen than display points. The various detection methods are different ways of showing each display point (see “Trace Detector Types” on page 2-24).

- **Peak:** Shows the maximum amplitude of sampled data for each display point, assuring that a narrow peak is not missed.
- **Sample:** Shows the transient amplitude of the center of sampled data for each display point. This method is useful when measuring low-level signals and noise measurements.
- **Negative:** Shows the minimum amplitude of sampled data for each display point. This method is also useful when measuring modulated signals to see if some frequencies are not being used.

**CLEAR:** Clears the currently active trace data.

**AVERAGES:** Sets the number of trace sweeps (N) to average. Available when the trace type is set to one of the averaging modes.

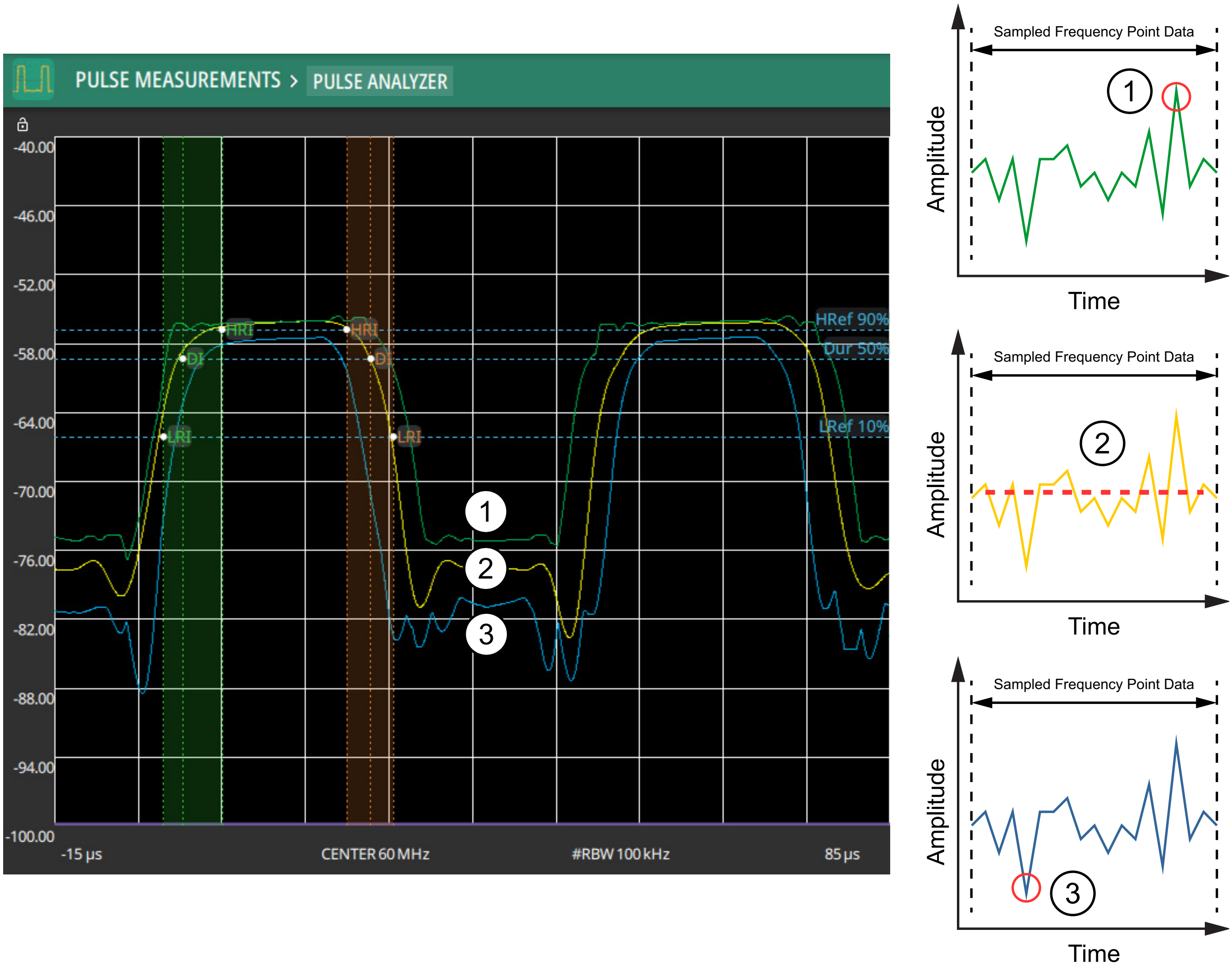
**PRESET DETECTORS:** Sets all trace detectors to Peak.

**PRESET TRACES:** Presets cursor and trace setup to Clear/Write, Active, with Peak Detector.

**Figure 2-21.** TRACE Menu

## Trace Detector Types

The figure below shows the available detector types:




1. Green trace set to Peak detection.
2. Yellow trace set to Sample detection.
3. Blue trace set to Negative detection.

**Figure 2-22.** Trace Detector Types (Pulse Analyzer View)

## 2-12 Setting Sweep Parameters

Sweep parameters are set using the “SWEEP Menu” on page 2-25.

### Single/Continuous

When the Continuous toggle is pressed, the instrument toggles between single sweep and continuous sweep. In single sweep setting, the instrument waits until SWEEP ONCE is pressed or another setting is selected.

### Trace Points

The number of points sets the number of display points in the trace that are generated from the measurement data.

