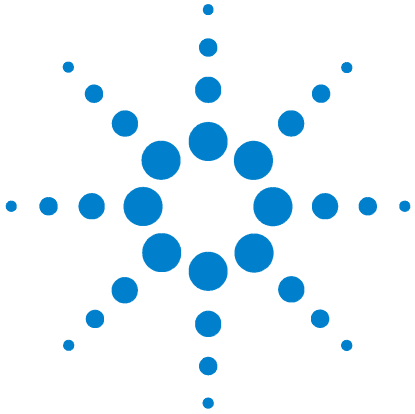


Agilent N8201A Option 226 Performance Downconverter Synthetic Instrument Module

Phase Noise Measurement Personality Guide

First edition, July 2007

Agilent Technologies

Notices

®Windows

Manual Part Number

N8201-90013

Edition

First edition, July 2007

Printed in USA

Agilent Technologies, Inc.
1400 Fountaingrove Pkwy
Santa Rosa, CA 95403

Warranty

The material contained in this document is provided "as is," and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contract or subcontract, Software is delivered and licensed as "Commercial computer software" as defined in DFAR 252.227-7014 (June 1995), or as a "commercial item" as defined in FAR 2.101(a) or as "Restricted computer software" as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Agilent Technologies' standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

Safety Notices

A **CAUTION** 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 damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

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.

1 Getting Started

Introduction 8
- Specifications 8
- Available Measurement Personality Options 8

Overview of theN8201A Option H02 Spectrum Analyzer GUI 9
- File Menu 9
- Help Menu 9
- Left Pane (Display) 10
- Center Pane (Softkeys) 10
- Right Pane (Hard Keys) 10
- Right Pane 10

Starting the Phase Noise Measurement Personality 12

2 Using the Phase Noise Personality

Tips for Using the Measurement Examples 14

Functionality 15
- Log Plot Measurements 15
- Spot Frequency Measurements 16
- Smoothing, Averaging and Filtering 16
- Signal Tracking 17

Measurement Considerations 18
- Slowly Drifting Signals 18
- System Noise Floor 18
- Display Accuracy at 10 dB Per Division 18

Cancellation and Log Plot Measurements 19
- Background Information 19
- Log Plot Cancellation 20
- Creating a DANL Floor Reference Trace 21
- Example Measurement - Using a DANL Reference for Cancellation 21
- Creating a Signal Phase Noise Reference Trace 23
- Example Measurement - Using a Phase Noise Measurement for Cancellation 23
- Saving Traces 24

Restoring Traces 25

Additional Information 26

3 Front-Panel Key Reference

Key Descriptions and Locations 28

AMPLITUDE Y Scale ‘ 29

Ref Level 29
Attenuation 29
Scale/Div 29
Ref Value 29

Det/Demod 30

Detector 30

Display 32

Display Line 32

File 33

Browse User Directory 34
Load 34
Save 35

FREQUENCY Channel 37

Carrier Freq 37
Carrier Search 37
Search Span 37
Signal Track 37
Tracking 37

Input/Output 39

DANL Method 39
Advanced 39
Input/Output 40

Marker 45

Select Marker 45
Residual FM 47
Marker Trace 47
Readout 47
Marker Table 48
Marker All Off 48

Meas Ctrl (Control) 49

Restart 49
Measure 49

Pause 49
Meas Setup 50
Avg Number 50
Avg Mode 50
Meas Type 50
Smoothing 51
Filtering 51
Decade Table 52
Cancellation 52
MEASURE 53
Monitor Spectrum 53
Spot Frequency 53
Log Plot 53
MODE 54
Spectrum Analysis 54
Phase Noise 54
Peak Search 55
Next Peak 55
Next Pk Right 55
Next Pk Left 55
Pk-Pk Search 55
Mkr -> CF 55
Continuous Pk On Off 55
Search Param 56
Preset 57
User Preset 57
Factory Preset 57
Mode Preset 57
SPAN X Scale 58
Start Offset 58
Stop Offset 58
Scale/Div 58
Ref Value 58
Span 58
Full Span 59
Zero Span 59
Sweep Menu 60
Sweep Time 60
Sweep 60

Sweep Points 60
System 61
Show Errors 61
Power On/Preset 61
Time/Date 62
Alignments 62
Reference 63
Restore Sys Defaults 64
Trace/View 65
Trace 65
Mode 65
Operations 66
Normalize 66
Trig 68
Trigger 68
Trig Slope 68
Trig Delay 68

4 Language Reference

CALCulate Subsystem 72

CALCulate:LPLot Subsystem 73

CALCulate:MARKers Subsystem 75

CONFigure Subsystem 78

DISPlay Subsystem 79

FETCh Subsystem 80

FORMat Subsystem 81

INITiate Subsystem 82

INSTrument Subsystem 83

MEASure Group of Commands 85

- CONFigure, FETCh, MEASure, READ Interactions 85

MMEMory Subsystem 91

READ Subsystem 93

SENSe Subsystem 94

Frequency Commands 96

Phase Noise Log Plot Measurements 101

Monitor Spectrum Measurement 110

RF Power Commands 114

Spot Frequency Measurements 115

5 If You Have A Problem

Agilent Customer Assistance 124

- Agilent on the Web 124

1
Getting Started

Introduction

The phase noise measurement personality on the Agilent Technologies N8201A Option 226 performance downconverter synthetic instrument module provides advanced and comprehensive RF and microwave measurement capability. You can add the phase noise measurement personality to transform the N8201A into a one-button phase noise tester. Whether you're in R&D or manufacturing, the N8201A Option 226 phase noise personality provides a comprehensive measurement solution to characterize the phase noise behavior of your systems and components easily, quickly, and accurately.

High-purity, high-stability signals have become more important to the modern communications, aerospace, and defense industries. Phase noise is one of the most crucial measures to evaluate the short-term stability of a signal. Therefore, an accurate, fast, and easy-to-use phase noise measurement tool is critical in the R&D and manufacturing environments. In addition to its superior combination of speed, accuracy, flexibility, and dynamic range, the N8201A offers a Phase Noise Measurement Personality - providing an ideal tool for design verification and troubleshooting, as well as production-line testing. By adding this measurement personality, you integrate a phase noise tester and a high-performance spectrum analyzer into one box.

- Expand design possibilities with powerful measurement capability and flexibility.
- Expedite troubleshooting and design verification with an intuitive user interface and numerous features.
- Streamline manufacturing with speed, reliability, and ease of use.
- Maximize yields with accurate measurements and operator independent results.

Specifications

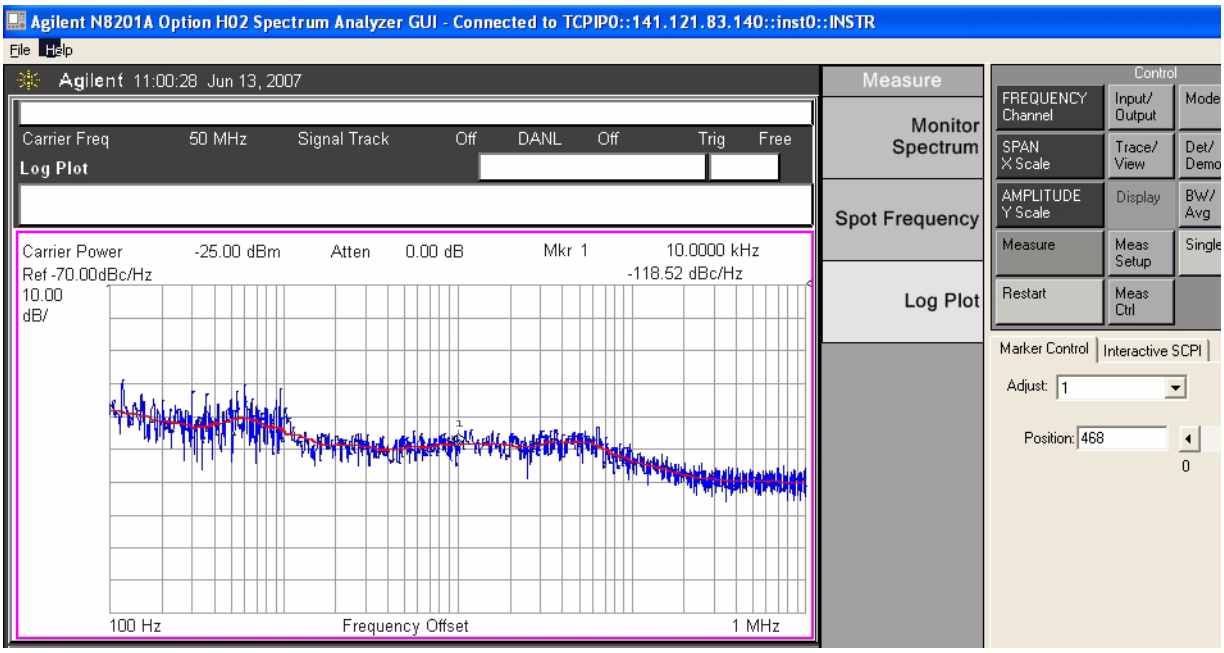
Performance specifications can be found in the *N8201A Data Sheet*.

Available Measurement Personality Options

Table 1 Measurement Personality Options

Available Personality Options	Option Number
Noise Figure measurement personality	219
Phase noise measurement personality	226

Overview of theN8201A Option H02 Spectrum Analyzer GUI



File Menu

The File menu allows you to specify a N8201A performance downconverter to monitor with the N8201A Option H02 Spectrum Analyzer GUI (Graphical User Interface).

Connect

Enter the VISA address (for example, TCPIP0::141.121.87.18::inst0::instr) of the instrument you wish to control with the Spectrum Analyzer GUI.

Disconnect

Terminates the connection between the Spectrum Analyzer GUI and the spectrum analyzer.

Exit

Closes the Spectrum Analyzer GUI application.

Help Menu

Provides information about the current version of the Spectrum Analyzer GUI.

Left Pane (Display)

Display Area

Replicates the actual hardware spectrum analyzer display.

Update Display

When clicked, the GUI display is updated with the current view of the hardware's spectrum analyzer display.

Refresh Data Automatically

When selected, automatically updates the GUI display to match the hardware's spectrum analyzer display up to five times per second. Note that using this function slows the sweep time.

Center Pane (Softkeys)

Displays the softkeys for the currently selected front panel key. For example, clicking Mode in the right pane, identifies "Mode" in the title area of the center pane and the Mode menu keys under the title.

Right Pane (Hard Keys)

Upper Area

Displays the front panel keys (that is, hard keys). Once a front panel key has been clicked, the associated menu keys are displayed in the center pane.

Right Pane

Front Panel Keys

Displays the front panel keys. Once a front panel key has been clicked, the associated menu keys are displayed in the center pane.

Marker Control

Provides control over the four markers.

Adjust Specifies one of the four markers for adjustment.

Position Displays the current position of the selected marker and allows you to enter in a specific position of the marker.

Position Slider Allows movement of the selected marker. Click and drag the slider bar to move the marker, or for fine tuning use the left and right arrow keys.

Interactive SCPI Tab

Command Allows you to enter a SCPI programming command to control the instrument. Some functions do not have a menu key and are only available by entering a SCPI command.

Send Writes what you have entered in the Command text box to the I/O buffer.

Read Reads the response that the instrument places on the I/O buffer.

Send & Read Writes to the I/O buffer and then reads the response from the I/O buffer.

Instrument Session History Displays a listing of recent activity.

Clear Clears the information in the Instrument Session History area.

Hide Controls

Conceals the right pane of the GUI allowing full screen display of the graph area.

Show Controls

Displays the front panel keys (right pane) along with the graph area. This key is only available when Hide Controls is the active function.

Starting the Phase Noise Measurement Personality

1. Connect the N8201A to the PC using Agilent Synthetic Instrument Finder or Agilent Synthetic Instrument GUI. Refer to the *N8201A Performance Downconverter User's Guide* for more information.
2. Click **Start** > **Programs** > **Agilent SI Tools** > N8201A Option H02 Spectrum Analyzer GUI to open the N8201A Option H02 Spectrum Analyzer GUI.
3. Click **File** > *Connect* and enter the VISA address for the N8201, and then click *OK*.
4. Click **MODE** > *Phase Noise* > to start the Noise Figure measurement personality.
5. Click **Measure** > *Monitor Spectrum* or *Phase Noise* to select the applicable measurement type.

2 Using the Phase Noise Personality

This chapter includes the following:

"Tips for Using the Measurement Examples" on page 14

"Log Plot Measurements" on page 15

"Spot Frequency Measurements" on page 16

"Smoothing, Averaging and Filtering" on page 16

"Signal Tracking" on page 17

"Slowly Drifting Signals" on page 18

"System Noise Floor" on page 18

"Display Accuracy at 10 dB Per Division" on page 18

"Background Information" on page 19

"Log Plot Cancellation" on page 20

"Creating a DANL Floor Reference Trace" on page 21

"Example Measurement - Using a DANL Reference for Cancellation" on page 21

"Creating a Signal Phase Noise Reference Trace" on page 23

"Example Measurement - Using a Phase Noise Measurement for Cancellation" on page 23

"Saving Traces" on page 24

"Restoring Traces" on page 25

Tips for Using the Measurement Examples

- All front panel key presses are indicated in **bold** text.
- All sub menu key presses are indicated in *italic* text.
- Make sure that you have selected the Phase Noise measurement personality. Click **Mode** > *Phase Noise*.
- You can choose to maximize the Spectrum Analyzer GUI display. The advantage of doing this is that most of the sub menu keys are available on one page. Also, the display area will be much larger.
- If you choose to leave the Spectrum Analyzer GUI window at its default size, you may have to click *More 1 of ...* to get to the desired function.
- While going through the measurement examples, you may want to select **Refresh Display Automatically**. This way you can see changes as you apply them. This selection can slow down the processing time of the instrument, therefore; during normal testing you may choose to have this feature turned off.
- All sub menu keys that contain frequency units, for example Start Frequency, are editable. Click on the numeric entry to change the value. Use the PC's keyboard to enter the desired value and then type in the first letter of the units designator. For example, G for gigahertz.

Functionality

Log Plot Measurements

The log plot measurement approximates a logarithmic frequency sweep with a set of linear sweeps that are pieced together. This gives a display of dBc/Hz versus logarithmic frequency offset for the single sideband measurement. Trace 1, which is the yellow trace, displays the point-by-point data as measured. Trace 2, the cyan blue trace, displays a smoothed version of trace 1. The amount of smoothing is determined by the current setting of the smoothing parameter. With the default settings, marker 1 is set to a frequency offset of 10 kHz, and the phase noise at that frequency is displayed numerically.

The Trace numbers, trace data and marker data referred to (above) apply if you are using the factory default settings, but these can be changed.

If the N8201A is set up to perform single sweeps, the Restart key allows a measurement to be repeated with a single key press. This is useful for seeing effects of circuit changes where the carrier and offset frequencies of interest do not change. The N8201A can also be set up to perform continuous sweeps. In this case a new measurement will be started as soon as the previous one has completed.

There are two ways to set continuous sweep:

- Click **Sweep** > *Sweep (Cont)*.
- Click **Meas Control** > *Measure (Cont)*.

Up to four markers can be used to display various parameters of the measurement, although the default display only shows data for one marker. Setting Marker Table to On allows you to view the data from all of your markers at once.

Phase noise measurement results can be integrated over a selected frequency range to get the total RMS (root mean squared) noise in a given bandwidth.

1. To access Log Plot mode, click **Measure** > *Log Plot*.
2. Click **Marker** > *Mode* > *Normal* and click in the **Position** box of the Marker Tab to set the starting point of your frequency range used for interrogation.
3. Click *Mode* > *RMS Noise* > *RMS Jitter*, or *RMS Degrees*, or *RMS Radians*.
4. Click in the **Position** box to set the ending point of your frequency range.

   The results are displayed in radians, degrees or seconds, depending on your previous selection.

To display RMS Residual FM over a specified range:

1. Click **Markers** > *Mode* > *Normal*.
2. Enter the start of the frequency range in the **Position** box.
3. Click *Mode* > *Residual FM* and enter the stop frequency range in the **Position** box to place the second marker at the end point of the frequency range.

