Agilent Technologies
8664A Option H15

Phase Noise Specification

User's and Service Guide Supplement

Use this service guide supplement with this document:

8664A/8665A/B Synthesized Signal Generator
(Including Opt 001, 003, 004, 008 & 010) Operation and Calibration Manual
Part Number 08665-90078

Agilent Technologies Part Number: 08664-90018
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Agilent Technologies 8664A Option H15

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Description

The Agilent Technologies 8664A Option H15 provides additional specifications for phase noise performance for the E5504B Option E18 Phase Noise Solution system.

Specifications

Phase noise specifications for the 8664A Option H15 are listed in Table 1. Performance is measured using the two oscillator measurement technique on 3048A or E55xx systems.

NOTE These specifications apply at 25° C ±3° C (room temperature), and apply only with the Linear DC FM mode at 10 kHz/volt sensitivity in mode 2.

Table 1 8664A Option H15 Performance Specifications

	Frequency Range					
Offset	**0.1 MHz to 187.5 MHz**	**187.5 MHz to 257.5 MHz**	**257.5 MHz to 515 MHz**	**515 MHz to 1030 MHz**	**1030 MHz to 2060 MHz**	**2060 MHz to 3000 MHz**
10 Hz	–39	–50	–48	–41	–35	–29
100 Hz	–70	–83	–78	–73	–67	–62
1 kHz	–100	–115	–109	–104	–96	–92
10 kHz	–126	–141	–135	–130	–123	–119
20 kHz	–131	–144	–140	–134	–127	–122
100 kHz	–134	–148	–145	–141	–134	–130
1 MHz	–136	–150	–150	–150	–147	–143
10 MHz	–138	–150	–151	–153	–156	–155
100 MHz	–138	–150	–151	–153	–156	–155

All measurements given in dBc.

Performance test data up to 10 MHz offset is provided with each system.

Performance Verification

To verify the performance of the Agilent 8664A Option H15, perform these tests:

Spectral Purity Test (SSB Phase Noise)

Description

The single-sideband (SSB) phase noise and non-harmonic spurious signals are measured by a system that is specifically designed to measure these parameters–the HP 3048A Phase Noise Measurement system, the Agilent E5501B Option 201, E5502B, E5503B, or E5504B. Measurements are made using a phase detector in a phase lock loop.

NOTE This document provides system measurement instructions for the HP 3048A only.

This method requires a reference signal generator that must have lower phase noise than the source being tested. A second 8664A can be used as this source (and thus both sources are measured as a pair) but the following considerations apply:

- If the measured results are within specification, both generators meet the specification individually.
- If the measured results are out of specification, at least one generator is out of specification and a third source must be measured against the first two to determine which one is faulty.

The following Spectral Purity SSB phase noise test is performed at carrier frequencies 187 MHz, 256 MHz, 514 MHz, 1029 MHz, 2059 MHz, and 2999 MHz using two 8664A Option 004/H15 instruments and a 3048A, E5501B Option 201, E5502B, E5503B or E5504B phase noise test system configured in a two-oscillator comparison method.

NOTE Both 8664A signal generators contribute to the phase noise level. The device under test contributes only half of the measured phase noise. During the test procedure, 3 dB will be subtracted from the measured values to compensate for the phase noise contribution of the reference generator.

Equipment

The performance tests described in this section assume use of the following test equipment:

Phase Noise Measurement System	HP 3048A Option 201: 3561A Dynamic Signal Analyzer 11848A Phase Noise Interface
Reference Signal Generator	Agilent 8664A Option 004/H15

NOTE Option 201 for the 3048A adds the 1.2 to 18 GHz phase detector and is required to measure the phase noise on carriers above 1.6 GHz. Measurement of carriers above 1.6 GHz can also be made using a down converter. Refer to the documentation for the 3048A, E5501B, E5502B, E5503B or E5504B.

