Measurement

Measurement

- Frequency Power Measurement
- Phase Noise Measurement
- Segment Phase Noise Measurement
- Spectrum Monitor Measurement
- Transient Measurement
- Baseband Noise Measurement
- AM Noise Measurement
- Common Setting
- User Measurement

Frequency Power Measurement

Frequency/Power Measurement

For frequency/power measurements, the E5052B measures the corresponding frequency, power and power supply DC current by sweeping the specified range of the DC control/power given to the DUT.

The E5052B's frequency/power measurement window has three measurement trace screens: RF power measurement trace, frequency measurement trace, and power supply DC current measurement trace. By using the individual trace screen, you can measure RF power, frequency and power supply DC current corresponding to the DC control/power of the DUT. This section describes the following topics about Frequency/Power Measurement:

- About Analyzer and Tester mode
- Setting Trace layout
- Common settings in RF power, frequency and power supply DC current
- About DC control voltage delay, DC power delay and point delay
- Confirming result of Frequency Measurement

- Confirming result of RF Power Measurement
- Confirming result of Power Supply DC Current Measurement

About Analyzer and Tester mode

The frequency/power measurement has two modes: analyzer mode, which analyzes input signals for a specific range swept by DC voltage (DC control voltage or DC power voltage), and tester mode, which performs measurement on the spot without DC voltage sweeping.

In the analyzer mode, an individual change in frequency, RF power or power supply DC current of the input signals for a specified range of DC voltage will be shown in a graph and analyzed by using the marker or analysis function.

In the tester mode, the frequency, RF power or power supply DC current of the input signals will be measured on the spot as if each was measured with dedicated single power meter, frequency counter, and DC current meter. You can confirm each numeric value by viewing the screen, however in this mode you cannot observe an exact change of the signals in response to DC voltage sweeping.

Analyzer mode is not available when option 011 is installed.

Selecting Analyzer Mode or Tester Mode

1. You can select either analyzer mode or tester mode by pressing the **Trigger** > **Mode** key. Analyzer mode is selected by default.

   The basic settings and their examples described in the following sections assume signal analysis using the analyzer mode.

   NOTE When option 011 is installed, switching analyzer mode and tester mode is not available; only tester mode is supported.

Example of Tester Mode Screen

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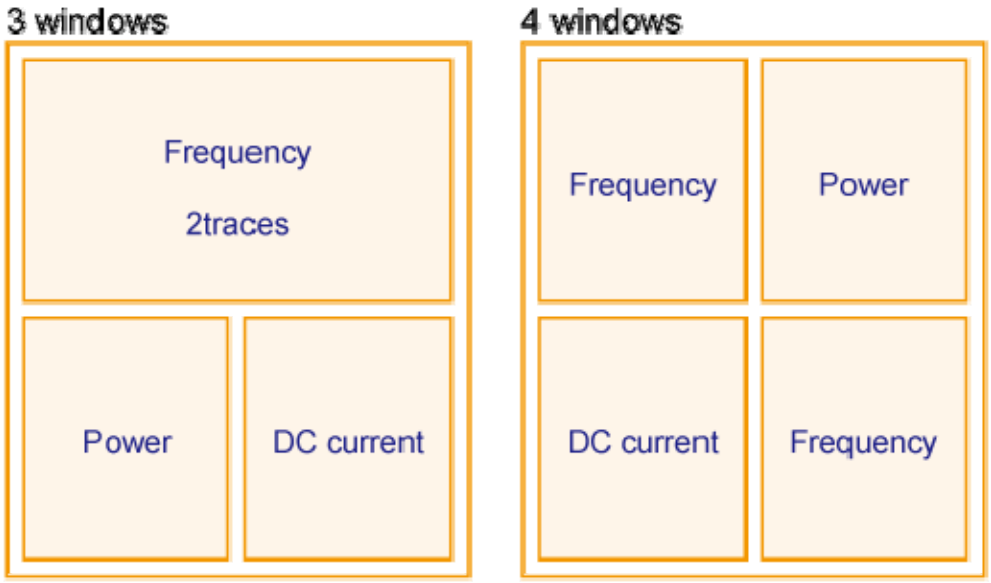
Setting Trace layout

In frequency/power measurement mode, four traces will be displayed at the same time. The four traces consist of two traces in frequency measurement (the unit is Hz and Hz/V), a trace in RF power measurement (the unit is dBm) and a trace in power supply DC current measurement (the unit is mA).

You can select the trace layout from three- or four-division mode. In each trace layout, data will be assigned as Trace Layout. In the four-division mode, the upper-left trace is frequency in Hz unit and the lower-right trace is frequency in Hz/V unit. Refer to Setting Frequency Format and Sensitivity Aperture for selecting the unit (data format).

1. Press **Display** > **Allocate** key.
2. Press the desired softkey to select the trace layout.

***Trace* Layout**



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Common settings in RF power, frequency and power supply DC current measurement

The following section describes the common setting steps to measure RF power, frequency and power supply DC current corresponding to the DUT's DC control/power by using the E5052B's frequency/power measurement window.

Selecting Measurement Window

1. Press **Meas/View** > **Freq & Power** to select the frequency/power measurement window.

NOTE You can maximize the frequency/power measurement window by pressing **Window Max** key while the window is selected. You can bring up the original size when you press the **Window Max** key once again.

You can select the next trace by pressing the **Trace Next** key and maximize the target trace by pressing the **Trace Max** key. The frequency/power window will come back when you press the **Trace Max** key once again.

Setting Trigger

Setting Averaging Trigger

Setting Attenuator

Procedure to Select Carrier Frequency Band

1. Press **Setup** > **Frequency Band**

   NOTE For analyzer mode, select a frequency band that contains the frequency of the sweep start position.

2. Select a frequency band that contains the carrier signal to be measured from the softkey menu list. The ranges of the frequency bands are shown below.

   NOTE Selectable frequency bands differ depending on whether the E5053A Microwave Downconverter is used and whether the RF input is direct input or downconverter input. For setting of downconverter and external mixer, refer to Setting E5053A Microwave Downconverter

Carrier Frequency Band	Standalone E5052B or Downconverter: OFF	Downconverter: ON & RF Input: E5052B Direct	Downconverter: ON & RF Input: Downconverter and External Mixer Not Used	Downconverter: ON & RF Input: Downconverter and External Mixer ON
10 M - 1.5 MHz	Y	Y	N	Y
250M - 3 GHz	N	Y	N	N
250 M - 7 GHz	Y	N	N	Y
3 G - 10 GHz	N	N	Y	N
9 G - 26.5 GHz	N	N	Y	N

Specifying Nominal Frequency

When the downconverter setting is turned on, the RF input setting is Downconverter, and the external mixer setting is Not Used, enter the nominal value of the carrier frequency to detect the carrier signal.

NOTE For analyzer mode, set the frequency of the sweep start position as the nominal frequency.

1. Press **Setup** > **Nominal Frequency**.
2. *Enter* the value of the nominal frequency in the data entry field displayed in the upper part of the screen.

NOTE When using the downconverter RF IN port, the Nominal Frequency setting range is limited to within the carrier frequency band, and the Nominal Frequency should be set to the actual input signal frequency.

In the tester mode, use the Carrier Search function to set the nominal frequency so as to the input signal frequency. See also Executing Carrier Search Function.

In the analyzer mode, the Nominal Frequency should be set to the initial frequency at the starting voltage of the built-in DC source (either control voltage or power voltage).

Specifying Maximum Input Level

When the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to Not Used, set the maximum input level value of the measurement signal supplied from the input port of the E5053A Microwave Downconverter.

The maximum input level is set to determine the IF gain of the E5053A Microwave Downconverter.

1. Press **Setup** > **Max Input Level**.
2. Enter the value of the maximum input level in the data entry field displayed in the upper part of the screen.

NOTE You can set the maximum input level only when the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to Not Used.

Specifying Sweep Range

1. Press **Setup** > **Sweep Parameter**.
2. Selecting from the softkey menu list, you can define a sweep operation to be performed for either DC control or DC power. Select **Control Voltage** for DC control and **Power Voltage** for DC power.
3. Press **Start/Center** (**Stop/Span**) > **DC Control**(**Power**)**Start**.
4. Enter the sweep start value in the data entry field that appears in the upper part of the screen.
5. Press **Start/Center** (**Stop/Span**) > **DC Control**(**Power**)**Stop**.
6. Enter the sweep stop value in the data entry field that appears in the upper part of the screen.

NOTE Otherwise, press **Start/Center** (**Stop/Span**) > **DC Control**(**Power**)**Center** to enter the sweep center value in the data entry field that appears in the upper part of the screen and then press **DC Control**(**Power**) **Span** to enter the sweep span value in the same way.

The same softkey will be displayed by pressing either **Start/Center** or **Stop/Span**. You can make the same settings by using either of the two keys.

Specifying Frequency Resolution, Number of Measurement Points and Delay

1. Press **Setup** > **Freq Resolution**.
2. Select the appropriate frequency resolution from the softkey menu list. The available frequency resolutions are as follows:

Frequency Resolution
10 Hz
1 kHz
64 kHz

3. Press **Setup** > **Points**.
4. Enter the number of measurement points in the data entry field that appears in the upper part of the screen.

5. Press **Setup** > **Points Delay**.

6. Enter the waiting time between each measurement in the data entry field that appears in the upper part of the screen.

About DC voltage setting and protection

You can specify the DC power/control that will be applied to the DUT. Refer to Setting DC power/DC control and protection for the setting procedure.

About Auto Frequency Control Function

If this function is turned on, the E5052B will adjust the control voltage automatically so that the output signal frequency from the DUT may keep the specified value. For the setting procedure, refer to the Auto Frequency Control Function.

Setting Average Function

About DC control voltage delay, DC power delay and point delay

This section describes the point delay for DC control delay, DC power delay, and common settings of E5052B. For more information about RF Power measurement settings, see Confirming Result of RF Power Measurement.

About delay while DC control is selected for sweep parameter

The following section describes how to set up DC control delay and point delay. For better understanding of each delay, "a," "b," "c" and "e" and the measurement point “d” used in the description below, refer to Delay While DC Control Selected for Sweep Parameter.

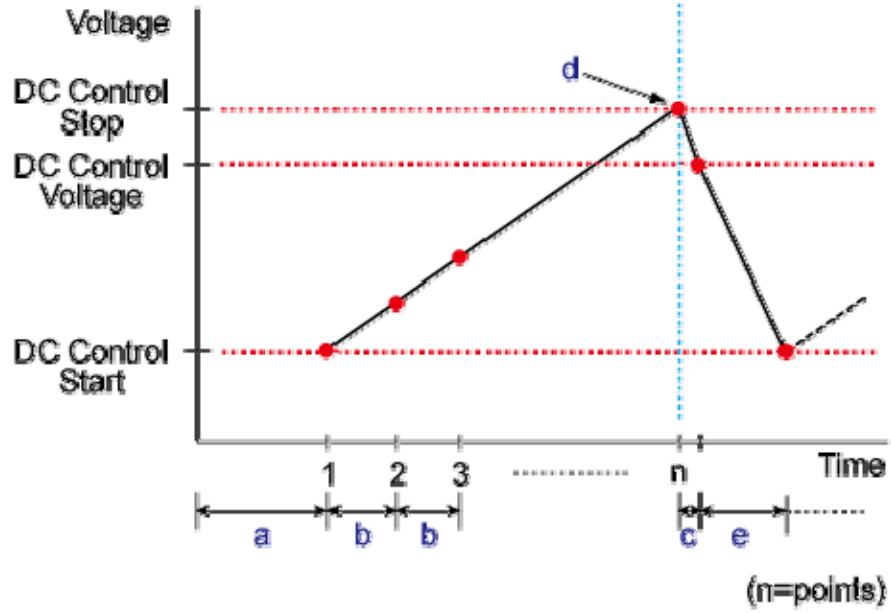
- "a" signifies the delay until measurement of the first point starts in the single sweep, or the delay until measurement of the first point of the first sweep in the continuous sweep. This delay is equal to the addition of the setting times of DC control delay and point delay.

- "b" signifies the individual delay between respective measurement points. The setting times of point delay is set as this delay.

- "c" signifies the time that elapses when the setting of the voltage (DC Control Stop) at the last measurement point (“d”) of the sweep is different from the setting value of DC Control Voltage. This time is required for generating the DC Control Voltage. It is not generated when the voltage setting of the DC Control Stop (**Start/Center** (**Stop/Span**) > **DC Control Stop**) and that of the DC Control Voltage (**DC Control** > **DC Control Voltage**) is same.

- "e" is signifies the time that elapses to set the voltage back to the starting voltage for next sweep in the continuous sweep. This time is required for setting of the DC Power Delay is completed.

Delay While DC Control Selected for Sweep Parameter



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NOTE If the output voltage falls 0 V or exceeds 20 V, the setting time of DC control delay will be set as the delay, after the voltage is output.

About Delay While DC Power is Selected for Sweep Parameter

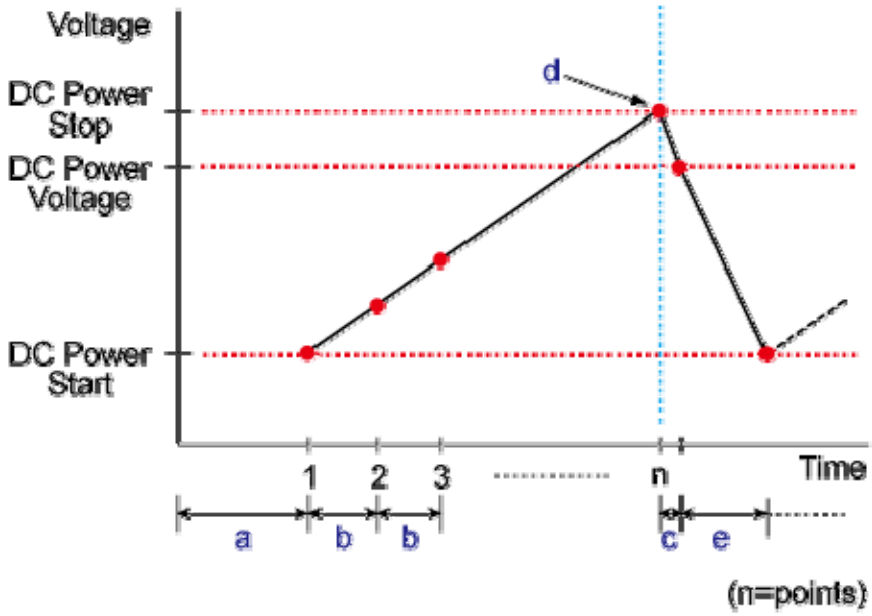
The following section describes how to set up DC power delay and point delay. For better understanding of each delay, "a," "b," "c" and "e" and the measurement point "d" used in the description, refer to Delay While DC power is Selected for Sweep Parameter.

- "a" signifies the delay until measurement of the first point starts in the single sweep, or the delay until measurement of the first point of the first sweep in the continuous sweep. This delay is equal to the addition of the setting times of DC control delay and point delay.
- "b" signifies the individual delay between respective measurement points. The setting times of point delay is set as this delay.
- "c" signifies the time that elapses when the setting of the voltage (DC Control Stop) at the last measurement point ("d") of the sweep is different from the setting value of DC Control Voltage. This time is required for generating the DC Control Voltage. It is not generated when the voltage setting of the DC

Control Stop (**Start/Center** (**Stop/Span**) - **DC Control Stop**) and that of the DC Control Voltage (**DC Control** > **DC Control Voltage**) is same.