### SWEEP Menu


**CONTINUOUS:** Toggles between continuous sweep and single sweep. When the toggle is off, the instrument is in single sweep. In single sweep, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep. The current state of the instrument is displayed in the status panel. With average/hold number (in TRACE menu) set to 1, or averaging is off, or no trace in trace average or hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met and the analyzer stops sweeping once that sweep has completed. To take one more sweep without resetting the average count, press the SWEEP ONCE button. This sweep control is also available in the status panel.

**RESTART:** The restart function restarts the current sweep or measurement from the start frequency.

**SWEEP ONCE:** When sweep is set to single sweep, SWEEP ONCE triggers a single measurement sweep.

**SWEEP TO N:** When sweep is set to single sweep and trace type is set to average, rolling average, rolling max hold, or rolling min hold, SWEEP TO N triggers N consecutive measurement sweeps, where N is the number of averages set in the TRACE menu. Each time the button is pressed, it will restart the average count, then sweep N times. This button has no function when the instrument is in continuous sweep.

**SWEEP TIME:** Sets the sweep time.

**Figure 2-23.** SWEEP Menu

## 2-13 Setting Up Markers (Pulse Viewer Mode)

The MARKER menu is only available when the view mode is set to Pulse Viewer (refer to Section 2-15 "Measurement Setup" on page 2-33). Marker parameters are set using the "MARKER Menu" on page 2-28. Refer to the figure below when working with this section.


In Pulse Viewer, markers can be placed on the time domain pulse trace similarly as in a normal spectrum frequency domain trace and all of the typical marker functions are available. The active marker is indicated with a solid green fill, other markers will show with a hollow fill, fixed markers show as a green X. A dashed vertical line is attached to the active marker and facilitates touch operations. Either the marker or the line can be dragged into position, and either can be double tapped to open a number of peak search options.

1. Marker 1 is a normal marker with a hollow fill (not active) and is placed on the trace at the peak of the pulse.
2. Marker 2 is a delta marker relative to Marker 2 and will indicate the difference in time and amplitude from Marker 1. It has a solid fill (active marker) and a dashed blue line that aids in touch drag operation to move it to the desired location.
3. The MARKER menu provides marker controls such as selecting the active marker and on which trace it should be place, their mode (normal, delta, or fixed), selecting marker functions, and accessing marker peak search operations. You can also enable the MARKER table described below.
4. The marker table shows all of the marker parameters and measurement values. You can edit marker parameters from the marker table as well as from the MARKER menu. In this example, the active marker is highlighted and the relative X and Y position values are shown (these values are also shown in the MARKER menu for the currently selected (active) marker.

**Figure 2-24.** Marker Table and Marker Settings Panels (Pulse Viewer Mode)

## Placing a Normal Marker

1. Press MARKER to display markers. If markers were off, Marker 1 will automatically be made active at the center of the time display.
2. Select another marker using MARKER > SELECT, then select one of 12 available markers. If the marker was off, the marker will be made active and be placed at the center of the time display. If the marker was on, it will be made the active marker. You can enable all 12 markers and place them separately on traces, cursors, or set them as a fixed marker at a static time and amplitude.
3. Place a marker by first selecting it as the active marker, then do one of the following:
   a. Enter a new TIME value from the MARKER menu. The time can be entered manually or adjusted by using the slider or the + and – buttons to move the marker to the left and right.
   b. Drag the marker on the trace (note that anywhere on the vertical dashed blue line can be touched to drag a marker's position).
   c. Use the PEAK SEARCH menu and the desired peak search function to automatically find signal peaks (refer to "MARKER PEAK SEARCH Menu" on page 2-29). Some peak search functions can be accessed by double tapping the marker or the blue marker line.

## Placing a Fixed Marker

Fixed markers are set up the same as normal markers above, but are set to Fixed using the MODE button. In addition to setting a fixed time value, you can set a fixed amplitude. Fixed markers are typically used as a reference marker when measuring time and amplitude differences relative to an absolute value.

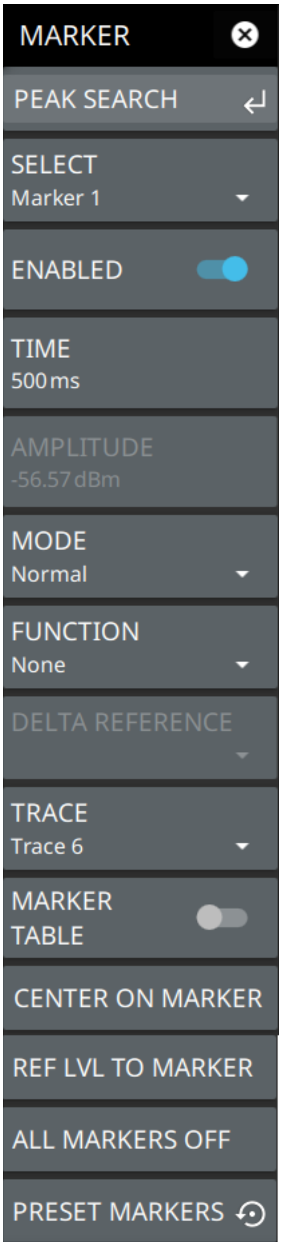
## Placing a Delta Marker

When a delta marker is on, its position data is relative to its reference marker. For example, if Marker 2 is set as a delta marker, the delta reference is set to Marker 1. To set a delta marker and its reference:

1. Activate either a normal or fixed marker and place it in a reference location as described previously.
2. Activate a delta marker using MARKER > SELECT > Marker #, then select MODE > Delta.
3. Place the active delta marker by doing one of the following:
   a. Enter a new TIME value.
   b. Drag the marker on the trace (note that anywhere on the vertical dashed blue line can be touched to drag a marker's position.
   c. Use the PEAK SEARCH menu and the desired peak search function to automatically find signal peaks (refer to "MARKER PEAK SEARCH Menu" on page 2-29).