Procedure

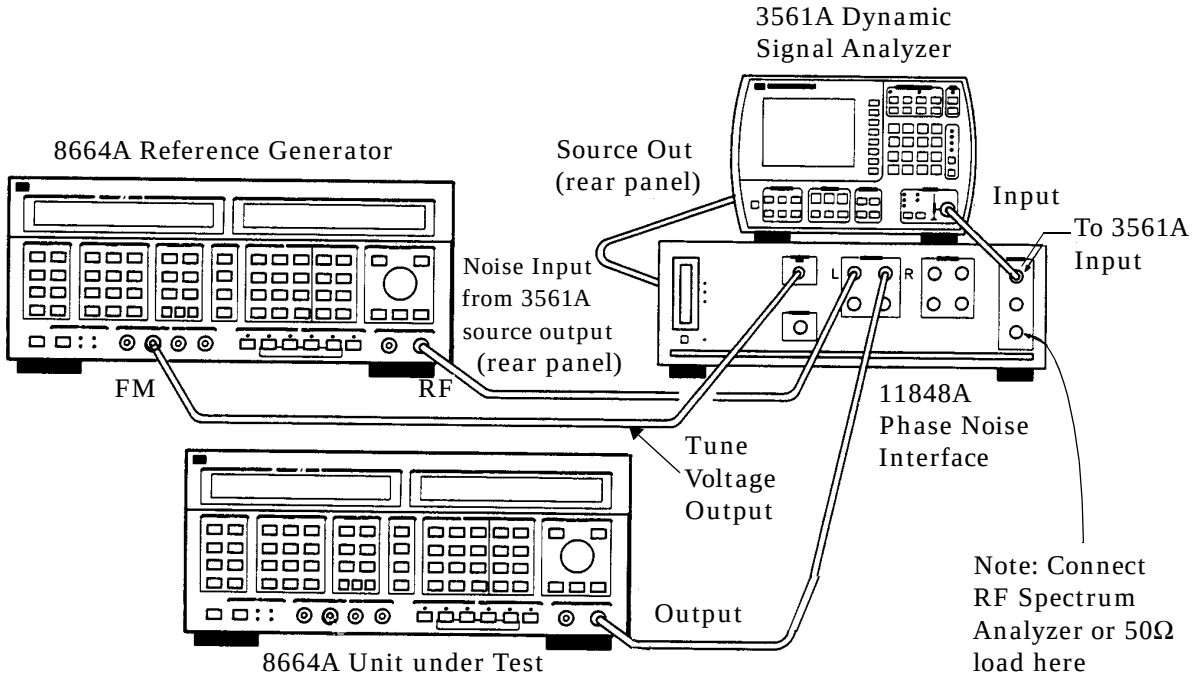
NOTE The following key conventions are used throughout this document.

- [**HARDKEYS**] are labeled front panel keys.
- **SOFTKEYS** are unlabeled keys whose function is determined by the instrument state and indicated on the instrument display.

Initial Setup

Step 1. Connect the equipment as shown in Figure 1. Refer to the user's guide for the 3048A or E55xx for additional standard system connections.

Figure 1 SSB Phase Noise Test Setup



Step 2. Set the 8664A reference signal generator's carrier to 187 MHz at 6 dBm. Select mode 2.

Step 3. Set the signal generator under test to each test frequency shown in Table 3 on page 17 as follows:

a. Press **[INSTR PRESET]**.

b. Key in **[FREQ]** > *value from table*> **[MHz]**.

c. Key in **[AMPTD]** > **[13]** > **[dBm]**. For frequencies greater than 1.2 GHz (1200 MHz) use 9 dBm instead of 13 dBm.

d. Key in **[FM]** > **[10]** > **[kHz]**.

