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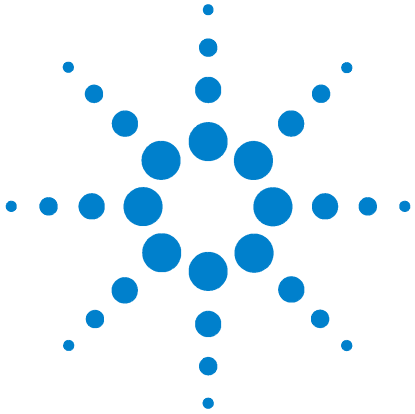
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Agilent E8663B
Option HAR

User's and Service Guide



Agilent Technologies

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CAUTION

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WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Safety Notes

The following safety notes are used throughout this document. Familiarize yourself with each of these notes and its meaning before performing any of the procedures in this document.

WARNING	**Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

CAUTION	Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

Definitions

- *Specifications* describe the performance of parameters covered by the product warranty (temperature –0 to 55 °C, unless otherwise noted.)
- *Typical* describes additional product performance information that is not covered by the product warranty. It is performance beyond specification that 80% of the units exhibit with a 95% confidence level over the temperature range 20 to 30 °C. Typical performance does not include measurement uncertainty.
- *Nominal* values indicate expected performance or describe product performance that is useful in the application of the product, but is not covered by the product warranty.
- *Characteristic Performance* describes performance parameter that the product is expected to meet before it leaves the factory, but is not verified in the field and is not covered by the product warranty. A characteristic includes the same guard bands as a specification.

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E8663B Option HAR

The following sections describe operations common to all E8663B Option HAR:

- "Description" on page 2
- "Verifying the Shipment" on page 2
- "Specifications" on page 3
- "Typical Performance" on page 4
- "Operation" on page 8
- "Service" on page 9
- "Safety and Regulatory Information" on page 23
- "Contacting Agilent Sales and Service Offices" on page 28

Description

The E8663B Option HAR is a frequency divider designed to provide improved phase noise in the 0.98 MHz to 500 MHz frequency range of the E8663B Signal Generator.

The Option HAR uses frequency division as a replacement for heterodyne mixing to create frequencies in the 0.98 to 500 MHZ range. This provides improved phase noise in this mode. The mode will be referred to as “Divider Mode” throughout this document.

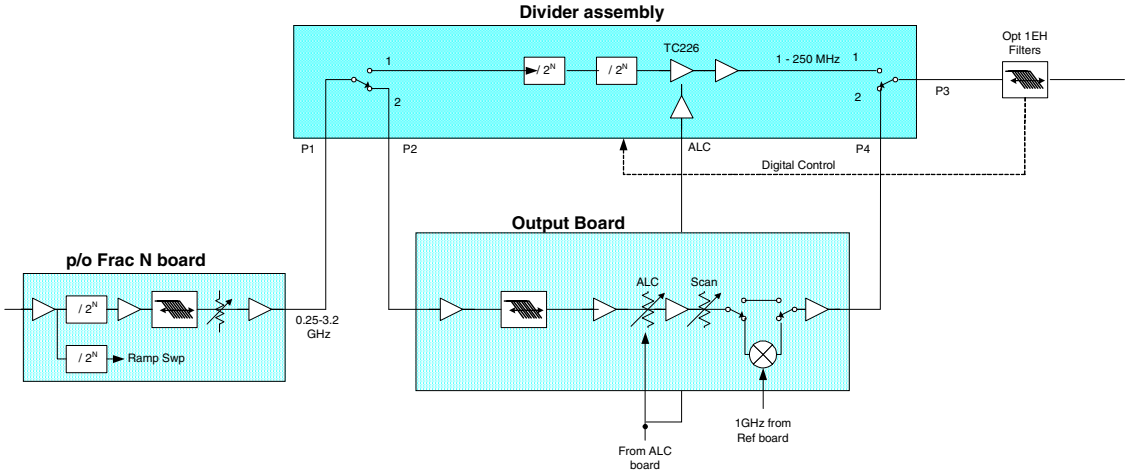
Verifying the Shipment

After the unit has been unpacked, keep the original packaging materials so it can be used if you need to transport the instrument.