The display will show the frequency range and the measured RMS residual FM over this range. RMS phase noise measurements are based on the log plot data which is a single-sideband measurement. The RMS phase noise results are therefore single-sideband.

Spot Frequency Measurements

A spot frequency measurement is a single sideband measurement of the phase error at a specified offset frequency from the main carrier signal. The average value of the trace points displayed on the screen is indicated by a magenta pink line. The N8201A is normally set up to display a continuous sweep, although a single measurement can be performed by clicking **Sweep** > *Sweep Single*.

To access Spot Frequency measurement mode:

1 Click **Measure** > *Spot Frequency.*

To set up the Spectrum Analyzer GUI to track a drifting signal:

2 Click **Frequency** > *Signal Track On*. When signal tracking is On, a trace showing the change in frequency against time is shown next to the spot frequency trace.

Smoothing, Averaging and Filtering

Repeatability on the trace can be improved in several different ways. Smoothing is used with log plot measurements while trace averaging is used with spot frequency measurements. Video filtering can be used with both types of measurements.

The smoothing process averages a number of adjacent trace points from the raw trace, typically Trace 1, and displays the smoothed result in second trace, typically Trace 2, for a log plot measurement. Smoothing is faster than averaging or filtering, but less accurate than either. Loss of accuracy is particularly noticeable when a trace has sudden changes in amplitude, for example when a carrier has a large discrete signal such as a spurious sideband.

To smooth a trace:

1 Click **Meas Setup** > *Smoothing* and then adjust it between 0.00% and 16.0%.

While inside the log plot measurement each level of smoothing can be tried without having to make a new measurement.

Video filtering can be applied to the active trace when making measurements. Additional video filtering can increase the accuracy and repeatability of the measurement, but it will also make the measurement process slower. Filtering changes the ratio of the video bandwidth to the resolution bandwidth. Filtering is slower than smoothing or averaging, but is more accurate than either.

The averaging process measures each frequency point multiple times, and then calculates and plots the average value.

Signal Tracking

Signal tracking can be used in all measurements to track a slowly drifting signal. When it is enabled (On), the measurement will follow a slowly drifting signal by periodically reacquiring the carrier signal.

How often the N8201A will retune to the drifting signal depends on the measurement being performed, and on N8201A settings such as tracking mode, drift span and tolerance. Log Plot and Monitor Spectrum do not have tolerance or drift span settings.

If the signal is not tracked correctly (such as might happen with a rapidly drifting signal), the N8201A may not be completely compensating for the drift, causing the measured phase noise to appear either higher or lower than it actually is.

Measurement Considerations

Slowly Drifting Signals

Spot frequency and log plot measurements can be made on slowly drifting signals by making use of the signal tracking function, although the measured value will be slightly inaccurate. The maximum drift rate that can be tracked will depend on N8201A settings such as Search Span and the tracking Mode (in the Frequency/Channel menu), although it is unlikely that you will approach these limits in practice.

System Noise Floor

The system noise floor can have a significant effect on low phase noise measurements such as those that will typically be found at large frequency offsets.The system noise floor can be measured using one of two methods. For greater accuracy, use the Removal method of measurement, and for greater convenience, use the Attenuation method. See "Cancellation and Log Plot Measurements" on page 19 for more details.

Display Accuracy at 10 dB Per Division

When the amplitude scale setting is 10 dB per division, the phase noise measurements are most accurate in the upper half of the display. In particular, if the measurements are occurring in the bottom 1½ divisions of the display, it is best to decrease the reference level until the result is displayed in the upper half.

To change the scale setting to 10 dB per division:

1 Click **AMPLITUDE**, then *Scale/Div*.

Cancellation and Log Plot Measurements

Many phase noise measurements do not benefit from cancellation. If the phase noise of your DUT is more than 10 dB higher then the N8201A noise, then cancellation has almost no effect on the calculated measurement data. The effectiveness of using the cancellation function also has a lower limit. When the phase noise of your DUT gets very close to the N8201A noise (within about 0.1 dB), the logarithmic nature of the calculation results in large, invalid cancellation values. The following table shows error cancellation values that will be applied to the measurement results for various DUT to N8201A phase noise ratios. Setting the threshold value limits the correction that will be applied.

Table 2 Error Cancellation Values

Phase Noise of DUT relative to Phase Noise of N8201A	Measurement Error Before Cancellation*	Threshold Δ Required for Maximum Cancellation
20 dB	0.043 dB	20.0 dB
10 dB	0.41 dB	10.41 dB
0 dB	3.01 dB	3.01 dB
–5.87 dB	6.87 dB	1.0 dB
–10 dB	10.41 dB	0.41 dB
–16.33 dB	16.43 dB	0.1 dB
–20 dB	20.04 dB	0.04 dB
–26.83 dB	26.84 dB	0.01 dB

* Only considers error due to additive affects of N8201A noise and DUT noise.

Background Information

When you make a phase noise measurement on a given signal, the measurement result that you get is actually a combination of three different noise sources. The first, of course, is the phase noise of the signal that you are measuring. If this noise is very small, it can be distorted or even hidden by the two other noise sources which are generated by the N8201A itself.

The first internal noise source is the phase noise generated by the N8201A as a side-effect of measuring an input signal. The second source is the Displayed Average Noise Level (DANL) of the N8201A. The DANL is the internally generated noise of the N8201A regardless of whether or not an input signal is present, so the DANL is derived from the noise figure of the N8201A. The DANL Floor is broadly flat across the spectrum and represents the absolute noise level below which measurements cannot be made because the signal gets lost in the N8201A noise.

If you make a measurement without any input signal, that measurement represents the absolute noise floor (DANL) of the N8201A. If you reference this absolute noise floor to the carrier amplitude, the DANL floor becomes a relative limit below which phase noise sidebands cannot be measured.

At far offset frequencies, the N8201A's phase noise is often below the N8201A's noise floor (DANL). The DANL floor of an N8201A thus limits the range over which an N8201A can measure phase noise. By making a log plot measurement of the N8201A's DANL noise floor, you are able to characterize the DANL limitation on phase noise measurements.

Log Plot Cancellation

The Log Plot measurement accuracy on low phase noise DUTs can be improved by using the cancellation feature to remove the affects of the N8201A's internal noise. This is done by comparing a stored reference measurement with the DUT's measured phase noise.

The stored reference measurement can be generated two ways.

If you have a signal source that has much better phase noise then the N8201A's phase noise, then you can measure that source and know that the resulting trace represents the N8201A's internal phase noise when an input signal is present.

If you do not have a good low-phase noise source, you can make a reference measurement with no input signal. This gives you a measurement of the N8201A's noise floor (DANL).

A reference trace from a good source that is relatively free of phase noise will let you compensate for both the phase noise and the DANL of the N8201A. A reference trace that is derived from the DANL only compensates for the DANL portion of the noise, but this may be adequate for measurement conditions where the N8201A DANL is the limiting factor (typically for offsets >1 to 10 MHz.)

General Process

1. Set up the N8201A as needed to measure the test signal's phase noise. (That is, use the same frequency range as needed for your intended DUT measurement.)
   a. Create and save a reference trace in Trace 3. Create either a DANL reference or a signal phase noise reference. (See "Creating a DANL Floor Reference Trace" on page 21 or "Creating a Signal Phase Noise Reference Trace" on page 23.)
   b. Set up the N8201A so it is making a log plot measurement of the DUT's phase noise and turn on the cancellation using the saved reference trace data.

Creating a DANL Floor Reference Trace

The reference trace must cover the same frequency range as your intended measurement.

1. With the carrier signal connected, set up the N8201A to measure the phase noise over the desired frequency range.
2. Click **Measure** > *Log Plot*.
3. Click **Meas Setup** > *Meas Type* > *DANL Floor* to set up the DANL floor measurement.
4. Click **Input/Output** > *DANL Method*, to select either the *Atten* (Attenuation) or the *Removal* method for making the DANL measurement. (The Removal method will prompt you for additional steps.)
5. Click **Restart**. You now have a reference trace available that you can either use immediately or save for later use. See the information about saving and restoring traces later in this section.

Example Measurement - Using a DANL Reference for Cancellation

Measuring a DANL Reference Trace

1. With the test signal connected, click **Preset** to set the N8201A to its startup condition.
2. Click **Meas Setup** > *Filtering* > *Maximum* to turn filtering on and set it to the maximum level.
3. Click **Meas Setup** > *Avg Number* (setting to On or Off), and enter an appropriate number.

Select the frequency range that you want to use for your reference trace.

4. Click **SPAN X Scale** > *Start Offset* and *Stop Offset* to specify the frequency range. The range must be the same range that you will be measuring on your test signal.
5. Click **Meas Setup** > *Meas Type* > *DANL Floor* > **Restart** to set up and make the DANL floor measurement.
6. Click **Input/Output** > *DANL Method* and then select either the Atten (Attenuation) or the Removal method of DANL measurement.
7. Click **Restart**.
   - If you selected the Signal Removal method of DANL measurement, you will be asked to disconnect the input signal from the N8201A and to replace it with a 50Ω termination.
   - If you selected the attenuation method of measurement, the N8201A will effectively remove the input signal by automatically setting the attenuation to its maximum level of 70 dB. Whichever method is used, the N8201A will go through the measurement as if a signal was still present. The displayed average noise is measured and treated as phase noise, and normalized to the carrier amplitude. The DANL phase noise is then displayed as the phase noise trace.

8 Once the measurement has completed, store the Trace data in Trace 3:

   a Click **Trace/View** > *Trace 3* > *Operations* > *2->3*.

   a Click **File** > *Save* > *Type* > *Trace* > *Source* > *Trace 3*.

   b Click *Destination Drive*, either *PC* or *Instrument*

   c Click *File Name* to specify a file name. If you selected Instrument as the Destination Drive there is an eight character limitation on the file name.

   d Click *Save Now*.

   You now have a reference trace stored in Trace 3.

Applying Cancellation to a Log Plot Measurement

For a reference trace to be valid, it must be in View mode, and must cover the same frequency range as your intended measurement.

1 Click **Meas Setup** and *Cancellation*.

2 Click *Ref Trace* until Trace 3 is underlined. Trace number 1 is yellow, Trace number 2 is cyan blue and Trace number 3 is magenta pink.

Set the threshold if required, although you will not normally have to change this value. The noise cancellation measurement compares your current measurement with the reference trace on a point by point basis. At each point, the current measurement has to exceed the reference trace by at least the threshold level. If the difference between the source trace and the reference trace is less then the threshold level, then the source trace is assumed to be exactly the threshold level above the reference level.

3 To set the threshold level, click **Meas Setup**, *Cancellation* > *Threshold* and then set your threshold level in dB.

4 Click **Cancellation On**. Any trace that is displaying smoothed data will change immediately to reflect the noise cancellation.

Table 3 Parameters of Interest When Performing a DANL Measurement

Parameter	Front Panel Access	Description
DANL Method	Input/Output, DANL Method	Determines which of the two possible methods is used to measure the DANL Floor.
Max Mixer Level	Input/Output, Advanced, Max Mixer Level	Determines the amount of input attenuation to use, depending on the measured carrier amplitude and the particular offset being measured.
Blanking the raw data trace	(When using the default settings) Trace/View, Trace 1, Blank	The trace of the raw data (normally the yellow trace) can sometimes get in the way when you are working with smoothed traces. The raw data trace can be blanked out to leave just the smoothed traces on display.
Decade Table	Meas Setup, Decade Table	This displays a table of offset frequencies versus amplitude. It provides an easy way of comparing spot amplitudes on different traces.

Creating a Signal Phase Noise Reference Trace

The reference trace must cover the same frequency range as your intended measurement.

1 Click **Measure** > *Lot Plot* to set up the N8201A to measure the test signal phase noise over the desired frequency range.

2 Connect a low phase noise signal source to the input of your N8201A and set it to the desired output frequency.

3 Click **Meas Setup** > *Meas Type* > *Phase Noise* > **Restart**. This measures and displays the phase noise of your test signal.

You now have a reference trace available that you can either use immediately or save for later use. See the information about saving and restoring traces later in this section.

Example Measurement - Using a Phase Noise Measurement for Cancellation

Measuring a Signal Phase Noise Reference Trace

1 Set the N8201A to its startup condition by clicking **Preset**.

2 Click **Meas Setup** > *Filtering* > *Maximum* to turn filtering on and set it to the maximum level.

3 Click *Avg Number On* and enter an appropriate number.

4 Click **Span X Scale** > *Start Offset* then *Stop Offset* to specify the frequency range. The range must be the same range that you will be measuring on your test signal.

5 Connect a low phase noise signal source to the input of your N8201A and set it to the desired output frequency.

6 Click **Meas Setup** > *Meas Type* > *Phase Noise* > **Restart**. This measures and displays the phase noise of your signal. If you are using the N8201A's default settings, the raw data is displayed by the yellow trace, and the smoothed data is displayed by the cyan blue trace.

7 Click **Trace/View** > *Operations* > *2 -> 3* to copy the trace data. You now have a reference trace stored in Trace number 3.

Applying Cancellation to a Log Plot Measurement

For a reference trace to be valid, it must be in View mode, and must cover the same frequency range as your intended measurement.

1 Click **Meas Setup** > *Cancellation*.

2 Click *Ref Trace* until the desired trace number is underlined.

Set the threshold if required, although you will not normally have to change this value. The noise cancellation measurement compares your current measurement with the reference trace on a point by point basis. At each point, the current measurement has to exceed the reference trace by at least the threshold level. If the difference between the source trace and the reference trace is less then the threshold level, then the source trace is assumed to be exactly the threshold level above the reference level. To set the threshold level.

3 Click **Meas Setup** > *Cancellation* > *Threshold* and then set your threshold level in dB.

4 Click *Cancellation On*. Any trace that is displaying smoothed data will change immediately to reflect the noise cancellation.

Saving Traces

All traces, including the reference traces used for noise cancellation measurement, can be saved. All traces are saved in binary format, and their format is independent of the N8201A on which they were saved.

1 Click **File** > *Save* > *Type* > *Trace* > *Source* and select the desired trace to be saved.

2 Click *Destination Drive* and select either PC or Instrument.

NOTE When selecting Instrument as the Destination Drive, the file name is limited to eight characters.

3 Click *File Name* and specify the file name of the Trace. I.

Restoring Traces

All traces, including the reference traces used for noise cancellation measurement, can be loaded. All traces are saved in binary format, and their format is independent of the N8201A on which they were saved.

1 Click **File** > *Load* > *Type* > *Trace* > *Source* to access the trace files.

2 Click *Source Device Instrument* or *PC* to specify where the trace is stored.

3 Click *File Name* and select the desired trace file name.

4 Click *Load Now* to retrieve the trace file.

Additional Information

The document listed below provides information on making phase noise measurements. It can be obtained through your local Agilent Technologies office.

Agilent Part Number	Title
1000-1132	*RF and Microwave Phase Noise Measurement Seminar*

3
Front-Panel Key Reference

This chapter details the front-panel keys and menu keys. The front-panel keys are listed alphabetically and are described with their associated menu keys. The menu keys are arranged as they appear in the Spectrum Analyzer GUI menus.

Key Descriptions and Locations

This chapter provides information on Phase Noise mode functions only. Some keys are described that are either not available in Spectrum Analysis (SA) mode, or that provide functions which differ from those provided by the same keys in SA mode. Other keys are described which provide fewer functions than the same key in SA mode, but the functions that are provided are identical in both modes.

.

AMPLITUDE Y Scale page 29
Det/Demod page 30
Display page 32
FREQUENCY Channel page 37
Input Output page 39
Marker page 45
Meas Setup page 50
MEASURE page 53
MODE page 54
Mode Setup page 54
Peak Search page 55
Preset page 57
SPAN X Scale page 58
Sweep Menu page 60
System page 61
Trace/View page 65

AMPLITUDE Y Scale ‘

Ref Level

*Ref Level is available in **Measure** > Monitor Spectrum mode only.*

Adjusts the absolute amplitude represented by the top graticule line on the display. Ref in the upper corner of the display, indicates the current value.

Attenuation

*Attenuation is available in **Measure** > Monitor Spectrum mode only.*

Adjusts the input attenuation. TheN8201A input attenuator reduces the power level of the input signal delivered to the input mixer. If set manually, the attenuator is recoupled when Attenuation (Auto) is selected.