A delta marker is labeled with a green delta symbol between each marker number. For example, delta Marker 2 relative to Marker 1 is displayed as "2Δ1". If another marker is desired to be the reference marker, select the delta marker as the active marker and then use DELTA REFERENCE > Marker # to select the desired reference marker number.

## MARKER Menu




**PEAK SEARCH:** Opens the "MARKER PEAK SEARCH Menu" on page 2-29.

**SELECT:** Turns on the selected marker if it is off or makes it the active marker if it is already turned on. Pressing the MARKER menu button for the first time will turn on Marker 1 as a normal marker at the center of the time display, and open the MARKER menu. Pressing the MARKER menu button thereafter opens the MARKER menu to the current active marker. When a marker is turned on, it is a normal marker positioned at the center of the time display on the active trace.

**ENABLED:** Enables the selected marker. When the toggle is off, the marker is disabled and not shown on the screen.

**TIME:** Displays the marker time value. For delta markers, the time value is relative to the reference marker. Change the marker time position by dragging it to the desired location. You can also change the marker time value by pressing the TIME button and changing it manually using the keypad controls.

**AMPLITUDE:** Displays the current marker amplitude. When the marker mode is set to Normal or Delta, the amplitude is set by the trace. In that case, the amplitude is not settable by the user. The button is grayed out, but the value is still updating with every sweep. If the marker is a Fixed marker, the amplitude value can be changed by dragging the marker to the desired location or by directly entering the amplitude using the keypad control.

**MODE:** Select marker preference:

- **Normal:** A Normal marker is also known as a tracking marker. The time value is fixed but the amplitude value varies from sweep to sweep.
- **Delta (Δ):** A Delta (Δ) marker displays the delta time value and amplitude between itself and a reference marker. If Marker 1 is selected to be a Delta marker, then Marker 2 is turned on as a reference marker for Marker 1 and it becomes a Normal marker at the same location. The reference marker can then be switched to a Fixed marker if desired.
- **Fixed:** A Fixed marker has a fixed amplitude and fixed time, which are defined by the user and not related to the trace or sweep data.

**FUNCTION:** Sets the function of the currently selected marker to None or Noise. For more information about using marker functions, refer to "Marker Functions" on page 2-30.

**DELTA REFERENCE:** Selects the Reference marker for a Delta marker. A Delta marker cannot be its own reference. Only Fixed and Normal markers may be used as a reference for Delta markers.

**TRACE:** Selects the trace number to which the marker is currently attached.

**MARKER TABLE:** Toggle on or off the marker table displayed below the screen.

**CENTER ON MARKER:** Sets the center frequency to the currently active marker's frequency value.

**REF LVL TO MARKER:** Sets the reference level to the currently active marker's amplitude value.

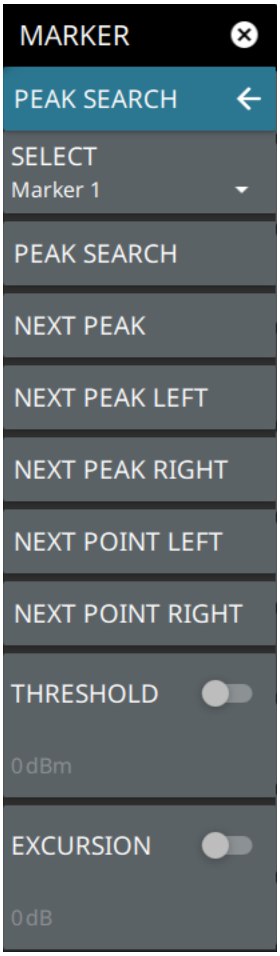
**ALL MARKERS OFF:** Turns all markers off, but markers will retain their last time position once re-enabled.

**PRESET MARKERS:** Presets marker selections to default values.

**Figure 2-25.** MARKER Menu

## MARKER PEAK SEARCH Menu

| Note | Double tapping a marker opens a quick peak search menu with some of the below features. |
|---|---|




**PEAK SEARCH:** Returns to the main MARKER menu.

**SELECT:** If the selected marker is off, it will be turned on and the selected marker positioned at the peak of Trace 1. If the selected marker is on, then it will become the active marker and any subsequent actions in the PEAK SEARCH menu will apply to the selected marker. If no markers are on, pressing the PEAK SEARCH button on the control panel will turn on Marker 1 at the peak of Trace 1.

**PEAK SEARCH:** Moves the selected marker to the highest peak.

**NEXT PEAK:** Moves the selected marker to the next highest peak regardless of location.

**NEXT PEAK LEFT:** Moves the selected marker to the next peak left of its current position.

**NEXT PEAK RIGHT:** Moves the selected marker to the next peak right of its current position.

**NEXT POINT LEFT:** Moves the selected marker one display point to the left of its current position. Useful for fine tuning the position of a marker.

**NEXT POINT RIGHT:** Moves the selected marker one display point to the right of its current position. Useful for fine tuning the position of a marker.

**THRESHOLD:** If turned on, sets the threshold that a peak has to achieve to be considered a peak.

**EXCURSION:** If turned on, sets the excursion value that a peak amplitude must rise and fall over the peak threshold to qualify as peak.