Inspect the instrument and all accessories for any signs of damage that may have occurred during shipment. If your test set or any accessories appear to be damaged or missing, refer to “Contacting Agilent Sales and Service Offices” on page 28.

Block Diagram

Figure 1 Block Diagram



Specifications

The E8663B Option HAR provides improved absolute phase noise in the 0.98 to 500 MHz frequency range. To achieve these improvements the Divider Mode must be turned On. See “Operation” on page 8.

The E8663B Option HAR impacts standard instrument performance for frequencies ≤ 3.2 GHz. Standard operation for frequencies above 3.2 GHz has not been affected. If Divider Mode is left on for frequencies outside of 0.98 to 500 MHz the “ALC Bandwidth” will be limited to 100 Hz.

Phase Noise

Divider Mode On

Table 1 E8663B Option HAR Specifications (25 °C)

Frequency	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz
10 MHz	–93	–120	–142	–152	–158	–158
100 MHz	–73	–100	–122	–140	–145	–145

Divider Mode Off

Standard performance per the E8663B data sheet.

Maximum Leveled Output Power

Divider Mode On

Typical performance see Table 4 on page 5.

Divider Mode Off

Table 2 Maximum Power Specification Impacts

Frequency	Delta
250 kHz to 3.2 GHz	–6 dB from Standard specification
> 3.2 GHz	no change from standard specifications

Typical Performance

Phase Noise

Table 3 Absolute Single Sideband Phase Noise (dBc/Hz) Frequency Offset from Carrier (Typical)[a]

Carrier Frequency (MHz)	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz
1 MHz	–120	–142	–155	–160	–160	–160
10 MHz	–106	–132	–148	–160	–160	–160
100 MHz	–86	–112	–129	–144	–149	–149
160 MHz	–81	–107	–122	–142	–145	–145
250 MHz	–76	–104	–121	–138	–142	–142
500 MHz	–70	–98	–115	–132	–136	–136

a. Divider Mode On.

Amplitude

Table 4 Maximum Leveled Output Power dBm[a] (Typical)[b]

Carrier Frequency	Lowband Filter	
	Off	On[c]
1 MHz	19	19
10 MHz	19	13
100 MHz	17	11
160 MHz	17	11
250 MHz	17	10
500 MHz	16	10

a. Amplitude accuracy is not specified in diver mode with the filters off, only with the filter On.
b. Divider Mode On.
c. For improved amplitude accuracy the lowband filters must be on.

Table 5 Harmonic Level dBc[a] (Typical)[b]

Carrier Frequency	Lowband Filter	
	Off	On
< 10 MHz	– 10	– 10
10 to 500 MHz	– 10	– 55

a. Divider Mode On.
b. Harmonic levels in divider mode are high (the output is a square wave)

Modulation

Frequency Modulation

Table 6 Maximum FM Modulation Deviation (Typical)[a]

Carrier Frequency	kHz
> 0.98 MHz to 1.953 MHz	3.906
> 1.953 MHz to 3.906 MHz	7.8125
> 3.906 MHz to 7.813 MHz	15.625
> 7.813 MHz to 15.63 MHz	31.25
> 15.63 MHz to 31.25 MHz	62.5
> 31.25 MHz to 62.5 MHz	125
> 62.5 MHz to 125 MHz	250
> 125 MHz to 250 MHz	500
> 250 MHz to 500 MHz	1000

a.Divider Mode On.

Phase Modulation

Table 7 Maximum Phase Modulation (Typical)[a]

Carrier Frequency	Normal Bandwidth Mode (radians)	High Bandwidth Mode (radians)
> 0.98 MHz to 1.953 MHz	0.0039063	0.0039063
> 1.953 MHz to 3.906 MHz	0.0078125	0.0078125
> 3.906 MHz to 7.813 MHz	0.015.625	0.015.625
> 7.813 MHz to 15.63 MHz	0.03125	0.03125
> 15.63 MHz to 31.25 MHz	0.0625	0.0625
> 31.25 MHz to 62.5 MHz	125	0.125
> 62.5 MHz to 125 MHz	250	0.250
> 125 MHz to 250 MHz	500	0.500
> 250 MHz to 500 MHz	10	1

a.Divider Mode On.

