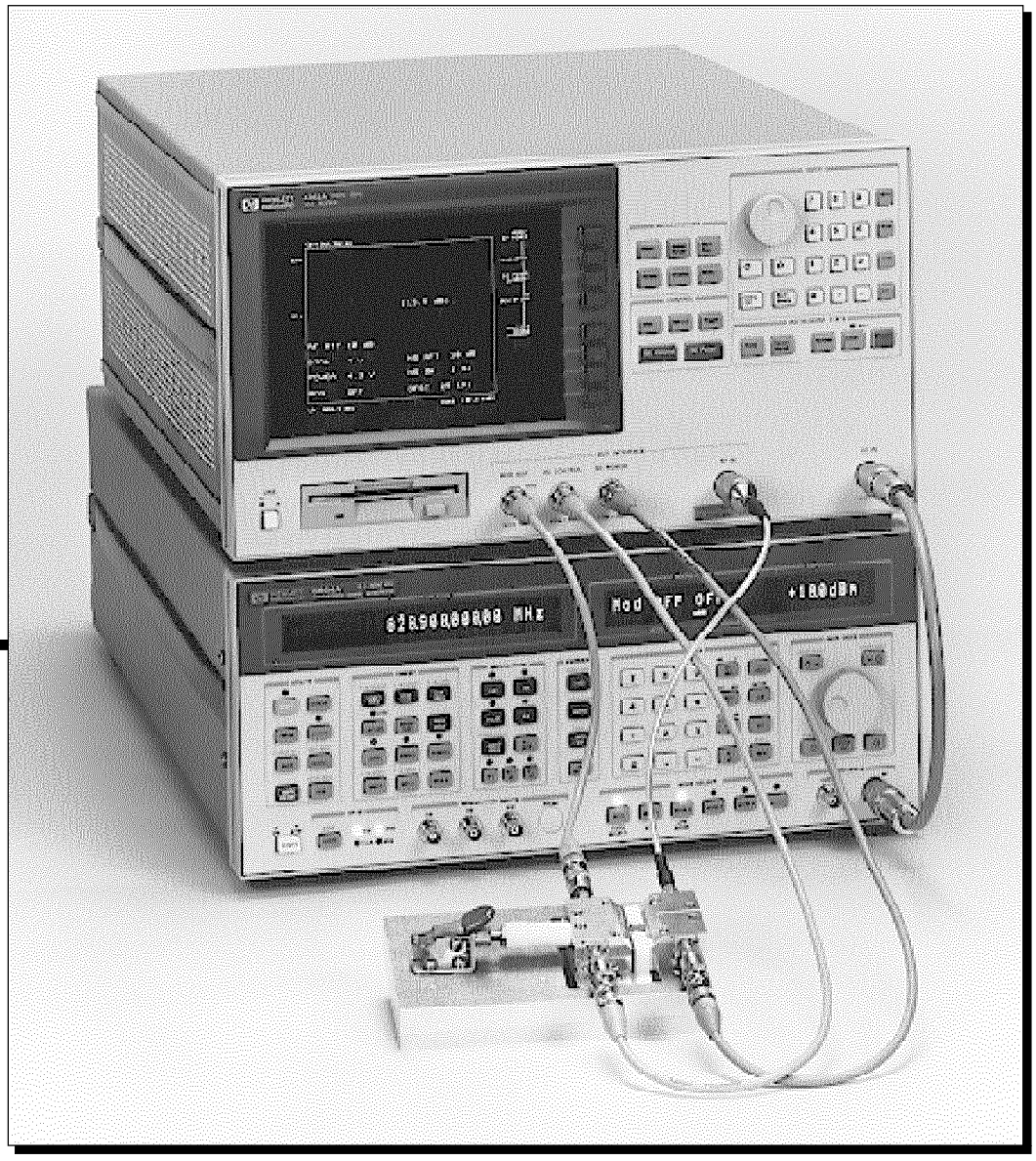
HEWLETT® PACKARD

