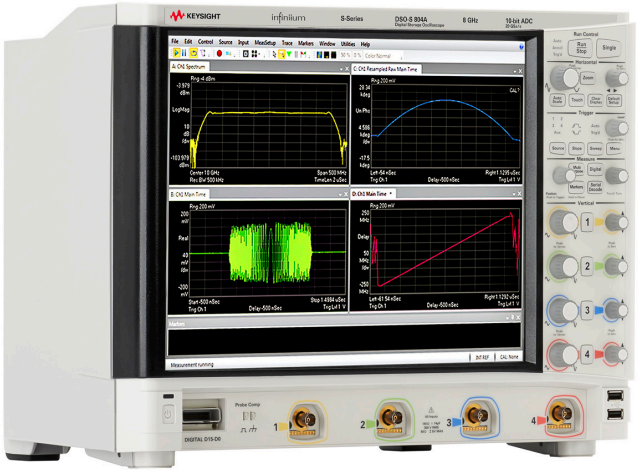
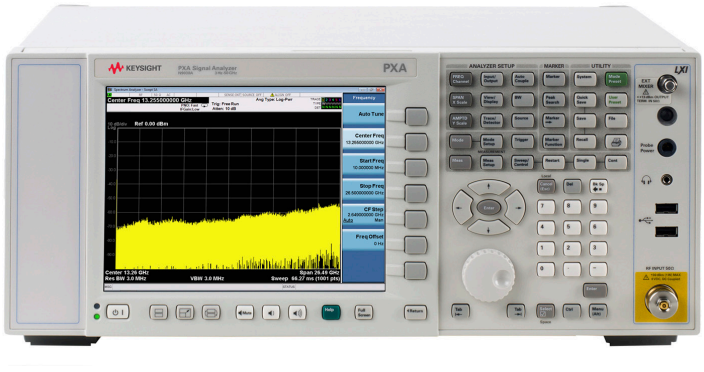
Keysight Technologies
Z9070B Wideband Signal Analysis Solution

Technical Overview





KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

Introduction

Wideband commercial, satellite or radar signals can now be analyzed with commercial test equipment at a fraction of the cost and measurement time of traditional solutions using the Z9070B wideband signal analysis solution. The Keysight Technologies, Inc. Z9070B consists of Keysight's N9030A PXA signal analyzer, combined with an Infiniium DSOS804A oscilloscope and 89600 VSA software, orderable as Z9070B-001.

The Z9070B takes advantage of the PXA's wide IF output, the high dynamic range of the Infiniium oscilloscope, and the powerful 89600 VSA to deliver a wideband high-dynamic range signal analysis solution at an affordable price. This solution does not require an external stimulus. The correction data is exported from the PXA to the 89600 VSA so the user does not need to do time consuming calibrations for acceptable measurement results. Correction data is quickly loaded when the user changes center frequency and span, and the full analysis capability of the 89600 VSA can then be utilized. The corrections contain both amplitude and phase information, enabling the 89600 VSA to make accurate analyses of chirp linearity, signal modulation for cell phone networks or even custom modulation formats.

Key Features:

- Automatically loads correction data from the PXA signal analyzer
- PXA correction data for > 1 GHz of bandwidth
- Measurement characteristics including frequency response and phase linearity performance up to 800 MHz of bandwidth
- Includes high dynamic range scope with up to 12 bits of resolution
- Quick setup and accurate measurements
- Frequency coverage to 50 GHz

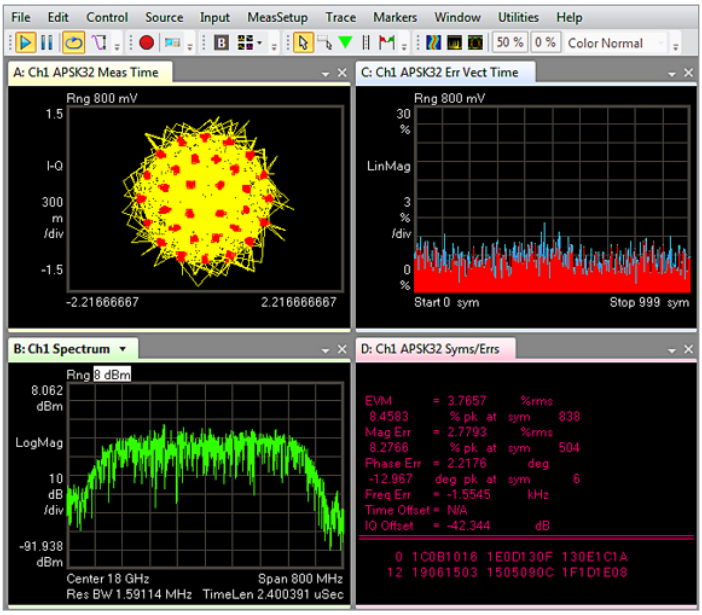


Figure 1. Demodulation of a wideband APSK signal without using equalization. Note the EVM at around 3.75%. The source has an expected EVM performance of > 2%.