Attenuation is coupled to the reference level so adjusting the reference level may change the attenuation. The current value is indicated by Atten at the top of the display. A # appears in front of Atten when Attenuation (Man) is selected.

CAUTION To prevent damage to the input mixer, do not exceed a power level of +30 dBm at the input.

Scale/Div

*Scale/Div is available in **Measure** > Monitor Spectrum mode only.*

Sets the units per vertical division on the display.

Ref Value

Ref Value is only available when **Measure** > *Log Plot is selected.*

Specifies the amplitude level represented by the Ref Position (see below) on the graticule display. The units of measurement are either dB or Kelvin, depending on the measurement being displayed in the active window.

Det/Demod

*Det/Demod functions are available in **Measurement** > Monitor Spectrum mode only.*

Detector

Allows you to select a specific detector for a particular measurement.

When discussing detectors, it is important to understand the concept of a trace "bucket." For every trace point displayed, there is a finite time during which the data for that point is collected. The N8201A has the ability to look at all of the data collected during that time and present a single point of trace data based on the detector mode. The interval during which the data for that trace point is being collected, is called the "bucket." Thus, a trace is more than a series of single points. It is actually a series of trace "buckets." The data may be sampled many times within each bucket.

The detector in use is indicated on the left side of the display. If the detector has been manually selected, a # appears next to it.

Normal

Displays the peak of CW-like signals and maximums and minimums of noise-like signals.

Average

Displays the average of the signal within the bucket. The averaging method depends upon Avg/VBW Type selection of either Log-Pwr Avg (Video) or Pwr Avg (RMS).

Because a spectral component's true peak may not be found, neither average nor sample detectors measure amplitudes of CW signals as accurately as peak or normal, but they do measure noise without the biases of peak detection.

Peak

Displays the maximum of the signal within the bucket.

Sample

Displays the instantaneous level of the signal at the center of the bucket represented by each display point.

Because a spectral component's true peak may not be found, neither average nor sample detectors measure amplitudes of CW signals as accurately as peak or normal, but they do measure noise without the biases of peak detection.

Negative Peak

Displays the minimum of the signal within the bucket.

Quasi Peak

A fast rise and fall detector used in making CISPR EMI compliant measurements. Quasi-peak detection is a weighted form of peak detection. During quasi-peak detection, the displayed response drops as the repetition rate of the measured signal decreases. This signal weighting is accomplished by circuitry with specific charge (1 millisecond) and discharge (600 milliseconds) time constants. For continuous wave signals, peak and quasi-peak values are the same.

EMI Average

Displays the instantaneous level of the signal at the center of the bucket, just like the sample detector.

EMI Peak

Displays the maximum of the signal within the bucket using CISPR related bandwidths.

MIL Peak

Displays the maximum of the signal within the bucket using MIL related bandwidths.

Display

*Display functions available in **Measure** > Monitor Spectrum mode only.*

Accesses the menu key that allows you to see and setup different measurement displays.

Display Line

Activates an adjustable horizontal line that is used as a visual reference line. The line has an amplitude that corresponds to its vertical position relative to the reference level. The value of the display line appears on the left side of the display below the label DI. The display line can be adjusted by clicking the numeric value and using the keyboard to enter a new value.

File

Displays a menu of functions that enable you to load, save, and manage data on either a the N8201A's internal drive or on your PC. You can recall, save, copy, delete, or rename files of instrument states, trace data, and screen captures.

You can save the following types of files:

- State - A file that contains a copy of the state of the instrument at the time the file is saved. The settings of most instrument functions are saved in the state files but not traces, limits, and corrections. When a State file is loaded into the instrument, the N8201A is restored to the same state as when the file was saved. Some settings are not saved in the State files, for example the GPIB address; these settings are called "persistent." In this manual, each function describes whether that function is saved in "Instrument State" or is persistent.
- Trace - A file that contains a copy of the trace data for one or more traces. There are two formats for trace files, Trace + State and CSV files.
  - **Trace + State:** A file that contains the trace data and a copy of the current instrument state. The trace and state are stored in an internal data format (TRC), which cannot be loaded into a PC, but can be loaded back into the N8201A. Traces can be loaded individually or as a group. When a Trace + State file is loaded into the N8201A the trace data that was on the screen, when saved, is loaded into the N8201A. This enables you to view the trace as it looked when it was saved. Because the state data is also saved, the N8201A settings, including all the annotation on the GUI, is restored as well. To preserve the trace data, the traces contained in the saved files are placed in View mode (see Trace/View, page 65) so that they are not immediately overwritten by new trace data. This means that you can save traces while making a measurement, and later load them back into the N8201A, where you can print them or transfer them to a computer, in CSV format, for analysis. If you wish to compare two saved traces, place traces in view mode before saving them. This prevents the trace from being rewritten based on a state change from subsequent loads.
  - **CSV:** A file that contains trace data in comma-separated values format (CSV, standard PC spreadsheet format), to be read into a spreadsheet for analysis. Most spreadsheet programs support CSV format. They cannot be loaded back into the N8201A.

NOTE Limits are only available in Spectrum Analysis mode.

- Limits - A file that contains a copy of the N8201A limit sets at the time the file is saved. Limits provide data sets to determine whether a trace has exceeded preset specifications. Limit sets can hold up to 200 points and can only be saved individually. Refer to the File, Save, Source key description, page 35. When you load a Limits file into the N8201A, you restore all of the limit sets that were in the instrument at the time of the save.
- Corrections - A file that contains a copy of the N8201A correction tables at the time the file is saved (CBL, ANT, OTH, AMP). Corrections provide a way to adjust the trace display for preset gain factors (such as for cable loss). A correction set can hold up to 200 points. Pressing Corrections activates the Source key. Refer to the File, Save, Source key description, page 131. When you load a Corrections file into the N8201A, you restore all of the corrections values that were in the instrument at the time of the save.

Browse User Directory

Opens the instrument directory where the stored data files are located.

Load

Accesses a menu to load stored files into the instrument.

Load Now

Loads the selected file into the instrument.

Type

Allows you to select the desired type of instrument-data files to be displayed. Common types of instrument data files include trace data, limit line data, and amplitude correction data.

Table 4 Instrument Data File Types

Type	Format	Destination	Extension
State	State		STA
Trace	Trace + State	Trace 1, 2, 3 or all traces	TRC
	Comma separated trace values	Trace 1, 2, 3 or all traces	CSV
Limits	Internal data format		LIM
Corrections	Internal data format		ANT, CBL, OTH, and AMP

Destination

When the file type is set to Trace, Destination accesses the keys to load either Trace 1, 2, 3 or All traces.

When the file type is set to Corrections, Destination accesses the keys to select Antenna, Cable, Other, or User as the type of correction to load.

When the file type is set to Limits, Destination accesses the keys to load either Limit Line 1, 2, 3, or 4. Limit sets can only be loaded individually.

Source Device Instrument PC

Specifies either the N8201A or the PC as the source of the saved files.

File Name

Opens the dialog box allowing selection of a previously stored file. Depending on the Source Device selected, a different dialog box will appear.

Instrument Opens the Load File from Instrument window where the saved files are stored.

PC Opens Windows Explorer allowing you to navigate to the saved files.

Save

Accesses a menu to save a file to either the instrument or the PC.

Save Now

Saves the specified file.

Type

Allows you to select the desired type of instrument-data files to be saved. Common types of instrument data files include trace data, limit line data (in Spectrum Analysis mode only), and amplitude correction data. See Table 4.

Format

When Trace is selected as the file type, then you can either choose to save the trace data as Trace + State or as a CSV file. See page 33 for more information on these file formats.

Source

When the file type is set to Trace, Source accesses the keys to save either Trace 1, 2, 3 or All traces. Saving all traces saves all traces in a single file.

When the file type is set to Corrections, Source accesses the keys to select Antenna, Cable, Other, or User as the type of correction to save.

When the file type is set to Limits, Source accesses the keys to save either Limit Line 1 or 2. Limit sets can hold up to 200 data points and can only be saved individually.

Destination Device Instrument PC

Specifies either the N8201A or the PC as the destination drive for the saved files.

File Name

Opens the dialog box allowing you to save a file. Depending on the Source Device selected, a different dialog box will appear.

Instrument Opens the Load File from Instrument window where the saved files are stored.

PC Opens Windows Explorer allowing you to navigate to the directory where the saved files are stored.

FREQUENCY Channel

Accesses the menu of frequency functions.

Carrier Freq

Specifies the frequency of the carrier wave whose phase noise is to be measured. As long as the frequency you enter is within plus or minus 5% of the carrier signal's true frequency, the N8201A will tune to it automatically.

Carrier Search

Automatically tunes the N8201A to the strongest signal it can find. If Search Span is set to Automatic, the search is performed from a lower limit of 100 Hz to an upper limit of the N8201A's maximum capabilities. When Search Span is set to Manual, the search is performed within the frequency range specified in Search Span, centered on the current carrier frequency.

Search Span

Determines the spectral range that a Carrier Search will search for a signal. This key toggles between Automatic and Manual settings. When Search Span is set to Automatic, the search is performed from a lower limit of 100 Hz to an upper limit of the N8201A's maximum capabilities. When Search Span is set to Manual, the search is performed within the frequency range specified here, centered on the current carrier frequency.

Signal Track

Specifies whether or not the N8201A automatically tracks a slowly drifting signal.

On

Repeatedly measures the frequency of the carrier signal to check for any change that might have occurred, and retunes to the new frequency if necessary.

Off

Makes its measurement at a fixed frequency.

NOTE The repeated realignment with the signal when tracking is On causes measurements to take longer than when tracking is Off.

Tracking

*Tracking functions are available in **Measure** > Spot Frequency mode only.*

Displays a menu which allows you to control exactly how signal tracking is performed.

Drift Span

Specifies the span, as a percentage of the carrier frequency, within which the frequency drift will be tracked. For example, if a Drift Span of 12% is specified, the signal will be tracked as long as it remains within plus or minus 6% of the most recent frequency measurement. The drift span is limited to a maximum of 50 MHz.

Mode

Displays a menu which allows control over how signal tracking operates. You can select from three modes of operation - Interval, Tolerance or a combination of the two.

Interval Retunes to the carrier signal after every Interval number of measurements have been made.

Tolerance Retunes to the carrier signal whenever one phase noise measurement differs from the average value by Tolerance percent.

Both Retunes to the carrier signal after every Interval number of measurements or whenever the latest phase noise measurement deviates from the average by Tolerance percent, depending on which occurs first. This is a combination of Interval and Tolerance modes.

Input/Output

Allows control on how noise levels are to be measured and gives access to the advanced menu.

DANL Method

Specifies one of two alternative methods of measuring the Displayed Average Noise Level (**DANL**).

Atten

Attenuates any incoming signal to such an extent that it is almost lost within the background noise. The noise level can then be measured.

Removal

The Removal method of measuring DANL requires the input signal to be physically disconnected from the N8201A before the noise level is measured. The Spectrum Analyzer GUI will tell you when to remove or disconnect the signal, and when to reconnect it afterwards.

Every N8201A generates some noise of its own. By measuring this noise level, you can compensate for it and thus obtain more accurate phase noise measurements. The Attenuation method of DANL measurement is accurate enough for most purposes and is generally more convenient, but the Removal method is the more accurate.

Advanced

Min Mixer Level

Enables you to set the relationship between the highest signal that can be displayed (the reference level) and the input attenuation. The relationship applies whenever the Attenuation is set to Auto. The relationship is that the attenuation is given by reference level minus the max mixer level. That is, as the reference level changes, the input attenuator changes to ensure that a signal at the reference level does not exceed the Max Mixer Lvl setting.

Min Carrier Level

Specifies the minimum carrier level.

Corrections

Accesses a menu for setting up and activating Antenna, Cable, and User corrections.

Apply Corrections On Off Allows you to either apply all corrections or turn all corrections off.

Antenna Accesses a menu to define antenna correction parameters.

Correction On/Off allows you to turn on or off just the antenna corrections.

Edit access the antenna correction table to enter frequency and amplitude correction data for a specific antenna.

Delete Correction deletes the data in the antenna correction table.

Cable Accesses a menu to define cable correction parameters.

Correction On/Off allows you to turn on or off just the cable corrections.

Edit access the cable correction table to enter frequency and amplitude correction data for a cable.

Delete Correction deletes the data in the cable correction table.

User Accesses a menu to define User correction parameters.

Correction On/Off allows you to turn on or off just the user corrections independently of the other corrections.

Edit access the user correction table to enter frequency and amplitude correction data.

Delete Correction deletes the data in the user correction table.

Freq Interpolation Log Lin

Delete All Corrections Deletes the data in all of the correction tables. That is, Antenna, Cable, and User.

Input/Output

Displays the functions that control some of the N8201A's signal inputs and outputs.

Input Port

Brings up a menu of input signal sources, the most common one being the front panel RF Input port.

RF Selects the front panel RF Input port as the N8201A signal input.

Amptd Ref Selects the 50 MHz, –25 dBm internal amplitude reference as the input signal.

RF Coupling AC DC

Specifies alternating current or direct current coupling at the N8201A RF input port by selecting AC switches in a blocking capacitor that blocks any DC voltage present at the N8201A input. This decreases the input frequency range of the N8201A, but prevents damage to the input circuitry of the N8201A if there is a DC voltage present at the RF input.

In AC coupling mode, signals less than 20 MHz are not calibrated. You must switch to DC coupling to see calibrated frequencies of less than 20 MHz. Note that the message DC Coupled will be displayed on the Spectrum Analyzer GUI when DC is selected.

Some amplitude specifications apply only when coupling is set to DC. Refer to the N8201A data sheet.

Input Mixer

Selects either the internal mixer or an external mm-wave mixer. When internal mixing is selected you get normal N8201A operation and the rest of the external mixing functions are unavailable. With external input mixing is selected, you can analyze high frequency signals (higher than the N8201A maximum frequency of 26.5 GHz) by using an appropriate external mixer.

Ext Mix Band Displays the menus to select one of the pre-defined bands corresponding to the external mixer being used. Or you can define your own frequency band by selecting User.

18-26.5 GHz (K) Selects K band (mixing harmonic .6). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -6 harmonic band.

26.5-40 GHz (A) Selects A band (mixing harmonic .8). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the –8 harmonic band.

Bands A, Q, U, and V are available with both preselected and unpreselected mixers. The sign of the harmonic value changes with the mixer type. For example with A Band preselected mixer, the harmonic value is 8 while the unpreselected value is -8.

33-50 GHz (Q) Selects Q band (mixing harmonic .10). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -10 harmonic band.

40-60 GHz (U) Selects U band (mixing harmonic .10). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -10 harmonic band.

50-75 GHz (V) Selects V band (mixing harmonic .14). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -14 harmonic band.

60-90 GHz (E) Selects E band (mixing harmonic .16). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -16 harmonic band.

75-110 GHz (W) Selects W band (mixing harmonic .18). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -18 harmonic band.

90-140 GHz (F) Selects F band (mixing harmonic .20). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -20 harmonic band.

110-170 GHz (D) Selects D band (mixing harmonic .24). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -24 harmonic band.

140-220 GHz (G) Selects G band (mixing harmonic .32). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -32 harmonic band.

170-260 GHz (Y) Selects Y band (mixing harmonic .38). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -38 harmonic band.

220-325 GHz (J) Selects J band (mixing harmonic -46). Displays the start and stop frequencies for that particular band. Other start/stop frequencies are available as long as they are within the -46 harmonic band.

User Lets you define the frequency band for your input mixer. The frequencies available depend on the currently selected harmonic mixing number. Use *Mixer Config* > *Harmonic* to select a particular harmonic number.