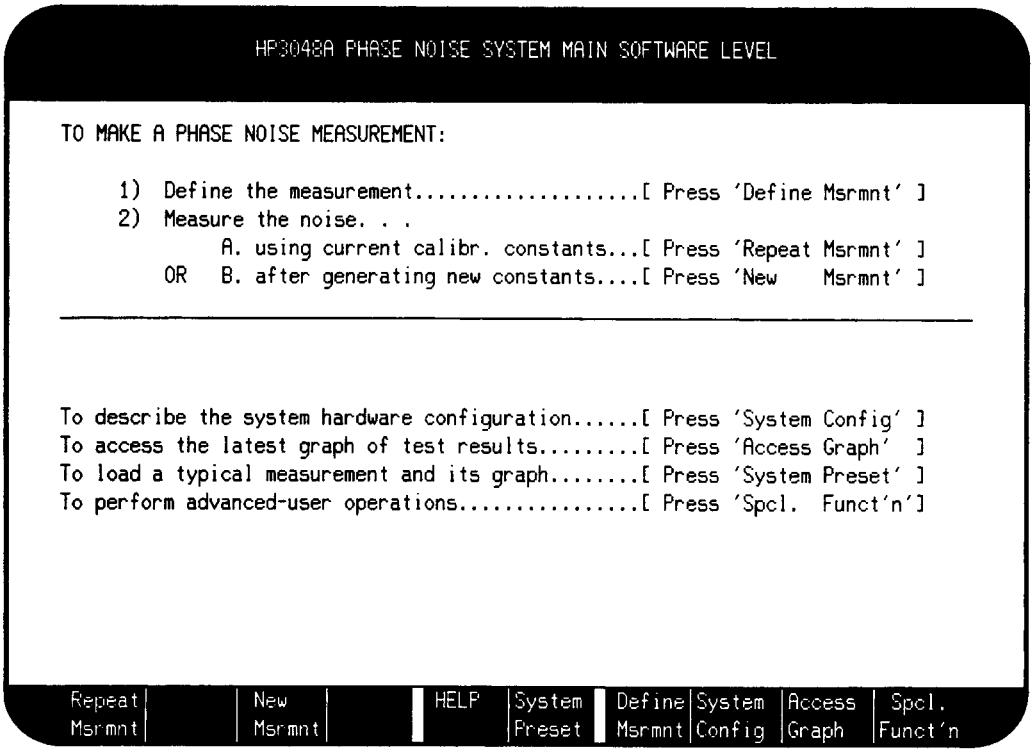
e. Press **[INT]** in the MODULATION key group to turn off the internal modulation source.

f. Press **[EXT DC]** in the MODULATION key group to enable DC FM.

g. Press **[MODE 2]** in the MODE SELECT key group.

Step 4. Set the 3048A to the Main Software Level menu. Refer to Figure 2.

Figure 2 Main Software Level Menu

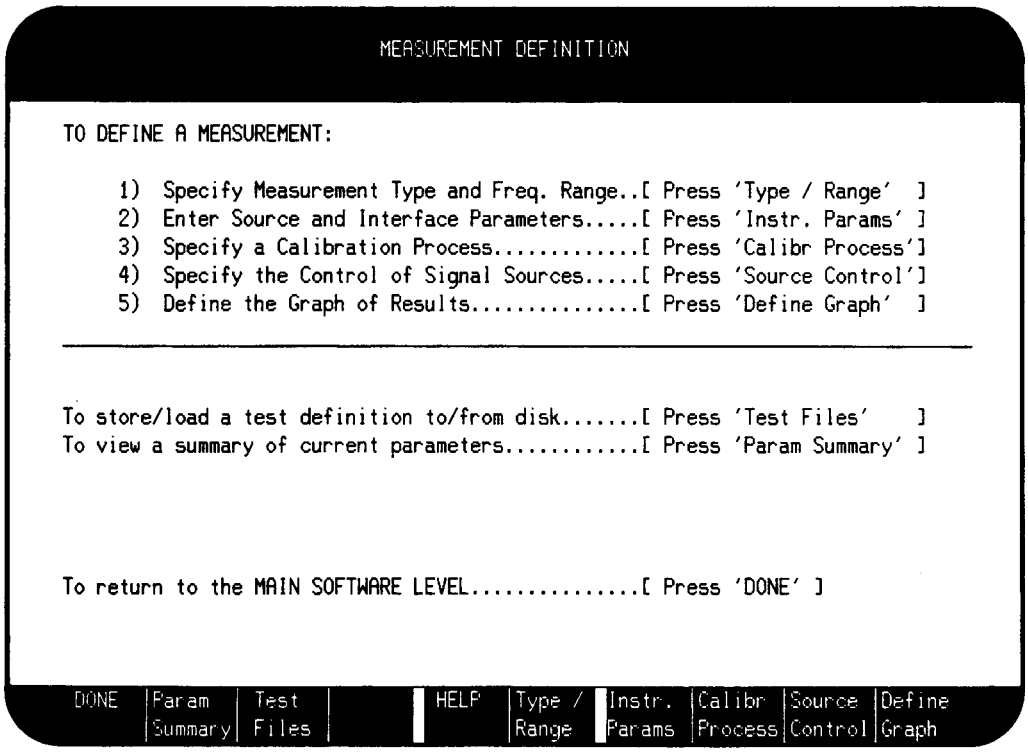


Example Measurement

NOTE The following steps are the procedure for making a single-sideband phase noise measurement on a 187 MHz carrier in Mode 2. For other carrier frequencies, the procedure is similar. If these measurements are to be repeated in the future for this or other 8664A generators, it will be advantageous to record or save the test file entries for each carrier frequency; these test files can be recalled as needed later, instead of having to re-enter them each time.