Figure 2. Analysis of a wideband chirp and evaluation phase and frequency across the band.

Keysight's high dynamic range oscilloscopes bring up to 12-bit digitizer performance, enabling the Z9070B to attain results similar to an integrated signal analyzer. Measurements such as error vector magnitude are accurate due to IF correction data and the performance of the digitizer. The 89600 VSA can run inside the scope, giving the user a large screen display to view an extensive array of measurement views.

The Z9070B is an easy-to-use solution. Setup is done in a few simple steps and using the integrated software component in the VSA, switching measurement parameters is fast and straightforward. Using an Ethernet cable between the PXA and scope enables the 89600 VSA to load correction data and set up the measurement; the user does not have to interact between the signal analyzer or the scope interface.

Figure 3. The Z9070B is downcoverting two 802.11ac signals (160 MHz bandwidth each) that are adjacent to each other. The 89600 VSA has multi-measurement capability to analyze both signals simultaneously. Note span of 400 MHz.

The Z9070B allows for a flexible measurement capability without sacrificing usability. Once bandwidth, center and IF frequencies are selected by the user, the software automatically loads the appropriate correction data. When signal recording is required, using the Z9070B allows for much longer record lengths than typical solutions due to the use of the downconverter. The recorded waveform data can be analyzed using the 89600 VSA or easily exported to MATLAB or other popular formats.

89600 VSA software

The 89600 VSA software is a comprehensive set of tools for demodulation and vector signal analysis.

- Gain greater insight with high resolution FFT-based spectrum, time and modulation domain analysis
- Capture and playback signals for detailed gap-free analysis
- Vector measurements for RADAR/EW including pulse and FMCW radar analysis
- Over 75 signal standards and modulation types, including:
  - Cellular communications: LTE-Advanced, W-CDMA, HSPA+, GSM/EDGE Evolution, TD-SCDMA, cdma2000®
  - Wireless connectivity: WLAN 802.11a/b/g/n/ac, WiMAX™, *Bluetooth*®, Zigbee, RFID, Wi-SUN
  - Aerospace, defense, satellite: AM, FM, PM, BPSK, QPSK, QAM, APSK, FSK, VSB, SOQPSK, APCO 25
  - Custom modulation: evaluate non-standard or proprietary customized IQ, OFDM and APSK signals

The PXA may continue to be used to do traditional swept measurements, such as spur search or occupied bandwidth. All of the X-Series measurements such as noise figure and phase noise are also available. The PXA correction data are complex (both magnitude and phase) and can be used with many of the digitizers supported by the 89600 VSA.

