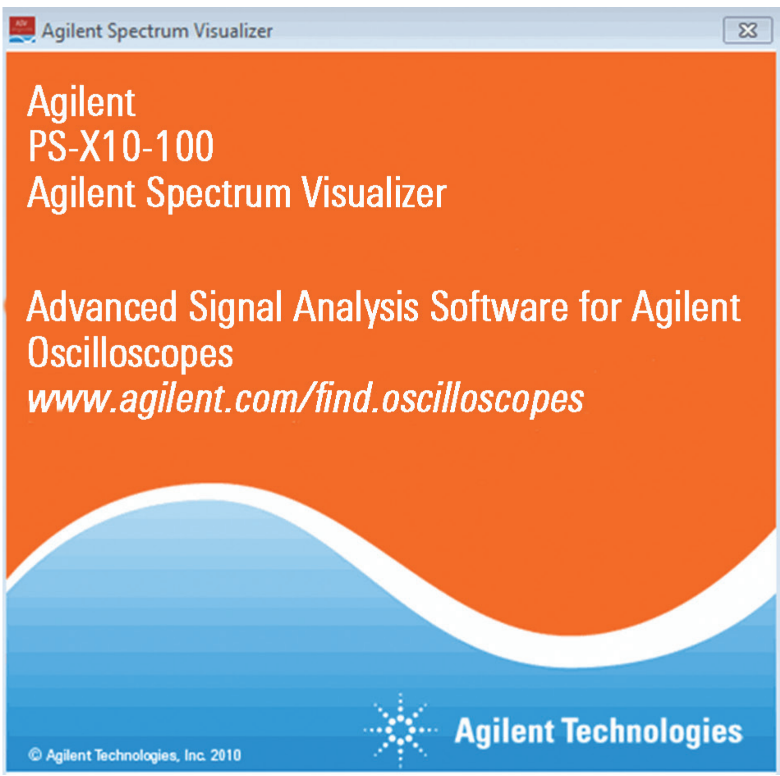
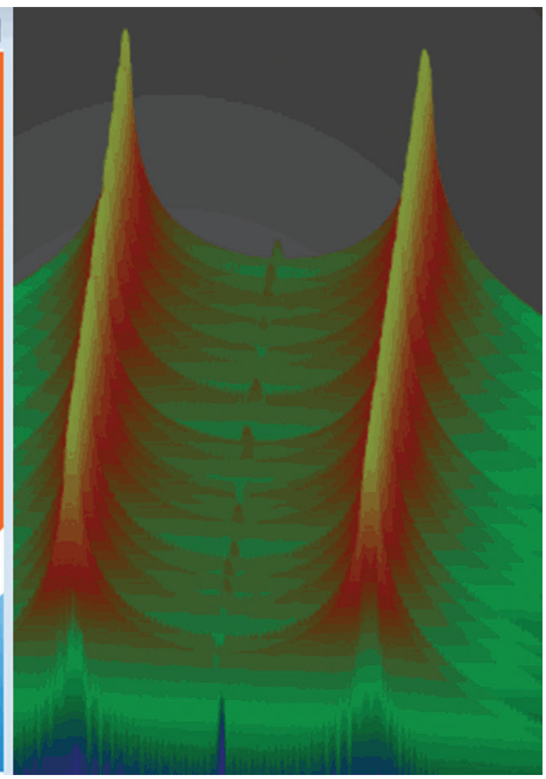
Agilent Spectrum Visualizer (ASV) Software

Data Sheet





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Technical Overview

The Agilent spectrum visualizer (ASV) software provides advanced FFT frequency domain analysis for the InfiniiVision and Infiniium Series high performance oscilloscopes at a cost-effective price. The ASV software extends the InfiniiVision and Infiniium Series oscilloscopes to perform frequency-domain FFT analysis. It provides spectrum and spectrogram analysis with an intuitive user interface, parameter and control settings, and marker functionality that RF engineers are familiar with, offering advantages over traditional oscilloscope FFT solutions. This new capability helps engineers gain greater insight into their design performance and helps engineers debug issues faster when they occur.