Step 1. On the 3048A press the **Define Msrmnt** softkey to obtain the Measurement Definition menu. Refer to Figure 3.

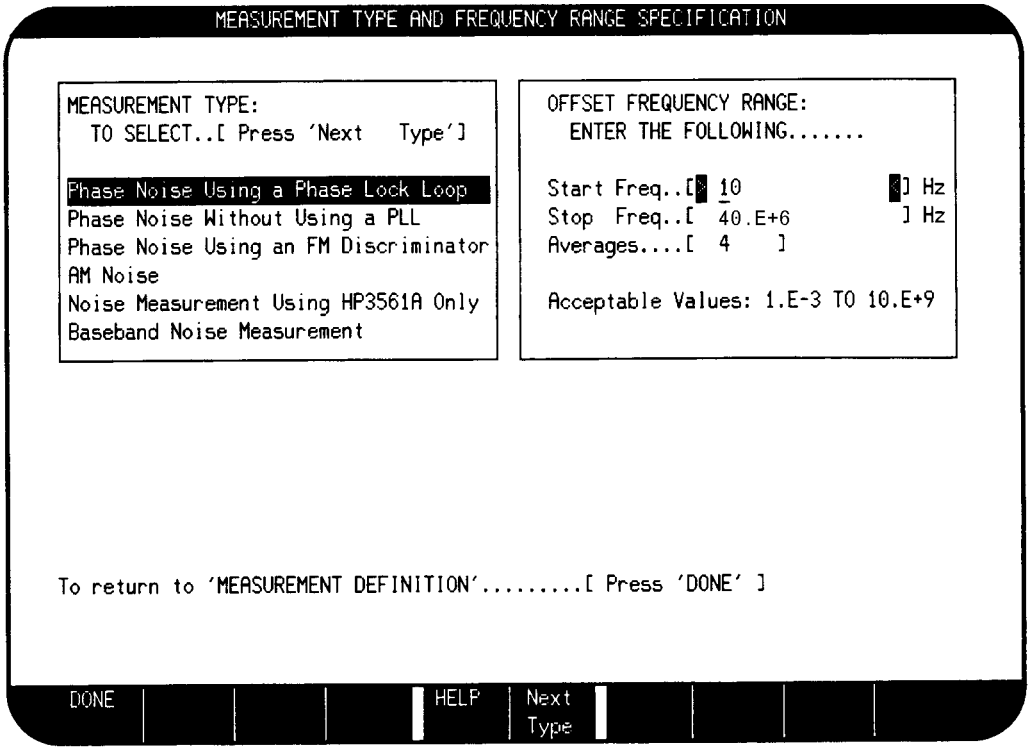
Figure 3 Measurement Definition Menu



Step 2. On the 3048A press the **Type/Range** softkey to obtain the Measurement Type and Frequency Range Specification Menu. Set the measurement type and offset frequency range as shown in Figure 4. When done, press the **DONE** softkey.

NOTE The start frequency is shown as 10 Hz. This low offset will slow the measurement time but give more confidence in the general phase noise performance of the Signal Generator. To measure the phase noise to its specification only, change the start frequency to 1 kHz.

Figure 4 Measurement Type and Frequency Range Specification Menu



Step 3. On the 3048A press the **Instr. Params** softkey to obtain the Source and Interface Parameter Entry menu shown in Figure 5. Set the parameters and phase detector as shown in Table 2 on page 11. When done, press the **DONE** softkey.