Equation 2-1

Preselected External Mixer Frequency Ranges vs. Harmonic Number

For N = positive harmonic mixing band numbers:

Minimum frequency = (N. 2.9GHz)+ 321.4MHz

Maximum frequency = (N. 6.666GHz)+ 321.4MHz–650MHz

For N = negative harmonic mixing band numbers:

Minimum frequency = (N. 2.9GHz) –321.4MHz + 650MHz

Maximum frequency = (N. 6.666GHz) –321.4MHzEquation 2-2

Unpreselected External Mixer Frequency Ranges vs. Harmonic Number

For N = positive harmonic mixing band numbers:

Minimum frequency = (N . 2.9GHz)+ 321.4MHz

Maximum frequency = (N . 6.9GHz)+ 321.4MHz–650MHz

For N = negative harmonic mixing band numbers:

Minimum frequency = (N . 2.9GHz) –321.4MHz + 650MHz

Maximum frequency = (N . 6.9GHz) –321.4MHz

The 650 MHz term in the equations above is approximately 2XIF. This term is for the signal identification algorithm. The 6.666 GHz term is the maximum LO range based on the preselector tune circuitry in the N8201A.

Signal ID On Off

Activates a signal identification algorithm that either removes or aids with the identification of multiple and image responses of true input signals. Multiple and image responses may be generated when using unpreselected external mixers.

The amplitude accuracy of the N8201A is degraded when signal identification is on. Use Signal ID to identify true signals, then turn Signal ID off to make accurate amplitude measurements.

If the input signal is too broadband or unstable for the identification process to properly identify it, turn off the signal identification and look for two similar responses separated by approximately 642.8 MHz (twice the 321.4 MHz first IF). If a “–” mixer mode (for example: 8–) is active, the right member of the response pair is the correct response; if a “+” mixer mode is active, the left member of the response pair is the correct response.

Signal ID Mode

Displays a menu to select the method of signal identification.

Image Suppress This signal identification method attempts to suppress all but valid responses by mathematically removing all image and multiple responses of signals present at the mixer input. The N8201A internally acquires the data in a two sweep sequence: operates on the acquired data, and displays the result in Trace 1. Since two measurements are taken for each display cycle, the display update rate is reduced.

Image Shift Executes signal identification in a two sweep sequence. Places data from the first sweep in Trace 1, and data from the second (frequency shifted) sweep in Trace 2. Signal responses of Trace 1 and Trace 2 having the same horizontal position are considered to be in the current band and therefore can be analyzed with the amplitude and frequency measurement systems of the N8201A. All other responses are invalid and should be ignored.

Mixer Config

Displays the Mixer Config menu keys to manually set the harmonic, select the preselected mixers or unpreselected mixers, and adjust the internal bias source for use with mixers requiring bias.

Harmonic The harmonic mixing number, its associated sign, and the availability of mixer bias can be automatically controlled by setting Harmonic to Auto. In Auto, the harmonic number and sign are determined by the Ext Mix Band selected. For bands A, Q, U and V, they are determined by the Ext Mix Band and by whether Mixer Type is set to preselected or unpreselected. There are no auto rules for Ext Mix Band set to Auto, therefore, selecting Auto forces Ext Mix Band to A band.

The harmonic number indicated is a signed number. Positive numbers (sign not displayed) indicate that the tuned frequency is above the desired LO harmonic by the 321.4 MHz IF. Negative numbers indicate an LO harmonic below the tuned frequency by the 321.4 MHz IF.

Mixer Type Presel Selects which type of mixer is in use. Mixer Type (Presel) activates a tuning signal that is routed to the PRESEL TUNE OUTPUT connector on the N8201A. This signal has a sensitivity of 1.5V/GHz of the LO frequency and drives the tune input of the HP/Agilent 11974 series of preselected mixers. The sweep rate in Presel mode is limited to 40 MHz/ms.

Mixer Bias On Off Turns on/off the Mixer Bias and adjusts an internal bias source for use with external mixers. The bias signal is present on the center conductor of the IF INPUT connector on the front panel.

321.4 MHz IF Out Optimize

Configures the IF path for the default narrow band measurement path (Spectrum Analysis) or for improved 321.4 MHz IF out performance (Downconverter WBIF).

When the IF signal is being used for normal operation, the frequency response at the 321 MHz Aux IF Out port is degraded. Diverting the IF using the down converter setting lets you take advantage of this improved frequency response at the output port, but you can no longer use the internal path for making measurements.

Changes in the impedance seen by the 321.4 MHz Aux Out port can impact the amplitude accuracy of the N8201A. If the impedance on this port is changed, the user should perform an Align All Now to ensure the amplitude accuracy of the N8201A.

Spectrum Analyzer Switches the IF path to the spectrum analyzer path that is used for normal operation.

DnConverter 321.4 MHz IF Configures the IF path for improved frequency response at the 321.4 MHz IF Out connector. While this 321.4 MHz IF path is selected, the signal is routed away from the normal spectrum analyzer signal path. This disables measurements, so no signal is displayed on the display.

Marker

Marker functions are available in ***Measure*** *> Monitor Spectrum and Measure > Log Plot modes only.*

Displays a menu to set each of the four markers to mark or display a particular measurement.

Select Marker

Selects one of the four possible markers. Having selected one of the markers, use the other softkeys on this menu to specify the type of marker or measurement.

Normal

Sets the specified marker to be a normal marker. That is, it marks the point of the frequency offset that you specify, and then the N8201A measures and displays the phase noise at this point.

Delta

Activates a pair of markers at your current frequency offset. The marker that is indicated by an 'R' on the display is fixed while the second marker can be moved using the arrow keys. The frequency difference and the phase noise difference between these two points is displayed.

Delta Pair

Delta Pair is available in **Measure** *> Monitor Spectrum mode only.*

Displays the difference between the delta marker and a reference marker and enables you to adjust both the Ref (start) and Delta (stop) markers independently. After you turn on the delta pair function the Marker Control area (in the bottom portion of the right pane) provides controls for both the start or Reference marker and the delta marker. The start marker number is indicated with a number and an R above the marker (for example, 1R) and the delta marker is indicated with a marker number. There are four conditions that can occur when Delta Pair mode is selected. • If marker mode is Off, the delta marker and reference marker are placed at the center of the display.

- If marker mode is Normal, the delta marker and reference marker are placed at the current marker position on the trace.
- If the marker mode is Delta, the current marker position remains unchanged and the reference marker is placed on the trace at the reference marker position.
- If the marker mode is Span Pair, the marker positions remain unchanged.

The difference between Delta Pair and Delta modes is that in Delta Pair mode the reference marker stays on the trace and you can adjust its trace point. By comparison, in Delta mode the reference marker does not track changes in the trace results, it remains

anchored in amplitude and frequency. Once positioned, the markers stay on the trace points you have selected. Ref and Delta markers maintain their displayed x-axis location, but not their frequency values when you change a parameter that redefines the x-axis scale. Adjusting the Span changes the difference between the two markers. Changing the Center changes the center point of the two markers. This function is useful in functions such as Band Power. Changing the frequency or sweep time of the N8201A does not change the trace point of the markers. You cannot move the markers off the screen.

Span Pair

*Span Pair is available in **Measure** > Monitor Spectrum mode only.*

Sets the control mode for the selected marker to Span Pair. In Span Pair mode the display shows the difference between the delta marker and a reference marker and enables you to adjust both the ref and delta markers. The start marker number is indicated with a number and an R above the marker (for example, 1R) and the stop marker is indicated with a marker number. After you turn on the span pair function the Marker Control area (in the bottom portion of the right pane) provides controls for both the start or Reference marker and the span marker.

Adjusting the span changes the frequency difference between the two markers while maintaining the midpoint between the two markers at a fixed frequency. Changing the center changes the center point between the two markers while maintaining the frequency difference.

There are four conditions that can occur when Span Pair mode is selected.

- If marker mode is Off, the delta marker and reference marker are placed at the center of the display.
- If marker mode is Normal, the delta marker and reference marker are placed at the current marker position on the trace.
- If the marker mode is Delta, the current marker position remains unchanged and the reference marker is placed on the trace at the reference marker position.
- If the marker mode is Delta Pair, the marker positions remain unchanged.

RMS Noise Degrees

The root mean square (RMS) of the phase noise between the two points is calculated, and is displayed in degrees.

RMS Noise Radians

The root mean square (RMS) of the phase noise between the two points is calculated, and is displayed in radians.

RMS Noise Jitter

The root mean square (RMS) of the jitter between the two points is calculated, and is displayed in units of time, typically in picoseconds ('ps' or 10^{-12} sec) or femtosecond ('fs' or 10^{-15} sec).

Residual FM

Activates a pair of markers at your current frequency offset. One of the markers (indicated by an 'R' on the display) is fixed while the second can be moved using the arrow keys. The root mean square (RMS) of the residual FM between these two points is calculated and displayed.

Off

Switches the specified marker off.

Marker Trace

Specifies one of the three traces to place the active marker.

Readout

*Readout functions are available in **Measure** > Monitor Spectrum mode only.*

Enables you to affect how the x-axis information for the selected marker is displayed in the marker area (top-right of the display) and the active function area of the display. It only affects the readout on the display of the horizontal position information (for example, frequency).

Frequency

Sets the marker readout to Frequency, displaying the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker. Frequency readout is the default setting in non-zero spans and is not available in zero spans.

Period

Sets the marker readout to Period, displaying the reciprocal of the frequency at the marker position, or the reciprocal of the frequency separation of the two markers in a delta-marker mode. Period readout is not available in zero spans. If the markers are at the same frequency in a delta marker mode, the result will be the reciprocal of 0, which is infinitely large. The display will show a very large number.

Time

Sets the marker readout to Time, displaying the interval between a normal marker and the start of a sweep or the time of the delta marker relative to the reference marker. Time is the default setting in zero spans. With a span of zero, the time value is the time position relative to the start of the sweep. In a delta marker mode, it is the sweep time interval between two markers.

Inverse Time

Sets the marker readout to Inverse Time, displaying the reciprocal of sweep time between two markers. This function is only available when in both zero span and in a delta marker mode. If the markers are at the same x position, the time between them is 0, so the reciprocal of sweep time is infinitely large. The display will show a very large number.

Marker Table

*Marker Table functions are available in **Measure** > Log Plot mode only.*

Displays all of the data from all of your markers in a tabular form. For every marker you have set, the table will show the number of the trace to which it has been applied, the marker's position on the X axis, and its measured Y axis value. As an aid to interpretation, each marker's trace number is displayed in the same color as the trace itself, that is yellow for trace 1, cyan blue for trace 2 and magenta pink for trace 3.

On

Sets the marker table on. The table is displayed beneath the graticule.

Off

Sets the marker table display off.

Marker All Off

Switches all markers off. All markers are removed from the graticule display, and if the marker table is also being displayed, all entries will be removed from it.

Meas Ctrl (Control)

These functions allow you to pause and resume the currently selected measurement and to select between continuous and single measurements.

Restart

Restarts a previously paused measurement at the beginning. If the current measurement is still in progress, it will stop it as soon as possible and restart it from the beginning.

Measure

Switches the N8201A between triggering a Continuous measurement/sweep or triggering a Single measurement. The front panel Single key also puts the N8201A in single measurement mode.

Pause

Pauses the currently running measurement. Pressing Pause will toggle between pausing and resuming the measurement. If an averaged measurement is in progress, the average counter is frozen when the measurement is halted.

Meas Setup

Displays a menu that allows you to enter custom setup parameters for a measurement. The setup menu displayed depends on whether the Monitor Spectrum, Spot Frequency or the Log Plot measurement was selected in the MEASURE menu.

Avg Number

Specifies the number of measurements that will be averaged. After the specified number of average counts, the Avg Mode setting determines the averaging action. You can also set the averaging function to On or Off.

On

Enables the measurement averaging.

Off

Disables the measurement averaging.

Avg Mode

Selects the type of termination control used for the averaging function. This determines the averaging action after the specified number of measurements (average count) is reached.

Exp

After the average count is reached, each successive data acquisition is exponentially weighted and combined with the existing average.

The Exponential average mode is not available when Phase Noise optimization f Mode is On and the spot frequency offset is between 40 kHz and 60 kHz.

Repeat

After the average count is reached, the averaging is reset and a new average is started.

Meas Type

Meas Type is available in ***Measure*** *> Spot Frequency and* ***Measure*** *> Log Plot modes only.*

Provides the menu keys that allow you specify whether you want to measure the phase noise of a signal or the DANL floor of the N8201A.

Phase Noise

Specifies that the N8201A is to measure the phase noise of an input signal.

DANL Floor

Specifies that the N8201A's DANL (Displayed Average Noise Level) Floor level is to be measured.

Smoothing

*Smoothing is available in **Measure** > Log Plot mode only.*

Specifies the amount of smoothing done to the trace after the measurement has been performed. The amount of smoothing can be varied between 0.00% and 16.0%. By default, both the trace of the raw data and the smoothed trace are displayed.

Filtering

*The Filtering functions are available in **Measure** > Log Plot mode only.*

Applies filtering to the signal.When Filtering is selected, there are four levels from which you can select - none, little, medium and maximum.

None

No filtering is performed. The video bandwidth to resolution bandwidth ratio (VBW/RBW) is fixed at 1.000.

Little

A small amount of filtering is performed. The video bandwidth to resolution bandwidth ratio (VBW/RBW) is fixed at 0.300.

Medium

A moderate amount of filtering is performed. The video bandwidth to resolution bandwidth ratio (VBW/RBW) is fixed at 0.100.

Maximum

A large amount of filtering is performed. The video bandwidth to resolution bandwidth (VBW/RBW) is fixed at 0.030.

NOTE Smoothing is faster than Filtering. However, there is a risk with smoothing that you might hide sudden changes in amplitude that might occur over a very small frequency range.

Decade Table

*Decade Table is available in **Measure** > Log Plot mode only.*

Toggles the Decade Table On and Off. The Decade Table is a table of measurements which shows, for each of the N8201A's three traces (3 max.), the value in dBc/Hz at the point where the traces cross each decade line on the display.

Cancellation

*The Cancellation functions are available in **Measure** > Log Plot mode only.*

If you have acquired a DANL trace from the N8201A, or a trace taken from a very clean source at the same frequency range that you are measuring, then you can automatically subtract this from your measurement. This softkey displays a submenu allowing you to perform this type of automatic noise cancellation.

Cancellation

Switches the automatic noise cancellation feature On or Off.

Ref Trace

Specifies which of the three traces holds the reference trace data. This data is automatically subtracted from your phase noise measurement when Cancellation is switched On.

In order for a trace to be used as a Ref Trace, it must be in Reference (View) mode, and must cover the same range of frequencies as those currently being measured.

Threshold

Specifies the threshold level for noise cancellation. This value represents the minimum difference that must exist at each frequency point between the reference trace and the measured trace for one to be subtracted from the other.

MEASURE

Accesses menu keys that allow Monitor Spectrum, Spot Frequency and Log Plot measurements.

Monitor Spectrum

Displays the frequency spectrum.

Spot Frequency

Measures the phase noise of the input signal at one discrete frequency offset.

Log Plot

Measures the phase noise of a signal at a specified frequency range offset from the main carrier signal. The results are plotted on a graph of phase noise power against the log of the offset frequency.

MODE

Accesses menu keys allowing you to select the measurement mode of your N8201A. Additional measurement personality software must be installed and activated in the N8201A for the other mode softkeys to be labeled and functional.

Spectrum Analysis

Accesses the Spectrum Analysis mode menu keys and associated functions.

Phase Noise

Accesses the Phase Noise measurement personality menu keys and associated functions. This allows you to setup and make valid Phase Noise measurements.

This menu will have additional entries if other personalities have been installed, for example Noise Figure if Option 219 is installed.

Peak Search

*These functions are only available for **Measure** > Monitor Spectrum mode only.*

Next Peak

Places the marker on the next highest peak with an amplitude less than the current peak. The peak must meet the defined peak excursion and threshold values. Peaks that are less than 1% of the current span away from 0 Hz are ignored. If no valid peak is found, an error (No Peak Found) is displayed. Press ESC to clear this message before attempting another search. (Also see the Peak Excursn and Pk Threshold key descriptions.)

Next Pk Right

Moves the marker to the next peak to the right of the current marker. The peak must meet the defined peak excursion and threshold limits. Peaks that are less than 1% of the current span away from 0 Hz are ignored. If no valid peak is found, an error “No Peak Found” is displayed. Press ESC to clear this message before attempting another search. (Also see the Peak Excursn and Pk Threshold key descriptions.)