Amplitude Modulation

AM modulation is not recommended in divider mode. In divider mode, ALC Bandwidth is limited to 100 Hz and dynamic range is restricted below 500 MHz.

Pulse Modulation

Divider Mode On:

Standard Pulse (UNU) can not be used in divider mode. Option UNW can be used.

Divider Mode Off:
Pulse On/Off ratio is degraded by 10 dB from 2.0 to 3.2 GHz in Standard Pulse (UNU). Option UNU is not affected.

ALC Performance

The ALC bandwidth is limited to 100 Hz in divider mode. Operation with ALC off is not recommended.

Lowband Filters

In addition to the phase noise improvements added by the divider circuitry, this option also includes circuitry to improve the lowband harmonics in the frequency range of 10 MHz to 2 GHz. The typical harmonic performance is ≤ –55 dBc. This hardware is located in the option list of the instrument as Option 1EH.

To access the filters, select **[Frequency] > More (2 of 2) > Low Pass Filter below 2 GHz** toggle **On or Off**.

SCPI Commands

This command enables or disables the lowband filter located in the RF path. Use this filter to reduce harmonics below 2 GHz.

[:SOURce]: LBFilter ON|OFF|1|0

[:SOURce]: LBFilter?

Operation

E8663B Option HAR requires firmware revision ≥ C.04.93.

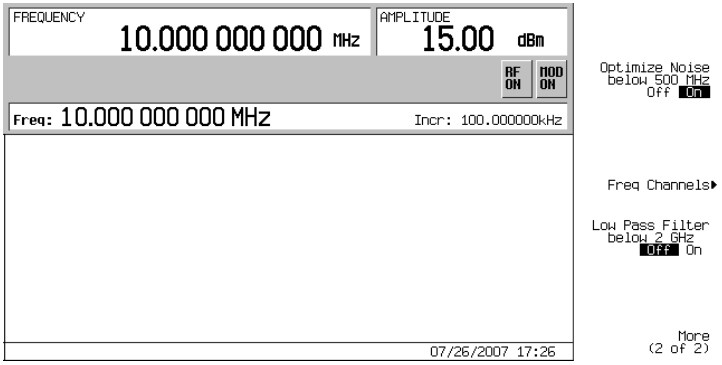
To turn on the frequency divider circuitry (Divider Mode) select **[Frequency]** > **MORE (2 of 2)** > **Optimize noise below 500 MHz** > toggle **On** or **Off**.
The normal preset state is Off.

The SCPI command is as follows:

[:SOURce]: LFDivider ON|OFF|1|0

[:SOURce]: LFDivider?

Figure 2 Frequency Divider Circuitry



E8663B Option HAR Using the E5500 Phase Noise Measurement Subsystem

The E5500 software currently does not recognize Option HAR. To improve reference phase noise when using your E8663B Option HAR with the E5500, manually turn on the Divider Mode (refer to Operation), when the **Agilent E5500 Instrument Connections** window appears.