Figure 5 Source and Interface Parameter Entry Menu

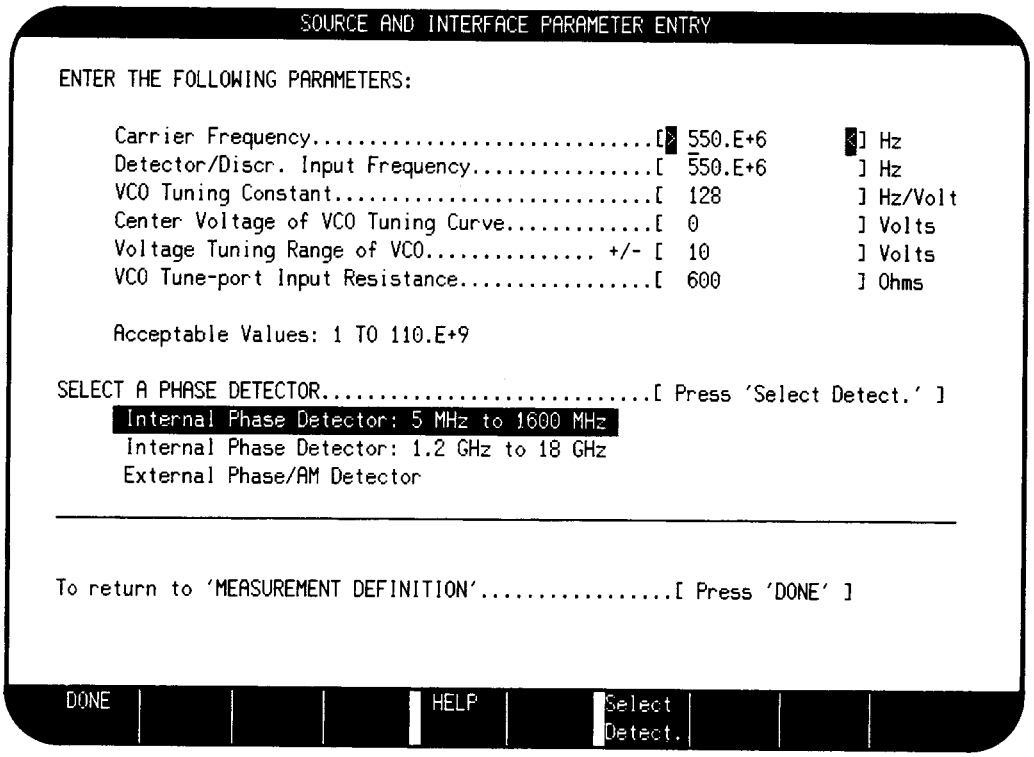
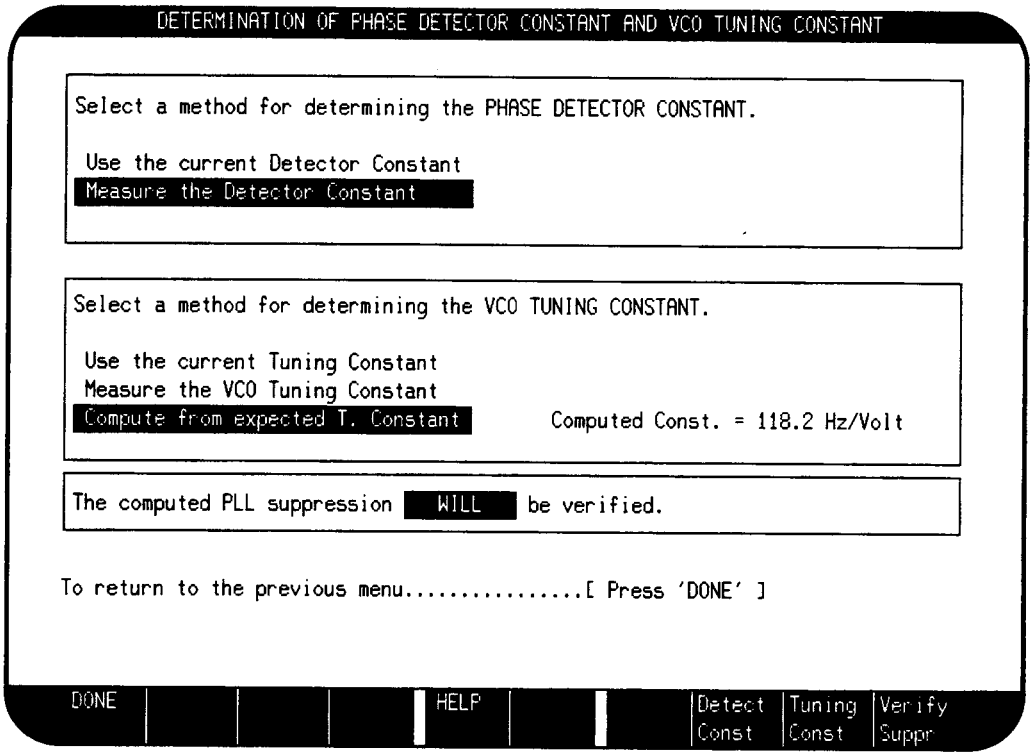