- "e" signifies the time that elapses to set the voltage back to the starting voltage for next sweep in the continuous sweep. This time is required for setting of the DC Power Delay is completed.

Delay While DC power is Selected for Sweep Parameter



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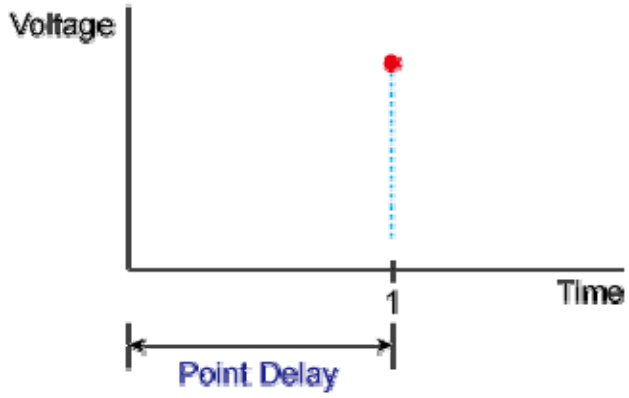
About Delay in Tester Mode

In the tester mode, measurement is made for only one measurement point. The delay for the measurement point can be set by using a point delay setting.

Delay in Tester Mode



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Confirming Result of Power Supply DC Current Measurement

The following section describes the procedure used to confirm the measurement results of the power supply DC current corresponding to the DUT's DC control/power by using the E5052B's frequency/power measurement window.

Selecting Trace

Press the **Trace Next** key to select the power supply DC current measurement trace.

NOTE If you want to maximize the screen, press the **Trace Max** key.

To improve readability and reduce search time, few sections of this topic are combined with similar sections from other measurements in **Measurement** > **Common Settings**. Links to these new sections are provided in this topic.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

Setting Attenuator

Executing Carrier Search Function

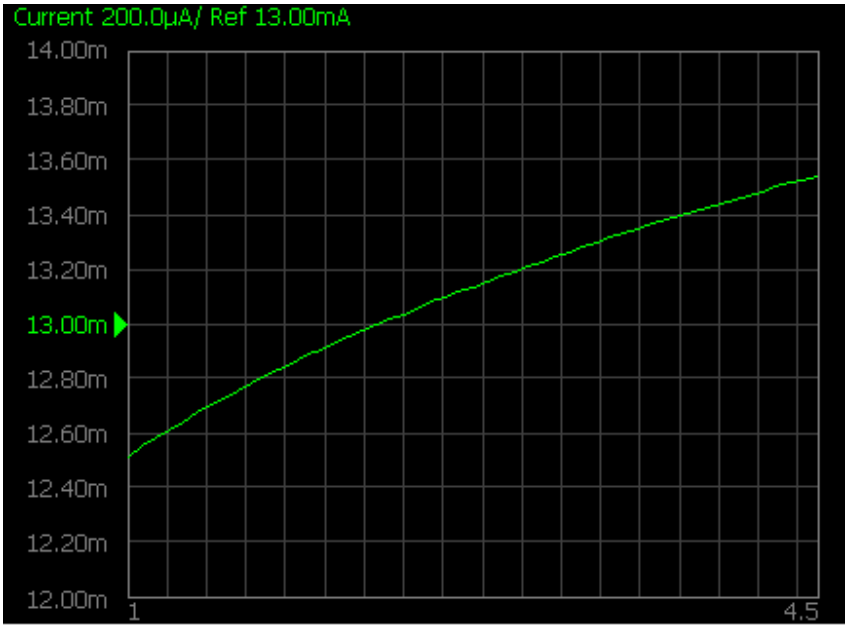
The carrier search function is to detect the input signal frequency with the selected carrier frequency band for the downconverter RF IN (i.e. 3 to 10 GHz or 9 to 26.5 GHz) and reflect the result to the nominal frequency. Refer to Executing Carrier Search Function for the setting procedure.

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (power supply DC current characteristics)



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NOTE By taking into account the transient of DC control/power prior to the sweep, the instrument will start the sweep after the time specified in **DC Control** > **DC Control Delay** or **DC Power** > **DC Power Delay** has elapsed. This delay time is not included in the sweep time, and it only applies to the first measurement point.

Confirming Result of Frequency Measurement

The following section describes the procedure used to confirm the measurement results of frequencies corresponding to the DUT's DC control/power by using the E5052B's frequency/power measurement window.

Selecting Trace

1. Press the **Trace Next** key to select the frequency measurement trace.

   NOTE If you want to maximize the screen, press the **Trace Max** key.

   To improve readability and reduce search time, few sections of this topic are combined with similar sections from other measurements in **Measurement** > **Common Settings**. Links to these new sections are provided in this topic.

Setting Frequency Format and Sensitivity Aperture

You can select the unit (frequency format) used in the frequency trace screen and set the sensitivity aperture.

1. Press **Format** > **Frequency Format**.
2. Select an appropriate frequency format from the softkey menu list. The available options are as follows.

Format List

Softkey	Overview
Hz	Displays the measurement frequency data.
Hz/V	Displays the data obtained from measurement frequency differentiated by the DC control voltage.
Δ Hz	Displays the difference subtracted from the reference frequency.
%	Displays the difference subtracted from the reference frequency in percent.
ppm	Displays the difference subtracted from the reference frequency in ppm.

3. Press **Format** > **Sensitivity Aperture**. (This setting will be used when "Hz/V" is selected for the frequency format.)
4. Enter the sensitivity aperture value in the data entry field that appears in the upper part of the screen. The unit is %.
5. Press **Format** > **Frequency Reference**. (This setting will be used when either "Δ Hz", "%", "ppm" is selected for the frequency format.)
6. Enter the frequency reference value in the data entry field that appears in the upper part of the screen. The unit is Hz.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

X-Axis Scale Setting Procedure (X-Axis band marker setting)

Setting Attenuator

Executing Carrier Search Function

The carrier search function is to detect the input signal frequency with the selected carrier frequency band for the downconverter RF IN (i.e. 3 to 10 GHz or 9 to 26.5 GHz) and reflect the result to the nominal frequency.

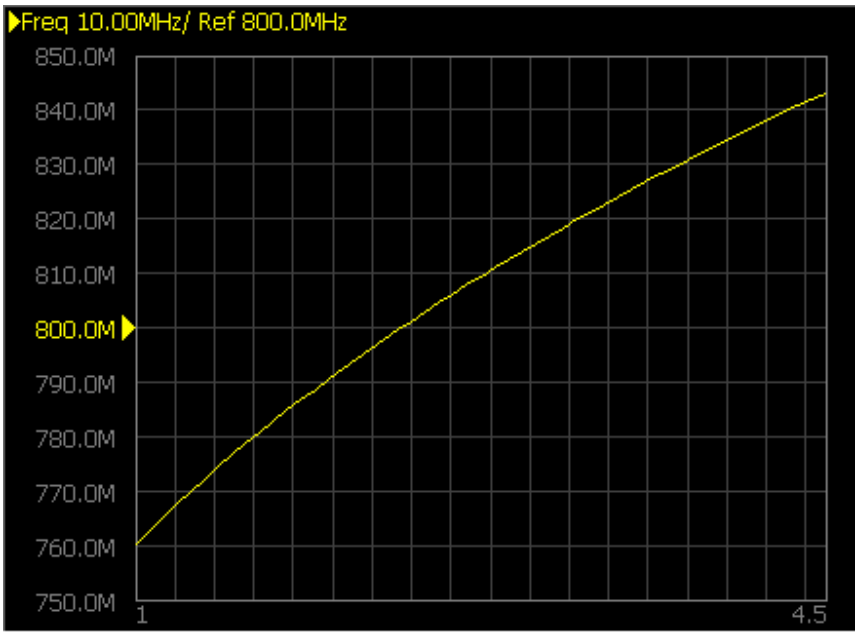
1. Press **Setup**.
2. Press **Carrier Search** to execute the carrier signal search.
3. The detected signal frequency is reflected on the nominal frequency.

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (frequency characteristics)



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NOTE

By taking into account the transient of DC control/power prior to the sweep, the instrument will start the sweep after the time specified in **DC Control** > **DC Control Delay** or **DC Power** > **DC Power Delay** has elapsed. This delay time is not included in the sweep time, and it only applies to the first measurement point.

Confirming Result of RF Power Measurement

The following section describes the procedure to confirm the measurement results of RF power corresponding to the DUT's DC control/power by using the E5052B's frequency/power measurement window.

NOTE Measurement display indicates a measured value obtained with the power meter if the downconverter is turned off, otherwise a measurement result obtained through the FFT.

To improve readability and reduce search time, few sections of this topic are combined with similar sections from other measurements in **Measurement** > **Common Settings**. Links to these new sections are provided in this topic.

Selecting Trace

1. Press **Trace Next** key to select the RF power measurement trace.

   NOTE If you want to maximize the screen, press the **Trace Max** key.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

Setting Attenuator

Executing Carrier Search Function

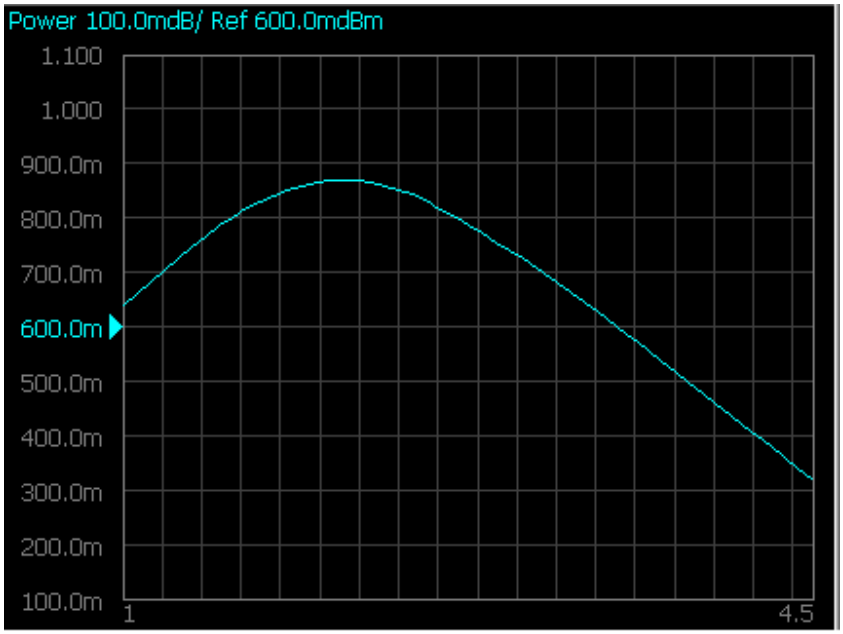
The carrier search function is to detect the input signal frequency with the selected carrier frequency band for the downconverter RF IN (i.e. 3 to 10 GHz or 9 to 26.5 GHz) and reflect the result to the nominal frequency. Refer to Executing Carrier Search Function for the setting procedure.

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (RF power characteristics)



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NOTE By taking into account the transient of DC control/power prior to the sweep, the instrument will start the sweep after the time specified in **DC Control** > **DC Control Delay** or **DC Power** > **DC Power Delay** has elapsed. This delay time is not included in the sweep time, and it only applies to the first measurement point.

Phase Noise Measurement

Phase Noise Measurement

This function locks on the DUT's output signal and measures the phase of the signal in the specified offset frequency range.

The following section describes the basic measurement method of the DUT's phase noise corresponding to the offset frequency from the carrier by using the E5052B's phase noise measurement window. This section describes the following topics about Phase Noise Measurement:

- Setting Phase Noise Measurement
- Confirming Result of Phase Noise Measurement

Setting Phase Noise Measurement

Follow the steps below to measure the phase noise by using the E5052B's phase noise measurement window.

Selecting Measurement Window

1. Press **Meas/View** > **Phase Noise** to select the phase noise measurement window.

NOTE You can maximize the phase noise measurement window by pressing the **Window Max** key while the window is selected. You can return to the original size when you press the **Window Max** key once again.

Selecting Capture Range

1. Press **Setup** > **Capture Range** > **Normal** for PLL method.
2. Press **Setup** > **Capture Range** > **Wide** for Discriminator method.

If the DUT response is drifting or noisy, the E5052B cannot lock the signal using PLL method. In such cases, use Discriminator method technique.

The drift should be typically smaller than both of the following limitations:

- **Normal**: 40 kHz/20 msec, 0.4% of carrier frequency
- **Wide**: 2 MHz/sec, 0.4% of carrier frequency

NOTE PLL and Discriminator are the two types of methods available in E5052B. PLL is the default capture range setting. When Capture Range is Wide, it is possible to measure from 250MHz. In order to change the frequency range, it is recommended to change the capture range to PLL method.

For more details on PLL method and discriminator method, refer to Overall Instrument Operation.

Setting Trigger

Setting Averaging Trigger

Switch Reference Signal

The switch reference signal option is available in both phase noise measurement and segment phase noise measurement that enables you to select as channel 1 (CH1) and channel 2 (CH2). Normally in both phase noise measurement and segment phase noise measurement, CH1 is set to internal, and CH2 is set to external and then reference signal provided from CH2 is distributed to CH1

internally. For other measurement modes, CH1 is set to internal, and CH2 is set to external.

Follow the steps below to switch reference signal:

1. Press **Meas/View** > **Phase Noise**
2. Press **Setup** > **Reference Oscillator** > **Bandwidth** > **Narrow** | **Wide**

NOTE The selection of Narrow/Wide is for the Bandwidth of Reference Oscillator of PLL.

3. Press **Setup** > **Ref. Osc.1 Source** > **Internal** | **External**
4. Press **Setup** > **Ref. Osc.2 Source** > **Internal** | **External**

NOTE When reference source is Internal, Internal Oven Controlled Crystal Oscillator signal is used as reference signal.

External input signal is used as reference when the source is External. If E5052B cannot recognize the External input signal, it will automatically select Internal signal as the reference source.

Setting Attenuator

Selecting Carrier Frequency Band

1. Press **Setup** > **Frequency Band**.
2. Select the appropriate frequency band that contains the target carrier signal from the softkey menu list. The range of each frequency band is listed in the following table.

NOTE Selectable frequency bands differ depending on whether the E5053A Microwave Downconverter is used and whether the RF input is direct input or Downconverter input. For setting of downconverter and external mixer, refer to Setting E5053A Microwave Downconverter.

Carrier Freq. Band	Standalone E5052B or Downconverter: OFF	Downconverter: ON & RF Input: E5052B Direct	Downconverter: ON & RF Input: Downconverter and External Mixer Not Used	Downconverter: ON & RF Input: Downconverter and External Mixer ON
10M to 41MHz	Y	Y	N	Y
39M to 101MHz	Y	Y	N	Y
99M to 1.5GHz	Y	Y	N	Y
250M to 3GHz	N	Y	N	N
250M to 7GHz	Y	N	N	Y
3G to 10GHz	N	N	Y	N
9G to 26.5GHz	N	N	Y	N

Setting IF Gain

"IF over flow" error may be displayed when phase noise is distorted. On the other hand, internal noise level of the instrument may be significant in the measurement display when the DUT has a low-noise characteristics. In this case, follow the steps below to adjust the IF Gain value.