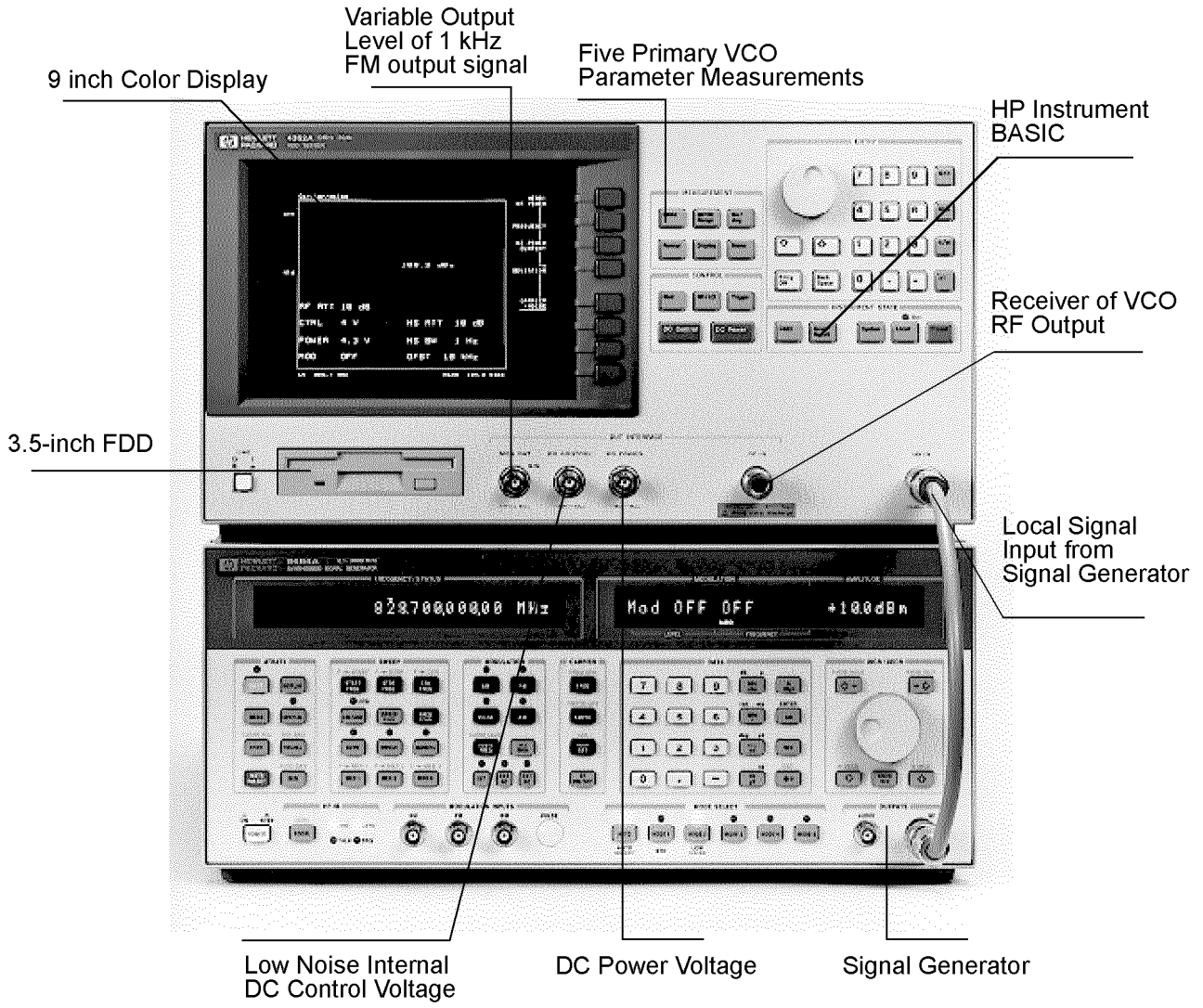
HP 4352S VCO Test System 10 MHz to 3 GHz