**Figure 2-26.** PEAK SEARCH Menu

## Marker Functions

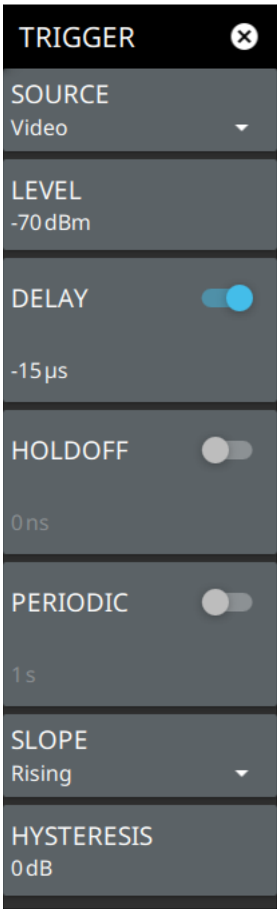
### Noise Markers

Noise Markers use an averaging routine applied to multiple data-point groups to calculate the readout, which is typically comparable to using 1 Hz bandwidth filtering. Because the noise marker routine uses groups of data points for the calculation, the noise marker should not be placed in close proximity to measurable signals. You can observe this effect by moving the marker further away from a signal until the marker readout stabilizes to a more consistent value. Noise markers should be used with an RMS/Avg detector type for proper measurement. When a noise marker function is selected, the marker amplitude value is displayed in dBm/Hz, which is the noise level within the resolution bandwidth filter. Delta markers can also be put into a noise function, but the reference marker must also be a noise marker. If they are different functions, one will be updated to match the other. Fixed markers are not allowed to be set to a noise function, so if a noise marker is changed to fixed mode, the function will automatically be set to off.

## 2-14 Setting Up Triggering

Trigger parameters are set using the "TRIGGER Menu" on page 2-31.

### TRIGGER Menu




**SOURCE:** The SOURCE button offers several triggering options depending on which view mode the instrument is set:

- **Free Run:** A new sweep is started immediately upon completion of the current sweep. No trigger event is required to initiate a sweep.
- **Video:** When enabled, the trigger level will be indicated graphically on the display with a horizontal VIDEO line. A new sweep is started when the input video level meets the value set via the LEVEL button. The level can also be adjusted by dragging the VIDEO line up or down. Video triggering is useful for monitoring a known time position and its transients, such as pulsed signal rise or fall times.
- **External 1 or 2:** A TTL signal applied to the selected External Trigger MCX input connector causes a single sweep. After the sweep is complete, the resultant trace is continuously displayed until the next trigger signal is received.

**LEVEL:** Used when the trigger source is set to Video. Sets the video trigger level threshold that initiates a sweep. The level crossing applies to rising or falling edges. Use the hysteresis setting below to adjust the sensitivity of the trigger level.

**HOLDOFF:** Available only when the trigger source is set to External or Video. When toggled on, the analyzer waits the user defined amount of time to re-arm the trigger between trigger events. If a trigger event is received after the previous trigger, but before the holdoff time has elapsed, that trigger event will be ignored.

**PERIODIC:** Used to set a periodic sweep trigger. When toggled on, the instrument waits the set time to start a sweep.

**SLOPE:** Used when the trigger source is set to External or Video. Sets the trigger slope to rising or falling edge.

**HYSTERESIS:** Hysteresis is used to address noisy trigger signals. The hysteresis setting adjusts the sensitivity of the trigger system (the difference between the firing level and the arming level as shown in Figure 2-28). A low hysteresis value sets the arming and firing levels close to each other, meaning a small signal change will cause a trigger. A large hysteresis value sets the arming and firing levels far apart, meaning a large signal change will be required to cause a trigger.

**Figure 2-27.** TRIGGER Menu in Pulse Analyzer mode

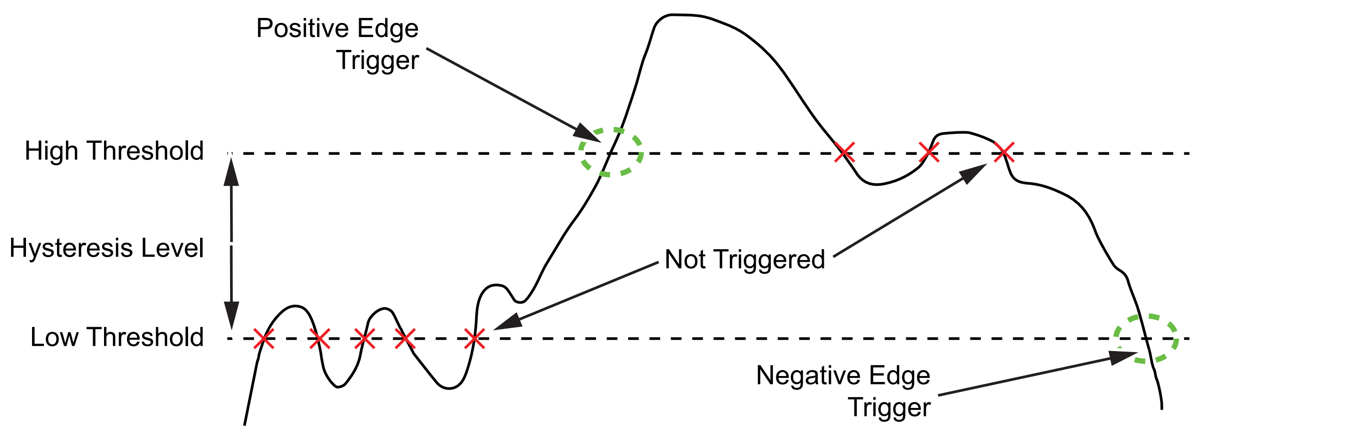
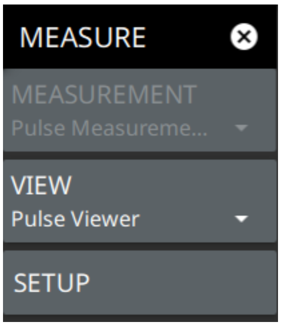