Next Pk Left

Moves the marker to the next peak to the left of the current marker. The peak must meet the defined peak excursion and threshold limits. Peaks that are less than 1% of the current span away from 0 Hz are ignored. If no valid peak is found, an error “No Peak Found” is displayed. Press ESC to clear this message before attempting another search. (Also see the Peak Excursn and Pk Threshold key descriptions.)

Pk-Pk Search

Finds and displays the amplitude and frequency (or time, if in zero span) differences between the highest and lowest trace points by setting a reference marker on the peak signal and placing a ⊗ marker on the minimum signal.

Mkr -> CF

Sets the center frequency of the N8201A to the frequency of the selected marker. The marker stays at this frequency, so it moves to the center of the display. This function is not available in Zero Span.

Continuous Pk On Off

When a marker is placed on a signal and Continuous Pk is On, the marker will remain on the signal even if the signal frequency changes, as long as the amplitude of the signal does not change by more than 3 dB from one sweep to another. If the signal is lost, an attempt will be made to find it again and maintain the marker on the signal peak. If there

are other signals on screen near the same amplitude, one of them may be found instead. Signals near 0 Hz cannot be maintained effectively, because they cannot be distinguished from the LO feedthrough, which is excluded by intent from the search algorithm.

This function is intended to maintain the marker on signals with a frequency that is changing, and an amplitude that is not changing.

Search Param

Displays the search parameter criteria menu that enables you to adjust the parameters for the peak search functions. These parameters mean that only peaks that rise above the peak threshold by at least the peak excursion and then drop by at least the peak excursion, are identified as peaks.

Excursion

Sets the minimum amplitude variation of signals that the marker can identify as a separate peak. For example, if a peak excursion value of 10 dB is selected, the marker Next Peak function moves only to peaks that rise more than 10 dB above the Peak Threshold and then fall back down by at least the Peak Excursn. This criteria applies to all traces. This function applies to Next Peak, Next Peak Left, and Next Peak Right. If Peak Search is set to Param, it also applies to Peak Search.

Threshold

Specifies the minimum signal level for the N8201A internal peak identification routine to recognize as a peak. To be considered a peak, a signal must rise above the Peak Threshold value by at least the value specified in Peak Excursn, then fall back down by at least the Peak Excursn. This applies to all traces and all windows. Press ESC or select another active function to hide the threshold line. Applies to Next Peak, Next Peak Left, and Next Peak Right. If Peak Search is set to Param, it also applies to Peak Search.

Peak Search Max Param

Sets the mode for Peak Search to either Max or Param and applies to Peak Search only.

- **Max** (Maximum mode) places a marker on the highest peak whenever a Peak Search is performed.
- **Param** (Parameter mode) searches only for peaks that meet the values set with Peak Excursn and Pk Threshold.

Preset

Provides a convenient starting point for making most measurements.

The preset state depends on the preset type setting (user, mode, or factory) in the System keys. If the preset type is set to Factory, pressing Preset results in an immediate N8201A preset to the factory defaults. If it is set to User, pressing Preset accesses a menu that allows you choose your preset settings from either the factory default values or the settings you have previously defined as the User preset state. Refer to "Preset Type" on page 61.

User Preset

Restores the N8201A to a user defined state. The state was defined from the System menu when the **System** > *Power On/Preset* function was selected and Save User Preset was pressed. If you did not save a user state, then the current power-up state is stored as the user preset file for use when Preset is pressed.

Factory Preset

A full factory preset is executed so the N8201A is returned to the factory default state. The preset type can be set to Factory from the Power On/Preset function in the System menu.

Mode Preset

Restores the mode defaults of the current mode, or of the mode that was in use when the N8201A was turned off or powered down.

SPAN X Scale

Start Offset

*Start Offset is available in **Measure** > Spectrum Monitoring and Measure >Log Plot modes only.*

Specifies the offset frequency at which your Log Plot measurement will start.

Stop Offset

*Stop Offset is available in **Measure** > Spectrum Monitoring and Measure >Log Plot modes only.*

Specifies the offset frequency at which your Log Plot measurement will stop.

Scale/Div

*Scale/ Div is available in **Measure** > Spot Frequency mode only.*

Specifies how many measurements will be plotted between each successive division on the graticule. Although the Spot Frequency display appears to be showing a continuously moving plot, it is actually made up of a number of discrete individual measurements plotted over time.

Scale/Div affects both the phase noise display and the delta freq display simultaneously.

Ref Value

*Ref Value is available in **Measure** > Spot Frequency mode only.*

The N8201A stores up to 101 measurement values which it updates continually. These values are then used to generate the plot on the screen. If you are displaying fewer than the full 101 measurements (in other words, you have set Scale/Div (above) to less than 10), you can use this softkey to specify the measurement number with which your display is to start.

Ref Value affects both the phase noise display and the delta freq display simultaneously.

Span

*Span is available in **Measure** > Monitor Spectrum mode only.*

Changes the displayed frequency range symmetrically about the center frequency. Setting the span to 0 Hz puts the N8201A into zero span.

Span is coupled to center frequency. The maximum span may be limited by the center frequency setting.

Full Span

*Full Span is available in **Measure** > Monitor Spectrum mode only.*

Changes the displayed frequency span to show the full frequency range of the N8201A. When using external mixing, it changes the displayed frequency span to the frequency range specified for the selected external mixing band.

Zero Span

*Zero Span is available in **Measure** > Monitor Spectrum mode only.*

Changes the displayed frequency span to zero hertz. The horizontal axis changes to time rather than frequency. The input signal that is at the current center frequency is the displayed amplitude. This is a special operation mode that changes several measurement functions/couplings. The instrument behavior is similar to an oscilloscope with a frequency selective detector installed in front of the oscilloscope. See Application Note 150 for more information on how to use this mode.

Sweep Menu

Sweep Time

*Sweep Time is available in **Measure** > Monitor Spectrum and Spot Frequency modes only.*

Specifies the sweep time for your measurement or to let the N8201A or sets it automatically. This is grayed out in Log Plot measurements as the best setting is automatically calculated for each linear segment.

Sweep

Specifies whether the N8201A sweeps (or measures) continually, or whether it performs a single sweep and then stops.

Single

Performs one single measurement and then stops. You have to press the Restart button every time you want to make another measurement.

Cont

Continuously measures the signal it is receiving and repeatedly updates the plots and the measurements.

Sweep Points

*Sweep Points is available in **Measure** > Monitor Spectrum mode only.*

Sets the number of points per sweep, from 101 to 8192 in non-zero span and 2 to 8192 in zero span. Resolution of setting the sweep time will depend on the number of points selected. If Factory Preset is selected, or the N8201A power is cycled, the number of points per sweep will default to 601. The current value of points is displayed parenthetically, next to the sweep time in the lower-right corner of the display.

Changing the number of points has several effects on the N8201A. Since markers are read at the point location, the marker reading may change. All trace data for the active trace is cleared. If sweep is set to continuous, a new sweep begins immediately. If average is set to On, the averaging starts over with a count of 0.

By selecting a number of sweep points greater than 601, you are optimizing frequency resolution and accuracy while accepting a reduced measurement speed. In addition to sweep points, the span, resolution bandwidth, video bandwidth, average detection, and center frequency will also affect measurement speed.

This function is coupled with the span setting. Increasing the span can change the number of sweep points.

System

Displays the System menu keys to control overall system functions.

Show Errors

Accesses a menu to display the last 30 errors reported. The most recent error will appear at the top of the list. The first error listed will be the first error removed if the error list is longer than 30 entries. If the same error message occurs several times the error message will be incremented rather than added to the list as a new error message. If there is more than one of the same type error, the date and time identify the first time and the last time an error occurred and the number of identical errors is shown.

Update Error List

When On, the error list will be updated with new errors.

Verbose SCPI

Adds additional information to the error messages returned by the SYSTem:ERRor? command. It indicates which remote command was executing when the error occurred and what about that command was unacceptable.

Clear Error Queue

Clears the error queue from the Show Errors display.

Power On/Preset

Determines the state of the instrument when the power is first turned on.

Power On Last/Preset

Sets the power on state to the last instrument settings used before power off, or to the instrument preset state, which is determined by the Preset Type as described below.

Preset Type

Enables you to select what type of preset will be initiated when you select the Preset front panel key.

User Sets the preset state to the user-defined settings. If you have not saved a user state, then the instrument will save the power-up state for you to use as a default user preset state.

Mode Sets the preset state to the current mode factory default instrument state.

Factory Restores the factory default instrument state. A factory preset switches the N8201A to Spectrum Analyzer mode and resets the settings of all the modes to the factory defaults (That is, Spectrum Analysis Mode with continuous sweep).

Save User Preset

Saves the current state of the N8201A into the User Preset state register. After the state is saved, go to System > Power On/Preset > Preset Type > User in order to have this state used as the preset state.

Time/Date

Displays the menu keys used to set and display the real-time clock.

Time Date On/Off

Turns the display of the real time clock on or off.

Date Format MDY/DMY

Sets the date display to month-day-year or day-month-year. It is set to a month-day-year format when the instrument system defaults are restored.

Set Time

Sets the time of the real-time clock. Enter the time in 24 hour HHMMSS format.

Set Date

Sets the date of the real-time clock. Enter the date in the YYYYMMDD format.

Alignments

Displays functions that control the automatic alignment of the instrument and loads default values for the alignment system.

Auto Align

Turns the instrument automatic alignment on or off, or alerts you that alignments are needed.

On Initiates an automatic alignment.

Alert Notifies you when an automatic alignment needs to be run. A 3 degree (Celsius) temperature change or a time span of 24 hours since the last successful alignment will trigger an alert that alignments need to be done, but no alignments will be performed without user input.

Off The instrument will not initiate any visible alignments or alerts.

Align All Now

Immediately executes an alignment cycle of all the subsystems (that is Align RF, Align IF, Align ADC, and Align Current Sys Gain). The instrument will stop any measurement currently underway, perform the full alignment, then restart the measurement from the beginning (similar to pressing the Restart key). All other operations are stopped and the alignments will be visible on the display.

Align Subsys

Access the functions to immediately execute an alignment of one of the subsystems (that is, Align RF, Align IF, Align ADC, and Align Current Sys Gain). When one of the subsystem alignments is started all other operations are stopped and any alignment messages will be visible on the display.

Align RF Initiates an alignment of the RF assembly.

Align IF Initiates an alignment of the IF assembly.

Align ADC Initiates an alignment of the ADC circuitry.

Align Current IF Flatness Initiates an alignment of the current IF flatness, for the purpose of improving absolute amplitude within FFT sweeps and improving group delay in some digital demodulation measurements.

Align Current Sys Gain Initiates a fine-tuning adjustment of the system gain, primarily to correct for small amplitude variations that occur as resolution bandwidth is switched.

Restore Align Defaults

Loads the default values for the alignment system, turns on the frequency correction, and resets the timebase to the factory values. Align All Now must be executed three times after initiating a Restore Alignments Defaults function to meet specifications.

Reference

Displays functions that control the external frequency reference.

Freq Ref

Specifies the frequency reference as being internal or external. If the frequency reference is specified as internal, the frequency of the reference is automatically identified as being 10 MHz. If the frequency reference is external, you must enter the frequency of the external reference being used. If External Reference is being used Ext Ref will be displayed on the right side of the screen.

10 MHz Out

Uses the N8201A's 10 MHz Reference Out signal as the reference.

Restore Sys Defaults

Resets the system settings to their factory defaults, including "persistent functions." It also does a Factory Preset that resets the N8201A to the Spectrum Analysis mode. If does not reset user data such as saved instrument states.

Persistent functions are things such as time/date display style and auto alignment state. These are the parameters that are unaffected by a power cycle or an instrument preset.

Trace/View

*Trace/View functions are not available in **Measure** > Spot Frequency mode.*

Accesses the view menu keys that allow you to set the way measurement result information is displayed. The menu options will vary depending on the measurement that is selected under the Measure menu.

Trace

Selects one of three traces to then specify its characteristics.

Mode

Clear Write

Clear Write is available in **Measure** > *Monitor Spectrum mode only.*

Erases any data previously stored in the selected trace and updates the display with new trace data.

Max Hold

*Max Hold is available in **Measure** > Monitor Spectrum mode only.*

Maintains the maximum level for each trace point of the selected trace and updates each trace point if a new maximum level is detected in successive sweeps.

Min Hold

*Min Hold is available in **Measure** > Monitor Spectrum mode only.*

Maintains the minimum level for each trace point of the selected trace and updates each trace point if a new minimum level is detected in successive sweeps.

Raw

*Raw is available in **Measure** > Log Plot mode only.*

The trace selected in Trace (above) records and displays the raw measurement data.

Smoothed

*Smoothed is available in **Measure** > Log Plot mode only.*

The trace selected in Trace (above) records and displays the smoothed measurement data.

View

Displays the selected trace on the screen. Trace 1 is yellow, Trace 2 is cyan blue, and Trace 3 is magenta pink.

Blank

Hides the currently selected trace on the display so you can no longer see it.

Operations

Selects a menu allowing you to move data between traces.

1 -> 2 Copies the data in Trace 1 to Trace 2.

1 -> 3 Copies the data in Trace 1 to Trace 3.

2 -> 1 Copies the data in Trace 2 to Trace 1.

2 -> 3 Copies the data in Trace 2 to Trace 3.

3 -> 1 Copies the data in Trace 3 to Trace 1.

3 -> 2 Copies the data in Trace 3 to Trace 2.

1 <-> 2 Swaps the data in Trace 1 and Trace 2.

1 <-> 3 Swaps the data in Trace 1 and Trace 3.

2 <-> 3 Swaps the data in Trace 2 and Trace 3.

When data is stored in a trace, that trace is set to View mode.

Normalize

Displays menu keys that enable you to normalize trace data.

Store Ref (1 -> 3)

Copies trace 1 into trace 3. Store Ref (1 > 3) must be pressed before pressing Normalize (On). Note that this puts trace 3 in view mode.

Normalize On Off

Normalize (On) activates the normalize function. On each sweep, the normalized trace (trace 1) is subtracted from trace 3 and the result is added to the normalized reference level. The display shows the result of the following calculation in trace 1. Note that this determines the location of the trace on the display, not the marker reading.

Trace 1 – Reference Trace. Normalized Reference Level where trace 1 and the reference trace are in absolute units and the reference level is in relative units.

The new trace 1 is normalized with respect to the normalized reference level and reference trace, even if the values of the normalized reference level or reference are changed. This function remains in effect on all subsequent sweeps until it is turned off.

The normalize function is most useful for applying correction data to a trace while making a stimulus-response measurement with a tracking source. For example, connect the cables and a through line in place of the device to be measured (between the tracking source and the N8201A input). Notice that the frequency response is not perfectly flat, showing the response of the cables, as well as the flatness of both the tracking generator and the N8201A. Now press Store Ref (1 -> 3) > Normalize On. Notice that the displayed trace is now flat, or normalized. The position of the normalized trace can now be moved to a different position on the display by changing the normalized reference position. This may be useful if the device to be tested has positive gain, such as an amplifier. Now replace the through line with the device under test, and an accurate measurement of the gain or loss can be made.

Normalize Ref Lvl

Sets the level (in dB) of the normalized reference.

Norm Ref Posn

Offsets the displayed trace without affecting the instrument gain or attenuation settings. This allows the displayed trace to be moved without decreasing measurement accuracy. The normalized reference position is indicated with a (>) character on the left side of the display and a (<) character on the right side of the display, just inside the graticule.

Ref Trace 3 View Blank

Views or blanks the reference trace on the display. The reference trace is trace 3, so this is the same as setting trace 3's display attribute.

Trig

Displays menu keys for selecting the trigger mode of a sweep or measurement. When in a trigger mode other than Free Run, the N8201A will begin a sweep only with the proper triggering condition.

Trigger

Accesses a menu of trigger modes.

Free Run

Sets the trigger to start a new sweep as soon as the last one has ended (continuous sweep mode) or immediately (single sweep mode).

Video

Activates the trigger condition that allows the next sweep to start if the detected RF envelope voltage crosses a level set by the video trigger level. When Video is pressed, a line appears on the display. The N8201A triggers when the input signal exceeds the trigger level at the left edge of the display. The line remains on the display as long as video trigger is the trigger type.

Line

Sets the trigger to start a new sweep to be synchronized with the next cycle of line voltage.