Product Overview

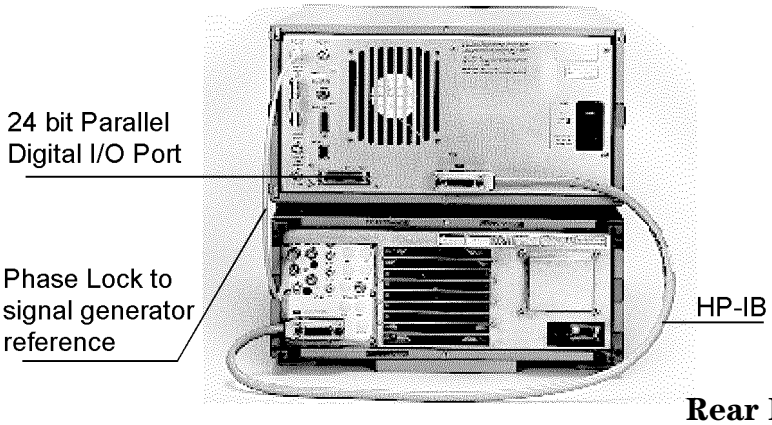


Hewlett-Packard's high performance multi-functional test system for increasing test productivity of VCOs used in mobile wireless communication equipment

Dedicated Test System For VCO Evaluation



Front Panel



Rear Panel

HP 4352S VCO Test System

The HP 4352S is a high throughput VCO Test System which can measure five VCO parameters from 10 MHz to 3 GHz. The five parameters are RF Power Level, Frequency, DC Consumption Current, FM Deviation, and Phase Noise (Carrier-to-Noise). In addition, other VCO parameters such as Signal-to-Noise, Control Voltage (Tuning) Sensitivity, Power Voltage Sensitivity (Frequency pushing) can be easily obtained by using the internal programming language, HP Instrument BASIC (IBASIC). The HP 4352S system consists of the HP 4352A VCO Tester and your choice of a Hewlett-Packard low noise signal generator. The multi-functionality of the system reduces equipment rack space, and allows fast and convenient operation. The HP 4352S system offers you the ability to increase your productivity easily and effectively in manufacturing, development and QA.

HP 4352S Main Features

High Speed Test Throughput
The HP 4352S can achieve high test throughput levels by virtue of its internal firmware design interacting with multi-mode PLL technique. It's phase noise measurement speed is more than three times faster than a conventional rack-and-stack test system. The HP 4352S employs an ultra low noise DC control voltage source; this allows you to remove a low pass filter used for reducing noise on DC control signal source. The system can also quickly change the control voltage for VCO testing.

Simple Configuration with Ease of Use
The combination of a HP 4352A and a signal generator provides all of the tools necessary to measure VCO parameters; nothing else is required. Cable connection change is not necessary, either. These features reduce both VCO test setup time and rack space. A new feature, Automatic Frequency Control function, reduces a test operator's time to evaluate the VCO parameters at a specified output frequency.

High Reliability Test Data
The HP 4352S can measure VCO phase noise with high repeatability using a wide dynamic range. Since all signal sources of the HP 4352A are floated from ground, the test system is isolated from external noise.

Test Automation
The IBASIC programming language is useful for developing automation and performing secondary VCO parameters calculation. The 24-bit parallel digital I/O port allows users to interface directly to automatic component handlers. Measurement data can flow to the handler, or the handler can externally trigger the HP 4352S. The 3.5-inch disk drive gives you the ability to save or recall the test setups, IBASIC programs or measurement results.