1. Press **Setup** > **IF Gain**.
2. Enter the IF Gain value in the data entry field that appears in the upper part of the screen.

You can select the value from the options: 0 dB, 10 dB, 20 dB, 30 dB, 40 dB or 50 dB.

NOTE The E5052B automatically set PLL BW depending on both the carrier frequency and IF Gain when selecting "Normal" in the capture range. Refer to the table below for the relationship.

IF Gain and PLL BW

	IF Gain is set to either 0 or 10 dB	**IF Gain is set to either 20, 30, 40, or 50 dB**
Carrier frequency is less than or equal to 100 MHz	PLL BW = 1 kHz	PLL BW = 1 kHz
Carrier frequency is greater than 100 MHz	PLL BW = 5 kHz	PLL BW = 350 Hz

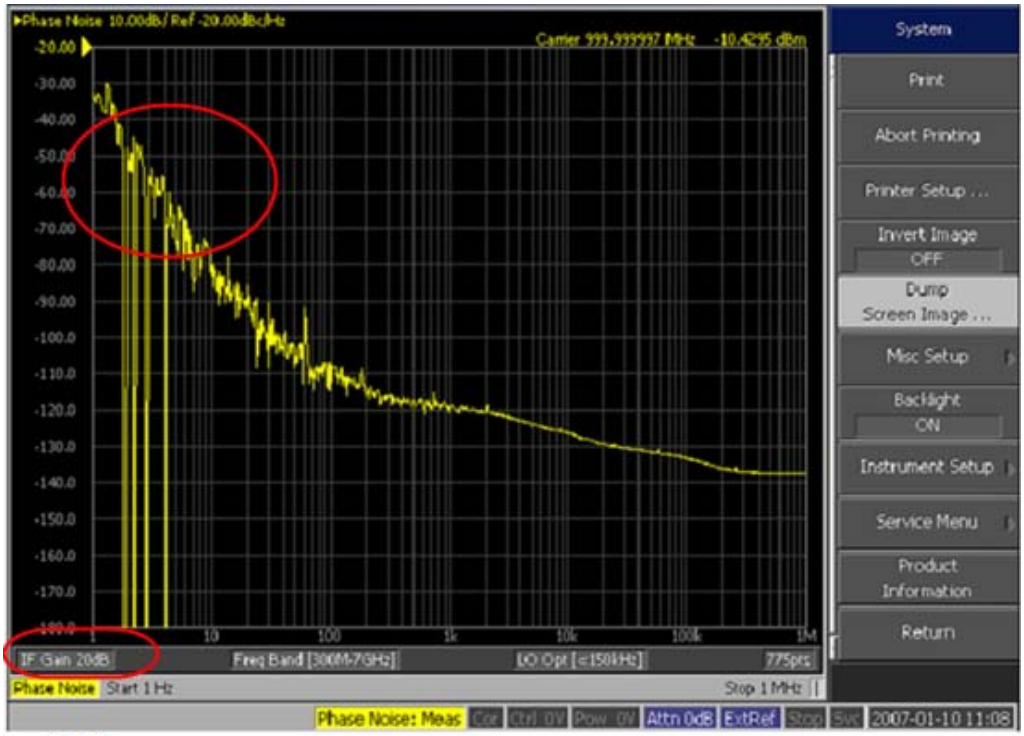
NOTE When either “Phase lock loop unlocked” or "IF A/D overflow" error message is displayed, choose an appropriate IF Gain value as indicated in the table below.

IF Gain selection table

DUT type	**IF Gain**
Frequency drifting sources (Free-run VCO, etc.)	0, 10 dB
Frequency locked sources (PLL Synthesizer, etc.)	20, 30, 40, 50 dB

NOTE With the Option 011 configured, available IF Gain options are 0 dB, 10 dB, 20dB and 30 dB.

NOTE If the IF signal is not at appropriate value a “drop out” may occur as it will not be able to detect the phase noise of the DUT at the ADC resulting in strange measurement as shown in the figure below.



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In such case, it is recommended to increase the value of IF gain (default value of 20dB) as it is important to correctly measure the phase noise at close in offset.

Auto Settings in Attenuator, Carrier Frequency Band and IF Gain

From firmware rev A.3.10, Frequency band, Input Attenuator and IF Gain can be set to optimum value according to input signal through an automatic setting.

NOTE Enables when you selected **Trigger to Phase Noise**.

1. Press **Setup** > **Auto Setting**.
2. Carrier frequency band, Attenuator and IF Gain should be set to optimum value according to input signal.

Auto setting Parameter at each measurement status as follows.

Measurement status (PN/Normal(PLL))	Freq Band	Attn	IF Gain
Downconverter=Off	Y	Y	Y
Downconverter=On, RF Input=E5052B Direct	Y	Y	Y

Downconverter=On, RF Input=Downconverter, Ext.Mixer=Off	User set	10dB	Y
Downconverter=On, RF Input=DownConverter, Ext.Mixer=On	N	N	N

Measurement status (PN/Wide(Discriminator))	Freq Band	Attn	IF Gain
Downconverter=Off	Band4	Y	N
Downconverter=On, RF Input=E5052B Direct	Band4	Y	N
Downconverter=On, RF Input=Downconverter, Ext.Mixer=Off	User set	10dB	N
Downconverter=On, RF Input=DownConverter, Ext.Mixer=On	N	N	N

NOTE When one of the following error messages is displayed, please try to set the wide capture mode (Press **Setup** > **Capture Range** > **Wide**).

"130 Auto setting failed"
"133 Failed to find IF gain"
"132 Try wide capture range"

When "IF A/D overflow" is displayed, please try to decrease 10 dB from the current IF Gain setting (Press **Setup** > **IF Gain**).

NOTE The auto setting function of the E5052B does not change capture range from the normal capture range to wide capture range automatically. When the carrier frequency is less than 250 MHz or the DUT is noisy (or drifty) while the auto setting is being executed, a message "132 Try wide capture range" is displayed.

Specifying Nominal Frequency

Enter the nominal value of the carrier frequency.

1. Press **Setup** > **Nominal Frequency**.
2. Enter the value of the nominal frequency in the data entry field displayed in the upper part of the screen.

NOTE You need to specify nominal frequency only when the downconverter is available.

NOTE The carrier search function is to detect the input signal frequency with the selected carrier frequency band for the downconverter RF IN (i.e. 3 to 10 GHz or 9 to 26.5 GHz) and reflect the result to the nominal frequency.

See also Executing Carrier Search Function.

Optimizing LO Phase Noise Characteristics

In the SSB phase noise measurement of the DUT, LO phase noise characteristics can be selected for optimizing the phase noise measurement accuracy.

1. Press **Setup** > **LO PhNoise Optimize**.
2. Select LO phase noise characteristics in the softkey menu displayed.

Softkey	Overview
L(f) for > 150 kHz	Lowering LO SSB phase noise at > 150 kHz offset frequency
L(f) for < 150 kHz	Lowering LO SSB phase noise at < 150 kHz offset frequency

NOTE Refer to the Phase Noise Measurement in the Specifications.

Selecting Measurement Quality

1. Press **Setup** > **Measurement Quality**.
2. Select the appropriate quality level from the softkey menu list. The available options are Normal and Fast.

NOTE To obtain the outline of the measurement data, select "Fast" for the quality level. If you need more precise frequency resolution, select "Normal" for the quality level.

The fast mode allows you to do faster measurement than that in the normal mode. The fast mode uses 8 times wider RBW than that in the normal mode at all offset frequency set, while the number of measurement points (Relation Table for Measurement Points and Sweep Range), which is determined by the start and stop offset frequency, are the same between two modes. With the fast mode, the

ability to distinguish spurious in frequency gets less precise than that in the normal mode. The default is set to normal mode.

Specifying Sweep Range for Offset Frequency

1. Press **Start/Center** (**Stop/Span**) > **Start**.
2. Select the sweep start value from the softkey menu list.

   You can select the value from the options: 1 Hz, 10 Hz, 100 Hz or 1 kHz.
3. Press **Stop/Span** (**Start/Center**) > **Stop**.
4. Select the sweep stop value from the softkey menu list.

   You can select the value from the options: 100 kHz, 1 MHz, 5 MHz, 10 MHz, 20 MHz, 40 MHz or 100MHz.

   NOTE For PLL Measurement method only the offset frequency is expanded to 100MHz.

   Sweep stop values that are selectable differ depending on the selection of the carrier frequency band.

   - For 10 M - 41 MHz

     100 kHz, 1 MHz, 5 MHz
   - For 39 M -101 MHz

     100 kHz, 1 MHz, 5 MHz, 10 MHz, 20 MHz
   - For 99M - 1.5GHz

   100 kHz, 1MHz, 5MHz, 10MHz, 20MHz, 40MHz
   - For frequency bands other than above

     100 kHz, 1 MHz, 5 MHz, 10 MHz, 20 MHz, 40 MHz, 100MHz

   NOTE The number of measurement points varies depending on the setting value for the sweep range.

Relation Table for Measurement Points and Sweep Range

Start/Stop	100 kHz	1 MHz	5 MHz	10 MHz	20 MHz	40 MHz	100 MHz
1 Hz	646	775	865	904	943	982	1033
10 Hz	517	646	736	775	814	853	904
100 Hz	388	517	607	646	685	724	775
1 kHz	259	388	478	517	556	595	646

NOTE For phase noise measurement, you cannot use the center value or span value for log sweep.

In the phase noise measurement for log sweep, the number of correlation pre-defined depends on the start offset frequency. For example, when the start offset frequency is set to 1 Hz, the correlation of 128000 times is executed in offset frequency of 10MHz or more. The specification of the phase noise sensitivity in the datasheet is when the start offset frequency is 1 Hz. Refer to Tables as follows to confirm the effect of the start offset frequency on the phase noise sensitivity.

Start offset frequency : 1 Hz

Offset Frequency Range [Hz]	1 to 47.7	47.7 to 190.7	190.7 to 1.53k	1.53k to 12.21k	12.21k to 97.66k	97.66k to 781.25k	781.25k to 6.25M	6.25M to 100M
Number of Correlation	1	4	32	256	2048	16384	32000	128000
Improvement of sensitivity [dB]	0	3.0	7.5	12.0	16.6	21.1	22.5	25.5

Start offset frequency : 10 Hz

Offset Frequency Range [Hz]	10 to 190.7	190.7 to 1.5k	1.5k to 12.21k	12.21k to 97.66k	97.66k to 781.25k	781.25k to 6.25M	6.25M to 100M
Number of Correlation	1	8	64	512	4096	8000	32000
Improvement of sensitivity [dB]	0	4.5	9.0	13.5	18.1	19.5	22.5

Start offset frequency : 100 Hz

Offset Frequency Range [Hz]	100 to 1.5k	1.5k to 12.21k	12.21k to 97.66k	97.66k to 781.25k	781.25k to 6.25M	6.25M to 100M
Number of Correlation	1	8	64	512	1000	4000
Improvement of sensitivity [dB]	0	4.5	9.0	13.5	15.0	18.0

Start offset frequency : 1 kHz

Offset Frequency Range [Hz]	1k to 12.21k	12.21k to 97.66k	97.66k to 781.25 k	781.25 k to 6.25M	6.25M to 100M
Number of Correlation	1	8	64	125	500
Improvement of sensitivity [dB]	0	4.5	9.0	10.5	13.5

Setting Average Function and Correlation Number

About DC Voltage Setting and Protection

You can specify DC power/control that is applied to DUT. Refer to Setting DC power/DC control and protection for the setting procedure.

About Auto Frequency Control Function

If this function is turned on, the E5052B will adjust the control voltage automatically so that the output signal frequency from the DUT may keep the specified value. For the setting procedure, refer to the Auto Frequency Control Function.

Confirming Result of Phase Noise Measurement

Follow the steps below to confirm the results of the DUT's phase noise measurement by using the E5052B's phase noise measurement window.

NOTE To improve readability and reduce search time, few sections of this topic are combined with similar sections from other measurements in **Measurement** > **Common Settings**. Links to these new sections are provided in this topic.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

Setting IF gain

Setting Attenuator

Setting Format

Format options are not available for Phase Noise measurement.

Executing Carrier Search Function

When the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to Not Used, the function to search for the carrier signal in the specified carrier frequency band and reflect the result to the nominal frequency is available.

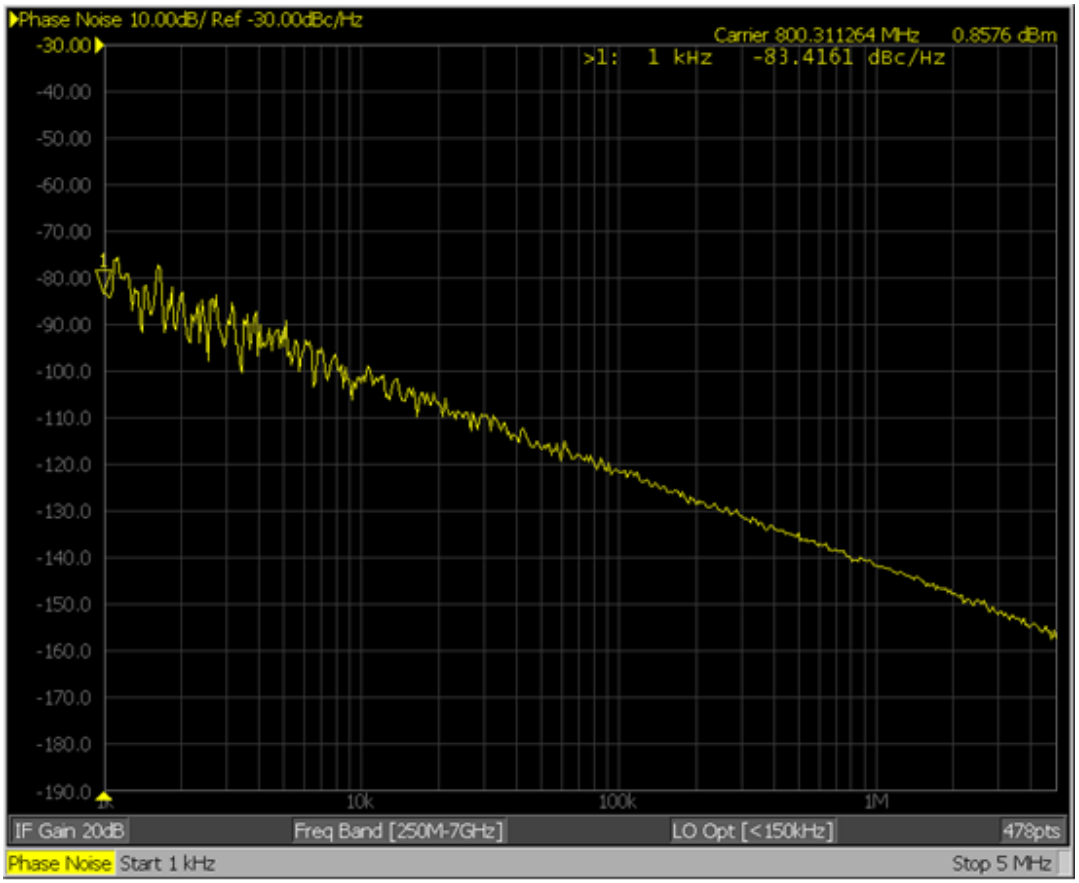
1. Press **Setup**
2. Press **Carrier Search** to execute the carrier signal search.
3. The detected signal frequency is reflected on the nominal frequency.