Features and Benefits:

- ASV 64997A supports the InfiniiVision 2000, 3000, 4000 and 6000 X-Series oscilloscopes
- ASV 64996A supports the high-performance Infiniium 9000, 90000, S-Series and 90000 X-Series oscilloscopes
- Spectrum analysis with bandwidths ranging from 100 MHz to 33 GHz, depending on the InfiniiVision or Infiniium oscilloscope selection, Maximum FFT sample rates range from 2 GSa/s on the 3000 X-Series scilloscope , and up to 80 GSa/s on the 90000 X-Series oscilloscope.
- ASV software can reside on the oscilloscope (applies to Infiniium Series oscilloscopes only, ASV 64996A) or on an external PC
- Single or dual channel measurements and displays (channels 1 and 3)
- Free run or triggered measurements, Single or continuous sweep modes
- Spectrogram measurements (spectrum vs. frequency vs. time) to analyze time-varying signals with vertical, horizontal, or waterfall display modes
- Multiple oscilloscopes can be configured to allow user to rapidly switch between multiple instruments

Select from a wide range of frequency domain measurement capabilities, utilizing the Frequency, Analog, and Spectrogram views.

Spectrum measurements:

- Power (dBm) vs. frequency
- Horizontal (x-axis): Specify center frequency and frequency span, or start and stop frequencies
- Vertical (y-axis): Specify reference level (dBm) and scale (dB/div)
- Settable resolution bandwidth
- Flat top, Guassian, or Hanning windows applied to the time domain data for the FFT analysis
- Marker to peak amplitude, and marker to center frequency.
- Marker peak search can be enabled for time-varying signals
- Multiple marker, with delta X and delta Y readouts

Select different acquisition and display modes to isolate and diagnose issues quickly and efficiently.

Acquisition and display modes:

- Free Run (continous), Triggered, Stop, Single, Preset
- Triggered mode: specify trigger power level (dBm), single or continous sweep
- Enable/disable y-axis label
- Enable/disable main trace display
- Max hold display mode

Get started easily and quickly with pre-configured waveforms on the InfiniiVision oscilloscopes with the WaveGen function/arbitrary waveform generator option.(DSOX2WAVEGEN or DSOX3WAVEGEN)

Arbitrary waveform generator source control (on InfiniiVision oscilloscopes only, ASV 64997A):

- 20 MHz sine wave
- 10 MHz square wave
- Pulsed waveform
- WaveGen source settings can be altered while ASV is running for interactive signal source and analysis capability

Gain Insight into Performance Issues Quickly Using the ASV Software with InfiniiVision and Infiniium Series Oscilloscopes

Using oscilloscopes for time domain analysis may only provide part of the information needed to understand and debug issues when they occur. Measuring the frequency domain characteristics, in addition to the time domain characteristics, can quickly reveal important information about the hardware performance, functionality, and potential issues that may arise and can accelerate hardware debug by providing greater insight into performance issues.

An example is a phase-locked loop (PLL) circuit, where the output of the PLL is being tuned for a given output frequency or range of frequencies. While it may be fairly straightforward to determine a PLLs static fundamental output frequency by using a time-domain analysis approach on an oscilloscope and measuring the period (ΔT) to calculate the frequency (F=1/(ΔT), it can be relatively difficult to tell what the PLL's output spectral purity is or the PLL's frequency domain response is without measuring the PLLs frequency domain performance.

In addition, given the complexity of testing and debugging today's commercial wireless and military radios, another example might be evaluating the frequency hopping characteristics of a frequency-hopped radio, or the frequency shift keying (FSK) of a GFSK (Gaussian FSK) radio such as Bluetooth. A more advanced example might be measuring the spectral characteristics of an orthogonal frequency division multiplexing (OFDM) radio to determine the occupied frequency bandwidth for a given number of subcarriers allocated.

These types of issues can be very difficult to evaluate without using frequency domain analysis.

An actual example is shown below, with a frequency shift keying (FSK) signal being measured and analyzed with the ASV software on an InfiniiVision 3000 X-Series oscilloscope.