Table 2 Source and Interface Parameter Values

	187 MHz	256 MHz	514 MHz	1029 MHz	2059 MHz	2999 MHz
Carrier Frequency	187.E+6	256.E+6	514.E+6	1.029E+9	2.059E+9	2.999E+9
Detector/Discr. Input Frequency	187.E+6	256.E+6	514.E+6	1.029E+9	2.059E+9	2.999E+9
VCO Tuning Constant	250	100	100	200	250	500
Center Voltage of VCO Tuning Curve	0					
Voltage Tuning Range of VCO	10					
VCO Tune-port Input Resistance	600					
Phase Detector	Internal Phase Detector 5 MHz to 1600 MHz				1.2 to 18 GHz	

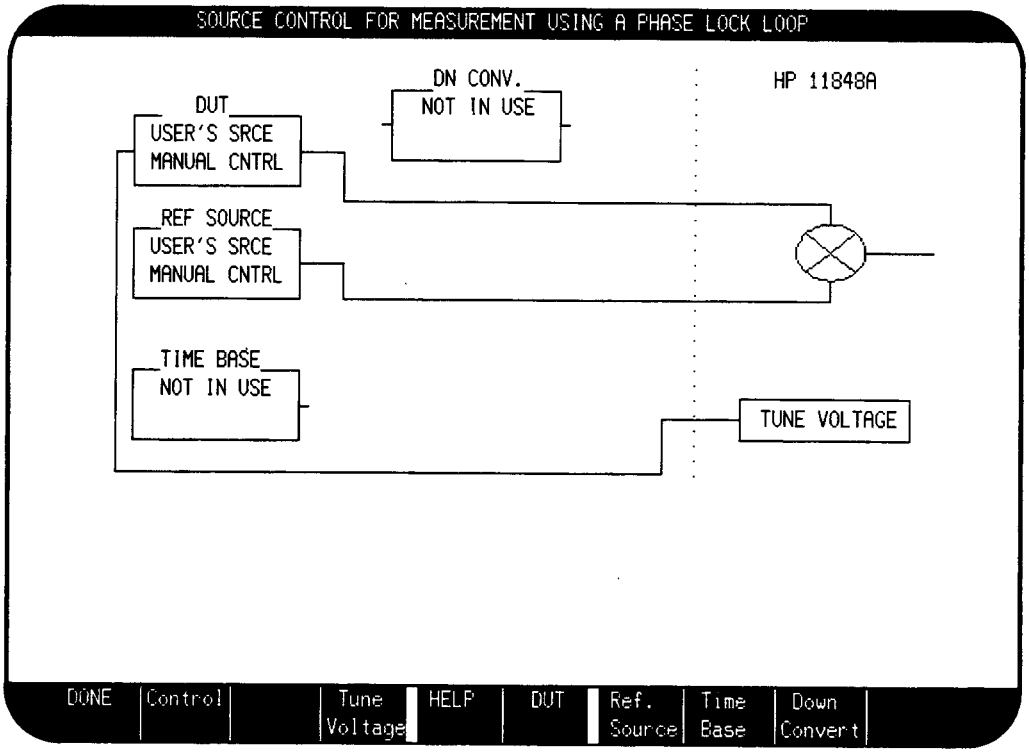
Step 4. On the 3048A press the **Calibr Process** softkey to obtain the Determination of Phase Detector Constant and VCO Tuning Constant menu. Set the method of determining the phase detector and VCO tuning constants and the verification of the phase lock loop suppression as shown in Figure 6. (The displayed Computed Constant may be quite different from the one in Figure 6. It will be updated later.) When done, press the **DONE** softkey.