**Figure 2-28.** Trigger Levels and Hysteresis

## 2-15 Measurement Setup

Refer to Spectrum Analyzer measurement guide (10580-00447) for basic information on setting up a spectrum measurement. This section provides setup information for the Pulse measurement.

### MEASURE Menu




**VIEW:** Selects Pulse Analyzer or Pulse Viewer.

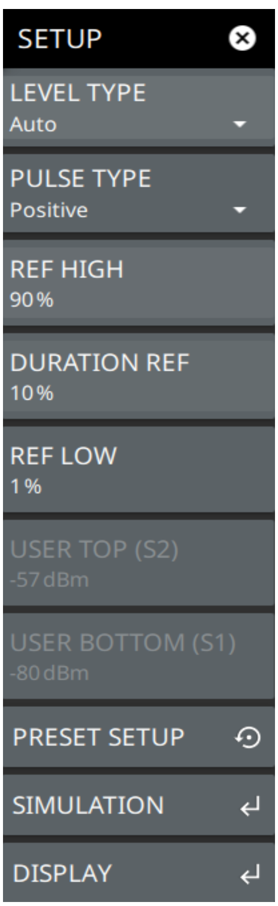
Pulse Analyzer view provides the signal trace with pulse instant and transition indicators on the trace along with pulse analytics below the trace display. Refer to Section 2-3 “Pulse Analyzer GUI Overview” on page 2-2 and Section 2-4 “Pulse Measurements” on page 2-7.

Pulse Viewer displays the signal trace without the pulse instant and transition indicators nor the pulse analytics, and it enables the MARKER menu and faster sweep updates. Refer to Section 2-13 “Setting Up Markers (Pulse Viewer Mode)” on page 2-26.

**SETUP:** Opens the SETUP menu. The SETUP menu can also be accessed directly from the main menu.

**Figure 2-29.** MEASURE Menu

### SETUP Menu




**LEVEL TYPE:** Selects the desired measurement type from the following list:

- **Auto:** Automatically sets the top and bottom reference levels based on the received signal. See Section 2-4 “Pulse Measurements”.
- **User:** Provides manual setting of the top and bottom reference levels. When se to User, use the USER TOP (S2) and USER BOTTOM (S1) buttons below.

**PULSE TYPE:** Selects Pulse Type as either positive or negative.

**REF HIGH:** Sets the high reference level.

**DURATION REF:** Sets the duration reference level.

**REF LOW:** Sets the low reference level.

**USER TOP (S2):** Used to set the top reference level when LEVEL TYPE is set to User.

**USER BOTTOM (S1):** Used to set the bottom reference level when LEVEL TYPE is set to User.

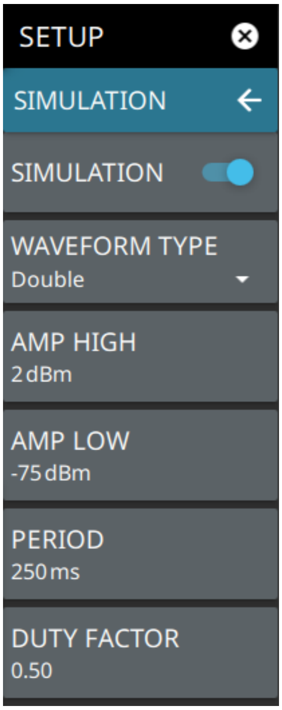
**PRESET SETUP:** Presets all values on the SETUP menu to default values.

**SIMULATION:** Opens the PULSE SIMULATION menu. Refer to “PULSE SIMULATION Menu” on page 2-34.

**DISPLAY:** Opens the DISPLAY menu. Refer to “DISPLAY Menu” on page 2-36.

**Figure 2-30.** Pulse SETUP Menu

## PULSE SIMULATION Menu




**SIMULATION:** Toggles pulse simulation on or off. When simulation mode is on, the analyzer stops sweeping and displays an example trace to show the Pulse Analyzer measurement capabilities.

**WAVEFORM TYPE:** Selects the desired waveform type. You can select a single positive, or a single negative pulse, pulse train, or double pulse. See Figure 2-32 for a double pulse simulation.