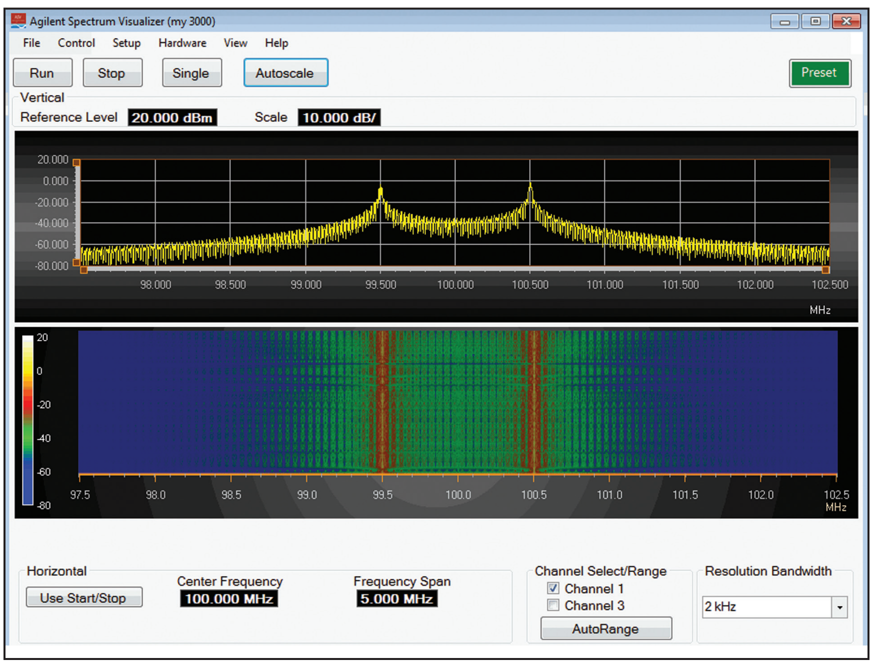

Figure 1: Frequency shift keying (FSK) signal measured with the ASV software and InfiniiVision 3000 X-Series oscilloscope

The top plot in Figure 1 is a frequency spectrum measurement with amplitude (dBm) on the y-axis and frequency (MHz) on the x-axis. We can see that the FSK signal is shifting between the two frequencies, by observing the two peaks on the frequency spectrum. The center frequency, frequency span, and resolution bandwidth have been set to measure the 100 MHz carrier which is being FSK-modulated between two frequencies, 99.5 MHz and 100.5 MHz (Δ F= 1MHz).

Gain Insight into Performance Issues Quickly Using the ASV Software with InfiniiVision and Infiniium Series Oscilloscopes