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (phase noise - offset frequency characteristics)



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NOTE In this measurement, you cannot specify the sweep time. It will be determined automatically based on the selection of the offset frequency sweep range and the carrier frequency band.

Confirming Integral Phase Noise, Jitter and Residual FM

1. Specify the noise integration range by using the band marker. For further detail, refer to Searching in Specified Range. You do not have to use the band marker to integrate the entire range.
2. Press **Marker Fctn** > **Analysis Type**.
3. Press **Integral**. In the upper right part of the screen, you will see the Integral Phase Noise value [dBc], the RMS Noise value [rad, deg], the RMS Jitter value [sec] and Residual FM value [Hzrms].

   NOTE Calculate Integral Phase Noise, Jitter and Residual FM, using the specified data by Analysis range.

Integral Phase Noise returns the value of SSB Integral result. RMS Noise, Jitter and Residual FM returns the value after applying the DSB conversion.

Value	Formula
Integral Phase Noise	10 × log(integ(10 ^ (L(f) / 10))) [dBc]
RMS Noise	sqrt(2 × 10 ^ (Integral Phase Noise / 10)) [rad]
RMS Jitter	RMS Noise / (2 × ƒÎ × Carrier frequency) [sec]
Residual FM	sqrt(2 × integ(f ^ 2 × 10 ^ (L(f) / 10))) [Hz]

where, L(f): Phase Noise [dBc/Hz] and integ(x): Integral

When Power is selected in the Spurious measurement, it is calculated with adding the power of Spurious after integrating except Spurious.

Confirming Spurious

Confirming Allan Variance using with Phase noise measurement value

It is available to calculate the Allan Variance and Jitter using the measured average time and the measured cut-off frequency.

This operation is available to execute with SCPI commands, and it is not supported with the key operation. For more information refer to the following SCPI commands

SCPI.CALCulate.PN(1-1).TRACe(1-1).FUNCtion.AVARiance.DATA

SCPI.CALCulate.PN(1-1).TRACe(1-1).FUNCtion.AVARiance.MEMory

NOTE The value obtained with E5052B as Sigma is standard deviation, and the Allan Variance as the general definition is the value that is squared this Sigma.

Segment Phase Noise Measurement

Segment Phase Noise Measurement

This section describes the following topics about Segment Phase Noise Measurement:

- Setting Segment Phase Noise Measurement
- Confirming Result of Segment Phase Noise Measurement

NOTE This measurement is not available when option 011 is installed.

Setting Segment Phase Noise Measurement

Follow the steps below to measure the phase noise by using the E5052B's segment phase noise measurement window.

Functional Differences Between Phase Noise Measurement and Segment Phase Noise Measurement

The table below describes the functional differences between the phase noise measurement (PN) and segment phase noise measurement (PS). As for functions other than these, it is the same as the phase noise measurement.

Phase Noise Measurement vs. Segment Phase Noise Measurement

Function	Phase Noise Measurement	Segment Phase Noise Measurement
Offset Frequency	Make a Selection	Discretionary
Correlation	Max:10,000	Max:200,000
Sweep Type	Log	Linear
RBW Setting	Disable	Enable

In the phase noise measurement (PN), the number of correlation pre-defined depends on the start offset frequency. For example, when the start offset frequency is set to 1 Hz, the correlation of 128000 times is executed in offset frequency of 10 MHz or more. The specification of the phase noise sensitivity in the datasheet is when the start offset frequency is 1 Hz. Refer to Tables as follows to confirm the effect of the start offset frequency on the phase noise sensitivity.

Start offset frequency : 1 Hz

Offset Frequency Range [Hz]	1 to 47.7	47.7 to 190.7	190.7 to 1.53k	1.53k to 12.21k	12.21k to 97.66k	97.66k to 781.25k	781.25k to 6.25M	6.25M to 100M
Number of Correlation	1	4	32	256	2048	16384	32000	128000
Improvement of sensitivity [dB]	0	3.0	7.5	12.0	16.6	21.1	22.5	25.5

Start offset frequency : 10 Hz

Offset Frequency Range [Hz]	10 to 190.7	190.7 to 1.5k	1.5k to 12.21k	12.21k to 97.66k	97.66k to 781.25k	781.25k to 6.25M	6.25M to 100M
Number of Correlation	1	8	64	512	4096	8000	32000
Improvement of sensitivity [dB]	0	4.5	9.0	13.5	18.1	19.5	22.5

Start offset frequency : 100 Hz

Offset Frequency Range [Hz]	100 to 1.5k	1.5k to 12.21k	12.21k to 97.66k	97.66k to 781.25 k	781.25 k to 6.25M	6.25M to 100M
Number of Correlation	1	8	64	512	1000	4000
Improvement of sensitivity [dB]	0	4.5	9.0	13.5	15.0	18.0

Start offset frequency : 1 kHz

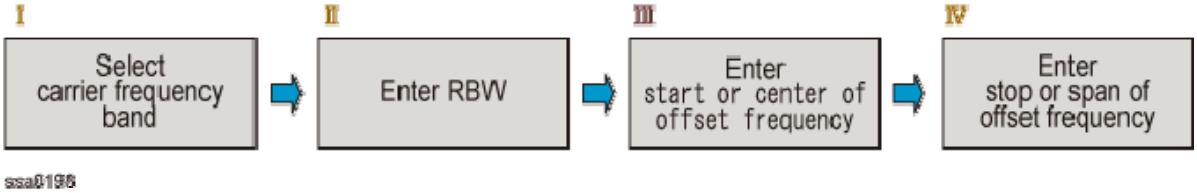
Offset Frequency Range [Hz]	1k to 12.21k	12.21k to 97.66k	97.66k to 781.25 k	781.25 k to 6.25M	6.25M to 100M
Number of Correlation	1	8	64	125	500
Improvement of sensitivity [dB]	0	4.5	9.0	10.5	13.5

In the segment phase noise measurement (PS), pre-defined correlation is not set. Therefore, you need to set the number of correlation with considering pre-defined correlation in the regular mode to obtain enough sensitivity for your application. For more information regarding the correlation settings, see Setting Average Function.

Relation Among Carrier Frequency Band, RBW and Offset Frequency

The procedure of selecting the carrier frequency band and setting the offset frequency is shown in the figure below:

Procedure to setup offset frequency



The internal operation after setting the carrier frequency band, RBW and offset frequency is shown in the figure below.

1. Select carrier frequency band

*1 Maximum stop frequency is the same as the phase noise measurement.
However, when Freq Band6 (9G-26.5GHz) is selected, the maximum stop frequency is set at 99.9 MHz, not 100 MHz.

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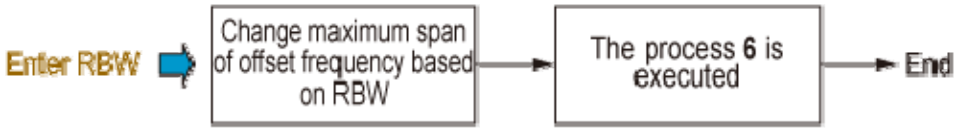
NOTE Changing the offset frequency or RBW does not affect the setting of carrier frequency band.

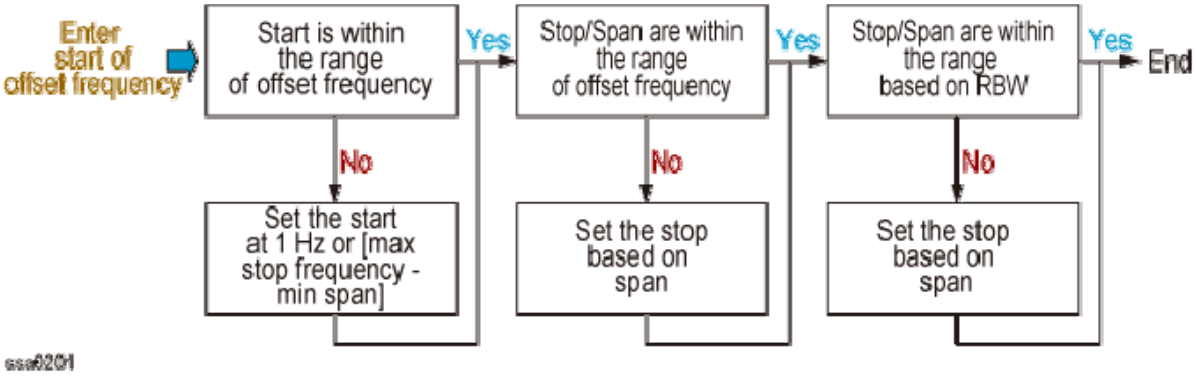
2. Enter RBW



ssa0200

NOTE Changing the offset frequency or carrier frequency band does not affect the setting of RBW. The RBW maximum span on the RBW is shown in the table Specifying_Measurement_Resolution_Bandwidth.

3. Enter start of offset frequency



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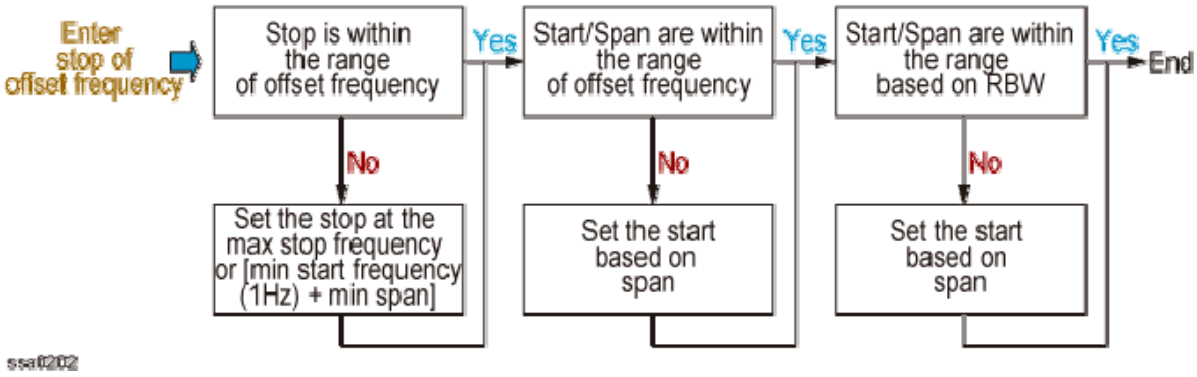
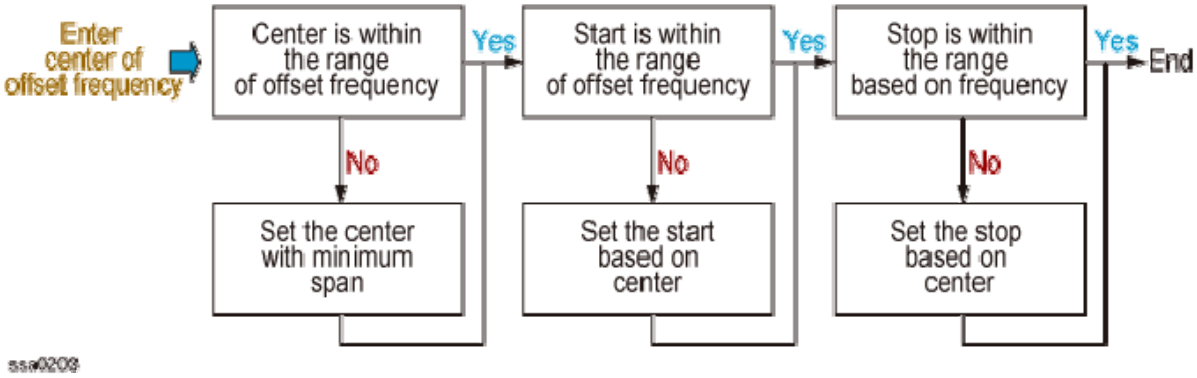
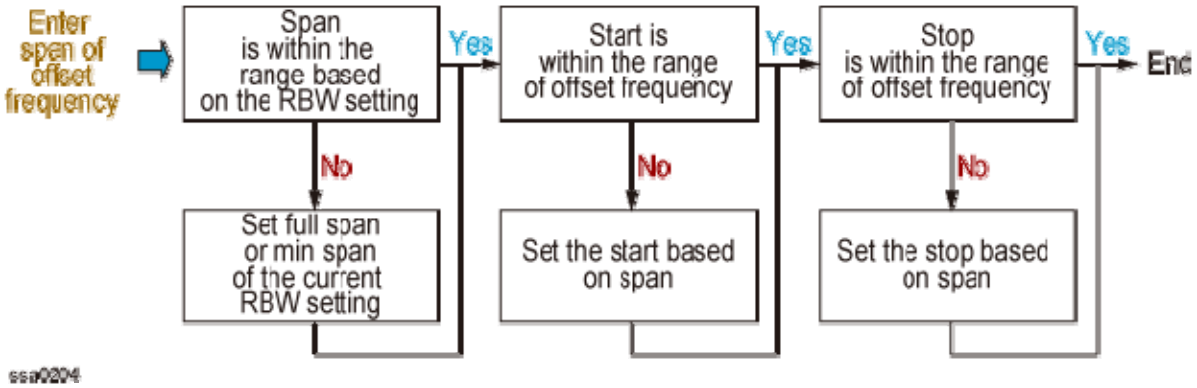
4. Enter stop of offset frequency



5. Enter center of offset frequency



6. Enter span of offset frequency



Setting Measurement Window

1. Press **Meas/View** > **Show Window** > **Segment PN** to toggle **ON** the segment phase noise measurement.

2. Press **Meas/View** > **Segment PN** to select the segment phase noise measurement window.

NOTE You can maximize the segment phase noise measurement window by pressing the **Window Max** key while the window is

selected. You can return to the original size when you press the **Window Max** key once again.

Selecting Capture Range

1. Press **Setup** > **Capture Range** > **Normal** for PLL method.
2. Press **Setup** > **Capture Range** > **Wide** for Discriminator method.

If the DUT response is drifting or noisy, SSA cannot lock the signal using PLL method. In such cases, use Discriminator method technique.

The drift should be typically smaller than both of the following limitations.

- **Normal**: 40 kHz/20 msec, 0.4 % of carrier frequency
- **Wide**: 2 MHz/sec, 0.4 % of carrier frequency

NOTE

PLL and Discriminator are the two types of methods available in E5052B. PLL is the default capture range setting. When Capture Range is Wide, it is possible to measure from 250 MHz. In order to change the frequency range, it is recommended to change the capture range to PLL method.

For more details on PLL method and discriminator method, refer to Overall Instrument Operation.

Setting Trigger

Setting Averaging Trigger

Switch Reference Signal

The switch reference signal option is available in both phase noise measurement and segment phase noise measurement that enables you to select as channel 1 (CH1) and channel 2 (CH2). Normally in both phase noise measurement and segment phase noise measurement, CH1 is set to internal, and CH2 is set to external and then reference signal provided from CH2 is distributed to CH1 internally. For other measurement modes, CH1 is set to internal, and CH2 is set to external.