Service

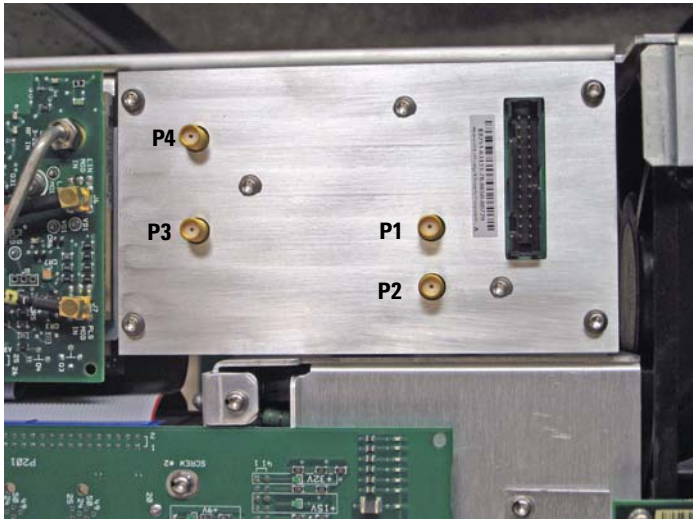
Troubleshooting

1. Before troubleshooting E8663B Option HAR, verify that the standard instrument is operating properly with the Divider Mode Off. If not, troubleshoot in Standard Mode.
2. For the instrument to operate properly with the Option HAR circuitry installed (Divider Mode On or Off), licenses are needed for the following options:
   - Option HAR
   - Option 1EH
3. If the Phase Noise in Divider Mode is does not meet specification (refer to "Performance Test" on page 12), replace the Divider Assembly.
4. Measure the losses through Option HAR in Standard Mode (Divider Mode Off).

Table 8 Divider Assembly

Assembly	Path	Frequency	Loss
Divider Assembly E8251-60433	P1 to P2	250 MHz to 3.2 GHz	≤ 3 dB
Divider Assembly E8251-60433	P4 to P3	250 MHz to 3.2 GHz	≤ 3 dB

Figure 3 Divider Assembly with Connectors Labeled



5. If there is excessive loss in one path, replace the Divider Assembly.
6. If there is excessive loss in both paths, remove the ribbon cable from the Divider Assembly and measure the following voltages at the end of the ribbon cable.

Pin	Voltage
23	> 14.5
24	≤ –4.5
25	> 8
26	≤ –14.5

7. If any of the voltages are wrong, measure the same voltages on the Lowband Filter Assembly (J6).
   a. If the voltage at pin 25 is incorrect, measure the voltage on the motherboard at P142, pin 7.
      1. If the voltage at P142, pin 7 is < 8 volts, replace the Motherboard.
      2. If the Motherboard is working properly, replace the Lowband Filter Assembly.
   b. If the voltage on the Lowband Filter Assembly (J6) pin 23, 24 or 26 is incorrect.
      1. Replace the Lowband Filter Assembly.
      2. If the Lowband Filter Assembly is working properly, replace the ribbon cable from the Lowband Filter Assembly to the Divider Assembly.
8. Set the instrument frequency to 1 MHz, Output power to maximum and RF On.
9. With all other cables connected, make the following measurements on the Divider Assembly with a spectrum analyzer.

	P2		P3	
Divider Mode	On	Off	On	Off
Frequency	256 MHz	999 MHz	1 MHz	1 MHz
Amplitude	–35 dBm	+9 dBm	+12 dBm	+11 dBm

10. If the frequencies at connector P2 are incorrect.
    a. Troubleshoot the standard synthesizer system.
11. If the amplitude at connector P2 is incorrect.
    a. Replace the Divider Assembly.
12. If the frequencies or amplitude at connector P3 are incorrect.
    a. Replace the Divider Assembly.

Replaceable Parts

Table 9 Replaceable Parts

Description	Agilent Part Number
Option 1EH Board	E8251-60595
Div Board	E8251-60433
Ribbon Cable	E8251-60594
Cable (Frac-N to Div)	E8251-20394
Cable (Div to Lowband filter)	E8251-20395
Cable (Lowband Out to Div)	E8251-20396
Cable (Div to Lowband filter)	E8251-20397

- If the mother board is changed, it must be replaced with an E8251-60441 or later.
- If the modulation filter (5087-7061) is changed, reuse the thermal pad.
- If the synthesizer assembly (E8251-60328) is replaced, refer to "Appendix" on page 22 to modify the self test limits.

Performance Test

Table 10 Performance Test Equipment

Instrument	Critical Specifications (for this test)	Recommended Model
Phase Noise System	Sensitivity	E5504B Option 001

Setting up the E5500 Software

Step 1. If necessary, install the E5500 revision A.03.03 (or later) software.

Step 2. Open the E5500 Software User Interface.

Step 3. Select **System** > **Asset Manager**.

Step 4. Verify that the Agilent E8663B is listed under Source. If not, double-click Source and click **Next**.