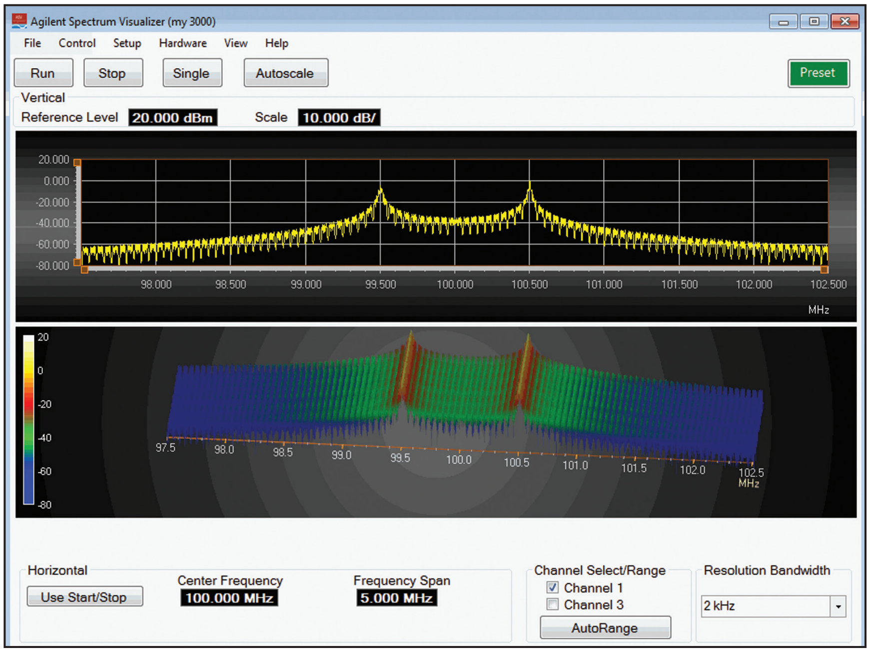

Figure 2: Waterfall view for ASV spectrogram measurement

The bottom plot in Figure 1 is a spectrogram display which enables the signal amplitude/intensity to be viewed as a function of frequency (MHz) and time (y-axis). The amplitude/intensity of the time varying signal is displayed as a function of color, so the two fundamental frequencies, 99.5 MHz and 100.5 MHz, are displayed in red and orange indicating that they have high amplitudes at any given point in time, while other spectral components are displayed in green and blue indicating a lower amplitude at each point in time. Figure 2 shows an alternate waterfall view for the spectrogram measurement.

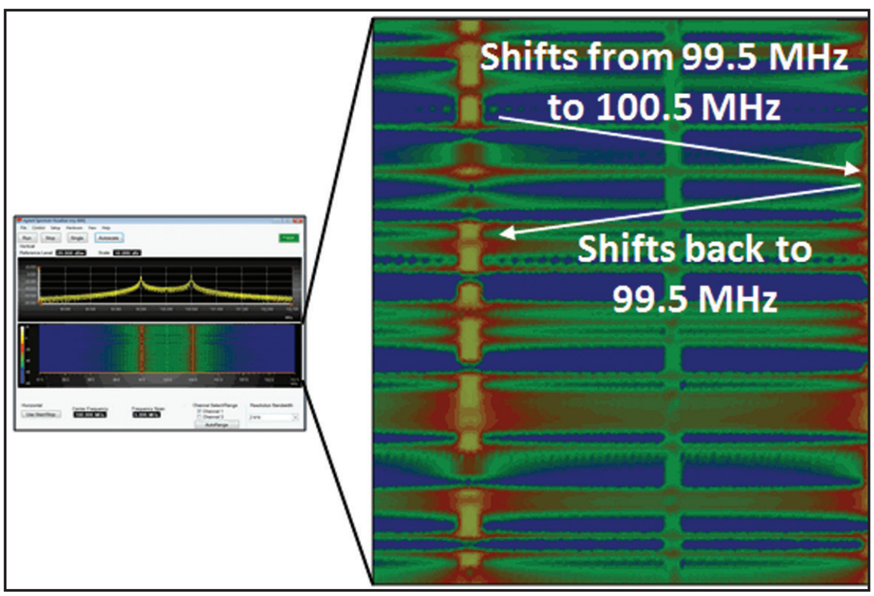

Figure 3: Close-up detail on frequency shift keying (FSK) characteristics with the ASV spectrogram measurement

A closer look at a spectrogram display reveals more detail on the actual frequency shift keying between the two frequencies as a function of the PN data sequence being used to control the frequency shift keying.

The arrows on the spectrogram show one PN data sequence transition where the frequency shifts from 99.5 MHz (yellow spectrogram trace on left) to 100.5 MHz (yellow spectrogram trace on right), then shifts back to 99.5 MHz. Using the spectrogram measurement, we can view the amount of time in which the frequency was set to 99.5 MHz versus the amount of time in which the frequency was set to 100.5 MHz. This would correlate to the +/- 1 NRZ pattern and a series of +1s or -1s on the PN data sequence which is controlling the frequency shift keying.

Note that this measurement was performed using the continuous acquisition mode (**Run** button in Figure 1), but an alternative acquisition mode includes using a single acquisition mode by pressing the **Single** button in Figure 1. Setting up the triggered mode, in conjuction with the single acquisition mode can be useful in capturing and analyzing single isolated events.