Reducing VCO Test Time

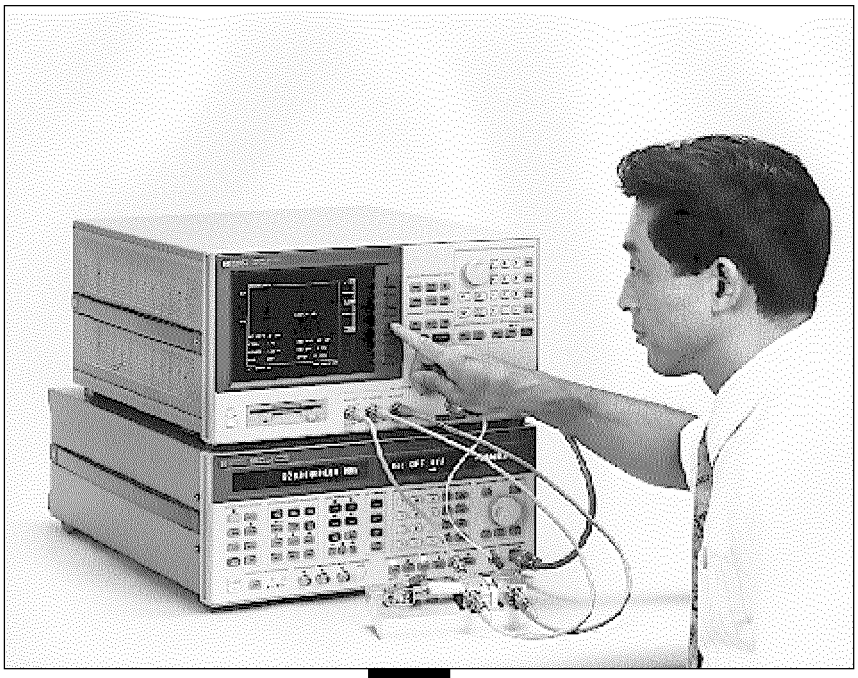
Rapid phase noise measurement is a big issue in improving the total throughput of VCO testing. The HP 4352S can achieve fast phase noise measurements over conventional modulation analyzer/selective voltmeter system. The HP 4352S has several unique features that contribute to higher throughput testing in a VCO production line.

Fast and Excellent Phase Noise Measurement
Accurate and stable phase noise measurement takes a long time. This is due to the VCO output carrier being unstable. The HP 4252A employs a multi-mode PLL technique which allows the HP 4352S system to phase lock to the VCO output frequency, which automatically eliminates VCO output carrier drift. The HP 4352S can dramatically reduce phase noise test time by the using multi-mode PLL technique. For example, a typical phase noise measurement time is about two seconds (Offset frequency 25 kHz with noise repeatability of 0.6 dB peak-peak).

Ultra Low Noise Internal DC Power Supply
Usually the low pass filter (LPF) must be placed between the dc control voltage power supply and the VCO to eliminate the noise on the dc control voltage signal for accurate VCO testing. The filter tends to increase the response time every time VCO control voltage is changed. The HP 4352S has an ultra low noise DC control voltage source ($1\ nV/\sqrt{Hz}$ at 10 kHz offset). Now the LPF is not needed, and the HP 4352S can quickly change the control voltage.

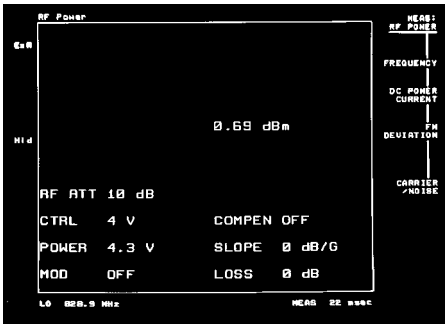
Fast RF Power Level Measurement
The HP 4352S employs a peak detector method for RF power level measurement. This allows it to make fast RF power level measurement in less than 25 milliseconds, even with low test signal levels. This technique is much faster than using a conventional power meter.

