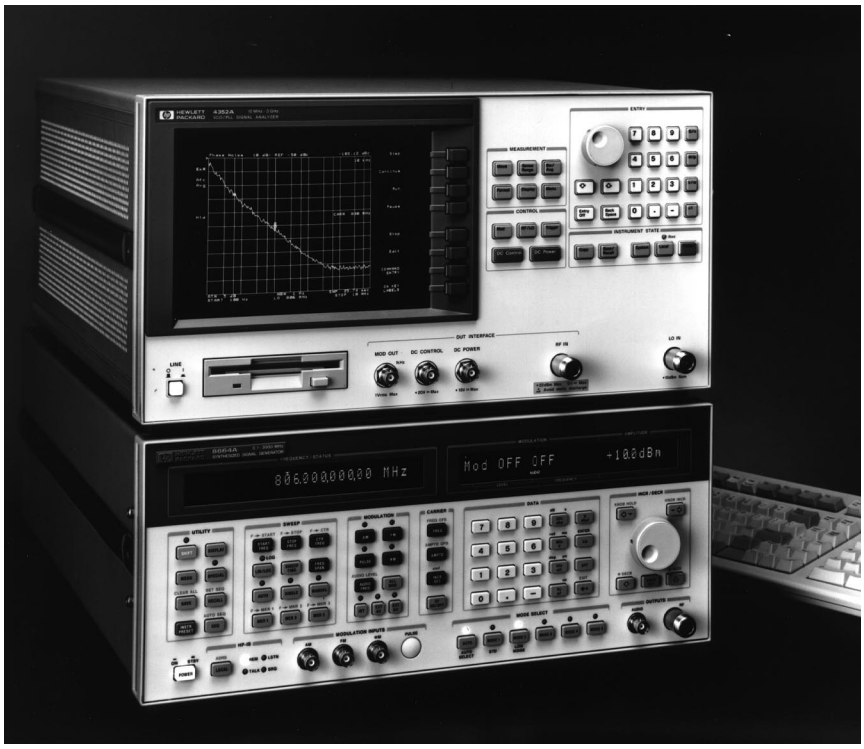
HEWLETT® PACKARD

HP 4352S VCO/PLL Signal Test System 10 MHz to 3 GHz

Product Overview

For the VCO/PLL Evaluation Essential to RF Oscillator Circuit Design
Easy Evaluation With a Simple Test System



Signal Analysis Functions Added:

- Graphical Analysis of Basic VCO/PLL Characteristics
- High-Speed Phase Noise Characteristic Measurement
- Frequency Transient Measurement
- Spectrum Measurement for Spurious/Harmonics Analysis

Generally, a frequency synthesizer is employed in the Local Oscillator used in RF wireless communication equipment (such as mobile phones). The frequency synthesizer consists of a voltage controlled oscillator (VCO) to generate a carrier signal, a phase locked loop (PLL) circuit to control the VCO frequency, and a crystal oscillator to provide a reference signal to the PLL. Currently, the operating frequencies of RF wireless communication equipment or wireless local area networks (W-LAN) are about 400 MHz to 2.5 GHz. Therefore, VCO and PLL evaluation are critical to the design of the local oscillator circuit to ensure quality communication within such a high frequency range. Because of the many VCO and PLL evaluation parameters, traditional measurement systems have a complicated system configuration and setup and slow phase noise measurements. Now, signal analysis functions that easily evaluate many of these VCO and PLL characteristics have been added to the current HP 4352A VCO Tester. These function enhancements dramatically improve the efficiency of the VCO and PLL evaluations that are required for quality oscillator design (as well as VCO testing productivity).

The product and system name of the HP 4352S and the HP 4352A were changed to reflect this function enhancement:

- HP 4352S VCO/PLL Signal Test System
- HP 4352A VCO/PLL Signal Analyzer

The HP 4352S VCO/PLL Signal Test System consists of the HP 4352A VCO/PLL Signal Analyzer and a Hewlett-Packard signal generator. This supplemental product overview introduces the newly enhanced HP 4352A's functions. Please refer to the product overview of the HP 4352S VCO Test System (P/N 5964-6866E) for the details of HP 4352A's original measurement functions.