ASV Frequency Domain Analysis Up To 33 GHz on Infiniium Series Oscilloscopes

Figure 4: Time-domain waveforms measured with the Infiniium 90000 Series oscilloscope

Another example of using frequency domain analysis to gain more insight is measuring the harmonic frequency content on a high speed data sequence. Figure 4 shows two time-domain traces being measured with an Infiniium 90000 Series oscilloscope.

The top waveform (yellow channel 1 trace) in Figure 4 shows significant waveform distortion, relative to the bottom waveform (blue channel 3 trace), however it's difficult to identify and measure the performance degradation issue which is causing this impairment.

To provide greater insight into this, the ASV software is used on the Infiniium 90000 Series oscilloscope to measure and compare the harmonic content of the two waveforms in the frequency domain using the oscilloscope's channel 1 and channel 3 inputs.

ASV Frequency Domain Analysis Up To 33 GHz on Infiniium Series Oscilloscopes

Figure 5: Harmonic spectrum measurement with the ASV software and Infiniium 90000 Series oscilloscope

Figure 6: Using the marker functionality in the ASV software to determine the harmonic attenuation of the third harmonic relative to the fundamental frequency

By measuring the frequency domain characteristics of the two waveforms with the ASV software, we can clearly see that the odd harmonic spectral content present on the blue channel 1 waveform is rapidly attenuated on the yellow channel 3 waveform. This is particularly true at the higher odd-order harmonics above the 3rd harmonic, indicating that something in the signal path is frequency-limiting the waveform, which correlates to the ringing observed on the yellow channel 1 time-domain waveform measurement in Figure 4. Using the ASV software with the oscilloscope can help this type of issue to be quickly diagnosed, by probing at various stages along the signal path to determine where the performance degradation is occurring.

Here we are performing measurements only up to 10 GHz, but the ASV software can be used with the high-performance Infiniium 90000 X-Series oscilloscopes to enable frequency domain measurements to be performed up to 33 GHz.

Performing two-channel spectrum measurements enables convenient A-B comparison between the two waveforms to help debug issues. In addition, the built-in marker functionality in the ASV software can be used to determine the harmonic attenuation of the third harmonic relative to the fundamental as shown in Figure 6. Comparing channel 1 marker measurements with channel 3 marker measurements provide insight into the frequency response differences between the channel 1 waveform and channel 3 waveform.

Getting Started with Pre-Configured Source Waveforms

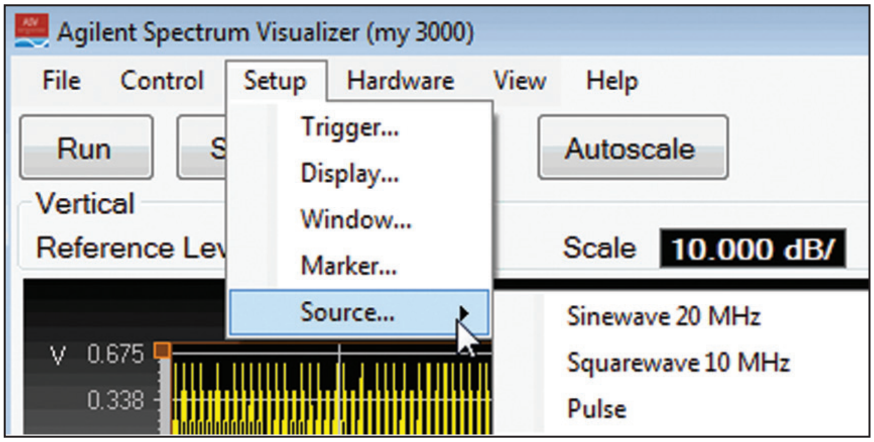

Figure 7: Using built-in source waveforms with the ASV and InfiniiVision X-Series oscilloscopes with WaveGen arbitrary waveform generator (AWG)

Getting started with the ASV software is convenient and easy using the built-in WaveGen feature on the InfiniiVision X-Series oscilloscopes (note that this feature is not available on the Infiniium Series oscilloscopes), The ASV software offers three pre-configured waveforms: 20 MHz sine wave, 10 MHz square wave, and a pulsed waveform.