Step 5. In the list of **Sources**, select **Agilent E8663B** and click **Next**.

Step 6. In the **Interface** drop-down menu, select **GPIB**.

Step 7. In the **Address** field, enter the GPIB address of the E8663B. Example, 19.

Step 8. Verify that the **Library** field identifies **Agilent Technologies VISA**.

Step 9. Click **Next** > **Finish**.

Step 10. In the list of **Sources**, select **Agilent E8663B**.

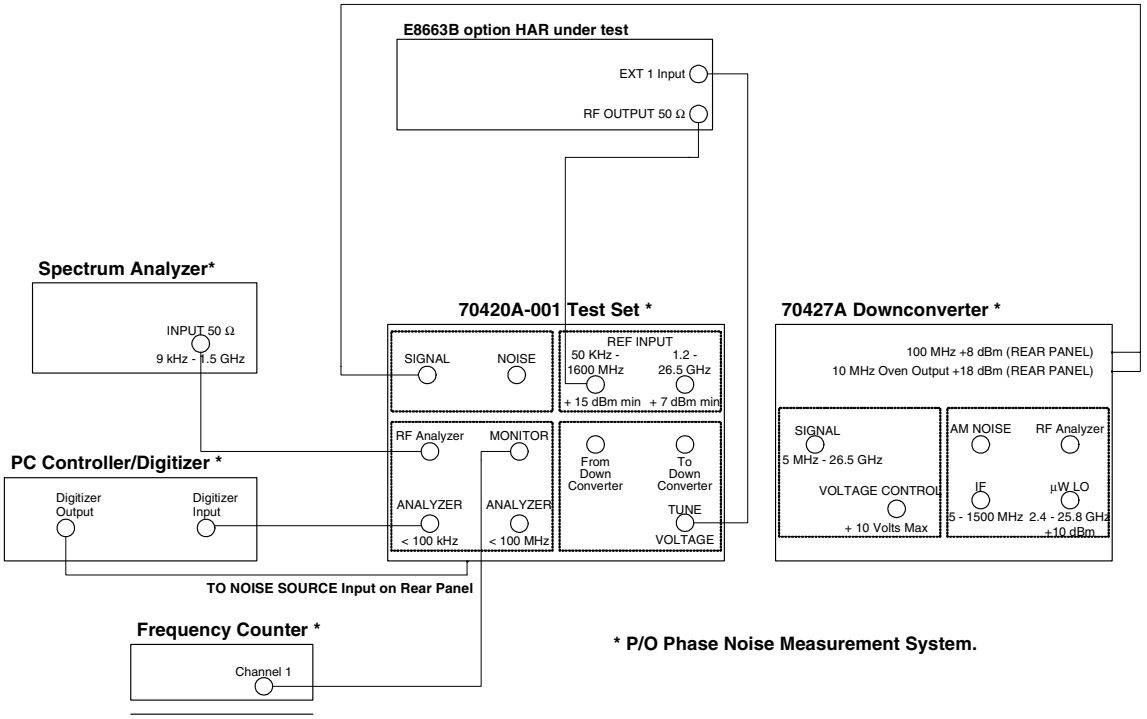
Step 11. Select the icon with the green check-mark. Verify that the connection to the selected asset has been completed. Press **OK**.

Step 12. Verify that the **Library** field identifies **Agilent Technologies VISA**.

Step 13. Close the **Asset Manager**.

Step 14. Verify that the Phase Noise System is connected as shown in Figure 4. The connections from the 70427A should not be made at this time. The user will be instructed to make the appropriate connections as part of the following Performance Test procedure.

Figure 4 Test Setup Block Diagram



10 MHz Phase Noise Test Limits

Table 11 Phase Noise Test Limits

10 MHz	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz
Noise Spec	–93	–120	–142	–152	–158	–158

10 MHz Test Procedure

Using the E5504B Phase Noise Measurement System.

Step 1. Select **Define** > **Limit Lines**.

Step 2. Enter the Noise Spec data (Table 11) in the **Upper Noise Limit** tab.