HP 4352S Main Features

- Wide variety of VCO/PLL parameter evaluations using one system
- High speed phase noise measurement
- Easy measurement data analysis

Enhanced Functions

For VCO evaluation
The following VCO basic characteristics can be easily measured with trace curves on the display:

- RF Power vs Tuning (DC Control) Voltage characteristic
- Frequency vs Tuning Voltage characteristic
- Tuning Sensitivity characteristic
- Phase Noise characteristic
- Harmonics characteristic

In addition, the FM deviation and DC power consumption current can be measured with the HP 4352A's original measurement functions. In total, seven VCO parameters can be easily evaluated without changing any cable connections.

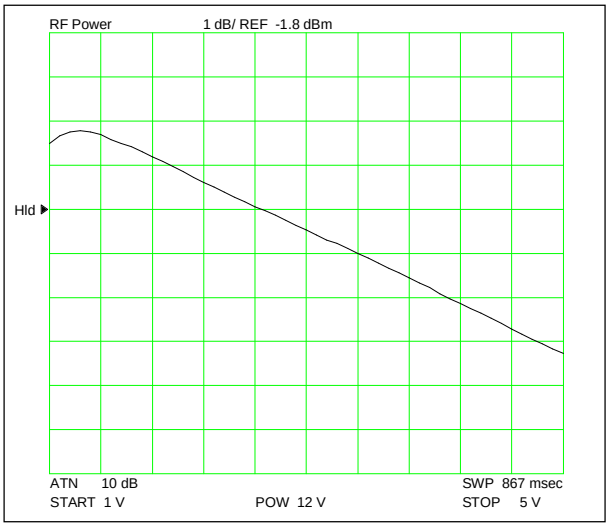
For PLL evaluation
Basic characteristics important for PLL design can be measured and the PLL setup change that is required for every measurement can be easily performed.

- Phase noise characteristic
- Frequency transient characteristic
- Harmonics characteristic
- Spurious characteristic
- Automatic setup of PLL divider

These powerful functions enable you to perform the VCO and PLL evaluations essential to designing quality oscillators using just one compact system.

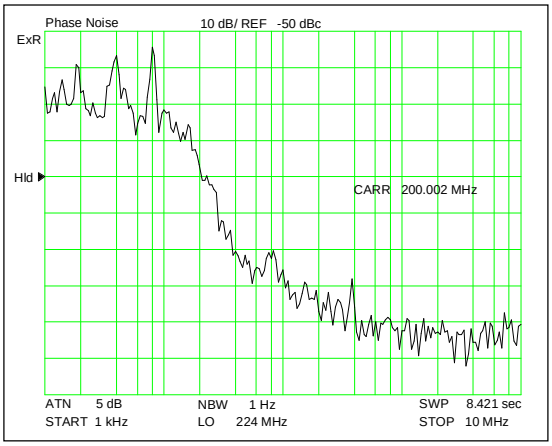
Wide variety of VCO/PLL parameter evaluations are available

- **RF Power vs Tuning Voltage characteristic measurement**
  You can quickly obtain the VCO carrier level vs Tuning Voltage characteristic.