Simple Configuration

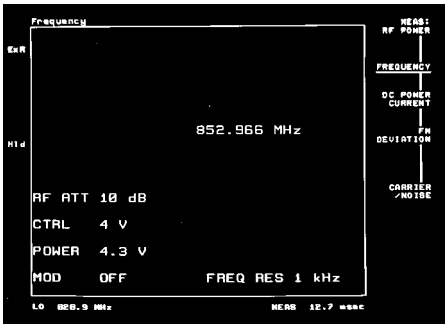


Two Instruments Solution for VCO evaluation

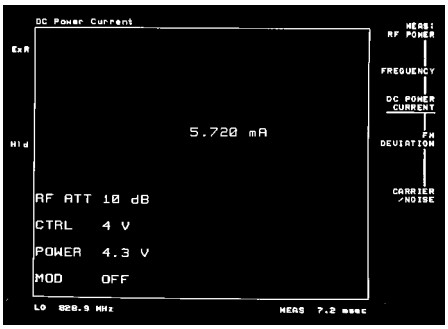
The HP 4352S is composed of a HP 4352A and a signal generator. The HP 4352A provides and controls all signals; the DC control voltage, the DC power and the 1 kHz modulation signal. No external power supplies are necessary. The HP 4352S has the capability of five VCO parameters evaluation by itself. The cable connection change required at every measurement parameter change is not needed. As a result, the HP 4352S can save physical test space and allow you to perform a wide variety of VCO tests easily. The signal generator is used as the local signal source for the HP 4352A. The HP 4352A down-converts the VCO output



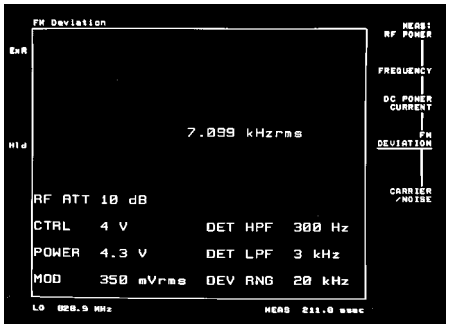
RF Power Level



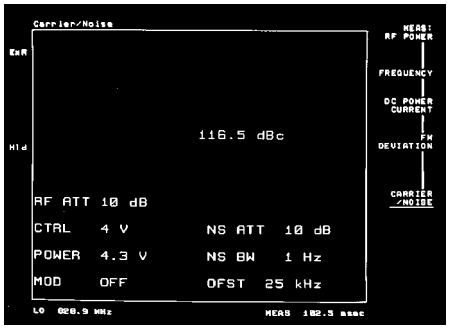
Frequency



DC Consumption Current



FM Deviation



Phase Noise (Carrier-to-Noise)

Five VCO Parameters

signal to the applicable frequency range by using the local signal from the signal generator. All control is automatic, the HP 4352A automatically controls the signal generator via HP-IB.

Automatic Frequency Control Function
Various kinds of VCO parameters are generally tested when the VCO output frequency reaches its specified state. In order to obtain the specific VCO frequency, you have to adjust the DC control voltage for each different device.

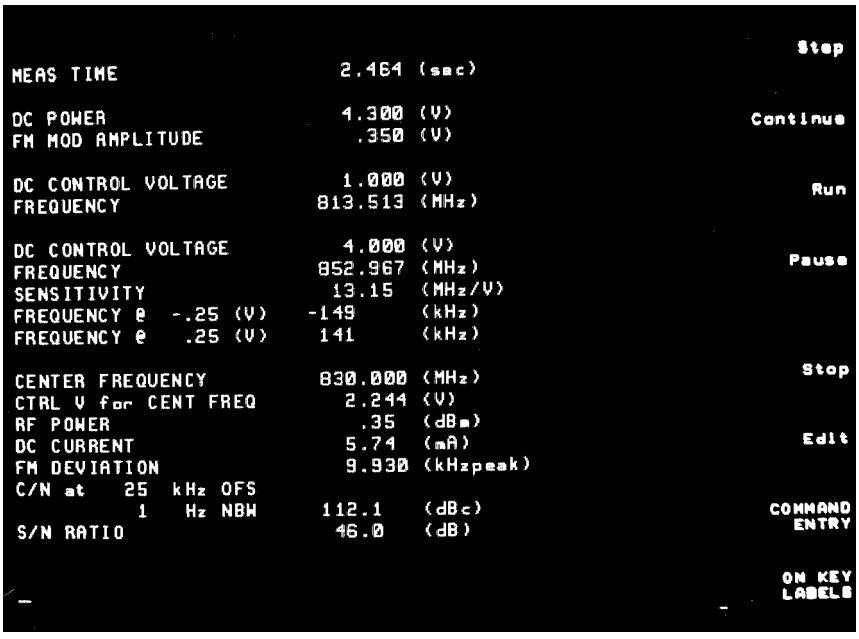
The AFC (Automatic Frequency Control) function allows the system to automatically search and provide the optimized DC control voltage for the specified VCO output frequency. When activated, the AFC function can search for the proper setting in less than 100 milliseconds. The AFC function operates in the following way. First, the HP 4352S sets the assumed proper control voltage for the target VCO output frequency as the initial setting, by using the information of the user-defined control voltage sensitivity. Second, the HP 4352S measures the actual output frequency, and recognizes the difference between target and actual output frequencies. Then the HP 4352S sets the control voltage to be more closer to the proper voltage for the target frequency by using the information of the previous step. The system repeats these steps for the VCO to reach the target frequency. The AFC function eliminates time required for the pre-test adjustment of the VCO, and offers users the ability to increase test productivity.