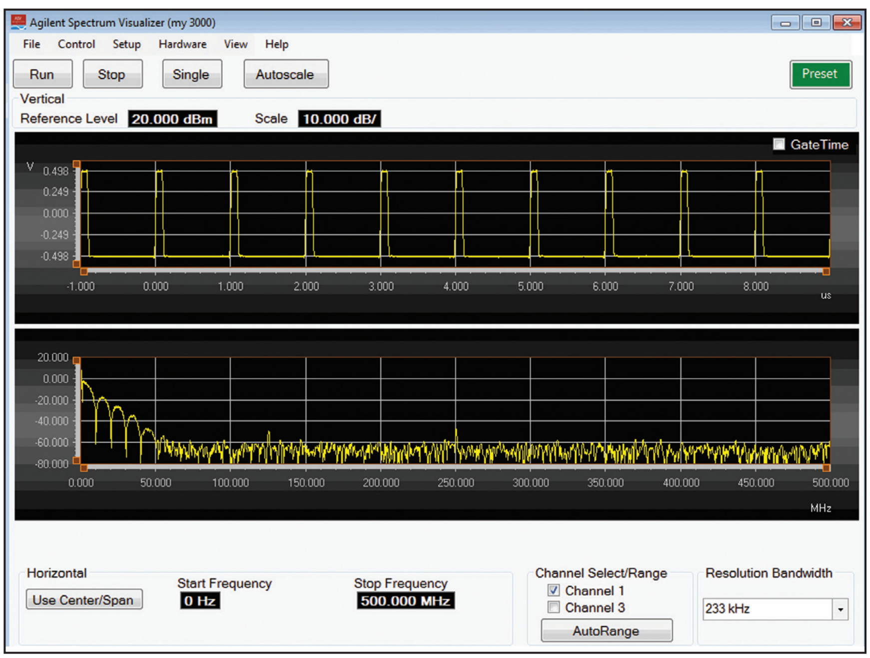

Figure 8: Measurement on pre-configured pulse waveform using the ASV and InfiniiVision X-Series oscilloscopes with WaveGen AWG

After downloading the AWG waveform, connect the source output to the channel 1 or channel 3 inputs on the InfiniiVision to quickly start performing measurements such as the pulsed waveform measurement shown in Figure 8.

Oscilloscope Selection Guide for the ASV Software

In summary, the Agilent Spectrum Visualizer (ASV) software provides advanced FFT frequency domain analysis at a cost-effective price to help engineers accelerate their hardware debugging by providing greater insight into performance issues in the frequency domain. The oscilloscope hardware selection is scalable, from the 2000 and 3000 X-Series InfiniiVision oscilloscopes to the high performance Infiniium 9000, 90000, and 90000X Series oscilloscopes (order 64997A for InfiniiVision oscilloscopes and 64996A for Infiniium oscilloscopes). Contact your local Agilent Technologies representative to get more information on the ASV software.

Instrument model	Bandwidths	Max sample rate	WaveGen source
InfiniiVision 2000 X-Series	70,100, 200 MHz	1 GSa/s	YES
InfiniiVision 3000 X-Series	100, 200, 350, 500 MHz	2 GSa/s	YES
InfiniiVision 4000 X-Series	200, 350, 500 MHz, 1, 1.5 GHz	5 GSa/s	YES
InfiniiVision 6000 X-Series	1, 2.5, 4, 6 GHz	20 GSa/s	YES
Infiniium 9000 Series	600 MHz, 1, 2.5, 4,6 GHz	20 GSa/s	NO
Infiniium 90000 Series	8, 12, 13 GHz	40 GSa/s	NO
Infiniium 90000 X-Series	16, 20, 25, 28, 33 GHz	80 GSa/s	NO
Infiniium S-Series	500 MHz, 1, 2, 2.5, 4, 6, 8 GHz	20 GSa/s	NO

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