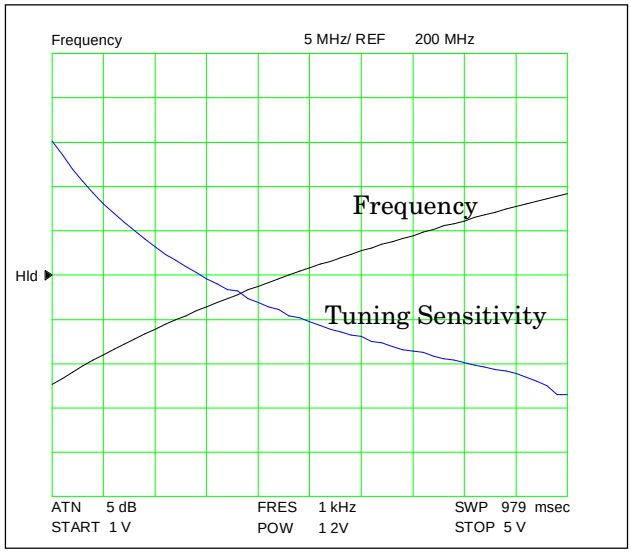
RF Power Measurement Example

- **Phase Noise vs Offset Frequency characteristic measurement**
  There are some problems in traditional phase noise test systems, such as "Complicated measurement setup" and "Very slow measurement" that are often mentioned. The HP 4352S uses a very simple measurement setup and takes only 8.4 seconds to measure the phase noise characteristic at 201 measurement points within the offset frequency range of 1 kHz to 10 MHz. Your phase noise evaluation efficiency is dramatically improved when using the HP 4352S.



Phase Noise Measurement Example

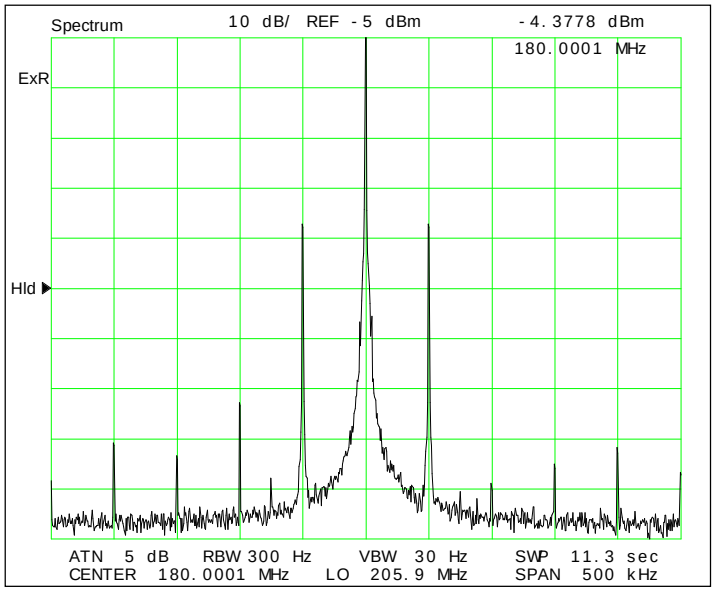
- **Frequency and Tuning Sensitivity characteristic measurement**
  The Frequency vs Tuning voltage characteristic can be measured easily. In addition, the Tuning Sensitivity, which is the differential of the Frequency vs Tuning voltage characteristic can be simultaneously evaluated on the same display. This useful measurement capability allows you to ensure stable PLL loop gain. The aperture to be used to derive the tuning sensitivity can be flexibly set in accordance with the characteristic of the device under test.



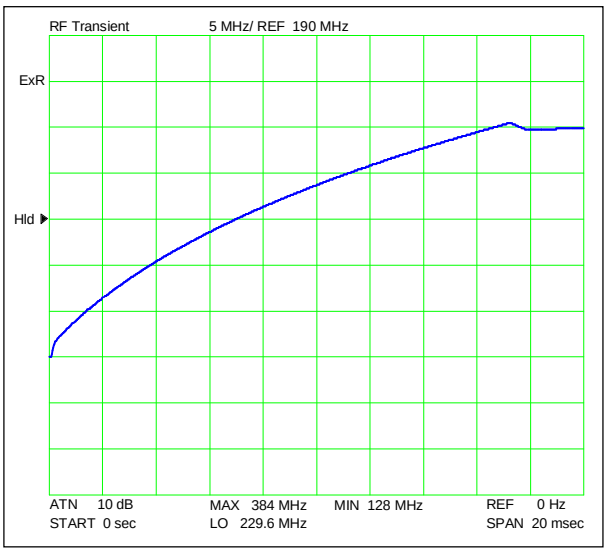
Frequency/Tuning Sensitivity Measurement Example

- **Frequency transient characteristic measurement**
  The frequency transient measurement function enables you to evaluate Frequency vs Time characteristic such as PLL frequency lock up time and VCO post tuning drift. Usually, the trigger of the frequency transient measurement has to be linked to the PLL setup change. The HP 4352S can provide the Strobe (Load) signal to the PLL (via a 24-bit I/O interface) to synchronize the measurement trigger. In addition, the HP 4352S's video trigger function can automatically trigger the frequency transient measurement when the PLL carrier reaches a specified frequency (after the PLL setup is changed). You can make suitable frequency transient measurements in accordance with the measurement system or condition.