Follow the steps below to switch reference signal:

1. Press **Meas/View** > **Segment PN**
2. Press **Setup** > **Reference Oscillator** > **Bandwidth** > **Narrow** | **Wide**

   NOTE

   The selection of Narrow/Wide is for the Bandwidth of Reference Oscillator of PLL.
3. Press **Setup** > **Ref. Osc.1 Source** > **Internal** | **External**

4. Press **Setup** > **Ref. Osc.2 Source** > **Internal** | **External**

NOTE When reference source is Internal, Internal Oven Controlled Crystal Oscillator signal is used as reference signal.

External input signal is used as reference when the source is External. If E5052B cannot recognize the External input signal, it will automatically select Internal signal as the reference source.

Setting Attenuator

Selecting Carrier Frequency Band

1. Press **Setup** > **Frequency Band**.
2. Select the appropriate frequency band that contains the target carrier signal from the softkey menu list. The range of each frequency band is listed in the following table.

NOTE Selectable frequency bands differ depending on whether the E5053A Microwave Downconverter is used and whether the RF input is direct input or Downconverter input. For setting of downconverter and external mixer, refer to Setting E5053A Microwave Downconverter

Carrier Freq. Band	Standalone E5052B or Downconverter: OFF	Downconverter: ON & RF Input: E5052B Direct	Downconverter: ON & RF Input: Downconverter and External Mixer Not Used	Downconverter: ON & RF Input: Downconverter and External Mixer ON
10M to 41MHz	Y	Y	N	Y
39M to 101MHz	Y	Y	N	Y
99M to 1.5GHz	Y	Y	N	Y

250M to 3GHz	N	Y	N	N
250M to 7GHz	Y	N	N	Y
3G to 10GHz	N	N	Y	N
9G to 26.5GHz	N	N	Y	N

Setting IF Gain

"IF over flow" error may be displayed when segment phase noise is distorted. On the other hand, internal noise level of the instrument may be significant in the measurement display when the DUT has a low-noise characteristics. In this case, follow the steps below to adjust the IF Gain value.

1. Press **Setup** > **IF Gain**.
2. Enter the IF Gain value in the data entry field that appears in the upper part of the screen.

   You can select the value from the options: 0 dB, 10 dB, 20 dB, 30 dB, 40 dB or 50 dB.

NOTE The E5052B automatically set PLL BW depending on both the carrier frequency and IF Gain when selecting "Normal" in the capture range. Refer to the table below for the relationship.

IF Gain and PLL BW

	IF Gain is set to either 0 or 10 dB	**IF Gain is set to either 20, 30, 40, or 50 dB**
Carrier frequency is less than or equal to 100 MHz	PLL BW = 1 kHz	PLL BW = 1 kHz
Carrier frequency is greater than 100 MHz	PLL BW = 5 kHz	PLL BW = 350 Hz

NOTE When either “Phase lock loop unlocked” or "IF A/D overflow" error message is displayed, choose an appropriate IF Gain value as indicated in the table below.

IF Gain selection table

DUT type	IF Gain
Frequency drifting sources (Free-run VCO, etc.)	0, 10 dB
Frequency locked sources (PLL Synthesizer, etc.)	20, 30, 40, 50 dB

Auto Settings in Attenuator, Carrier Frequency and IF Gain

From firmware revision A.3.10, Frequency band, Input Attenuator and IF Gain can be setup to optimum value according to input signal through automatic setting.

NOTE Enables when you selected **Trigger to Segment PN**.

1. Press **Setup** > **Auto Setting**.
2. Carrier frequency band, Attenuator and IF Gain should be set to optimum value according to input signal.

Auto setting Parameter at each measurement status.

Measurement status (PS/Normal(PLL))	Freq Band	Attn	IF Gain
Downconverter=Off	Y	Y	Y
Downconverter=On, RF Input=E5052B Direct	Y	Y	Y
Downconverter=On, RF Input=Downconverter, Ext.Mixer=Off	User set	10dB	Y
Downconverter=On, RF Input=DownConverter, Ext.Mixer=On	N	N	N

Measurement status (PS/Wide(Discriminator))	Freq Band	Attn	IF Gain
Downconverter=Off	Band4	Y	N
Downconverter=On, RF Input=E5052B Direct	Band4	Y	N
Downconverter=On, RF	User set	10dB	N

Input=Downconverter, Ext.Mixer=Off			
Downconverter=On, RF Input=DownConverter, Ext.Mixer=On	N	N	N

NOTE When one of the following error messages is displayed, please try to set the wide capture mode (Press **Setup** > **Capture Range** > **Wide**).

"130 Auto setting failed"
"133 Failed to find IF gain"
"132 Try wide capture range"

When "IF A/D overflow" is displayed, please try to decrease 10 dB from the current IF Gain setting (Press **Setup** > **IF Gain**).

NOTE The auto setting function of the E5052B does not change capture range from the normal capture range to wide capture range automatically. When the carrier frequency is less than 250 MHz or the DUT is noisy (or drifty) while the auto setting is being executed, a message "132 Try wide capture range" is displayed.

Specifying Nominal Frequency

Enter the nominal value of the carrier frequency.

1. Press **Setup** > **Nominal Frequency**.
2. Enter the value of the nominal frequency in the data entry field displayed in the upper part of the screen.

NOTE You need to specify nominal frequency only when the downconverter is available.

NOTE The carrier search function is to detect the input signal frequency with the selected carrier frequency band for the downconverter RF IN (i.e. 3 to 10 GHz or 9 to 26.5 GHz) and reflect the result to the nominal frequency.

See also Executing Carrier Search Function.

Optimizing LO Phase Noise Characteristics

In the SSB segment phase noise measurement of the DUT, LO phase noise characteristics can be selected for optimizing the segment phase noise measurement accuracy.

1. Press **Setup** > **LO PhNoise Optimize**.

2. Select LO phase noise characteristics in the softkey menu displayed.

LO Phase Noise Characteristics

Softkey	Overview
L(f) for > 150 kHz	Lowering LO SSB phase noise at > 150 kHz offset frequency
L(f) for < 150 kHz	Lowering LO SSB phase noise at < 150 kHz offset frequency

NOTE Refer to the Segment Phase Noise Measurement in the Specifications.

Specifying Sweep Range for Offset Frequency

1. Press **Start/Center** (**Stop/Span**) > **Start**.
2. Enter the sweep start value in the data entry field that appears in the upper part of the screen.
3. Press **Stop/Span** (**Start/Center**) > **Stop**.
4. Enter the sweep stop value in the data entry field that appears in the upper part of the screen.

NOTE Otherwise, press **Start/Center** (**Stop/Span**) > **Center** to enter the sweep center value in the data entry field that appears in the upper part of the screen and then press **Stop/Span** (**Start/Center**) > **Span** to enter the sweep span value in the same way.

The same softkey will be displayed by pressing either **Start/Center** or **Stop/Span**. You can make the same settings by using either of the two keys.

NOTE Allowable setting range for the frequency sweep varies depending on whether the E5053A is turned on/off and the RF input is set to 'E5052B Direct'/'Downconverter'.

Device Configuration	Carrier Frequency Bands (Hz)	Possible Setting Range for Start Frequency (Hz)	Possible Setting Range for Stop Frequency (Hz)
E5052B is stand-alone, or with downconverter turned off	10 M to 41 M 39 M to 101 M 99 M to 1.5 G 250 M to 7 G	1 to 4.999999M 1 to 19.999999M 1 to 39.999999M 1 to 99.999999M	2 to 5M 2 to 20M 2 to 40M 2 to 100M
With the downconverter turned on and RF input set to 'E5052B Direct'	10 M to 41 M 39 M to 101 M 99 M to 1.5 G 250 M to 3 G	1 to 4.999999M 1 to 19.999999M 1 to 39.999999M 1 to 99.999999M	2 to 5M 2 to 20M 2 to 40M 2 to 100M
With the downconverter turned on and RF input set to 'Downconverter'	3 G to 10 G 9 G to 26.5 G	1 to 99.999999M 1 to 99.899999M	2 to 100M 2 to 99.9M

Specifying Measurement Resolution Bandwidth

1. Press **Avg/BW** > **RBW**
2. Enter the RBW value in the data entry field that appears in the upper part of the screen.

   You can select the value from the options as follows:

Relation between RBW and Span

RBW value	Maximum Span	Minimum Span
25kHz	24.43MHz	1Hz
12.5kHz	12.215MHz	1Hz
6.25kHz	6.1075MHz	1Hz
3.13kHz	3.05375MHz	1Hz
1.56kHz	1.526875MHz	1Hz
781Hz	763.4376kHz	1Hz
391Hz	381.7188kHz	1Hz
195Hz	190.8594kHz	1Hz
97.7Hz	95.4296kHz	1Hz
48.8Hz	47.7148kHz	1Hz
24.4Hz	23.8574kHz	1Hz
12.2Hz	11.9288kHz	1Hz
6.1Hz	5.9644kHz	1Hz
3.05Hz	2.9822kHz	1Hz
1.53Hz	1.491kHz	1Hz
763mHz	745.6Hz	1Hz
381mHz	372.8Hz	1Hz
191mHz	186.4Hz	1Hz
95.4mHz	93.2Hz	1Hz

Confirming Result of Segment Phase Noise Measurement

Follow the steps below to confirm the results of the DUT's segment phase noise measurement by using the E5052B's segment PN window.

- Setting Format
- Executing Carrier Search Function
- Setting Smoothing
- Confirming Measurement Points by Markers
- Confirming Integral Phase Noise Jitter and Residual FM
- Confirming Spurious
- Confirming Allan Variance using with segment phase noise measurement value

Other topics about Common Settings

Setting Format

Format options are not available for Segment Phase Noise measurement.

Executing Carrier Search Function

When the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to Not Used, the function to search for the carrier signal in the specified carrier frequency band and reflect the result to the nominal frequency is available.

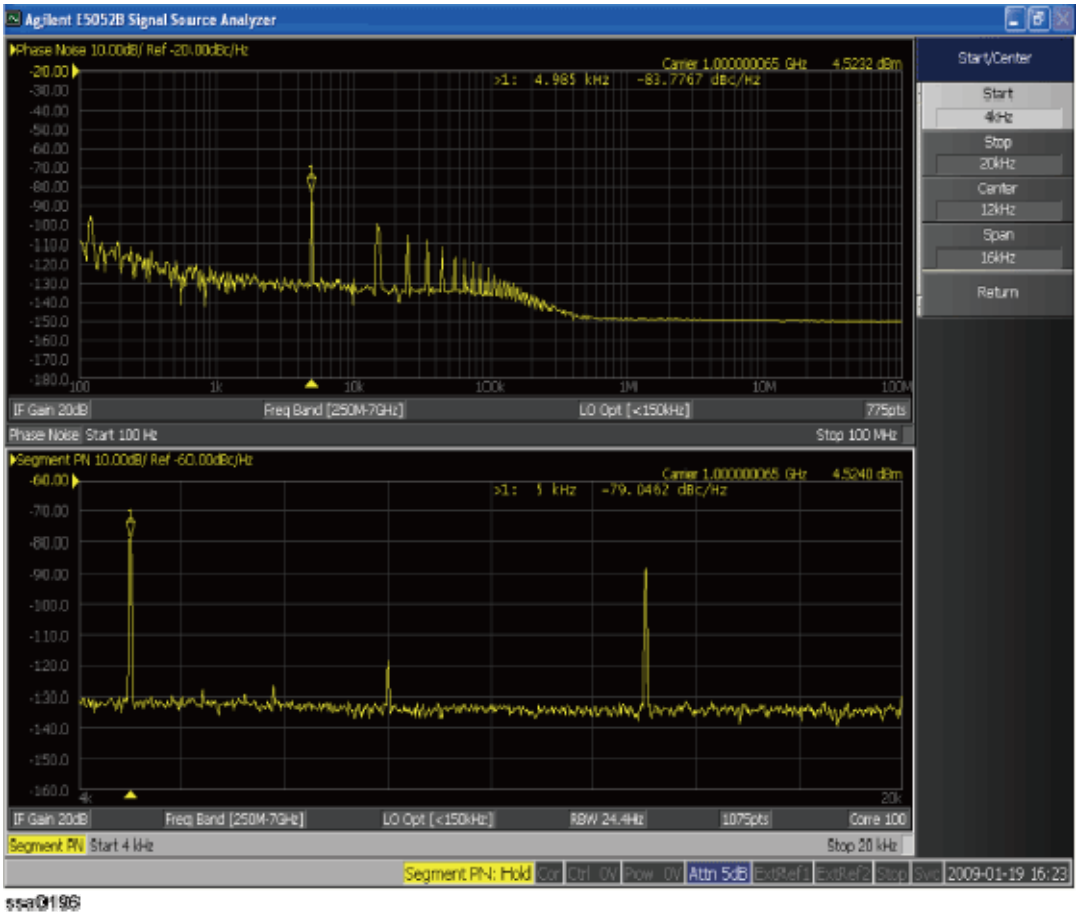
1. Press **Setup**
2. Press **Carrier Search** to execute the carrier signal search.
3. The detected signal frequency is reflected on the nominal frequency.

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (Phase Noise vs. Segment PN)



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NOTE In this measurement, you cannot specify the sweep time. It will be determined automatically based on the selection of the offset frequency sweep range and the resolution bandwidth.

Confirming Integral Phase Noise, Jitter and Residual FM

1. Specify the noise integration range by using the band marker. For more information, refer to Searching in Specified Range. You do not have to use the band marker to integrate the entire range.

2. Press **Marker Fctn** > **Analysis Type**.

3. Press **Integral**. In the upper right part of the screen, you will see the Integral Phase *Noise* value [dBc], the RMS Noise value [rad, deg], the RMS Jitter value [sec] and Residual *FM* value [Hzrms].

   NOTE Calculate Integral Phase Noise, Jitter and Residual FM, using the specified data by Analysis range.

   Integral Phase Noise returns the value of SSB Integral result. RMS

Noise, Jitter and Residual FM returns the value after applying the DSB conversion.

Value	Formula
Integral Phase Noise	10 * log(integ(10 ^ (L(f) / 10))) [dBc]
RMS Noise	sqrt(2 * 10 ^ (Integral Phase Noise / 10)) [rad]
RMS Jitter	RMS Noise / (2 x ƒÎ x Carrier frequency) [sec]
Residual FM	sqrt(2 x integ(f ^ 2 * 10 ^ (L(f) / 10))) [Hz]

where, L(f): Phase Noise [dBc/Hz] and integ(x): Integral

When Power is selected in the Spurious measurement, it is calculated with adding the power of Spurious after integrating except Spurious.

Confirming Spurious

Confirming Allan Variance using with segment phase noise measurement value

It is available to calculate the Allan Variance and Jitter using the measured average time and the measured cut-off frequency.

This operation is available to execute with SCPI commands, and it is not supported with the key operation. For more information refer to the following SCPI commands

SCPI.CALCulate.PS(Ch).TRACe(Tr).FUNCtion.AVARiance.DATA

SCPI.CALCulate.PS(Ch).TRACe(Tr).FUNCtion.AVARiance.MEMory

NOTE The value obtained with E5052B as Sigma is standard deviation, and the Allan Variance as the general definition is the value that is squared this Sigma.