Step 3. Select **Define** > **Measurement**. Refer to Table 12.

Table 12 10 MHz Phase Noise System Setup

Parameter	Setting
Type and Range Tab:	
Measurement Type	Absolute Phase Noise (using a phase locked loop)
Start Offset Frequency	1 Hz
Stop Offset Frequency	2 MHz (2E+6)
FFT Averages	10
FFT Quality	High Resolution
Swept Quality	High Resolution
Source Tab:	
Carrier Source Connected	Test Set
Carrier Source Frequency	10 MHz (10E+6)
Carrier Source Power	+15 dBm
Detector Input Frequency	No entry needed
Reference Source Power	16 dBm
VCO Tune Constant	0.1 ppm x Carrier 0.1 ppm x 10 MHz = 1 Hz/Volt
VCO Tune Range	±5 Volts
VCO Input Resistance	600 Ohms
Cal Tab:	
Measure Phase Detector Constant	Measure Phase Detector Constant
Calculate VCO Tune Constant	Measure VCO Tune Constant
Verify calculated phase lock loop suppression	Check
If Limit is exceeded	Use Theoretical Value
Block Diagram Tab:	
Carrier Source	Manual
Downconverter	None
Reference Source	Agilent E8663B
Phase Detector Mode	Automatic Detector Selection
Test Set Tune Voltage Destination	Reference Source
VCO Tune Mode	DC FM
Test Set Tab:	
Input Attenuation	0 dB
LNA Low Pass Filter	Auto

Table 12 10 MHz Phase Noise System Setup

Parameter	Setting
LNA Gain	Auto Gain
PLL Integrator Attenuation	0 dB
Downconverter Tab:	
Input Attenuation	Auto
IF Gain	Auto
Microwave/Millimeter Band	Microwave (0 to 26.5 GHz)
Reference Chain Reference	10 MHz
Graph Tab:	
Title	10 MHz Agilent E8663B SNxxxxxxxx
Graph Type	Single-sideband Phase Noise (dBc/Hz)
X Scale Minimum	1 Hz
X Scale Maximum	100E+6
Y Scale Maximum	0
Y Scale Minimum	-170
Normalize Trace Data to	1 Hz Bandwidth

Making the 10 MHz Measurement

Step 1. In the **Measure** drop-down menu verify that the **Pause at Connect Diagram** is selected. If not, select it.

Step 2. In the **Measure** drop-down menu select **New Measurement**.

Step 3. Select **Yes** in the **Do you want to perform a new Calibration and Measurement?** dialog box. The **Agilent E5500 Instrument Connections** window will appear.

Step 4. On the 70427A rear panel, remove the jumper from the 105 MHz Oven Out to 10 MHz In. Refer to Figure 4 on page 13.

Step 5. Connect the 10 MHz Oven Out on the 70427A rear panel to the Signal Input on the 70420A.

Step 6. Turn On the Divider Mode. Refer to “Operation” on page 8.

Step 7. Select **Continue** and allow Phase Noise Measurement to complete.

Step 8. Compare the estimated mean value of the trace with the noise specification line (lower line). If the estimated mean value of the trace falls on or below the specification line, the LNSG is regarded as having met the noise specification.

Step 9. Print the E5500 Phase Noise Plot.

Step 10. Connect the jumper that was removed in Step 4.

100 MHz Phase Noise Test Limits

Table 13 Phase Noise Test Limits

100 MHz	1 Hz	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz
Noise Spec	–73	–100	–122	–140	–145	–145

100 MHz Test Procedure

Using the E5504B Phase Noise Measurement System.

Step 1. Select **Define** > **Limit Lines**.

Step 2. Enter the Noise Spec data (Table 13) under the **Upper Noise Limit** tab.

Step 3. Select **Define** > **Measurement**. Refer to Table 14.