- **Spectrum measurement**
  Both harmonics and spurious components can affect the adjacent channel communication and other communication functions. The HP 4352S can make a fast spectrum measurement with a 10 MHz SPAN at maximum frequency. This allows you to easily and surely detect these unwanted signal components in the VCO or PLL and helps you design a quality oscillator circuit.



Spectrum Measurement Example



Frequency Transient Evaluation at the PLL setup change

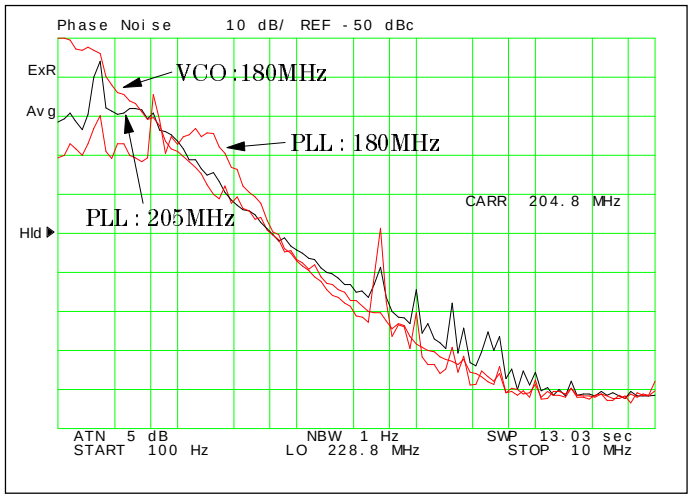
Easy measurement data analysis

- **Marker analysis function**
  Up to four markers can be used on one trace for verifying data on the trace and searching maximum/minimum/target values for detailed analysis.

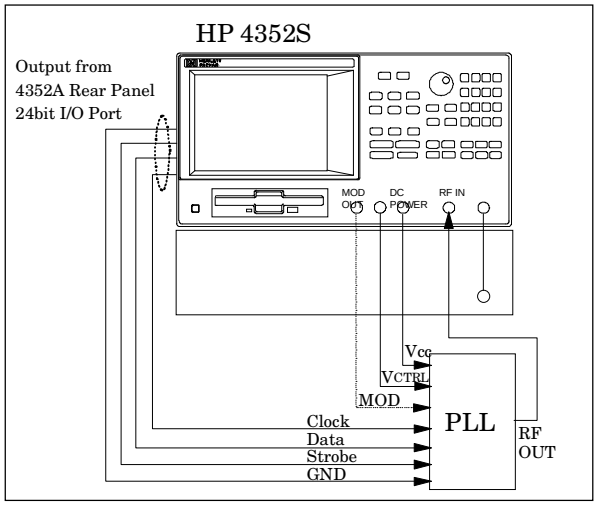
- **Limit line function**
  In order to design for the optimized characteristics of the device, a circuit adjustment is required. The HP 4352S's limit line function enables you to adjust your device efficiently. In addition, Go/No-go testing in your production line can be performed on the display using this function.

- **Four traces on the color display**
  The HP 4352S has up to four data traces so you can easily compare the characteristic of the device under different conditions on the same display. This function dramatically improves your oscillator evaluation efficiency. And, it can be used in conjunction with other HP 4352S features such as high speed phase noise measurement. For example, the phase noise characteristics comparison of the VCO and PLL is available to verify the PLL loop bandwidth. Moreover, the PLL phase noise characteristics at a specific carrier frequency can be very easily and quickly compared with those at lower and higher frequencies on the display.

- **Automatic setup of PLL divider**
  The HP 4352S can automatically change the number of the PLL divider using a combination of the built-in IBASIC programming function and the 24-bit I/O interface. This combination can provide Data, Clock, and Strobe (load) signals to the PLL, so that you can easily evaluate the PLL with an IBASIC measurement program at a wide variety of carrier frequency settings.