Spectrum Monitor Measurement

Spectrum Monitor Measurement

You can measure the spectrum of a specified range by sweeping the DUT's output signals and approximate frequency range.

The following section describes the basic measurement method of spectrum monitor measurement by using the E5052B's spectrum monitor measurement window. This section describes the following topics about Spectrum Monitor Measurement:

- Setting Spectrum Monitor Measurement
- Confirming Result of Spectrum Monitor Measurement

Setting Spectrum Monitor Measurement

Follow the steps below to set up the measurement by using the E5052B's spectrum monitor measurement window.

Selecting Measurement Window

1. Press **Meas/View** > **Spectrum Monitor**.

NOTE You can maximize the Spectrum Monitor measurement window by pressing the **Window Max** key while the window is selected. You can return to the original size when you press the **Window Max** key once again.

Setting Trigger

Setting Averaging Trigger

Setting Attenuator

Procedure to select a carrier frequency band

1. **Start/Center** (**Stop/Span**) > **Carrier To** - **Frequency Band**.
2. Select a frequency band that contains the carrier signal to be measured from the softkey menu list. The ranges of the frequency bands are shown below:

NOTE Selectable frequency bands differ depending on whether the E5053A Microwave Downconverter is used and whether the RF input is direct input or downconverter input. For setting of downconverter and external mixer, refer to Setting E5053A Microwave Downconverter

Carrier Frequency Band	Standalone E5052B or Downconverter: OFF	Downconverter: ON & RF Input: E5052B Direct	Downconverter: ON & RF Input: Downconverter and External Mixer Not Used	Downconverter: ON & RF Input: Downconverter and External Mixer ON
10M - 1.5GHz	Y	Y	N	N
250M - 3GHz	N	Y	N	N
250M - 7GHz	Y	N	N	N
3G - 10GHz	N	N	Y	N
9G - 26.5GHz	N	N	Y	N

NOTE When the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to on, setting the carrier frequency band is not available.

Specifying Frequency Sweep Range

1. Press **Start/Center** (**Stop/Span**) > **Center**.
2. Enter the sweep center value in the data entry field that appears in the upper part of the screen.
3. Press **Start/Center** (**Stop/Span**) > **Span**.
4. Enter the sweep span value in the data entry field that appears in the upper part of the screen.

NOTE Otherwise, press **Start/Center** (**Stop/Span**) > **Start** to enter the sweep start value in the data entry field that appears in the upper part of the screen and then press **Span** (-> **Stop**) to enter the sweep stop value in the same way.

The same softkey will be displayed by pressing either **Start/Center** or **Stop/Span**. You can make the same settings by using either of the two keys.

NOTE Allowable setting range for the frequency sweep varies depending on whether the E5053A is turned on/off and the RF input is set to 'E5052B Direct'/'Downconverter.' Possible setting range for the center frequency is possible widest setting range of the carrier frequency bands. More specifically, when possible setting range for the carrier frequency bands are 10M to 1.5GHz and 300M to 3GHz, resultant possible setting range for the center frequency is 10M to 3GHz.

Device Configuration	Carrier Frequency Bands	Possible Setting Range for Center Frequency
E5052B is stand-alone, or with downconverter turned off	10 M to 1.5 GHz 250 M to 7 GHz	10 M to 7 GHz
With the downconverter turned on and RF input set to 'E5052B Direct'	10 M to 1.5 GHz 250 M to 3 GHz	10 M to 3 GHz
With the downconverter turned on and RF input set to 'Downconverter'	3 G to 10 GHz 9 G to 26.5 GHz	3 G to 26.5 GHz

The maximum span setting depends on the center frequency:

Centre Frequency	Maximum Span
≥ 100 MHz	15 MHz
> 50 MHz	10 MHz
≤ 50 MHz	Center frequency *0.2

Specifying Maximum Input Level of Input Signal

Follow the steps below to enter the maximum level value of the measurement signals that are input from the RF port. For more information, refer to the Specifications.

1. Press **Setup** > **Reference Level**.
2. Enter the maximum input level in the data entry field that appears in the upper part of the screen.

Setting Average Function

Specifying Measurement Resolution Bandwidth

1. Press **Avg/BW** > **RBW**.
2. Enter the RBW value in the data entry field that appears in the upper part of the screen.

   You can select the value from the options: 1.53 Hz, 6.1 Hz, 24.4 Hz, 97.7 Hz, 391 Hz, 1.56 kHz, 6.25 kHz, 25 kHz, 100 kHz, 400 kHz, 1.6 MHz.

About DC voltage setting and protection

You can specify DC power/control that is applied to the DUT. Refer to Setting DC power/DC control and protection for the setting procedure.

About Auto Frequency Control Function

If this function is turned on, the E5052B will adjust the control voltage automatically so that the output signal frequency from the DUT may keep the specified value. For the setting procedure, refer to the Auto Frequency Control Function

Confirming Result of Spectrum Monitor Measurement

Follow the steps below to confirm the results of the DUT's spectrum monitor measurement by using the E5052B's spectrum monitor measurement window.

NOTE To improve readability and reduce search time, few sections of this topic are combined with similar sections from other measurements in **Measurement** > **Common Settings**. Links to these new sections are provided in this topic.

Moving Carrier Frequency to the Center

1. Press **Marker** to display marker 1 on the screen.

2. Press **Marker Search** > **Peak** - **Search Peak** to move marker 1 to the position of carrier frequency.

3. Press **Marker ->** > **Marker->Center** to move the frequency in which the carrier resides to the center of the sweep range.

Moving harmonic Frequency to the Center

1. Press **Start/Center** (**Stop/Span**) > **Carrier to** to move the frequency at which the carrier resides to the center of the sweep range.

2. Press **Carrier x1 -> Center to** move the frequency at which the first harmonic resides, to the center of the sweep range. Pressing **Carrier x2 -> Center** or **Carrier x3 -> Center** moves the frequency at which the second or the third harmonic respectively resides, to the center of the sweep range.

   To move the frequency in which an n-order harmonic resides to the center of the sweep range, press **Harmonic #** and enter the number corresponding to n, and then press **Carrier x# -> Center**.

   NOTE "No Signal Found" may error occur when the attenuator setting is not appropriate. Refer to Error Messages for more detail explanation.

Setting Format and Detector Mode

You can select the unit (format) used in the spectrum monitor measurement trace screen and switch to the detector mode.

NOTE The E5052B displays the measurement value at the specified point; actually, it sweeps (measures) with the resolution determined by the RBW. The detector captures all of the signals not only at the display point but also between individual display points. If there are more measurement points than display points, you must select the detector mode so that each display point is converted from the individual value of multiple measurement points.

In the "Positive" mode, the E5052B displays the maximum value (peak) of the measurement values between the display points. In the "Sample" mode, the E5052B displays the measurement value at the nearest measurement point to the display point.

1. Press **Format** > **Format**.

2. Select the appropriate format from the softkey menu list. The available options are as follows.

Format List

Format	
dBm	dBm / Hz
dBV	dBV / Hz
Watt	Watt / Hz
Volt	Volt / Hz

3. Press **Format** > **Detector Mode**.
4. Select the appropriate detector mode from the softkey menu list. You can choose either **Positive** or **Sample**. **Positive** is selected by default.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

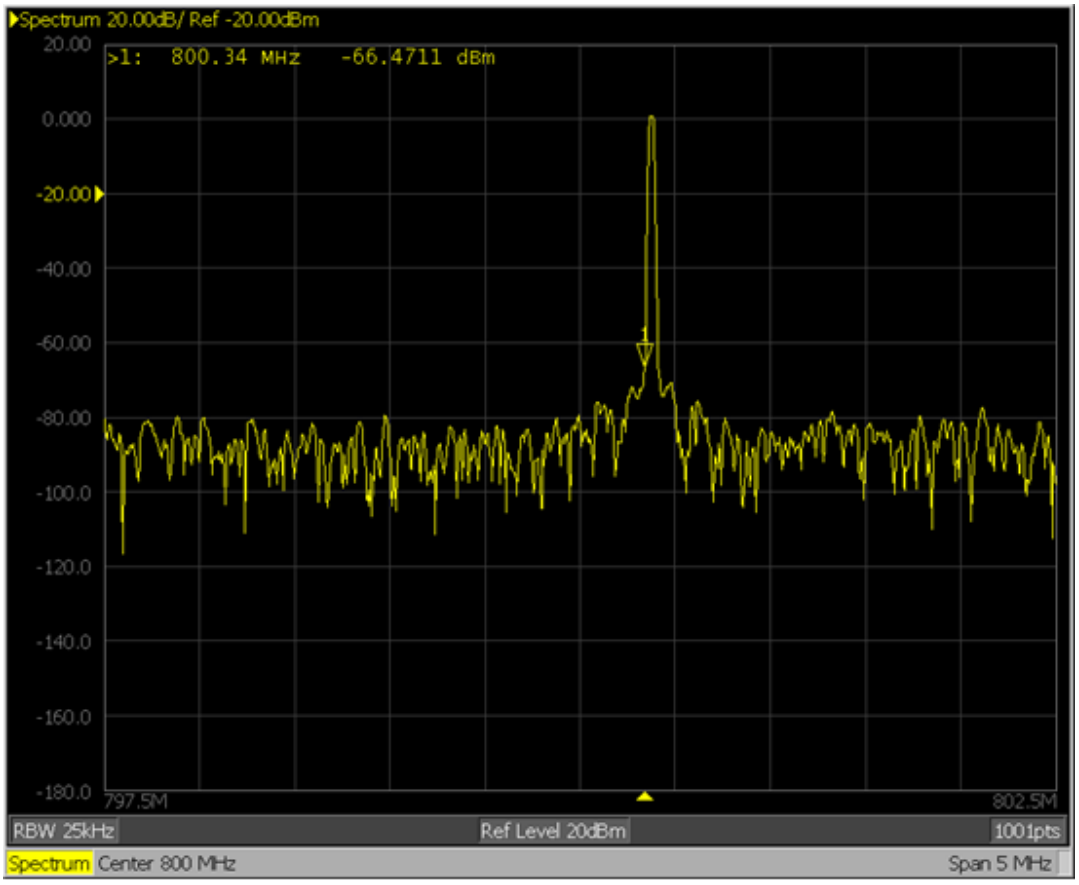
Setting Attenuator

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (spectrum)



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NOTE In this measurement, you cannot specify the sweep time. It will be determined automatically based on the frequency sweep range and measurement resolution bandwidth.

Transient Measurement

Transient Measurement

You can measure the frequency, power and phase of the DUT along the time axis using Transient Measurement.

The E5052B's transient measurement has Wide-Narrow band mode and Narrow-Narrow band mode. The Wide-Narrow mode has four measurement trace screens to perform transient measurement of frequency, power and phase. The Narrow-Narrow mode has six measurement trace screens to perform transient 2 channel measurement of frequency, power and phase.

You can use each trace screen to measure the variation in frequency, power or phase after you have changed the output settings of the DUT.

The following sections describes the basic measurement method of the variations in the DUT's frequency, power and phase by using the E5052B's transient measurement window. This section describes the following topics about Transient Measurement:

- Setting Measurement Mode
- Setting for Transient Measurement
- Setting Video Trigger
- Confirming Result of Frequency Transient (Wide Band) Measurement
- Confirming Result of Frequency Transient (Narrow Band) Measurement
- Confirming Result of Power Transient Measurement
- Confirming Result of Phase Transient Measurement

Setting Measurement Mode

- Setting Measurement Mode for Narrow Band-Narrow Band.
- Selecting Measurement Window

Other topics about Transient Measurement

Setting Measurement Mode for Narrow Band-Narrow Band

The transient measurement has two measurement modes: Wide-Narrow band mode, which consists of four traces of wide and narrow, and Narrow-Narrow band mode, which consists of six traces of narrow and narrow. For more information, refer to Overall Instrument Operation. Also refer to External Reference Signal Input Port.

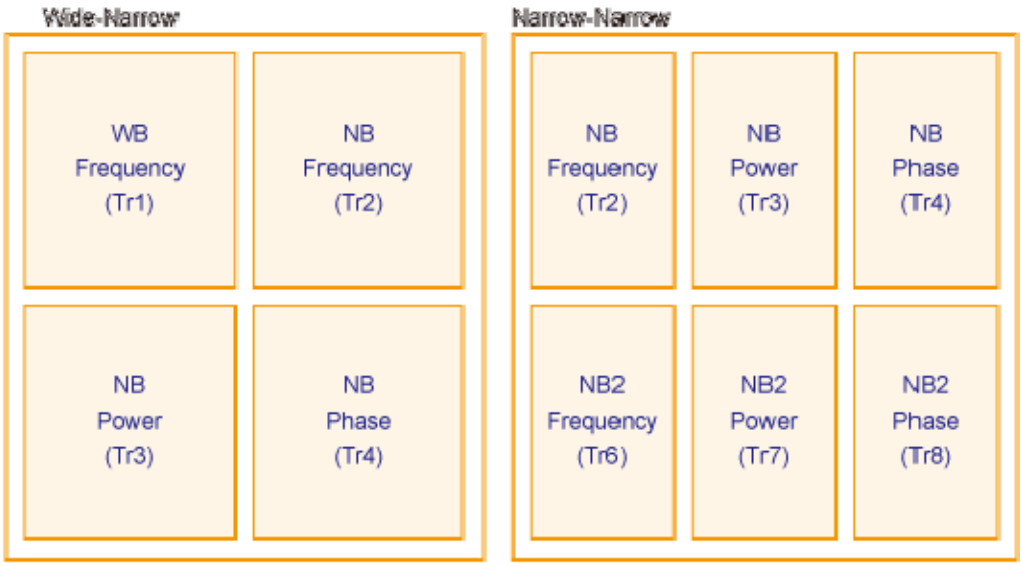
You can change the measurement mode from Wide-Narrow to Narrow-Narrow mode or vice-versa. In each measurement layout, data will be assigned as measurement layout. In the Wide-Narrow mode, the upper-left is wide-band frequency, the upper-right is narrow-band frequency, the lower-left is narrow-band power and the lower-right is narrow-band phase.

NOTE This function is added since firmware rev. A.03.20.

Selecting Wide-Narrow Measurement or Narrow-Narrow Measurement

1. You can select either Wide-Narrow or Narrow-Narrow by pressing the **Setup** > **Measurement Mode** key. Wide-Narrow mode is selected by default.

Measurement layout



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Describe measurement in relation to trace

Displays off trace 6 to 8 when Wide-Narrow measurement, display off trace 1 when Narrow-Narrow measurement.

NOTE Trace 5 is always OFF.

Selecting Measurement Window

You can select the measurement window when Narrow-Narrow measurement mode is selected.