Table 14 100 MHz Phase Noise System Setup

Parameter	Setting[a]
Type and Range Tab:	
Measurement Type	Absolute Phase Noise (using a phase locked loop)
Start Offset Frequency	1 Hz
Stop Offset Frequency	**20 MHz (20E+6)**
FFT Averages	10
FFT Quality	High Resolution
Swept Quality	High Resolution
Source Tab:	
Carrier Source Connected	Test Set
Carrier Source Frequency	**100 MHz (100E+6)**
Carrier Source Power	+15 dBm
Detector Input Frequency	No entry needed
Reference Source Power	16 dBm
VCO Tune Constant	0.1 ppm x Carrier 0.1 ppm x **100 MHz = 10 Hz/Volt**
VCO Tune Range	±5 Volts
VCO Input Resistance	600 Ohms
Cal Tab:	
Measure Phase Detector Constant	Measure Phase Detector Constant
Calculate VCO Tune Constant	Measure VCO Tune Constant
Verify calculated phase lock loop suppression	Check
If Limit is exceeded	Use Theoretical Value
Block Diagram Tab:	
Carrier Source	Manual
Downconverter	None
Reference Source	Agilent E8663B
Phase Detector Mode	Automatic Detector Selection
Test Set Tune Voltage Destination	Reference Source
VCO Tune Mode	DC FM
Test Set Tab:	
Input Attenuation	0 dB

Table 14 100 MHz Phase Noise System Setup

Parameter	Setting[a]
LNA Low Pass Filter	Auto
LNA Gain	Auto Gain
PLL Integrator Attenuation	0 dB
Downconverter Tab:	
Input Attenuation	Auto
IF Gain	Auto
Microwave/Millimeter Band	Microwave (0 to 26.5 GHz)
Reference Chain Reference	10 MHz
Graph Tab:	
Title	**100 MHz** Agilent E8663B SNxxxxxxxx
Graph Type	Single-sideband Phase Noise (dBc/Hz)
X Scale Minimum	1 Hz
X Scale Maximum	100E+6
Y Scale Maximum	0
Y Scale Minimum	–170
Normalize Trace Data to	1 Hz Bandwidth

a.Delta settings are indicated with a bold font.

Making the 100 MHz Measurement

Step 1. In the **Measure** drop-down menu verify that the **Pause at Connect Diagram** is checked. If not, select it.

Step 2. In the **Measure** drop-down menu select **New Measurement**.

Step 3. Select **Yes** in the **Do you want to perform a new Calibration and Measurement?** dialog box. The **Agilent E5500 Instrument Connections** window will appear.

Step 4. Connect the 100 MHz +8 dBm Output on the 70427A rear panel to the Signal Input on the 70420A. Refer to Figure 4 on page 13.

Step 5. Turn On the Divider Mode. Refer to "Operation" on page 8.

Step 6. Select **Continue** and allow Phase Noise Measurement to complete.

Step 7. Compare the estimated mean value of the trace with the noise specification line (lower line). If the estimated mean value of the trace falls on or below the specification line, the LNSG is regarded as having met the noise specification.

Step 8. Print the E5500 Phase Noise Plot.

Appendix

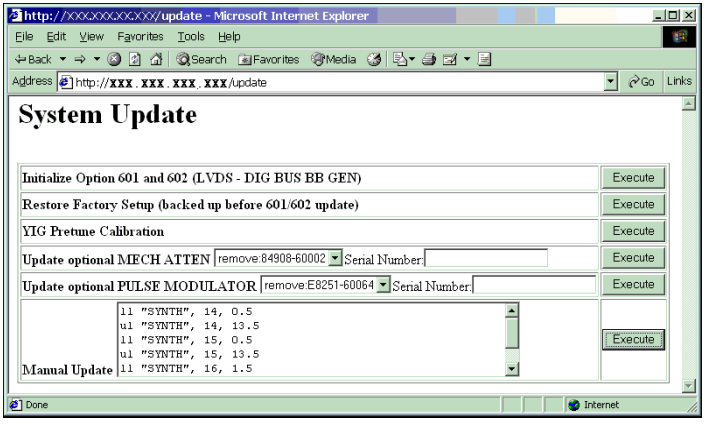
Modifying Synthesizer Self Test Limits

Procedure allows you to modify the synthesizer self test limits for test 704. (Firmware versions C.04.70 and later).