Phase noise evaluation at different carrier frequencies



System Configuration Example

Specifications

- **Output characteristic (changed)**
  DC Power Voltage: 0 to 15.5 V with 1 mV step, 50 mA maximum
- **Measurement accuracy (added)**
  RF Power Absolute accuracy: 0.2 dB Typical, (@ 1 GHz, -5 dBm)
- **Measurement Parameters (added)**

Frequency Transient:
Accuracy:

When measurement range >30 MHz, ±(the highest frequency within measurement range x 0.1% + 200 kHz)

When measurement range ≤ 30 MHz

1) When the highest frequency within measurement range ≥40 MHz + (measurement range x 0.1% + 3 kHz)

2) When the highest frequency within measurement range <40 MHz ±30 kHz

Measurement resolution (typ.): measurement range/40000

1) When measurement range ≤30 MHz measurement range : 4, 6, 8,..., 30 [MHz]
2) When measurement range > 30 MHz the lowest measurement frequency : 64 x N(N: 1,2,3,...,16) [MHz] measurement range: the lowest measurement frequency x 2 [MHz])

Maximum Sweep Time: 10 sec

Minimum Sweep Time Resolution: 12.5 µsec

- **Spectrum:**
  Absolute level accuracy: 2 dB (-5 dBm input, @ ATT=0 dB, 23 ± 10ºC) (typical)

  Relative level accuracy:
  0.5 dB (typical)
  1.5 dB
  (@ level ratio measurement of -10 dBm and -70 dBm inputs during one sweep, ATT = 0 dB)

Ordering Information

HP 4352S VCO/PLL Signal Test System

HP 4352A VCO/PLL Signal Analyzer

(Note: Please refer to the product overview of the HP 4352S VCO Test System (P/N 5964-6866E) for the furnished accessories.)

Options

1A2 Delete Keyboard
1CM Rack Mount Kit
1CN Handle Kit
1CP Rack Mount and Handle Kit
ABA US–English Localization
ABJ Japan–Japanese Localization
0B0 Delete Manual Set
0B1 Add Manual Set
(Note: Language selection depends on option ABA or ABJ.)
UK6 Commercial Cal. Certificate with test data

Recommended Signal Generators Specifications

- 8664A with Opt 004
  Frequency: 100 kHz–3 GHz
  Phase noise: -135 dBc/Hz ; @ 10 kHz offset, 1 GHz carrier
- 8644B with Opt 002
  Frequency: 252 kHz–2.06 GHz
  Phase noise: -135 dBc/Hz ; @ 10 kHz offset, 1 GHz carrier
- 8657B
  Frequency: 100 kHz–2.06 GHz
  Phase noise: -125 dBc/Hz ; @ 10 kHz offset, 1 GHz carrier
- 8648B
  Frequency: 100 kHz–2 GHz
  Phase noise: -109 dBc/Hz ; @ 10 kHz offset, 1 GHz carrier
- 8648C
  Frequency: 100 kHz–3.2 GHz
  Phase noise: -109 dBc/Hz ; @ 10 kHz offset, 1 GHz carrier

- **Signal generator selection**
  Signal generators other than recommended Hewlett-Packard signal generators can be used with the HP 4352A. Please contact Hewlett-Packard's sales office for details.

  To help you make the best choice for a signal generator, some examples of HP 4352S's total phase noise measurement error are listed below. The first case shows (when the phase noise of your device at a specified offset frequency is -120 dBc/Hz and those of the HP 4352A and the selected signal generator are -140 and -130) that the HP 4352S should show -119.55 dBc/Hz at the specified offset frequency. This result is 0.45 dB worse than your device's phase noise of -120. Please refer to figure 1 in the product overview of the HP 4352S VCO Test System (P/N 5964-6866E) for the phase noise characteristic of each instrument.

Phase Noise [dBc/Hz]

Device	HP 4352A	Signal Gener-ator	Measure-ment error [dB]
-120	-140	-130	0.45
-115	-140	-120	1.2
-130	-135	-135	2.13

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.

United States:
Hewlett-Packard Company
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5301 Stevens Creek Blvd.
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