**AMP HIGH:** sets the upper amplitude of the simulated pulse.

**AMP LOW:** sets the lower amplitude of the simulated pulse.

**PERIOD:** sets the period of the simulated pulse.

**DUTY FACTOR:** sets the duty factor of the simulated pulse.

**Figure 2-31.** PULSE SIMULATION Menu

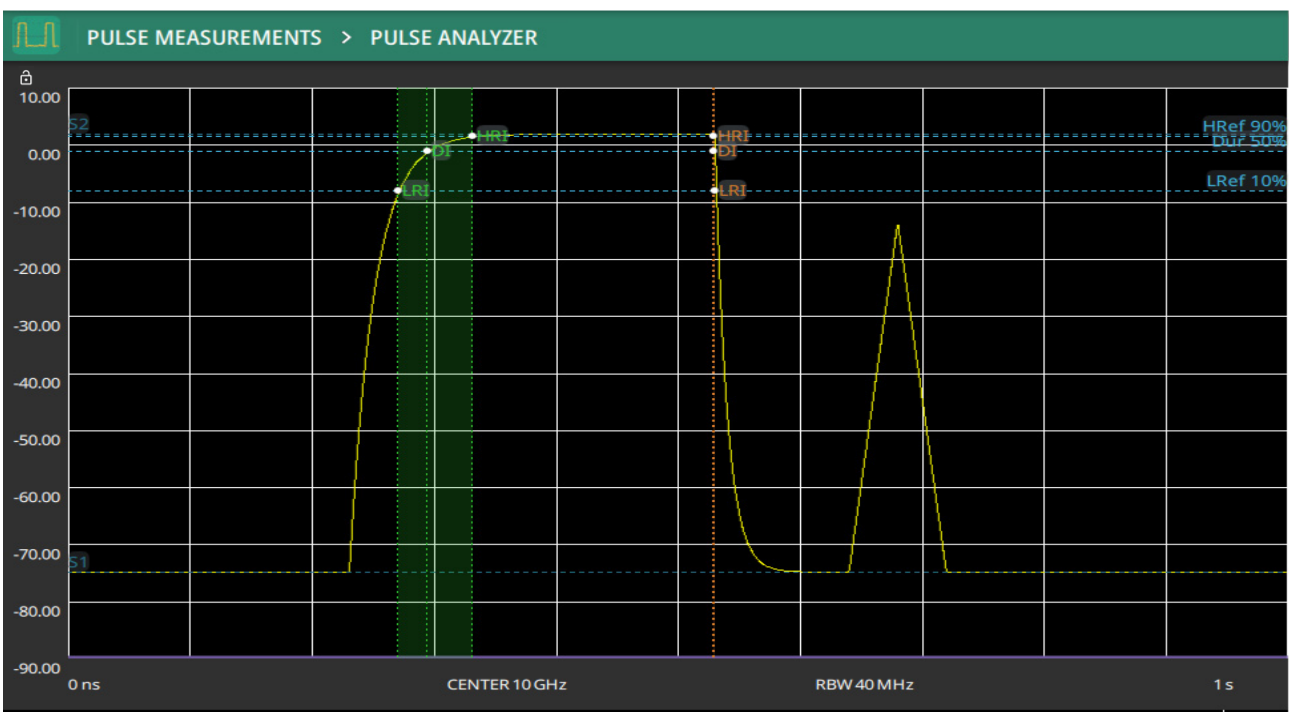



**Figure 2-32.** Double Pulse Waveform Simulation (Pulse Analyzer View)

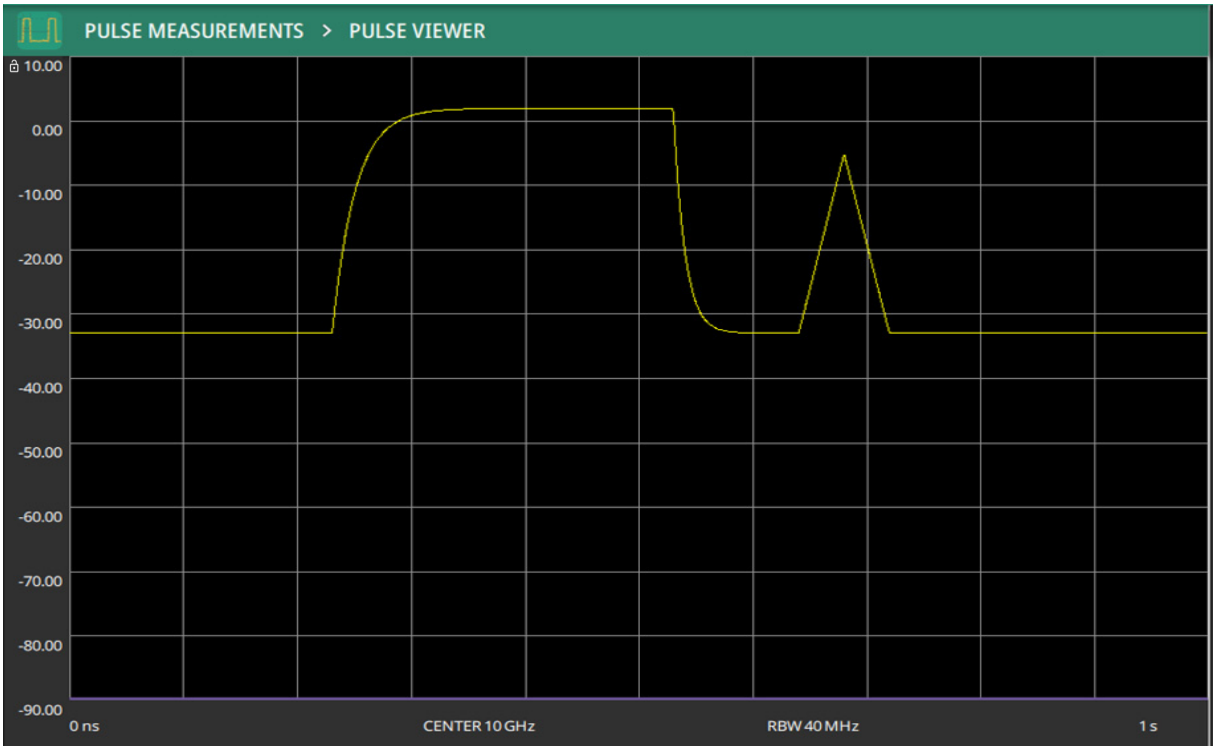
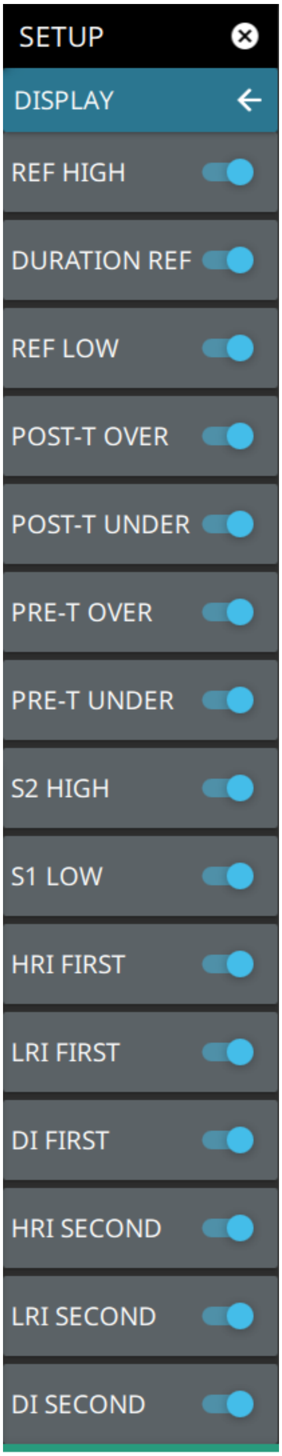