Easy Test Automation

24-bit Parallel Digital I/O Interface
The 24-bit parallel I/O Interface can be used for sending out pass/fail test results to automatic component handler or to externally trigger the HP 4352S from the handler.

Built-in 3.5-inch Disk Drive
The built-in 3.5-inch disk drive easily lets you save and recall test setups, automatic test IBASIC programs, and measurement results either LIF or MS-DOS® format (720 kB or 1.44 MB). If you save your measurement results in MS-DOS format, you can access the data files and analyze the statistics of your accumulated measurement results in your PC software environment.

Automated Measurements with HP IBASIC
The HP 4352S can measure five major VCO parameters, RF Power level, Frequency, DC Consumption Current, FM Deviation, and Phase Noise (Carrier-to-Noise). In addition the other secondary VCO parameters such as Signal-to-Noise, Control Voltage (Tuning) Sensitivity, Power Voltage Sensitivity (Frequency pushing) etc. can be obtained automatically by the HP IBASIC language. The program development is very easy and simple using the keyboard to control the instruments and develop calculations. HP IBASIC allows you to control another instruments via HP-IB, reducing the need for dedicated test station computers.



High Measurement Reliability

Wide Dynamic Range of Phase Noise measurement
The HP 4352A's typical phase noise measurement performance is 137 dBc/Hz at 10 kHz offset. When used with a suitably low noise signal generator, the HP 4352S delivers a highly reliable measurement of phase noise test solution for low noise VCOs.

Floating Internal Sources
All internal ac and dc signal sources use floating power supplies. This will minimize error introduced by external noise sources and maximize stable and reliable measurements.

Cable Loss Compensation Function
The cables between the instrument and the VCO are non-ideal and can add error due to the cable loss when attempting to accurately measure the VCO RF power level. This function determines the true RF power level by mathematically calculating the amount of loss contributed by the cable and adding the power due to the loss back into the test data.

High-Accuracy FM Deviation Measurement
The HP 4352A has the capability of internal self-calibration for FM deviation measurement. This function allows you to make more reliable measurement with the typical accuracy of ± 0.8% and high repeatability.

Ordering Information

HP 4352S VCO Test System

HP 4352A VCO Tester

Furnished Accessories:

- Operation Manual Set, 1 ea.
- BNC-BNC Cable (60cm) (HP PN 8120-1839), 1ea.
- N-N Cable (HP PN 41951-61602), 1 ea.
- HP-IB Cable (HP 10833A), 1 ea.
- HP-HIL Keyboard (HP 46021A), 1ea
- Keyboard Cable, 1ea.
- BNC Adapter, 1 ea.
- Power Cable, 1 ea.

Options

1A2 Delete Keyboard

1CM Rack Mount Kit

1CN Handle Kit

1CP Rack Mount & Handle Kit

ABA English Localization

ABJ Japanese Localization

0B0 Delete manual set

(Note: Language selection depends on option ABA or ABJ)

0B1 Add manual set

UK6 Commercial Cal. Certificate with Test Data

Guideline of Signal Generator Selection

The recommended signal generators are listed below.