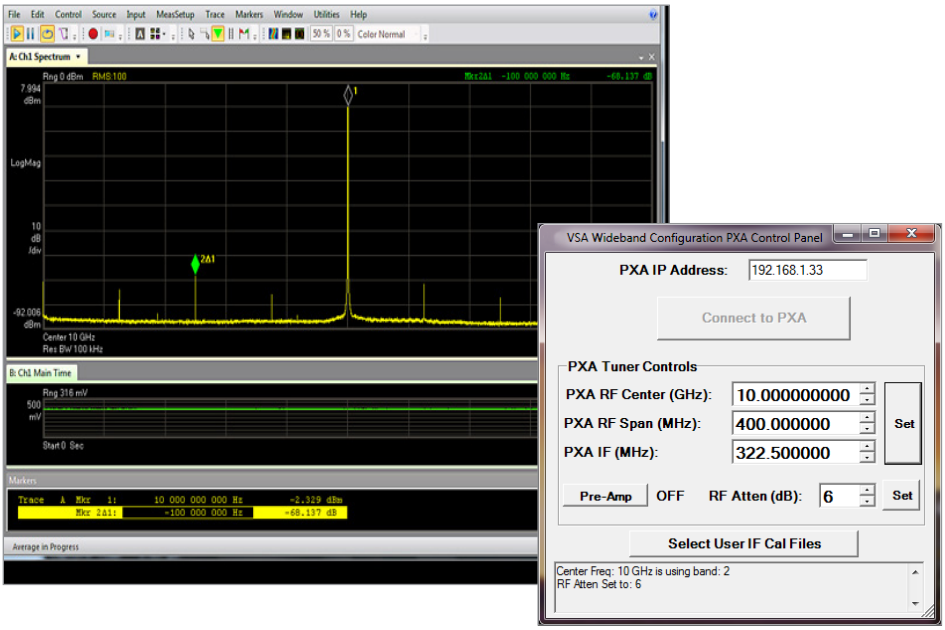


Figure 4. The downconverter control window and a spurious measurement of the Z9070B which is > 67 dBc.

The DSOS804A oscilloscope has been configured for the Z9070B but it is possible to choose other digitizers such as the Infiniium 90000 Series oscilloscopes or modular digitizers such as the M9703A. Dynamic range performance of alternate digitizers may be checked to determine overall system sensitivity. Correction functionality is not limited to the DSOS804A.

Characteristics

The following data represents nominal characteristics, and therefore is not tested over temperature. IF magnitude and phase variation data was collected on a sample of PXAs to determine corrections for the family of analyzers. Using banded corrections will lead to some box-to-box variation, but the resultant flatness is still quite good. The characteristics below are for the following hardware configurations unless otherwise noted: N9030A (Options 526, MPB, CR3), DSOS804A. Using a higher sample rate lower noise digitizer can lead to better performance and this configuration should work with any of the digitizers supported by the 89600 VSA software. Preselector has been bypassed for measurement results shown. Other measurement factors such as aliasing and images should be taken into conisderation. The PXA can act as an anti-aliasing filter, although this has not been fully characterized.

Spurious response	Spurious signal content will likely be dominated by the oscilloscope and the characteristics of spur free dynamic range will nominally be reviewed in this document. The PXA general spurious responses will not be addressed in this document.
Displayed average noise level (DANL)	DANL charcteristics will vary based on carrier frequency and the contribution will be from both the PXA and scope. Please review the PXA specification guide and Infiniium S-Series oscilloscope data sheet.
Third-order intermodulation (TOI)	This product can create additional TOI products outside of the noted TOI specifications in the N9030A specification guide; this is not specified for the Z9070B.
Phase noise	Phase noise should not degrade significantly.
Absolute amplitude accuracy	Amplitude accuracy can vary significantly more than the internal (Option B1X) digitizer but the relative frequency response should exhibit behavior as listed from the IF frequency response table in this document.

General specifications

More information on each product can be found in the N9030A specification guide or the Infiniium S-Series oscilloscope data sheet.

Oscilloscope/digitizer	DSOS804A	
Bandwidth	8 GHz	Useful for direct measurement. Using the downconverter, corrections are limited to 1.2 GHz (see correctable bandwidth below).
Bits of resolution	12 bit (< 500 MHz)	10 bit (< 2 GHz) Please consult the H-Series datasheet for more information.
Memory (standard)	100 Mpts	
Signal analyzer/downconverter	N9030A	With lower bandwidth X-Series instruments, correction data will not export.
Frequency range	3.6 to 50 GHz	Option N9030A-550. Measurements below 3.6 GHz are in band 0 and will be limited to < 160 MHz of BW; for wider bandwidths connect RF input directly to the scope. There are no auto-corrections needed for band 0.
Correctable bandwidth	1.2 GHz	Corrections are significant over 1 GHz and performance degrades. Suggested usable bandwidth is < 1 GHz.
Spur-free dynamic range (SFDR)		
Span ≤ 400 MHz	–67 dBc	Single tone in center of span; 3.6 GHz ≤ center frequency ≤ 26.5 GHz. Performance differs based on IF and RF frequency.
Span ≤ 800 MHz	–67 dBc	
Span ≤ 1000 MHz	–56 dBc	

Figure 5. Data collected over 500 MHz BW.