Trigger In

Sets the trigger to start a new sweep whenever the external voltage (connected to the front panel Trigger In) passes through approximately 1.5 V.

RF Burst

Sets the trigger to start by an RF burst envelope signal.

Trig Slope

Controls the trigger polarity. It is positive to trigger on a rising edge and negative to trigger on a falling edge.

Trig Delay

Controls a time delay during which the N8201A will wait to begin a sweep after receiving an external or line trigger signal. You can use negative delay to pre-trigger the instrument.

NOTE Trigger Delay is not available in Free Run mode, so turning Free Run on turns off Trigger Delay, but preserves the value of Trigger Delay.

4 Language Reference

These commands are only available when the Phase Noise mode has been selected using N8201A :SELect or N8201A :NSELect. If the Phase Noise mode is selected, commands that are unique to another mode are not available.

CALCulate Subsystem

This subsystem is used to perform post-acquisition data processing. In effect, the collection of new data triggers the CALCulate subsystem. In this instrument, the primary functions in this subsystem are markers and limits.

The SCPI default for data output format is ASCII. The format can be changed to binary with FORMat:DATA which transports faster over the bus.

CALCulate:LPLot Subsystem

The Log Plot measurement shows a graph of the phase noise power plotted against the log of the frequency offset from the carrier.

Decade Table On/Off

:CALCulate:LPLot:DECade:TABLe[:STATe] OFF|ON|0|1

:CALCulate:LPLot:DECade:TABLe[:STATe]?

Displays the measured values for each plot at every point where the trace(s) cross(es) a decade line on the display. This command turns the decade table display on or off.

Example:

CALC:LPLot:DEC:TABLE ON

Remarks:

The LPLot keyword must be specified in the command.

Front Panel Access:

Meas Setup, Decade Table

Copy Trace A to Trace B

:CALCulate:LPLot:TRACe:COPY[A][B]

Copies the contents of one trace [A] to another trace [B].

Remarks: There are no spaces in the command. In other words, :COPY12 is a valid command that would copy Trace 1 to Trace 2. :COPY1 2 would be invalid as it contains a space.

Front Panel Access:

Trace/View, Operations

Trace Mode

:CALCulate:LPLot:TRACe[1]|2|3:MODE RAW|SMOothed|VIEW|BLANk

:CALCulate:LPLot:TRACe[1]|2|3:MODE?

Determines the type of trace stored and displayed in the selected trace.

Factory Preset:

Trace 1: Raw

Trace 2: Smoothed

Trace 3: Blank

Range:

Raw, Smoothed, View or Blank

Front Panel Access:

Trace/View, Trace[1|2|3], Mode

Swap Trace A and Trace B

:CALCulate:LPLot:TRACe:SWAP[A][B]

Swaps the contents of two traces, [A] and [B]. Trace [A] data moves to Trace [B], while Trace [B] data moves to Trace [A].

Remarks:

There are no spaces in the command. In other words, :SWAP12 is a valid command that would swap Trace 1 to Trace 2 data. :SWAP1 2 would be invalid as it contains a space.

Front Panel Access:

Trace/View, Operations

CALCulate:MARKers Subsystem

Marker Mode

:CALCulate:LPLot:MARKer[1]|2|3|4:MODE
POSition|DELTa|RMSDegree|RMSRadian|RFM
|RMSJitter|OFF

:CALCulate:LPLot:MARKer[1]|2|3|4:MODE?

Specifies the calculation mode for each of the four markers.

POSition Sets the specified marker to be a 'normal' marker. That is, it measures the phase noise at your specified frequency offset.

DELTa Sets the specified marker to measure the difference in frequency between the first and the second marker.

RMSDegree Sets the specified marker to measure the RMS of the phase noise between the first and the second marker. The result is displayed in degrees.

RMSRadian Sets the specified marker to measure the RMS of the phase noise between the first and the second marker. The result is displayed in radians.

RFM Sets the specified marker to measure the RMS of the residual FM between the first and the second marker. The result is displayed in Hertz.

RMSJitter Sets the specified marker to measure the RMS of the jitter between the first and the second marker. The result is displayed in units of time.

OFF Sets the marker off

Example:

CALC:LPLot:MARK:MODE RMSD

Remarks:

The LPLot keyword must be specified in the command.

Front Panel Access:

Marker, Mode

Marker Table On/Off

:CALCulate:LPLot:MARKer:TABLe[:STATe] OFF|ON|0|1

:CALCulate:LPLot:MARKer:TABLe[:STATe]?

Turns the marker table display on or off.

Example:

CALC:LPLot:MARK:TABLE ON

Remarks:

The LPLot keyword must be specified in the command.

Front Panel Access:

Marker, Marker Table On/Off

Marker Trace

:CALCulate:LPLot:MARKer[1]|2|3|4:TRACe <tracenum>

:CALCulate:LPLot:MARKer[1]|2|3|4:TRACe?

Specifies the trace on which the specified marker will be placed.

Example:

CALC:LPLot:MARK:TRAC 3

Remarks:

The LPLot keyword must be specified in the command.

Front Panel Access:

Marker, Select Marker

Marker X Value

:CALCulate:LPLot:MARKer[1]|2|3|4:X <number>

:CALCulate:LPLot:MARKer[1]|2|3|4:X?

Positions the selected marker at the specified position on the X-axis.

Range:

Graph Start Offset and Stop Offset frequencies.

Factory Preset:

All four markers are preset to 10 kHz

Example:

CALC:LPLot:MARK:X 2.5 MHz

Front Panel Access:

Marker, Select Marker, Marker Control Position test box.

Marker Y Value

:CALCulate:LPLot:MARKer[1]|2|3|4:Y?

Queries and returns the current Y value for the selected marker. The value is returned in the Y-axis units of the current trace (typically dBc/Hz).

Range:

-200.0 to 200.0 dBc/Hz, dB/Hz, Radians or Degrees, depending on the type of marker.

Example:

CALC:LPLot:MARK3:Y?

Front Panel Access:

None

CONFigure Subsystem

The CONFigure commands are used with several other commands to control the measurement process. The full set of commands are described in the section “MEASure Group of Commands" on page 85.

Selecting measurements with the CONFigure/FETCh/MEASure/READ commands sets the instrument state to the defaults for that measurement and to make a single measurement. Other commands are available for each measurement to allow you to change: settings, view, limits, etc. Refer to:

SENSe:<measurement>, SENSe:CHANnel, SENSe:CORRection, SENSe:DEFaults, SENSe:DEViation, SENSe:FREQuency, SENSe:PACKet, SENSe:POWer, SENSe:RADio, SENSe:SYNC

CALCulate:<measurement>, CALCulate:CLIMits

DISPlay:<measurement>

TRIGger

The INITiate[:IMMediate] or INITiate:RESTart commands will initiate the taking of measurement data without resetting any of the measurement settings that you have changed from their defaults.

Configure the Selected Measurement

:CONFigure:<measurement>

A CONFigure command must specify the desired measurement. It will set the instrument settings for that measurement’s standard defaults, but should not initiate the taking of data. The available measurements are described in the MEASure subsystem.

If CONFigure initiates the taking of data, the data should be ignored. Other SCPI commands can be processed immediately after sending CONFigure. You do not need to wait for the CONF command to complete this 'false' data acquisition.

Configure Query

:CONFigure?

Returns the name of the current measurement.

DISPlay Subsystem

The DISPlay controls the selection and presentation of textual, graphical, and TRACe information. Within a DISPlay, information may be separated into individual WINDows.

Available in Monitor Spectrum measurement mode only.

Set the Display Line

:DISPlay:MONitor:WINDow:TRACe:Y:DLINe <ampl>

:DISPlay:MONitor:WINDow:TRACe:Y:DLINe?

Defines the level of the display line, in the active amplitude units if no units are specified.

Factory Preset:

2.5 divisions below the reference level

Range:

10 display divisions below the reference level to the reference level

Default Unit:

Current active units

Front Panel Access:

Display, Display Line

Control the Display Line

:DISPlay:MONitor:WINDow:TRACe:Y:DLINe:STATe OFF|ON|0|1

:DISPlay:MONitor:WINDow:TRACe:Y:DLINe:STATe?

Turns the display line on or off.

Factory Preset:

Off

Front Panel Access:

Display, Display Line

FETCh Subsystem

The FETCh? queries are used with several other commands to control the measurement process. These commands are described in the section on the “MEASure Group of Commands" on page 85. These commands apply only to measurements found in the MEASURE menu.

This command puts selected data from the most recent measurement into the output buffer (new data is initiated/measured). Use FETCh if you have already made a good measurement and you want to look at several types of data (different [n] values) from the single measurement. FETCh saves you the time of re-making the measurement. You can only fetch results from the measurement that is currently active.

If you need to make a new measurement, use the READ command, which is equivalent to an INITiate[:IMMediate] followed by a FETCh.

:FETCh <meas>? will return valid data only when the measurement is in one of the following states:

idle

initiated

paused

Fetch the Current Measurement Results

:FETCh:<measurement>[n]?

A FETCh? command must specify the desired measurement. It will return the valid results that are currently available, but will not initiate the taking of any new data. You can only fetch results from the measurement that is currently selected. The code number “n” selects the kind of results that will be returned. The available measurements and data results are described in the “MEASure Group of Commands" on page 85.

FORMat Subsystem

The FORMat subsystem sets a data format for transferring numeric and array information.

Measurement Results format

:FORMat:MEASure[:DATA] ASCii|REAL32

:FORMat:MEASure[:DATA]?

Controls the format of measurement data that is transferred to a remote user. The REAL and ASCII formats will format trace data in the current amplitude units.

ASCII - Amplitude values are in ASCII, in amplitude units, separated by commas. ASCII format requires more memory than the binary formats. Therefore, handling large amounts of this type of data, will take more time and storage space.

Real32 - Binary 32-bit real values in amplitude units, in a definite length block. Transfers of real data are done in a binary block format.

A definite length block of data starts with an ASCII header that begins with # and indicates how many additional data points are following in the block. Suppose the header is #512320.

- The first digit in the header (5) tells you how many additional digits/bytes there are in the header.
- The 12320 means 12 thousand, 3 hundred, 20 data bytes follow the header.
- Divide this number of bytes by your selected data format bytes/point, that is divide by 4 for Real32. In this example, if you are using Real32 then there are 3080 points in the block.

Factory Preset:

ASCII

Front Panel Access:

Not Applicable. This is a remote command only.

INITiate Subsystem

The INITiate subsystem is used to start a trigger for a measurement. These commands only initiate measurements from the MEASURE front panel key or the “MEASure Group of Commands" on page 85.

Take New Data Acquisition for Selected Measurement

:INITiate:<measurement>

Initiates a trigger cycle for the measurement specified, but does not return data. The valid measurement names are described in the MEASure subsystem.

If your selected measurement is not currently active, the instrument will change to the measurement in your INIT:<meas> command and initiate a trigger/measurement cycle.

This command is not available for the one-button measurements in the Spectrum Analysis mode.

Example:

INIT:MON

INSTrument Subsystem

This subsystem includes commands for querying and selecting instrument measurement (personality option) modes.

Select Application by Number

:INSTrument:NSELect <integer>

:INSTrument:NSELect?

Select the measurement mode by its instrument number. The actual available choices depends upon which applications are installed in the instrument.

1 = SA

8 = BASIC

14 = PNOISE (phase noise)

If you are using the SCPI status registers and the measurement mode is changed, the status bits should be read, and any errors resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Hence, any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

Example:

INST:NSEL 14

Factory Preset:

Persistent state with factory default of 1

Range:

1 to x, where x depends upon which applications are installed.

Front Panel Access:

Mode

Select Application

:INSTrument[:SELect]
SA|PNOISE|BASIC|CDMA|CDMA2K|EDGEGSM|NADC|PDC|WCDMA

:INSTrument[:SELect]?

Select the measurement mode. The actual available choices depend upon which modes (measurement applications) are installed in the instrument. A list of the valid choices is returned with the INST:CAT? query.

Once a measurement mode is selected, only the commands that are valid for that mode can be executed.

1 = SA

8 = BASIC

14 = PNOISE (phase noise)

If you are using the status bits and the measurement mode is changed, the status bits should be read, and any errors resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Hence, any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

Example:

INST:SEL PNOISE

Factory Preset:

Persistent state with factory default Spectrum Analyzer.

Front Panel Access:

Mode

MEASure Group of Commands

This group includes the CONFigure, FETCh, MEASure, and READ commands that are used to make measurements and return results. The different commands can be used to provide fine control of the overall measurement process, like changing measurement parameters from their default settings. Most measurements should be done in single measurement mode, rather than measuring continuously.

The SCPI default for the format of any data output is ASCII. The format can be changed to binary with FORMat:MEASure:DATA which transports faster over the bus.

CONFigure, FETCh, MEASure, READ Interactions

These commands are all inter-related. See Figure 1.

Measure Commands

:MEASure:<measurement>[n]?

This is a fast single-command way to make a measurement using the factory default instrument settings. These are the settings and units that conform to the Mode Setup settings (for example, radio standard) that you have currently selected.

- Stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory defaults.
- Initiates the data acquisition for the measurement.
- Blocks other SCPI communication, waiting until the measurement is complete before returning results.
- After the data is valid it returns the scalar results, or the trace data, for the specified measurement. The type of data returned may be defined by an [n] value that is sent with the command.

The scalar measurement results will be returned if the optional [n] value is not included, or is set to 1. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available.

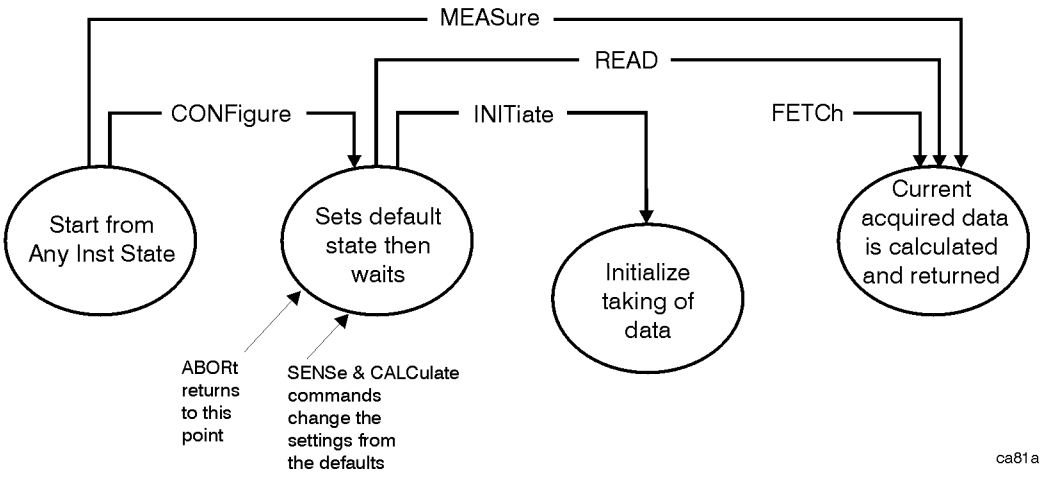
ASCII is the default format for the data output. The binary data formats should be used for handling large blocks of data since they are smaller and faster than the ASCII format. Refer to the FORMat:MEASure:DATA command for more information.

If you need to change some of the measurement parameters from the factory default settings you can set up the measurement with the CONFigure command. Use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to change the settings. Then you can use the READ? command to initiate the measurement and query the results. See Figure 1.

If you need to repeatedly make a given measurement with settings other than the factory defaults, you can use the commands in the SENSe:<measurement> and CALCulate:<measurement> subsystems to set up the measurement. Then use the READ? command to initiate the measurement and query results.

Measurement settings persist if you initiate a different measurement and then return to a previous one. Use READ:<measurement>? if you want to use those persistent settings. If you want to go back to the default settings, use MEASure:<measurement>?.

Figure 1 Measurement Group of Commands



Configure Commands

:CONFigure:<measurement>

This command stops the current measurement (if any) and sets up the instrument for the specified measurement using the factory default instrument settings. It sets the instrument to single measurement mode but should not initiate the taking of measurement data unless INIT:CONTinuous is ON. After you change any measurement settings, the READ command can be used to initiate a measurement without changing the settings back to their defaults.