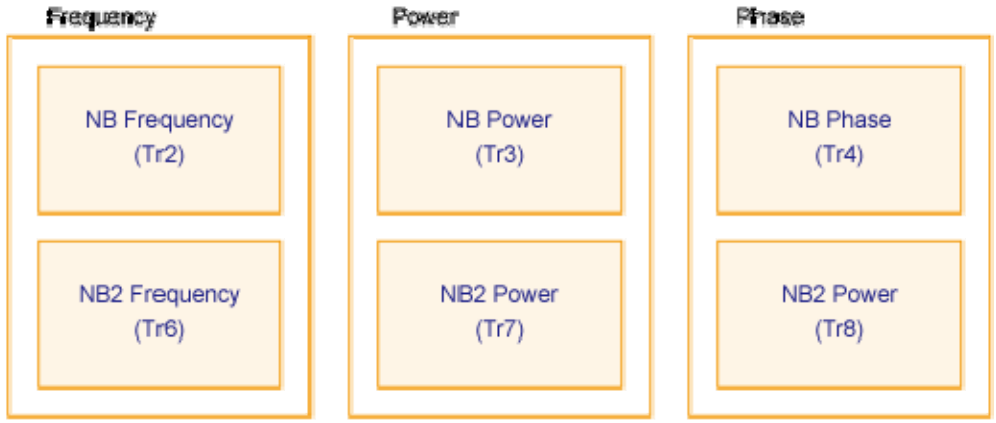
1. Press **Display** > **Parameters**.
2. Select the measurement window from the softkey menu list. The available measurement windows are as follows. All is selected by default.

Measurement Window List

Softkey	Overview
All	Displays all traces.
Frequency	Displays narrow band frequency by bisecting the screen vertically, with channel 1 displayed above channel 2.
Power	Displays narrow band power by bisecting the

	screen vertically, with channel 1 displayed above channel 2.
Phase	Displays narrow band phase by bisecting the screen vertically, with channel 1 displayed above channel 2.

Trace Layout



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Setting for Transient Measurement

Follow the steps below for the common settings to perform transient measurements of frequency, power or phase by using the E5052B's transient measurement window.

NOTE For more information about transient measurement specification, please refer to the data sheet.

The Data Sheet (PDF format) shows the E5052B specifications.

The latest version of data sheet is available at http://cp.literature.agilent.com/litweb/pdf/5989-6388EN.pdf

Selecting Measurement Screen

1. Press **Meas/View** > **Transient** to select the transient measurement window.

NOTE You can maximize the transient measurement window by pressing the **Window Max** key while the window is selected. You can return to the original size when you press the **Window Max** key once again.

You can select the next trace by pressing the **Trace Next** key and maximize the target trace by pressing the **Trace Max** key. The transient window will come back when you press the **Trace Max** key once again.

Setting Trigger

Setting Averaging Trigger

Setting Attenuator

Setting Downconverter and External Mixer

For information on settings of downconverter and external mixer, refer to Setting E5053A Microwave Downconverter

Specifying Target Frequency

Follow the steps below to specify the target frequency for the Narrow Band measurement:

1. Press **Setup** > **Target Freq** (or **N2 Target Freq**).
2. Enter the target frequency in the data entry field that appears in the upper part of the screen.

   Allowable setting range is 10 MHz to 7 GHz if the downconverter is turned OFF.

   Allowable setting range is 10 MHz to 3 GHz if the downconverter is turned on, the RF input is set to 'E5052B Direct.'

   Allowable setting range is 3 GHz to 26.5 GHz if the downconverter is turned on, the RF input is set to 'Downconverter,' and the external mixer is set to 'Not Used.'

   NOTE Among the target frequency and the frequency band or the maximum frequency of the input signal (described later), one that is specified later over-rides the other. For example, when the target frequency is set to 5 GHz, specifying the maximum frequency as 3 GHz will automatically decrease the target frequency below the maximum frequency.

Precautions for Using Downconverter

- In Wide-Narrow mode
  - The minimum frequency of wide band is the maximum frequency minus 500 MHz (The frequency span of wide band is 500 MHz).

    - The target frequencies for Narrow should be between minimum and maximum frequencies of wide band.

- In Narrow-Narrow mode

    - The target frequencies between Narrow and Narrow 2 should be within 500 MHz. If it exceeds over 500 MHz, the setting which is set previously will be changed automatically so that the frequency difference becomes 500 MHz. For example, the target frequency for Narrow 1 is set at 1 GHz, then one for Narrow 2 is set at 1.6 GHz. The target frequency of narrow 1 is automatically changed to 1.1 GHz.

Specifying Frequency Range

Follow the steps below to specify frequency range for the Narrow Band measurement

1. Press **Setup** > **Freq Range** (or **N2 Freq Range**) to select the frequency range.

   You can select either 80MHz, 1.6 MHz, 25.6 MHz, 200 kHz, 25 kHz, or 3.125 kHz.

   NOTE 80MHz range is available to select when Target Frequency is set as over 750MHz.

   25.6MHz is available to select when Target Frequency is set as over 200MHz.

   When Downconverter is ON and External Mixer is ON, Target Frequency is set over 200MHz.

Specifying Frequency Band of Input Signal

Follow the steps below to specify frequency range for the Wide Band measurement.

1. Press **Setup** > **Wide Freq Range**.
2. Select the frequency band (Wide Band) from the softkey menu list. The available options are as follows.

Frequency Band List (Wide Band)

Frequency Band	
50 M -150 MHz	1 G - 3 GHz
100 M -300 MHz	1.2 G -3.6 GHz
200 M -600 MHz	1.4 G -4.2 GHz
300 M -900 MHz	1.6 G -4.8 GHz
400 MHz -1.2 GHz	1.8 G -5.4 GHz
500 MHz - 1.5 GHz	2 G -6 GHz
600 MHz -1.8 GHz	2.2 G -6.6 GHz
800 MHz -2.4 GHz	2.4 G -7.2 GHz

NOTE The frequency bands shown above are all applicable only when the down-converter is turned off. When the downconverter is turned on and the RF input is set to 'E5052B Direct,' the maximum frequency band is "1 GHz to 3 GHz".

When the downconverter is turned on, the RF input set to 'Downconverter,' and the external mixer set to 'Not Used,' specifying the frequency band is not available. In this case, specify the maximum frequency of the input signal. For details in the procedure, refer to Specifying Maximum Frequency of Input Signal.

Specifying Maximum Frequency of Input Signal

When the downconverter is turned on, the RF input set to 'Downconverter,' and the external mixer set to 'Not Used,' specify frequency of the input signal as the maximum frequency.

1. Press **Setup** > **Wide Max Frequency**.
2. Enter the maximum frequency of the input signal in the data entry field that appears in the upper part of the screen.

Specifying the Maximum Input Level of Input Signal

Follow the steps below to enter the maximum level value of the measurement signals that are input from the RF port. For more information, refer to the Specifications.

1. Press **Setup** > **Max Input Level**.
2. Enter the maximum input level in the data entry field that appears in the upper part of the screen.

Specifying Start Time, Time Span and Reference Position for Frequency Transient (Wide Band) Measurement Trace

1. Press the **Trace Next** key to select the measurement trace for the frequency transient (Wide Band). You can confirm which trace is selected by viewing the cursor, which is displayed to the left of the trace title.

   NOTE You can also click on the trace of the frequency transient (Wide Band) for confirmation.

2. Press **Start/Center** > **Wide Ref Position**.
3. Select the sweep reference position from the softkey menu list.

You can select any of the three options: **Left**, **Center** or **Right**.

4. Press **Start/Center** > **Wide Span**.

5. Enter the time span value in the data entry field that appears in the upper part of the screen. The allowable input value may vary depending on the scale value, target frequency or frequency range of the measurement trace.

6. Press **Start/Center** > **Wide Time Offset**.

7. Enter the sweep offset value in the data entry field that appears in the upper part of the screen.

   NOTE The function of **Time Offset** on the softkey is same as that of the **Start/Center** key.

Specifying Start Time, Time Span and Reference Position for Frequency Transient (Narrow Band) Measurement Trace, Power Transient Measurement Trace and Phase Transient Measurement Trace

1. Press the **Trace Next** key to select the measurement trace for the frequency transient (Narrow Band). You can confirm which trace is selected by viewing the cursor which is displayed to the left of the trace title.

   NOTE You can also click on the trace of the frequency transient (Narrow Band) for confirmation.

   The procedure for specifying the start time, time span and reference position for frequency transient (Narrow Band) measurement trace is

also applicable to the measurement trace of power transient and phase transient.

You can also specify the start time, time span, and reference position for the frequency transient (Narrow Band) measurement trace by selecting the measurement trace of the power transient or phase transient.

2. Press **Start/Center** > **Narrow Ref Position**.

3. Select the sweep reference position from the softkey menu list.

You can select any of the three options: **Left**, **Center** or **Right**.

4. Press **Start/Center** > **Narrow Span**.

5. Enter the time span value in the data entry field that appears in the upper part of the screen. The allowable input value may vary depending on the scale value, target frequency, or frequency range of the measurement trace.

6. Press **Start/Center** > **Narrow Time Offset**.

7. Enter the sweep offset value in the data entry field that appears in the upper part of the screen.

NOTE The function of **Time Offset** on the softkey is the same as that of the **Start/Center** key.

You can apply the setting values of start time, time span, and reference position for the frequency transient (Wide Band) measurement trace to the frequency transient (Narrow Band) by pressing **Start/Center** > **Wide Settings -> Narrow**.

NOTE The E5052B calculates the transient measurements by FFT using the data from ADC. To do FFT, several data points from ADC are required. When the time span is set to a narrow value, an overlapped FFT technique is used to obtain accurate transient measurements. The measurement result adjacent to the previous measurement point is calculated by using some of the data (overlapped data) used in the previous measurement point. The rate of overlapped data depends on the frequency range and time span you set. When you evaluate a quick response, you will see the effect of this overlap. In this case, please try to use the time span that is narrower than the current time span.

Setting Average Function

About DC Voltage Setting and Protection

You can specify DC power/control that will be applied to the DUT. Refer to Setting DC power/DC control and protection for the setting procedure.

Analyzing Data on Trace Using Marker

Setting the X-axis, Target Frequency or Frequency Range by using the mouse

Specifying the area with a mouse enables to set time span of wide band and narrow band. In the wide-narrow mode, specifying area in the wide band enables to set the start/stop time in narrow band. In the narrow-narrow mode, specifying the area in the narrow band enables to display the same area in narrow band2. This function also enables to set the target frequency and frequency range at the center frequency of the specified area.

NOTE When you use this function, you must connect the mouse to the E5052B.

NOTE About the basic setting by using the mouse, see the description in Setting the scale by using the mouse.

NOTE When you specify the area in the wide mode to apply to the span of the narrow (or narrow 2) time, if the specified area is below 0 ms, there is a case that the scaled narrow time span is not the same as the span which you specified in wide mode. This is because the minus time offset can not be set below 30% of span. In this case, the area of narrow mode is set to include the specified wide area. The start time of narrow is set at the specified start time in wide mode and the span of narrow becomes wider than one you specified in wide mode.

Zoom-in

1. Drag (Press) the right button of the mouse on the measurement trace area of display.
2. Move the mouse to the desired point with pressing the right button of the mouse. The rectangle frame is displayed.
3. Release the right button to specify the rectangle frame area. Dialog box for action for scale is displayed. (See the following table.)
4. Select the scale type in the dialog box.
5. Click the OK button.

NOTE If you selected to a small area, auto scale type is displayed.

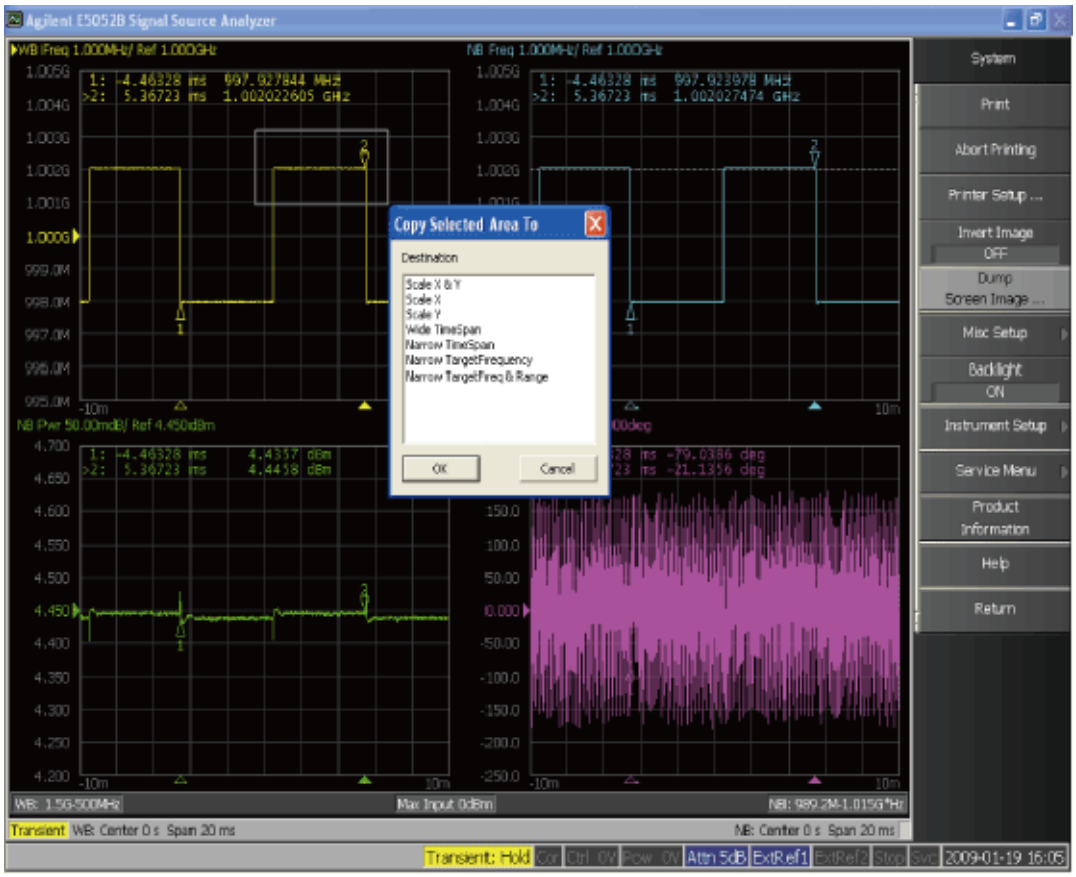
Zoom-out

1. Click a right button on a mouse in the measurement trace area of display.
2. Dialog box for action for auto scale is displayed. (See the following table.)
3. Select the auto scale type in the dialog box.
4. Click the OK button.

Selecting Scale Type for Transient Measurement

Scale Type	Operation
Scale X & Y	The area of specified rectangle frame is enlarged to fit the full display area.
Scale X	The X axis of display is set at X axis of the specified rectangle frame. The scale for Y axis is not changed.
Scale Y	The Y axis of display is set at Y axis of the specified rectangle frame. The scale for X axis is not changed.
Auto Scale X & Y	Set the full scale for X axis and adjust the Y axis scale to fit the displayed trace data.
Auto Scale X	Set the full scale for X axis.
Auto Scale Y	Executing the auto scale on the Y axis.
Wide Time Span	In the wide-narrow mode,set X-axis of wide band at one of specified the area.
Narrow Time Span / Narrow 2 Time Span	Set X-axis of narrow band at one of specified the area.
Narrow Target Frequency / Narrow 2 Target Frequency	In the frequency transient of either wide or narrow band, set the target frequency of narrow band at the center frequency of the specified area.
Narrow Target Freq & Range / Narrow 2 Target	In the frequency transient of either wide or narrow band, set the target frequency of narrow band at the center frequency of the specified area, and the

Freq & Range	frequency range is selected at the narrowest frequency range whose is wider than the specified area. NOTE When the frequency span of the specified area is wider than the maximum frequency range, the maximum frequency range is selected.