Open a browser window and type the IP address of the instrument, followed by '/update' as shown: http://xxx/xxx/xxx/xxx/update.

1. Enter the following text in the "Manual Update" form as shown below.

```
ll "SYNTH", 14, 0.5
ul "SYNTH", 14, 13.5
ll "SYNTH", 15, 0.5
ul "SYNTH", 15, 13.5
ll "SYNTH", 16, 1.5
ul "SYNTH", 16, 13.5
ky 53004
```



2. Press **Execute** (next to the manual update form). When the update is complete "Operation Completed" will be displayed.
3. Cycle the power on the instrument.

If you need to revert to the standard self test limits, use the following sequence:

```
ll "SYNTH", 14, 1.5
ul "SYNTH", 14, 13.5
ll "SYNTH", 15, 3.0
ul "SYNTH", 15, 13.5
ll "SYNTH", 16, 2.0
ul "SYNTH", 16, 13.5
ky 51873
```

Safety and Regulatory Information

Introduction

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Before Applying Power

Verify that the product is configured to match the available main power source. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Connector Care and Cleaning

If alcohol is used to clean the connectors, the power cord to the instrument must be removed. All cleaning should take place in a well ventilated area. Allow adequate time for the fumes to disperse and moist alcohol to evaporate prior to energizing the instrument.

WARNING **To prevent electrical shock, disconnect the Agilent Technologies model product from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

Declaration of Conformity

For a copy of the manufacturer's Declaration of Conformity for this apparatus, contact your local Agilent Technologies office or sales representative. Refer to "Contacting Agilent Sales and Service Offices" on page 28.

Statement of Compliance

This instrument has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

Shipping Instructions

You must always call the Agilent Technologies Instrument Support Center to initiate service before retuning your instrument to a service office. See "Contacting Agilent Sales and Service Offices" on page 28. Always transport or ship the instrument using the original packaging if possible. If not, comparable packaging must be used. Attach a complete description of the failure symptoms.

Compliance with Canadian EMC Requirements

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB du Canada.

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung-3. GSGV Deutschland).

Acoustic Noise Emission/Geraeuschemission	
LpA<70 dB	Lpa<70 dB
Operator Position	am Arbeitsplatz
Normal Operation	normaler Betrieb
per ISO 7779	nach DIN 45635 t. 19

Warnings

WARNING **The WARNING notice denotes a hazard. It calls attention to a procedure which if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.**

Warnings applicable to this instrument are:

WARNING **To prevent electrical shock, disconnect the Agilent Technologies instrument from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be inserted only into a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING **These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**

WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**

WARNING **This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010-1: 2001.**

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**

Cautions

CAUTION The CAUTION notice denotes a hazard. It calls attention to an procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the product. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met

Cautions applicable to this instrument are:

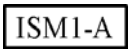
CAUTION Always use the three-prong ac power cord supplied with this instrument. Failure to ensure adequate earth grounding (by not using this cord) can cause instrument damage.

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 61010-1:2001.

CAUTION This instrument has autoranging line voltage input; be sure the supply voltage is within the specified range.

CAUTION Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 ×C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

Instrument Markings

	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.
	This symbol indicates hazardous voltages.
	The laser radiation symbol is marked on products that have a laser output.
	This symbol indicates that the instrument requires alternating current (ac) input.
	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The CSA mark is a registered trademark of the Canadian Standards Association.
	This symbol indicates the product meets the Australian Standards.
	This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).
	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).
	This symbol indicates that the power line switch is ON.
	This symbol indicates that the power line switch is in the STANDBY position.
	Safety Earth Ground. This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Contacting Agilent Sales and Service Offices

Assistance with test and measurement needs, and information on finding a local Agilent office are available on the internet at:
http://www.agilent.com/find/assist

You can also purchase accessories or documentation items on the internet at:
http://www.agilent.com/find/psg

If you do not have access to the Internet, contact your field engineer.

NOTE In any correspondence or telephone conversation, refer to the product by its model number and full serial number. With this information, the Agilent representative can determine whether your unit is still within its warranty period.

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