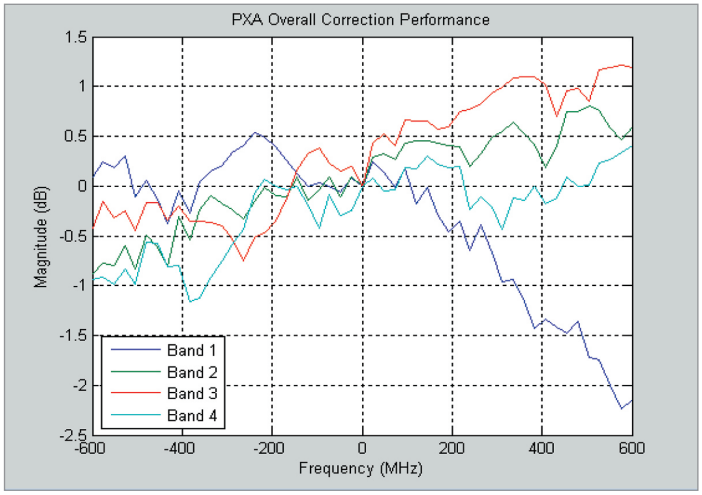


Figure 6. Data collected over 1.2 GHz BW.

IF frequency response[1,2]		
Center Frequency < 26.5 GHz		
Less than 400 MHz bandwidth	± 0.8 dB	See the graphs for measured results across frequency bands.
Less than 800 MHz bandwidth	± 1.5 dB	See the graphs for measured results across frequency bands.
Less than 1000 MHz bandwidth	± 2.2 dB	See the graphs for measured results across frequency bands.
Center Frequency < 50 GHz		
Less than 400 MHz bandwidth	± 2.0 dB	Using N9030A (550, MPB, CR3).
Less than 800 MHz bandwidth	± 3.5 dB	Using N9030A (550, MPB, CR3).
Less than 1000 MHz bandwidth	± 4 dB	Using N9030A (550, MPB, CR3).
IF phase linearity[1,2]		
Center frequency ≥ 3.6 GHz, < 18 GHz	RMS	
Less than 400 MHz bandwidth	3°	
Less than 800 MHz bandwidth	5.5°	
IF phase linearity is defined as the standard deviation of the phase deviation relative to mean phase deviation from a linear phase condition, where the RMS is compared across the span shown and over the range of center frequencies shown.		
Corrections range Understanding the amplitude correction range for the digitizer gives a general idea on impact to dynamic range. These are worst case measurements; the maximum needed corrections.		
	Peak-to-peak	
400 MHz	5 dB	Worst case for either 26.5 or 50 GHz hardware.
800 MHz	12 dB	Worst case for either 26.5 or 50 GHz hardware.
1200 MHz	16 dB	Worst case for either 26.5 or 50 GHz hardware.

1. The IF frequency response includes effects due to RF circuits such as input filters that are a function of RF frequency, in addition to the IF pass-band variations.
2. Not including moding issues above 18 GHz.

Deviation using Family Cal

The corrections for Z9070B have two components – RF and IF. This section describes the IF correction deviation from one instrument to the next. Users can choose to include a specific box measurement IF calibration (used in previous data) or use the family correction. RF calibration component is comprized of data that is always box specific; the software will automatically read correction data from the PXA (requires firmware > A.14.00). IF corrections are the dominant of the two sets of corrections.

	Frequency range	Frequency response	Phase linearity
26 GHz instruments (800 MHz Bandwidth)			
Band 1	3.5 to 8.4 GHz	0.2 dB	4°
Band 2	8.3 to 13.6 GHz	0.2 dB	2.5°
Band 3	13.5 to 17.1 GHz	0.3 dB	5°
Band 4	17 to 26.5 GHz	0.2 dB	5°
50 GHz instruments (800 MHz Bandwidth)			
Band 1	3.5 to 8.4 GHz	0.3 dB	5°
Band 2	8.3 to 13.6 GHz	0.4 dB	3.5°
Band 3	13.5 to 17.1 GHz	0.5 dB	4.5°
Band 4	17 to 26.5 GHz	0.8 dB	5°
Band 5	26.4 to 34.5 GHz	0.5 dB	4.5°
Band 6	34.4 to 50 GHz	0.2 dB	3.5°

Note: The maximum amplitude variation for full corrections (1.2 GHz) is 2.5 dB. Maximum phase deviation for full corrections (1.2 GHz) is 15°. The dominate phase deviation for full corrections (BW < 1.2 GHz) occurs within the last 50 MHz of the measurement.

For More Information

Z9070B Wideband signal analysis solution:	**www.keysight.com/find/wideband**
N9030A PXA X-Series signal analyzer:	**www.keysight.com/find/PXA**
Infiniium DSOS804A oscilloscope:	**www.keysight.com/find/S-Series**
89600 VSA software:	**www.keysight.com/find/89600**

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