Figure 6 Determination of Phase Detector and VCO Tuning Constant Menu



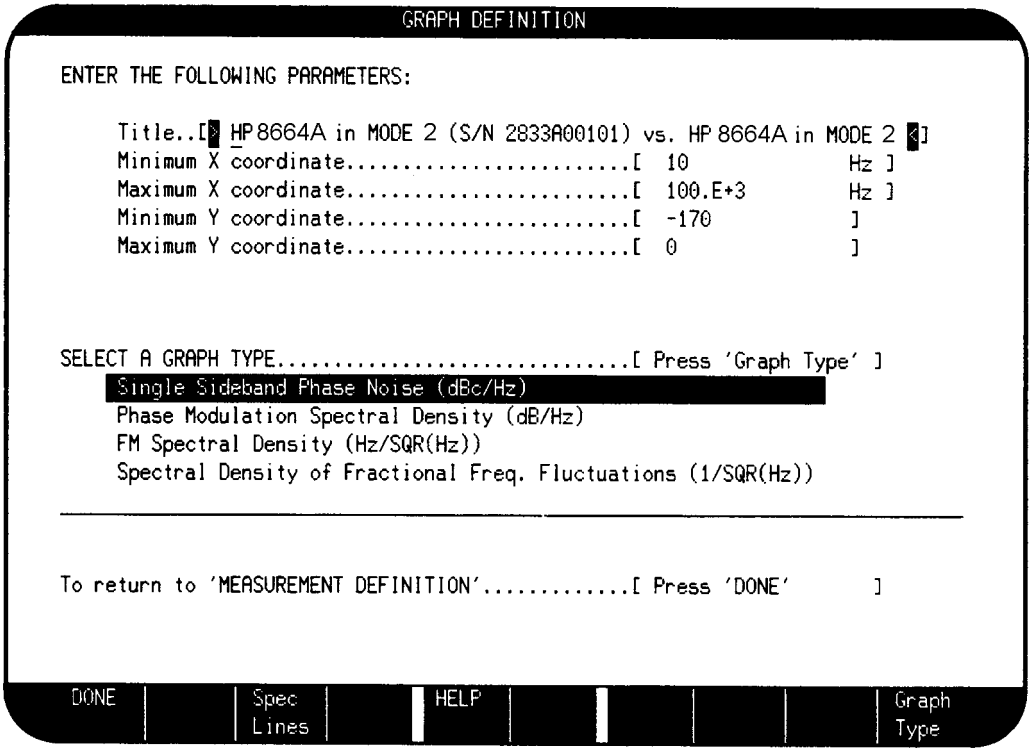
Step 5. On the 3048A press the **Source Control** softkey to obtain the source Control for Measurement Using a Phase Lock Loop menu. Set the various devices in the system as shown in Figure 7. When done, press the **DONE** softkey.

Figure 7 Source Control for Measurement Using a Phase Lock Loop Menu



Step 6. On the 3048A press the **Define Graph** softkey to obtain the Graph Definition menu. Set the graph parameters and graph type as shown in Figure 8. Change the title as appropriate for your particular setup. (You may wish to include the model and serial number of the device under test. For example “The Agilent 8664A with serial number 2833A00101.” Note that date, time and carrier frequency information will automatically appear on the measurement result graph.) When done, press the **DONE** softkey. (For measuring offsets only down to 1 kHz, set the minimum x coordinate to 1 kHz. See the note following Step 2 on page 9.

Figure 8 Graph Definition Menu



Step 7. On the 3048A press the **DONE** softkey again to obtain the Main Software Level menu.

Step 8. On the 3048A press the **New Msrmnt** softkey then press the **Yes, Proceed** softkey.

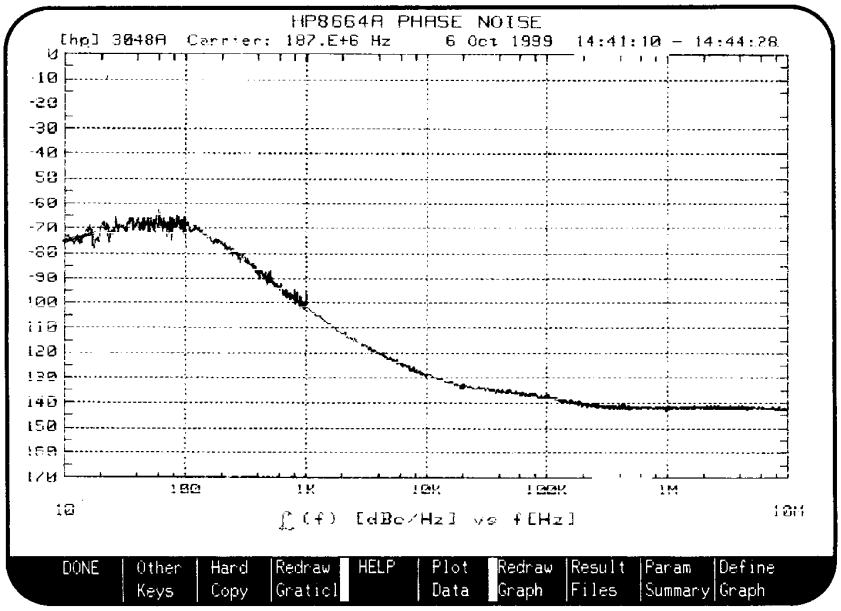
Step 9. When the connect diagram appears on the display, verify that the instrument connections are properly made (refer to Figure 1 on page 6) then press the **Proceed** softkey. The phase noise measurement should proceed without error and the phase noise plot should appear as in Figure 9 on page 16. Ignoring spurious signals, the phase noise should meet the specifications defined in Table 1 on page 3.