**Figure 2-33.** Double Pulse Waveform Simulation (Pulse Viewer)

## DISPLAY Menu




**REF HIGH:** Toggles the high level reference line on or off.

**DURATION REF:** Toggles the duration reference line on or off.

**REF LOW:** Toggles the low level reference line on or off.

**POST-T OVER:** Toggles the post-transition overshoot marker on or off.

**POST-T UNDER:** Toggles the post-transition undershoot marker on or off.

**PRE-T OVER:** Toggles the pre-transition overshoot marker on or off.

**PRE-T UNDER:** Toggles the pre-transition undershoot marker on or off.

**S2 HIGH:** Toggles the high (S2) reference line on or off.

**S1 LOW:** Toggles the low (S1) reference line on or off.

**HRI FIRST:** Toggles the first-transition high reference instant marker on or off.

**LRI FIRST:** Toggles the first-transition low reference instant marker on or off.

**DI FIRST:** Toggles the first-transition duration instant marker on or off.

**HRI SECOND:** Toggles the second-transition high reference instant marker on or off.

**LRI SECOND:** Toggles the second-transition low reference instant marker on or off.

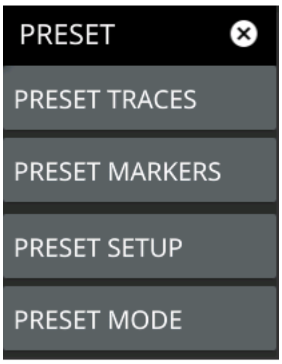
**DI SECOND:** Toggles the second-transition duration instant marker on or off.

**Figure 2-34.** Pulse DISPLAY Menu Markers and Reference Lines Toggles

## 2-16 Presetting the Analyzer

The PRESET menu sets certain settings to the default state. Preset only affects the current analyzer settings, such as those for the spectrum analyzer or for the 5GNR analyzer. Preset does not affect user files or system settings such as networking settings. For other reset options, such as a complete factory reset of the instrument, refer to “Reset Settings” section in Instrument Overview chapter of the user guide. To recover from system software faults, refer to Appendix A, “Instrument Messages and Troubleshooting” chapter of the user guide.

### PRESET Menu




**PRESET TRACES:** Presets all trace settings to default values.

**PRESET MARKERS:** Presets all marker settings to default values. Turns off all markers.

**PRESET SETUP:** Presets all values on the SETUP menu to default values.

**PRESET MODE:** Presets all of the current analyzer settings to default values.

**Figure 2-35.** PRESET Menu

# 2-17 Saving and Recalling Measurements

The instrument can save measurement setups, native trace and CSV trace data, and screenshots. You can recall setup and native trace files. For other file operations such as copy, move, and directory management, refer to “File Management” section in Instrument Overview chapter of the user guide.

## Saving a Measurement

To save a measurement or setup, refer to Figure 2-36.

1. Press FILE > SAVE AS...
2. If desired, press the save location to change the destination.
3. Enter the desired file name using the touchscreen keyboard.
4. Select the type of file to save from the selection list.
5. Press SAVE to save the file.