The CONFigure? query returns the current measurement name.

Fetch Commands

:FETCh:<measurement>[n]?

This command puts selected data from the most recent measurement into the output buffer. Use FETCh if you have already made a good measurement and you want to return several types of data (different [n] values, for example, both scalars and trace

data) from a single measurement. FETCh saves you the time of re-making the measurement. You can only FETCh results from the measurement that is currently active, it will not change to a different measurement.

If you need to get new measurement data, use the READ command, which is equivalent to an INITiate followed by a FETCh.

The scalar measurement results will be returned if the optional [n] value is not included, or is set to 1. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available. The binary data formats should be used for handling large blocks of data since they are smaller and transfer faster than the ASCII format. (FORMat:DATA)

FETCh may be used to return results other than those specified with the original READ or MEASure command that you sent.

Read Commands

:READ:<measurement>[n]?

- Does not preset the measurement to the factory default settings. For example, if you have previously initiated the PNOISE measurement and you send READ:PNOISE? it will initiate a new measurement using the same instrument settings.
- Initiates the measurement and puts valid data into the output buffer. If a measurement other than the current one is specified, the instrument will switch to that measurement before it initiates the measurement and returns results.

  For example, suppose you have previously initiated the PNOISE measurement, but now you are running the noise figure measurement. Then you send READ:PNOISE? It will change from channel power back to PNOISE and, using the previous PNOISE settings, will initiate the measurement and return results.
- Blocks other SCPI communication, waiting until the measurement is complete before returning the results.

  If the optional [n] value is not included, or is set to 1, the scalar measurement results will be returned. If the [n] value is set to a value other than 1, the selected trace data results will be returned. See each command for details of what types of scalar results or trace data results are available. The binary data formats should be used when handling large blocks of data since they are smaller and faster than the ASCII format. (FORMat:DATA)

Phase Noise Log Plot Measurement

Measures the phase noise of a signal at a specified frequency range offset from the main carrier signal. The results are plotted on a graph of phase noise power against the log of the offset frequency. You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:LPLot commands for more measurement related commands.

:FETCh:LPLot[n]?

:READ:LPLot[n]?

:MEASure:LPLot[n]?

Front Panel Access:

Measure, Log Plot

Table 5 Measurement Results Available

n	Results Returned
0	No return value.
not specified or n=1	Returns seven comma-separated scalar values corresponding to the following measurement results: Carrier Power (dBm) Carrier Frequency (Hz) RMS Phase Noise over the entire smoothed trace (degrees) RMS Phase Noise over the entire smoothed trace (radians) Residual FM over the entire smoothed trace (Hz) Spot Noise at the Start Offset Frequency (dBc/Hz) Spot Noise at the Stop Offset Frequency (dBc/Hz)
n=2	Returns three comma-separated scalar values corresponding to the following measurement values: Number of x/y value pairs in Trace 1 Number of x/y value pairs in Trace 2 Number of x/y value pairs in Trace 3
n=3	Returns a comma-separated list of the data points from Trace 1. The number of data points in the trace depends on the implementation and the frequency range being measured. This can be found by using the :LPLOT2? command (above):
n=4	Returns a comma-separated list of the data points from Trace 2. The number of data points in the trace depends on the implementation and the frequency range being measured. This can be found by using the :LPLOT2? command (above):
n=5	Returns a comma-separated list of the data points from Trace 3. The number of data points in the trace depends on the implementation and the frequency range being measured. This can be found by using the :LPLOT3? command (above):

Table 5 Measurement Results Available

n	Results Returned
n=6	Returns a comma-separated list of the data points which represent the values found on each trace at each decade offset frequency. The points in the list are returned in the following order: Frequency Offset, Trace number 1 (yellow) amplitude, Trace number 2 (cyan blue) amplitude and Trace number 3 (magenta pink) amplitude. Any data points that do not have an associated trace, or any data points that not covered by aa particular frequency will return SCPI_NAN. The total number of values listed can be calculated by multiplying the number of decades by 4, and adding 4.

Monitor Spectrum

Measures the power levels across the specified spectral band using one of three traces. By default, the N8201A's entire range is measured.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:MONitor commands for more measurement related commands.

:CONFigure:MONitor

:FETCh:MONitor[n]

:READ:MONitor[n]

:MEASure:MONitor[n]

Front Panel Access:

Measure, Monitor Spectrum

Table 6 Measurement Results Available

n	Results Returned
not specified or n=1	Trace 1 data
2	Trace 2 data
3	Trace 3 data

Phase Noise Spot Frequency Measurement

Measures the phase noise of a signal at a specified frequency offset from the main carrier signal. You must be in the Phase Noise mode to use this command.

Use INSTrument:SELect to set the mode.

The general functionality of CONFigure, FETCh, MEASure, and READ are described at the beginning of this section. See the SENSe:SFRequency commands for more measurement related commands.

:FETCh:SFRequency[n]?

:READ:SFRequency[n]?

:MEASure:SFRequency[n]?

Front Panel Access:

Measure, Spot Frequency

Table 7 Measurement Results Available

n	Results Returned
0	No return value.
not specified or n=1	Returns six comma-separated scalar values corresponding to the following measurement results: Carrier Power (dBm) Carrier Frequency (Hz) Initial carrier frequency (Hz) Carrier frequency delta (Hz) Upper or right SSB (Single Side Band) noise (dBc/Hz) Average SSB (Single Side Band) noise (dBc/Hz)
n=2	Returns 101 comma-separated scalar values representing a trail of the measured phase noise of the carrier signal.
n=3	Returns 101 comma-separated scalar values representing a trail of the measured carrier frequencies.
n=4	Returns 101 comma-separated scalar values representing a trail of the measured carrier powers.

MMEMory Subsystem

The purpose of the MMEMory subsystem is to provide access to mass storage devices such as internal drives. If mass storage is not specified in the filename, the default mass storage specified in the MSIS command will be used.

Load a Log Plot Reference Trace from Disk

:MMEMory:LPLot:LOAD:TRACe <tracenum>,<filename>

:MMEMory:LPLot:LOAD:TRACe <tracenum>,<filename>

Loads the contents of a data file to one of the traces. You must specify the complete file name and path.

Example:

:MMEM:LPL:LOAD:TRAC 2,“C:MYTRACE.lpt”

Remarks:

See also the command MMEMory:LPLot:STORe:TRACe<tracenum>,<filename>

Front Panel Access:

File, Load, Type, Trace, Source Device, File Name, Load Now

Remarks:

Three separate actions have to be performed when using the front panel keys to save a file. First the drive has to be specified. Then the file name has to be specified. Finally you have to load the data to your specified trace.

Store a Log Plot Reference Trace to Disk

:MMEMory:LPLot:STORe:TRACe <tracenum>,<filename>

:MMEMory:LPLot:STORe:TRACe <tracenum>,<filename>

Stores the contents of one of the traces to the PC or to the N8201A’s own internal file system for loading at a later time. You must specify the complete file name and path.

Example:

:MMEM:LPL:STOR:TRAC 2,“C:MYTRACE.LPT”

Remarks:

See also the command :MMEMory:LPLot:LOAD:TRACe<tracenum>, filename>

Front Panel Access:

File, Save, Type, State, Destination Device, File Name, Save Now

Remarks:

Three separate actions have to be performed when using the front panel keys to save a file. First the volume has to be specified. Then the file name has to be specified. Finally you have to save the data to your specified file.

READ Subsystem

The READ? commands are used with several other commands and are documented in the section in the “MEASure Group of Commands" on page 85.

Initiate and Read Measurement Data

:READ:<measurement>[n]?

A READ? query must specify the desired measurement. It will cause a measurement to occur without changing any of the current settings and will return any valid results. The code number n selects the kind of results that will be returned. The available measurements and data results are described in the “MEASure Group of Commands" on page 85.

SENSe Subsystem

These commands are used to set the N8201A state parameters so that you can measure a particular input signal. Some SENSe commands are only for use with specific measurements found under the MEASURE key menu or the “MEASure Group of Commands" on page 85. The measurement must be active before you can use these commands.

The SCPI default for the format of any data output is ASCII. The format can be changed to binary with FORMat:DATA which transports faster over the bus.

Display Average Noise Level—Measurement Method

[:SENSe]:DANL:METHod ATTenuator|REMoval

[:SENSe]:DANL:METHod?

Specifies which of the two possible methods of measuring DANL is to be used. Setting the mode to Attenuator causes the N8201A to attenuate any input signal to such a degree that it disappears into the background noise. The noise level can then be measured. Setting the mode to Removal requires that the input cable be physically disconnected form the N8201A before the measurement is made.

Factory Preset:

Attenuator

Remarks:

Removal is the more accurate method of measuring DANL, but Attenuator is generally more convenient and is suitable for most purposes.

Front Panel Access:

Input/Output, DANL Method

Default Reset

[:SENSe]:DEFaults

Restores personality Mode Setup defaults.

Front Panel Access:

Mode Setup, Restore Mode Setup Defaults

Remarks:

This command sets all the SENSe defaults but has no effect on the MEASure default settings. Use the CONFigure:<measurement> command to set measurement defaults.

Frequency Commands

Carrier Frequency

[:SENSe]:FREQuency:CARRier <freq>

[:SENSe]:FREQuency:CARRier?

Specifies the frequency of the carrier.

Factory Preset:

50 MHz

Range:

3 Hz to 26.5 GHz

Front Panel Access:

FREQUENCY/Channel, Carrier Frequency

Carrier Search

[:SENSe]:FREQuency:CARRier:SEARch

Automatically searches for and tunes to the strongest signal within the currently specified search span.

Front Panel Access:

FREQUENCY/Channel, Carrier Search

Remarks:

When Search Span is set to Auto, the N8201A searches the entire spectrum above 100 Hz. When Search Span is set to manual, the search is limited to the currently specified frequency span centered on the current carrier frequency.

Search Span Automatic

[:SENSe]:FREQuency:CARRier:SEARch:AUTO ON|OFF|1|0

[:SENSe]:FREQuency:CARRier:SEARch:AUTO?

Specifies whether automatic setting of the frequency span is set to On or Off. When Search Auto is set to On, the N8201A searches the entire spectrum above 100 Hz. When Search Auto is set to Off, the search is limited to the currently specified frequency span centered on the current carrier frequency.

Factory Preset:

On

Front Panel Access:

FREQUENCY/Channel, Search Span Auto/Manual

Search Span

[:SENSe]:FREQuency:CARRier:SEARch:SPAN <freq>

[:SENSe]:FREQuency:CARRier:SEARch:SPAN?

Specifies the frequency range within which the N8201A will search for a carrier wave.

Factory Preset:

10 kHz

Range:

100 Hz to 200 MHz

Remarks:

This is only applicable when automatic search span ([:SENSe]:FREQuency:CARRier:SEARch:AUTO) is set to Off.

Front Panel Access:

FREQUENCY/Channel, Search Span

Signal Tracking

[:SENSe]:FREQuency:CARRier:TRACk[:STATe] OFF|ON|1|0

[:SENSe]:FREQuency:CARRier:TRACk[:STATe]?

Specifies whether or not the N8201A tracks a slowly drifting signal. When signal tracking is Off, the N8201A measures at a fixed frequency, When signal tracking is On, the N8201A repeatedly measures the frequency of the carrier signal to check for any change that might have occurred, and retunes to the new frequency if necessary.

Factory Preset:

Off

Remarks:

The repeated realignment of the carrier signal when signal tracking is On causes measurements to take longer than when signal tracking is Off.

Front Panel Access:

FREQUENCY/Channel, Signal Track On/Off

Signal Tracking Drift Span

[:SENSe]:FREQuency:CARRier:TRACk:DSPan <value>

[:SENSe]:FREQuency:CARRier:TRACk:DSPan?

Specifies the span, as a percentage of the carrier frequency, within which the frequency drift will be measured. For example, if a drift span of 12% is specified, the signal will be tracked as long as it remains within plus or minus 6% of the most recent frequency measurement.

Factory Preset:

10%

Range:

10% to 25%

Remarks:

Only available when signal tracking is On and the Spot Frequency measurement is running.

Front Panel Access:

FREQUENCY/Channel, Tracking, Drift Span

Signal Tracking Interval

[:SENSe]:FREQuency:CARRier:TRACk:INTerval <value>

[:SENSe]:FREQuency:CARRier:TRACk:INTerval?

Specifies how often the N8201A retunes to a drifting carrier signal. If signal tracking is On and Tracking Mode is set to Interval or to Both, this value specifies the number of individual phase noise measurements that will be made before the N8201A retunes to the carrier signal.

Factory Preset:

10

Range:

1 to 100

Remarks:

Only available when signal tracking is On, the Spot Frequency measurement is running.

Front Panel Access:

FREQUENCY/Channel, Tracking On, Tracking, Interval

Signal Tracking Mode

[:SENSe]:FREQuency:CARRier:TRACk:METHod INTerval|TOLerance|BOTH

[:SENSe]:FREQuency:CARRier:TRACk:METHod?

Specifies how signal tracking operates. When Tracking Method is set to Interval, the carrier frequency is checked every Interval number of measurements. When Tracking Method is set to Tolerance, the carrier frequency is checked whenever the most recent phase error measurement deviates from the average measurement by Tolerance dBc/Hz. The two modes can be combined by specifying Both. In this case, retuning occurs either when interval measurements have been made or when a measurement deviates from the average by Tolerance dBc/Hz, depending on which happens first.

Factory Preset:

Tolerance

Range:

Interval|Tolerance|Both

Remarks:

Only available when signal tracking is On and the Spot Frequency measurement is running.

Front Panel Access:

FREQUENCY/Channel, Tracking, Mode

Signal Tracking Tolerance

[:SENSe]:FREQuency:CARRier:TRACk:TOLerance <value>

[:SENSe]:FREQuency:CARRier:TRACk:TOLerance?

Specifies when the N8201A retunes to a drifting carrier signal. If signal tracking is On and Tracking Mode is set to Tolerance or to Both, the N8201A retunes to the carrier wave every time a measurement is made that differs from the previous measurement by TOLERANCE dBc/Hz.

Factory Preset:

10 dBc/Hz

Range:

0 dBc/Hz to 40 dBc/Hz

Remarks:

Only available when signal tracking is On, the Spot Frequency measurement is running.

Front Panel Access:

FREQUENCY/Channel, Tracking, Tolerance

Phase Noise Log Plot Measurements

Commands for querying the log plot measurement results and for setting to the default values are found in the"MEASure Group of Commands" on page 85. The equivalent front panel keys for the parameters described in the following commands are found under the Meas Setup key when the Log Plot measurement has been selected from the MEASURE key menu.

Log Plot Number of Averages

[:SENSe]:LPLot:AVERage:COUNt <integer>

[:SENSe]:LPLot:AVERage:COUNt?

Specifies the number of measurements made when calculating the average result.

Factory Preset:

10

Range:

1 to 1000

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Avg Number

Log Plot Average State

[:SENSe]:LPLot:AVERage:[:STATe] ON|OFF|1|0

[:SENSe]:LPLot:AVERage[:STATe]?

Switches averaging on or off.

Factory Preset:

Off (Front panel preset)

On (:CONFigure via SCPI)

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Avg Number

Log Plot Averaging Mode Termination Control

[:SENSe]:LPLot:AVERage:TCONtrol?

Queries and returns the type of termination control used for the averaging function. This determines the averaging action after the specified number of acquisitions (average count) is reached.

REPeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset:

REPeat

Remarks:

The Average Mode will always be set to Repeat.

Log Plot Resolution Bandwidth

[:SENSe]:LPLot:BANDwidth|BWIDth[:RESolution]?

Queries and returns the resolution bandwidth.

Default Unit:

Hz

Front Panel Access:

None

Log Plot Video Bandwidth

[:SENSe]:LPLot:BANDwidth|BWIDth:VIDeo?

Queries the video bandwidth.

Default Unit:

Hz

Front Panel Access:

None

Log Plot Video to Resolution Bandwidth Ratio

[:SENSe]:LPLot:BANDwidth|BWIDth:VIDeo:RATio <numeric>

[:SENSe]:LPLot:BANDwidth|BWIDth:VIDeo:RATio?