HP 8664A with Opt.004 (Enhanced Spectral Purity)
Frequency: 100 kHz–3 GHz
Phase Noise: -135dBc/Hz at 10 kHz offset, 1 GHz carrier

HP 8644B with Opt.002 (Frequency Output Extension)
Frequency: 252 kHz–2.06 GHz
Phase Noise: -135dBc/Hz at 10 kHz offset, 1 GHz carrier

HP 8657B
Frequency: 100 kHz–2.06 GHz
Phase Noise: -125 dBc/Hz at 10 kHz offset, 1 GHz carrier

HP 8648B
Frequency: 100 kHz–2 GHz
Phase Noise: -109dBc/Hz at 10 kHz offset, 1 GHz carrier

HP 8648C
Frequency: 100 kHz–3 GHz
Phase Noise: -109dBc/Hz at 10 kHz offset, 1 GHz carrier

You can select the best signal generator based on your VCO requirements. Here is the selection guideline for signal generators.

1. Choose the signal generator which covers the frequency range of your VCO requirements.
2. Choose the signal generator which can achieve the phase noise measurement suitable for your VCO requirements. Refer to Figure 1. Phase Noise Comparison @1 GHz Carrier between HP 4352A and Recommended Signal Generators. Compare the phase noise of the HP 4352A with it of your chosen signal generator using Figure 1. Observe the worse case value of the phase noise as

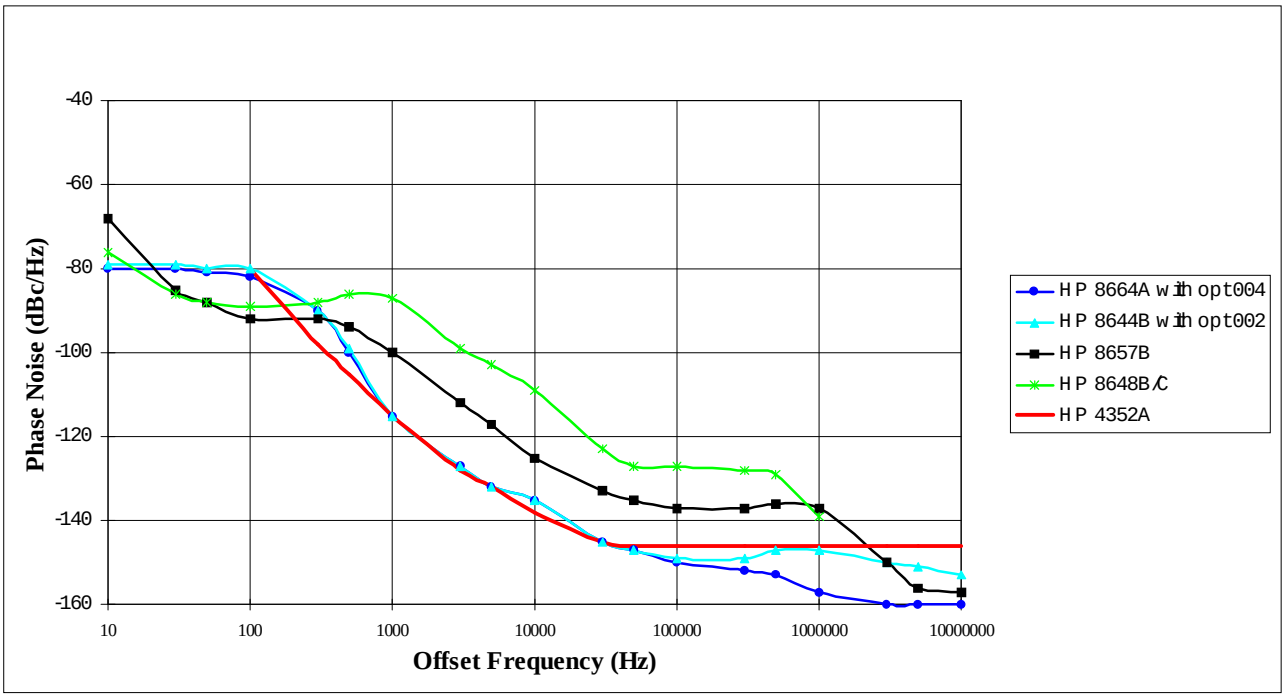


Figure 1. Phase Noise Comparison @1 GHz Carrier between HP 4352A and Recommended Signal Generators