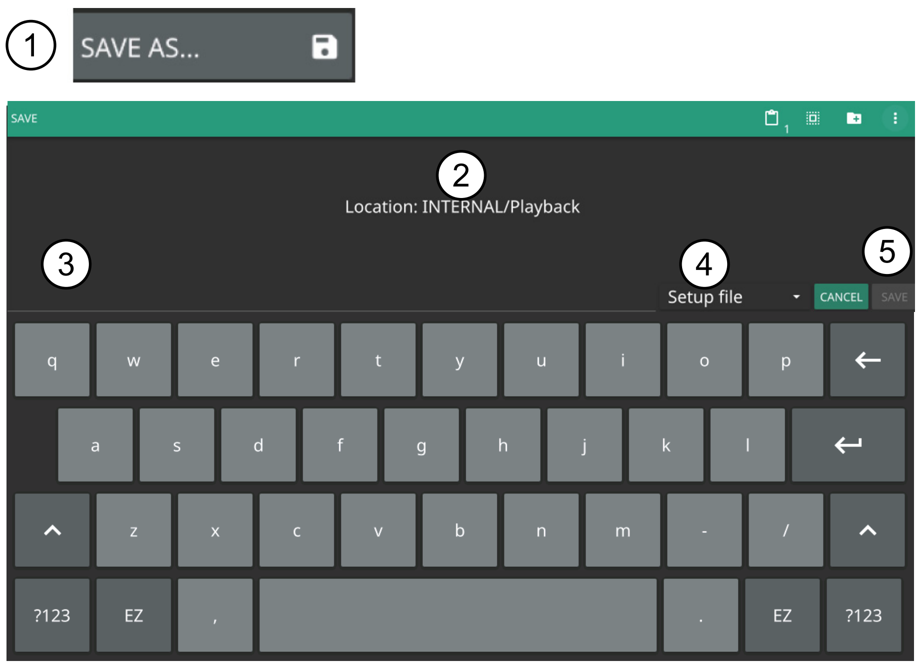



**Figure 2-36.** File Save Dialog

Once a file has been saved, the QUICK SAVE feature can be used to quickly save the same type of file with an incrementing number appended to the end of the original file name.

## Recalling a Measurement

You can recall a saved setup and native trace measurement. When recalling a setup, the instrument setup and operating state will be restored as it was when the setup was saved. When recalling a trace measurement, the instrument setup and on-screen measurement data will be restored as it was when the trace data was saved.

To recall a measurement or setup, refer to Figure 2-37:

1. Press FILE > RECALL...
2. Select the file location.
3. Use the file type filter to shorten the list if needed.
4. Select the desired file from the displayed list.
5. Press OPEN to recall the file.

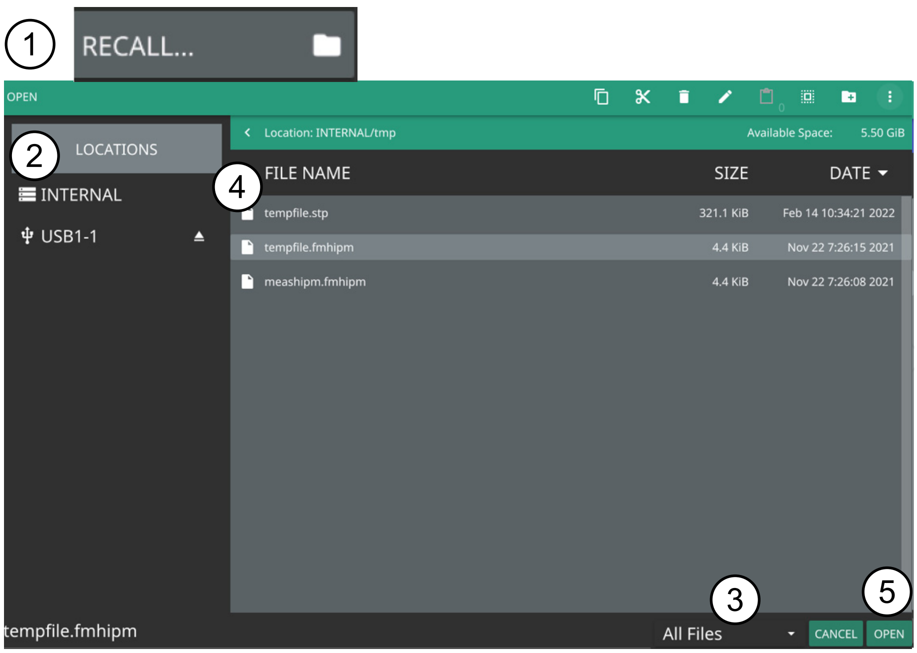



**Figure 2-37.** File Open Dialog

When a trace measurement is recalled, the trace or sweep state will be set to hold. To restore active measurements, set TRACE > MODE > Active.

## FILE Menu


**QUICK SAVE:** saves a setup file immediately with the name shown in the button. The number in the name is incremented automatically so that the new name is ready for the next setup file to be saved.

**SAVE AS:** Opens the Save dialog to manually enter a file location, enter a file name, and to set the file type to be saved. Depending on the selected measurement, you can save the following:

- Setup: Saves the current instrument setup (stp file type).
- Trace: Saves the measurement point (trace) data and the current instrument setup (fmpa file type).
- Trace CSV: Saves the visible trace point data in comma separated value format (csv file type). This format is useful for further analysis using other software tools.
- Screenshot: Saves a screenshot of the current measurement (png file type).
- Trace + Screenshot: Saves both the current measurement and screenshot files (both fmpa and png file types).

**RECALL:** Opens the Recall File dialog to retrieve a file from a desired location. Only supported files will be displayed depending on the currently set measurement. When trace data is recalled, the instrument will change the settings to match the settings of the saved trace. The data will be recalled to the appropriate trace. That trace will be in a Hold mode. To exit the recalled data, simply change the trace mode back to Active.

**BROWSE FILES:** Refer to “File Management” section in Instrument Overview chapter of the user guide.

**Figure 2-38.** FILE Menu

10580-00451 C



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