Specifies the ratio of the video bandwidth to the resolution bandwidth.

Factory Preset:

1.0

Range:

0.001 to 10

Front Panel Access:

BW/Avg, VBW/RBW

DANL Cancellation Delta Threshold

[:SENSe]:LPLot:CANCellation:DELTa <dB>

[:SENSe]:LPLot:CANCellation:DELTa?

Specifies a minimum difference that must exist between the DANL reference trace and the current measurement before any cancellation will be performed.

Range:

0.001 dB to 5 dB

Example:

LPLot:CANC:DELT 2

Remarks:

The cancellation delta is applied on an individual point by point basis.

Front Panel Access:

Meas Setup, Cancellation, Threshold Delta

DANL Cancellation On/Off

[:SENSe]:LPLot:CANCellation[:STATe] OFF|ON|0|1

[:SENSe]:LPLot:CANCellation[:STATe]?

Switches the noise cancellation feature On or Off. The cancellation feature allows a previously made measurement of the instrument's DANL noise floor to be automatically subtracted from the current measurement.

Example:

LPLot:CANC ON

Remarks:

The DANL of the instrument must first be measured and stored in a reference trace before the cancellation feature can be used.

Front Panel Access:

Meas Setup, Cancellation, Cancellation On Off

DANL Cancellation Reference Trace

[:SENSe]:LPLot:CANCellation:TRACe <tracenum>

[:SENSe]:LPLot:CANCellation:TRACe?

Changes the trace that is used to store the DANL noise floor reference data for use in the DANL cancellation feature.

Range:

1 to 3

Example:

LPLot:CANC:TRAC 2

Remarks:

This reference trace must be in View mode and must cover the same frequency range as that being measured.

Front Panel Access:

Meas Setup, Cancellation, Ref Trace

Log Plot Type of Detection

[:SENSe]:LPLot:DETector[:FUNCtion]?

Queries and returns the detection mode.

Front Panel Access:

None

Log Plot Diagnostic of Y-axis Reference Level

[:SENSe]:LPLot:DIAG:GRAPh:Y:REFerence <level>

[:SENSe]:LPLot:DIAG:GRAPh:Y:REFerence?

Sets and queries the Y-axis reference level.

Default Unit:

dBc/Hz

Example:

LPL:DIAG:GRAP:Y:REF -50

Front Panel Access:

Amplitude, Ref Level

Log Plot Filtering

[:SENSe]:LPLot:FILTering:NONE|LITTle|MEDium|MAXimum

Sets the video bandwidth/resolution bandwidth to one of four predetermined values (1.0, 0.3, 0.1 and 0.03).

Factory Preset:

None (VBW/RBW ratio = 1.000)

Remarks:

You cannot query this command. To find out the current setting, query the VBW/RBW parameter. See “Log Plot Video Bandwidth" on page 102.

Front Panel Access:

Meas Setup, Filtering

Log Plot Start Offset

[:SENSe]:LPLot:FREQuency:OFFSet:STARt <freq>

[:SENSe]:LPLot:FREQuency:OFFSet:STARt?

Specifies the frequency offset at which the measurement starts. The frequency is measured relative to the carrier signal, and refers only to the upper sideband.

Factory Preset:

100 Hz

Range:

10 times smallest RBW to 1 decade less than Stop Offset

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Span/X Scale, Start Offset

Log Plot Stop Offset

[:SENSe]:LPLot:FREQuency:OFFSet:STOP <freq>

[:SENSe]:LPLot:FREQuency:OFFSet:STOP?

Specifies the frequency offset at which the measurement stops. The frequency is measured relative to the carrier signal, and refers only to the upper sideband.

Factory Preset:

1 MHz

Range:

1 decade greater than Start Offset to nine decades greater than Start Offset.

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Span/X Scale, Stop Offset

Log Plot Span to Resolution Bandwidth Ratio

[:SENSe]:LPLot:FREQuency:SPAN:BANDwidth|BWIDth[:RESolution]:RATio <numeric>

[:SENSe]:LPLot:FREQuency:SPAN:BANDwidth|BWIDth[:RESolution]:RATio?

Specifies the ratio of the span to the resolution bandwidth.

Factory Preset:

106

Range:

2 to 1000

Front Panel Access:

BW/Avg, Span/RBW

Log Plot Span to Resolution Bandwidth Ratio Mode

[:SENSe]:LPLot:FREQuency:SPAN:BANDwidth|BWIDth[:RESolution]:RATio:AUTO ON|OFF|1|0

[:SENSe]:LPLot:FREQuency:SPAN:BANDwidth|BWIDth[:RESolution]:RATio:AUTO ?

Specifies whether the ratio of the span to the resolution bandwidth is set automatically.

Factory Preset:

Auto

Front Panel Access:

BW/Avg, Span/RBW

Log Plot Measurement Type

[:SENSe]:LPLot:METHod DANL|PN

[:SENSe]:LPLot:METHod?

Determines whether you are measuring the phase noise of a signal or the noise floor (DANL) of the N8201A. Measuring the phase noise of a signal is the default, and is the intended use of the measurement. However, it can be useful to measure the noise floor of the N8201A so that you can compensate for this in your measurement. See "[:SENSe]:DANL:METHod ATTenuator|REMoval" on page 94 for more details on the two different types of noise floor measurement.

Factory Preset:

PN

Remarks:

When measuring the phase noise of a signal, some of the measured phase noise is due to thermal noise generated by the N8201A itself. By measuring the N8201A's internal noise, it can be compensated for, thus giving more accurate results.

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Meas Type, DANL or Phase Noise

Log Plot Smooth Trace

[:SENSe]:LPLot:SMOoth <percentage>

[:SENSe]:LPLot:SMOoth?

Specifies the amount of smoothing that is done after the measurement has been completed. The smoothing function is a lot faster than filtering, but it can cause errors if the noise changes rapidly with respect to frequency. For example, when there are discrete signals present, such as harmonic spurs.

Factory Preset:

4%

Range:

0% to 16%

Remarks:

Changing the Smooth Trace parameter forces the smooth trace to be recalculated. This forces all results to be recalculated. Therefore, no need to perform a full restart.

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Smoothing

Monitor Spectrum Measurement

Commands for querying the Monitor Spectrum measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 85. The equivalent front panel keys for the parameters described in the following commands, are found under the Meas Setup key, after the Monitor Spectrum measurement has been selected from the MEASURE key menu.

Monitor Spectrum—Average Count

[:SENSe]:MONitor:AVERage:COUNt <integer>

[:SENSe]:MONitor:AVERage:COUNt?

Set the number of data acquisitions that will be averaged. After the specified number of average counts, the averaging mode (terminal control) setting determines the averaging action.

Factory Preset:

10

Range:

1 to 1,000

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Avg Number

Monitor Spectrum—Averaging State

[:SENSe]:MONitor:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:MONitor:AVERage[:STATe]?

Turn averaging on or off.

Factory Preset:

Off

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Avg Number

Monitor Spectrum—Averaging Termination Control

[:SENSe]:MONitor:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:MONitor:AVERage:TCONtrol?

Selects the type of termination control used for the averaging function. This determines the averaging action after the specified number of data acquisitions (average count) is reached.

Exponential - After the average count is reached, each successive data acquisition is exponentially weighted and combined with the existing average.

Repeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset:

Exponential

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Avg Mode

Monitor Spectrum—Frequency Span

[:SENSe]:MONitor:FREQuency:SPAN <freq>

[:SENSe]:MONitor:FREQuency:SPAN?

Sets the frequency span. Setting the span to 0 Hz puts the N8201A into zero span.

Factory Preset:

26.5 GHz

Range:

3 Hz to 26.5 GHz

Default Unit:

Hz

Front Panel Access:

SPAN/X Scale, Span

or SPAN/X Scale, Zero Span

Monitor Spectrum—Full Frequency Span

[:SENSe]:MONitor:FREQuency:SPAN:FULL

Sets the frequency span to full scale.

Factory Preset:

27.0 GHz

Front Panel Access:

SPAN/X Scale, Full Span

Monitor Spectrum—Zero Frequency Span

[:SENSe]:MONitor:FREQuency:SPAN:ZERO

Sets the frequency span to zero.

Factory Preset:

26.5 GHz

Front Panel Access:

SPAN/X Scale, Zero Span

Monitor Spectrum—Trace Points

[:SENSe]:MONitor:SWEep:POINts?

Quires the number of trace points.

Factory Preset:

601

Range:

Always 601

Front Panel Access:

None

Monitor Spectrum—Sweep Time

[:SENSe]:MONitor:SWEep:TIME <value>

[:SENSe]:MONitor:SWEep:TIME?

Specifies the sweep time of the measurement.

Factory Preset:

14.6 ms (automatically calculated)

Range:

1 ms to 6 ksecs

Front Panel Access:

Sweep, Sweep Time

Monitor Spectrum—Time Mode

[:SENSe]:MONitor:SWEep:TIME:AUTO ON|OFF|1|0

[:SENSe]:MONitor:SWEep:TIME:AUTO?

Specifies whether the sweep time is set automatically or manually.

Factory Preset:

Auto

Remarks:

If set to AUTO, the sweep time will be affected by the RBW setting.

Front Panel Access:

Sweep, Sweep Time Auto/Manual

RF Power Commands

RF Mixer Maximum Power

[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <power>

[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?

Specifies the maximum power at the input mixer.

Factory Preset:

4 dBm

Range:

–100 dBm to 10 dBm

Default Unit:

dBm

Front Panel Access:

Input/Output, Advanced, Max Mixer Lvl

Spot Frequency Measurements

Commands for querying the Spot Frequency measurement results and for setting to the default values are found in the "MEASure Group of Commands" on page 85. The equivalent front panel keys for the parameters described in the following commands, are found under the Meas Setup key, after the Spot Frequency measurement has been selected from the MEASURE key menu.

Spot Frequency Number of Averages

[:SENSe]:SFRequency:AVERage:COUNt <integer>

[:SENSe]:SFRequency:AVERage:COUNt?

Specifies the number of measurements made when calculating the average result.

Factory Preset:

10

Range:

1 to 1000

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Average Number

Spot Frequency Average State

[:SENSe]:SFRequency:AVERage[:STATe] ON|OFF|1|0

[:SENSe]:SFRequency:AVERage[:STATe]?

Switches averaging On or Off.

Factory Preset:

Off

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Average Number On/Off

Spot Frequency Averaging Mode Termination Control

[:SENSe]:SFRequency:AVERage:TCONtrol EXPonential|REPeat

[:SENSe]:SFRequency:AVERage:TCONtrol?

Selects the type of termination control used for the averaging function. This determines the averaging action after the specified number of acquisitions (average count) is reached.

Exponential - Each successive data acquisition after the average count is reached, is exponentially weighted and combined with the existing average.

Repeat - After reaching the average count, the averaging is reset and a new average is started.

Factory Preset:

Exponential

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Avg Mode Exp/Repeat

Spot Frequency Resolution Bandwidth

[:SENSe]:SFRequency:BANDwidth|BWIDth[:RESolution]?

Queries and returns the resolution bandwidth.

Front Panel Access:

None

Spot Frequency Resolution Bandwidth Automatic

[:SENSe]:SFRequency:BANDwidth|BWIDth[:RESolution]:AUTO?

Queries the resolution bandwidth mode. This is only available in the Monitor Spectrum measurement.

Front Panel Access:

None

Spot Frequency Video Bandwidth

[:SENSe]:SFRequency:BANDwidth|BWIDth:VIDeo?

Queries the video bandwidth.

Front Panel Access:

None

Spot Frequency Video Bandwidth Automatic

[:SENSe]:SFRequency:BANDwidth|BWIDth:VIDeo:AUTO?

Queries the video bandwidth mode.

Remarks:

This command is not available in Spot Frequency and Log Plot measurements, and the soft key is grayed out.

Front Panel Access:

None

Spot Frequency Video to Resolution Bandwidth Ratio

[:SENSe]:SFRequency:BANDwidth|BWIDth:VIDeo:RATio <numeric>

[:SENSe]:SFRequency:BANDwidth|BWIDth:VIDeo:RATio?

Specifies the ratio of the video bandwidth to the resolution bandwidth.

Factory Preset:

1.0

Range:

0.001 to 10

Front Panel Access:

BW/Avg, VBW/RBW

Spot Frequency Type of Detection

[:SENSe]:SFRequency:DETector[:FUNCtion]?

Queries and returns the detection mode.

Factory Preset:

Average

Front Panel Access:

None

Spot Frequency Measurement Type

[:SENSe]:SFRequency:METHod DANL|PN

[:SENSe]:SFRequency:METHod?

Determines whether you are measuring the phase noise of a signal or the noise floor of the N8201A itself. The noise floor is referred to as DANL (displayed average noise level). Measuring the phase noise of a signal is the default, and is the intended use of the measurement. However, if your phase noise level is low, it can be useful to measure the noise floor of the N8201A so that you can compensate for this in your measurement. See "[:SENSe]:DANL:METHod ATTenuator|REMoval" on page 94 for more details on the two different types of noise floor measurement.

Factory Preset:

Phase Noise

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Meas Type, Phase Noise or DANL

Spot Frequency Phase Noise Optimization

[:SENSe]:SFRequency:PNOFrequency <freq>

[:SENSe]:SFRequency:PNOFrequency?

The N8201A has two different filters which it can use to measure the phase noise. One filter is better suited to phase noise at small offsets, and the other is better suited to larger offsets. Use this command to specify the cross-over point from one filter to the other.

Factory Preset:

45 kHz

Range:

40 kHz to 60 kHz

Remarks:

If you are measuring phase noise at a frequency offset between 40 kHz and 60 kHz, you can make one measurement with :PNOFrequency greater than your measurement's offset and one with :PNOFrequency smaller. The lower of the two phase noise figures is the more accurate.

You must be in the Phase Noise mode, Spot Frequency measurement to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Advanced, PhNoise opt f

Spot Frequency Phase Noise Optimization Mode

[:SENSe]:SFRequency:PNOFrequency:AUTO ON|OFF|1|0

[:SENSe]:SFRequency:PNOFrequency:AUTO?

The N8201A has two different filters which it can use to measure the phase noise. One filter is better suited to phase noise at small offsets, and the other is better suited to larger offsets. This command specifies whether the crossover point from one filter to the other is controlled automatically or is under manual control.

Factory Preset:

On

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Advanced, PhNoise opt f

Spot Frequency Offset

[:SENSe]:SFRequency:SOFFset <value>

[:SENSe]:SFRequency:SOFFset?

Specifies the frequency offset at which the phase noise is to be measured.

Factory Preset:

10 kHz

Range:

100 Hz to 100 MHz

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

FREQUENCY/Channel, Tracking, Tolerance ±

Resolution Bandwidth/Spot Frequency Offset Percent

[:SENSe]:SFRequency:SOFFset:BANDwidth|BWIDth[:RESolution] :RATio <value>

[:SENSe]:SFRequency:SOFFset:BANDwidth|BWIDth[:RESolution] :RATio?

The Resolution Bandwidth is specified as a percentage of the offset frequency. This command allows you to specify this percentage value.

Factory Preset:

10

Range:

1 to 30

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Meas Setup, Advanced, RBW/Spot Offset %

Spot Frequency Sweep Time

[:SENSe]:SFRequency:SWEep:TIME <value>

[:SENSe]:SFRequency:SWEep:TIME?

Specifies the sweep time of the measurement.

Factory Preset:

5 ms

Range:

1 ms to 1 s

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Sweep, Sweep Time

Spot Frequency Sweep Time Mode

[:SENSe]:SFRequency:SWEep:TIME:AUTO ON|OFF|1|0

[:SENSe]:SFRequency:SWEep:TIME:AUTO?

Specifies whether the sweep time is set automatically or manually.

Factory Preset:

Auto

Remarks:

You must be in the Phase Noise mode to use this command. Use INSTrument:SELect to set the mode.

Front Panel Access:

Sweep, Sweep Time

5
If You Have A Problem

Agilent Customer Assistance

Agilent on the Web

You can find information about technical and professional services, product support, and equipment repair and service on the Web: http://www.agilent.com.

1 Click on the **Test & Measurement** link then click on **Select a Country**.

2 Click on the **Contact Us** link for contact information.