the system performance of the phase noise measurement capability. For example, if you choose the HP 8657B, the phase noise at carrier of 1 GHz with an offset frequency:10 kHz is approximately -125 dBc/Hz. Since the HP 4352A's phase noise is approximately -137dBc/Hz, the system performance (HP 4352A with HP 8657B) defaults to -125dBc/Hz.

3. Choose the correct signal generator options if needed.

Specifications Summary

Source Characteristics

DC Power Voltage: 0 to +15 V with 1 mV step, 50 mA maximum

DC Control Voltage: 0 to +20 V with 100 uV step, 20 mA maximum

Accuracy: ± (0.1% + 1 mV)

Settling Time: < 20 msec at 0.1% error (Typical)

Noise Density: <1 $nV/\sqrt{Hz}$ @ 1 kHz

FM signal: 1 kHz, 0 to 1 Vrms with 1 mVrms step

Connector Type: BNC (F), Output signals are floated from ground

Receiver characteristics

Measurement Frequency Range: 10 M to 3 GHz

Input Power Level: -10 to +20 dBm

Input Impedance: 50 ohm

SWR: <1.2 (0.01-2 GHz), <1.3 (2-3 GHz)

Connector Type: Type-N (F)

Measurement Parameters

RF Power

Response: Peak Voltage

Resolution: 0.01 dB

Absolute Accuracy: ± 0.6 dB (at ≤ 2 GHz, ≤ 15 dBm) ± 1 dB (at other conditions)

Frequency

Resolution: 1 kHz

Accuracy: ± (SG Freq. Acc. + 1 kHz)

Typical: ± 1.375 kHz @1 GHz (HP 8664A)

Phase Noise (Carrier-to-Noise):

Offset Frequency	Spec	Typical
1 kHz	-100 dBc/Hz	-110 dBc/Hz
10 kHz	-130 dBc/Hz	-137 dBc/Hz
100 kHz	-140 dBc/Hz	-147 dBc/Hz

Note: The phase noise of signal generator isn't included in these values.

Offset Frequency Range: 100–10 MHz

Accuracy: ± 2 dB @1 k–1 MHz
± 4 dB @1 M–10 MHz
± 4 dB @100–1 kHz (Typical)

FM Deviation:

Measurement Range: 0–200 kHz (Peak)

Accuracy: ± 2% + 0.1% of range ±0.8% (Typical after FM Deviation Cal)

Residual FM: <3 Hzrms (@300–3 kHz)

DC Consumption Current

Current Range: 0–50 mA

Accuracy: 0.2% ± 100 uA

Storage

3.5-inch FDD: LIF/DOS format (720 kB or 1.44 MB)

Internal RAM Disk: LIF/DOS format (512 kB max)

Interfaces

HP-IB, 24-bit Parallel Digital I/O Port

General Characteristics

Display: 9 inch, Color CRT

Operating Temperature: 0 to +55 °C

Operating Humidity: 5 to 95% RH

Storage Temperature/ Humidity: -40 to +65 / 15 to 95% RH

Power Requirements: 90 to 132 V or 198 to 264 V, 47 to 66 Hz, 500 VA max

Size: 235mm H x 425mm W x 553mm D

Weight (Typical): 27kg

Note: Refer to Signal Generator Selection Guide (PN 5091-7274E) or the specific signal generator technical data sheet for more information

For more information on Hewlett-Packard Test and Measurement products, applications, or services please call your local Hewlett-Packard sales office. A current listing is available via the Web through AccessHP at http://www.hp.com. If you do not have access to the internet, please contact one of the HP centers listed below and they will direct you to your nearest HP representative.

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1 800 452 4844

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