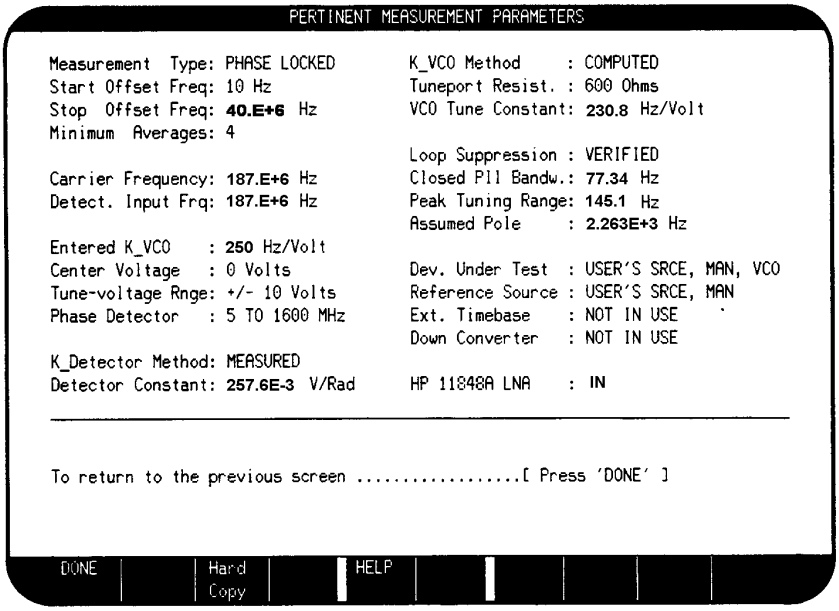
NOTE

Figure 9 also shows a listing of measurement parameters. This listing with the graph itself can be printed by holding down the keyboard **SHIFT** key and pressing the **Hard Copy** softkey.

If you intend to make measurements of this same type frequently, the setup information (carrier frequency, tuning constant, source control, etc.) can easily be stored as test files, then loaded as needed. Refer to the 3048A Reference Manual (part number 03048-90002) for information on storing and loading test files.

Figure 9 **Phase Noise Plot and Pertinent Measurement Parameters**





Further Measurements (Below 1600 MHz)

Step 1. To measure single-sideband phase noise for other carrier frequencies and modes of operation, set the signal generators and phase noise measurement system as outlined in Table 3. The phase noise should be within the limits indicated in the table.

Step 2. Call up the Source and Interface Parameter Entry menu (shown in Figure 5 on page 10) and select the phase detector labeled `Internal Phase Detector: 1.2 GHz to 18 GHz`.

Step 3. Proceed with the measurements using the technique of step 1. The phase noise should be within the limits indicated in Table 3.

Table 3 Performance Test Record

Carrier Frequency (MHz)[a]	Signal Generator Settings (Mode 2)	3048A VCO Tuning (Hz/V)
	FM Peak Dev. (kHz)	
187	10	250
256	10	250
514	10	250
1029	10	250
2059[b]	10	250
2999[b]	10	250

a. Make carrier frequency changes to the following:

The signal generator under test.
The reference signal generator.
The 3048A Source and Interface Parameter Entry menu (for carrier frequency and Detector/Disc. Input Frequency).
The Graph Definition menu (in the Title).

b. For Carrier Frequencies greater than 1.2 GHz (1200 MHz) set the power level on the signal generator under test to 9 dBm.

Step 4. Print a plot of the test results for each carrier frequency listed in Table 3. Subtract 3 dB from the measured values.

Step 5. Verify that performance meets the specifications in Table 1 on page 3 after making allowance for measurement uncertainty.

Service

The Agilent 8664A Option H15 can be serviced only at the Agilent Technologies factory. If any performance test produces a failing result, contact your nearest Agilent sales or service office. See “Agilent Technologies Sales and Service Offices” on page 19 for the location nearest to you.

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