Setting Advanced Mode

Advanced mode using long memory is added to Narrow Band Transient measurement. In this mode the maximum measurement span is extended to 1000 seconds. The pre-trigger can be set up to 80% of the span. However, the maximum value can be set to 20 second. In addition, not only the target frequency, frequency range and phase reference but also the frequency and time resolution can be set in Advanced mode.

Data of any continuous 1001 points out of maximum 10001 points of the measurement data (scroll available) can be displayed on a graph, and also, the complete measurement span can be displayed under the condition that the number of measurement points is below 1001.

NOTE This function is disabled when Narrow2 band (trace 6, 7 or 8) is selected.

Follow the steps below to use the advanced mode:

1. Press **Setup** > **Advanced Setup** > **Advanced mode** > **OFF** | **ON**

   NOTE Default mode is OFF. ON indicates advanced mode is selected for measurement.

2. Press **Setup** > **Advanced Setup** > **Narrow Freq Reso.** - select the frequency resolution based on the following table

   This softkey is disabled when Advanced mode is OFF.

Frequency Range	80 MHz	25.6 MHz	1.6 MHz	200 kHz	25 kHz	3.125 kHz
R1	810 Hz	290 Hz	4.5 Hz	0.2 Hz	0.0087 Hz	0.0004 Hz
R2	2.3 kHz	810 Hz	13 Hz	0.56 Hz	0.025 Hz	0.0011 Hz
R3	6.5 kHz	2.3 kHz	36 Hz	1.6 Hz	0.07 Hz	0.0031 Hz
R4	19 kHz	6.5 kHz	101 Hz	4.5 Hz	0.2 Hz	0.0087 Hz

3. Press **Setup** > **Advanced Setup** > **Narrow Time Reso.** > select the frequency resolution based on the following table

   This softkey is disabled when Advanced mode is OFF.

Frequency Range	Time Resolution
80 MHz	0.008u × N (N=1 - 12500000)
25.6 MHz	0.008u × N (N=1 - 12500000)

1.6 MHz	0.128u × N (N=1 - 781250)
200 kHz	1.024u × N (N=1 - 97657)
25 kHz	8.192u × N (N=1 - 12208)
3.125 kHz	65.536u × N (N=1 - 1526)

4. Press **Setup** > **Advanced Setup** > **Narrow Zoom Out** > **OFF** | **ON**

NOTE OFF: Displays the graph of data of continuous 1001 measurement points out of all measurement points.
ON: Displays the complete measurement span on the graph when the number of measurement points is below 1001.

The interval should be such the minimum integer that the number of display points becomes less than 1001.

Interval = integer of ((measurement points -1)/1000) or above.

For example, when the number of measurement points is 4900, every four points are skipped and the interval is 5.

NOTE The execution of this command clears the value of Average count and Data Hold.

This softkey cannot be used under the following conditions:

- If NOP is small.
- TR Narrow Trace is not 'Active'.
- Trigger is not 'Hold'.
- When the advanced mode is **OFF**.
- When measurement is not performed with the current setting conditions.
- While measurement is being performed.
- When the setting was changed after measurement (when the dirty flag# is displayed to the right of the TR measurement window).

5. Press **Setup** > **Advanced Setup** > **Narrow Display Start**

The leftmost value of the X-axis of the graph display. Data of 1001 measurement points after the measurement point of this setting value are displayed on a graph. The minimum value is the measurement start time. The maximum value is the (measurement end time - time_res × 1000)

NOTE The execution of this command clears the Average count and Data Hold.

This softkey is disabled under the following conditions:

- **Narrow Zoom Out** key is disabled.
- **Narrow Zoom Out** is **ON**.
- When this softkey is enabled, the horizontal scroll bar is displayed on the bottom of the TR window, which enables you to change the display area.

Setting Video Trigger

You must set up the video trigger when you select either **Wide Video**, **Narrow Video** or **Narrow2 Video** for the trigger source. You do not have to set up the video trigger when you select other trigger sources.

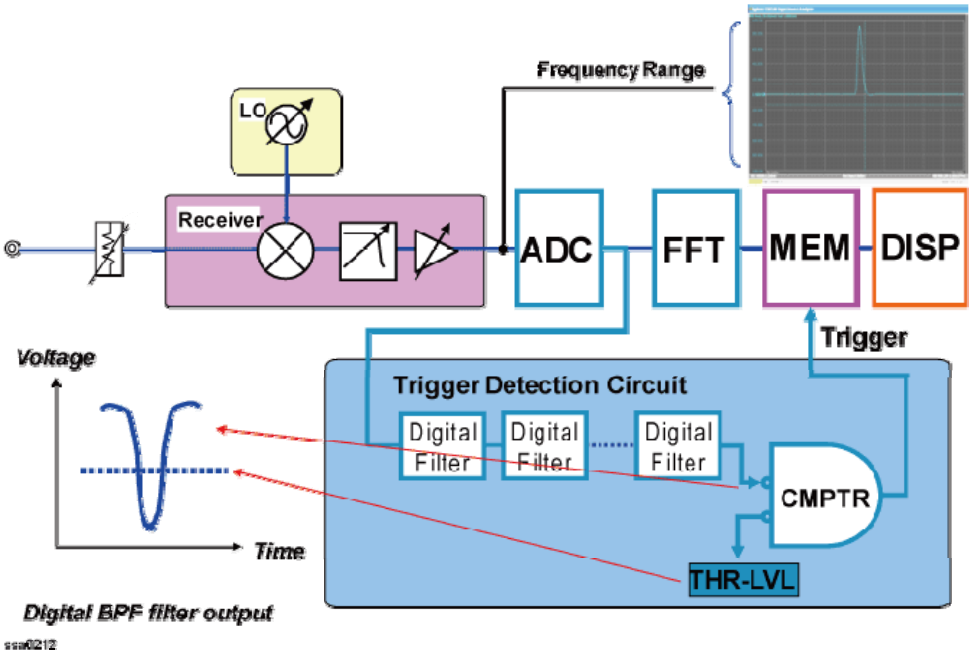
The E5052B video trigger includes the following functions:

- A function to select the trigger polarity
- Outbound trigger function
- Power trigger function
- A function to select the trigger detection bandwidth

Follow the steps below to set up the video trigger for the transient measurement:

- Setting for wide band
- Setting for narrow band

NOTE The following figure is a simplified block diagram of the E5052B transient measurement mode as well as the frequency boundary trigger (Video trigger) detection circuit.



The RF signal comes out of the receiver section, which is downconverted to an IF signal, and goes into the ADC. The digitized incoming data with available sampling rate of the ADC, with a maximum rate of 125 MSa/s. The data is fed into the FFT section to obtain frequency data and then recorded in the internal memory. The data is recorded continuously similar to an endless tape recorder if there is no trigger signal present.

The digitized data is also fed into the trigger detection circuit. The circuit consists of several stages of digital filter and a digital comparator. The digitized voltage data coming out of the trigger detection circuit is compared to the threshold level for triggering. In the frequency boundary out mode, the output signal of the digital filter stage is shown in the figure above. When the frequency goes out of the frequency boundary, the voltage of the digitized data drops accordingly.

NOTE

The method of data processing for obtaining measurement values of frequency transient and judging the condition of video trigger is different due to different data processing time. Data processing of measurement values is done after measurement is completed, while video trigger requires real-time processing during measurement. Therefore, the following things happen.

- The instrument is not triggered even though the conditions seem to be satisfied.

- The instrument is triggered even though the conditions seem not to be satisfied.

In this case, change the power level of video trigger and frequency bandwidth to adjust the sensitivity of trigger. In addition, if the instrument is triggered even though the condition is not satisfied, improve the time resolution. This enables to see the frequency change that had not been seen before and to investigate the cause.

NOTE The trigger standby band is determined based on a specified trigger frequency. Setting of a center frequency of the trigger standby band has limitation and therefore, the trigger frequency is not necessarily the same as the center frequency of the standby band. In this case, the standby band whose center frequency is closest to the specified trigger frequency is selected.

This standby band consists of two bands based on its center frequency: low frequency side and high frequency side. When the video mode is positive, the instrument is triggered when an input signal comes in the low frequency side and then high frequency side. When the video mode is negative, the instrument is triggered when an input signal comes in the high frequency band and then low frequency band. Adjustment is made at the timing of post processing so that the point when an input signal cuts across the trigger frequency becomes the zero point of the time-axis.

NOTE Above rev. A.03.20, the synchronization capability for X axis (Time) of 2 channels has been added. The synchronization works on the condition of satisfying all of following conditions.

- Wide-Narrow mode:
  - Frequency range of narrow is 25.6 MHz
  - Time spans of wide and narrow are the same
  - Advanced Mode for narrow is OFF
- Narrow-Narrow mode:
  - The frequency range and time span for both channels are the same.
  - Advanced Mode for narrow is OFF

Setting for Wide Band

1. Press **Setup** > **Video Trigger** > **Wide Video Mode** > **OUT** | **IN** | **Positive** | **Negative**

Mode	Description
IN	The instrument is triggered when the input signal comes in the trigger standby band. Adjustment is made so that the first measurement point when a signal comes in the standby band becomes the zero point of the time-axis. When the video trigger is selected in this mode, two dotted lines indicating the upper and lower limits of the standby band are displayed on the graph of the frequency measurement.
OUT	The instrument is triggered when the input signal is outside the trigger standby band. Adjustment is made so that the first measurement point when a signal goes outside the band becomes the zero point of the time-axis. When the video trigger is selected in this mode, two dotted lines indicating the upper and lower limits of the standby band are displayed on the graph of the frequency measurement.
POSitive	The instrument is triggered when an input signal cuts across the trigger standby frequency from the lower frequency side to the higher frequency side. Adjustment is made so that the point when an input signal cuts across the standby frequency becomes the zero point of the time-axis. When the video trigger is selected in this mode, three dotted lines indicating the standby frequency, the upper limit and lower limit of the standby band are displayed on the graph of the frequency measurement.
NEGative	The instrument is triggered when an input signal cuts across the trigger standby frequency from the higher frequency side to the lower frequency side.

	Adjustment is made so that the point when an input signal cuts across the standby frequency becomes the zero point of the time-axis. When the video trigger is selected in this mode, three dotted lines indicating the standby frequency, the upper limit and lower limit of the standby band are displayed on the graph of the frequency measurement.

2. Press **Setup** > **Video Trigger** > **Wide Freq**.
3. Enter the center frequency of the video trigger in the data entry field that appears in the upper part of the screen.

Trigger Mode	Description
IN/OUT	The center frequency of the trigger standby band. The value that can be set is a discrete value and the setting step is decided by the width of the trigger detection frequency.
POSitive / NEGative	The trigger standby frequency. Any frequency within the measurement range can be set.

4. Press **Setup** > **Video Trigger** > **Wide Width**

Assuming that max_width = fspan (span of the frequency range) × 1.1, choices of width for each range are as follows:

Trigger Mode	Frequency Range Span
IN/OUT	max_width, max_width/2, max_width/4, max_width/8, max_width/16, max_width/32, max_width/64
POSitive / NEGative	max_width/8, max_width/16, max_width/32

NOTE For example: When the range is 400 M - 1.2 GHz, fspan = 1.2 G - 400 M =800 MHz, max_width = 800M × 1.1 = 880 MHz, choices of width are 880 MHz, 440 MHz, 220 MHz, 110 MHz, 55 MHz, 27.5 MHz, and 13.8 MHz.

5. This setting is restricted by the settings of frequency band or maximum frequency of the input signal.

   The setting is enabled when you select **Wide Video** from the trigger source options.

Setting for Narrow Band

1. Press **Setup** > **Video Trigger** > **Narrow Video Mode** (or **Narrow2 Video Mode**) > **OUT** | **IN** | **Positive** | **Negative**

Mode	Description
IN	The instrument is triggered when the input signal comes in the trigger standby band. Adjustment is made so that the first measurement point when a signal comes in the standby band becomes the zero point of the time-axis. When the video trigger is selected in this mode, two dotted lines indicating the upper and lower limits of the standby band are displayed on the graph of the frequency measurement.
OUT	The instrument is triggered when the input signal is outside the trigger standby band. Adjustment is made so that the first measurement point when a signal goes outside the band becomes the zero point of the time-axis. When the video trigger is selected in this mode, two dotted lines indicating the upper and lower limits of the standby band are displayed on the graph of the frequency measurement.
POSitive	The instrument is triggered when an input signal cuts across the trigger standby frequency from the lower frequency side to the higher frequency side. Adjustment is made so that the point when an input signal cuts across the standby frequency becomes the zero point of the time-axis. When the video trigger is selected in this mode, three dotted lines indicating the standby frequency, the upper limit and lower limit of the standby band are displayed on

	the graph of the frequency measurement.
NEGative	The instrument is triggered when an input signal cuts across the trigger standby frequency from the higher frequency side to the lower frequency side. Adjustment is made so that the point when an input signal cuts across the standby frequency becomes the zero point of the time-axis. When the video trigger is selected in this mode, three dotted lines indicating the standby frequency, the upper limit and lower limit of the standby band are displayed on the graph of the frequency measurement.

2. Press **Setup** > **Video Trigger** > **Narrow Freq** (or **Narrow2 Freq**).
3. Enter the center frequency of the video trigger in the data entry field that appears in the upper part of the screen.

Trigger Mode	Description
IN/OUT	The center frequency of the trigger standby band. The value that can be set is a discrete value and the setting step is decided by the width of the trigger detection frequency.
POSitive / NEGative	The trigger standby frequency. Any frequency within the measurement range can be set.

4. Press **Setup** > **Video Trigger** > **Narrow Width** (or **Narrow2 Width**).

Trigger Mode	Frequency Range	Width
IN/OUT	80MHz	85MHz, 55MHz, 27.5MHz, 13.8MHz, 6.88MHz, 3.44MHz, 1.72MHz, 859kHz, 430kHz, 215kHz
	25.6MHz	27.5MHz, 13.8MHz, 6.88MHz, 3.44MHz, 1.72MHz, 859kHz, 430kHz, 215kHz,

		107kHz, 53.7kHz
	1.6MHz	1.72MHz, 859kHz, 430kHz, 215kHz, 107kHz, 53.7kHz, 26.9kHz, 13.4kHz, 6.71kHz, 3.36kHz
	200kHz	215kHz, 107kHz, 53.7kHz, 26.9kHz, 13.4kHz, 6.71kHz, 3.36kHz, 1.68kHz, 839Hz, 420Hz
	25kHz	26.9kHz, 13.4kHz, 6.71kHz, 3.36kHz, 1.68kHz, 839Hz, 420Hz, 210Hz, 105Hz, 52.5Hz
	3.125kHz	3.36kHz, 1.68kHz, 839Hz, 420Hz, 210Hz, 105Hz, 52.5Hz, 26.2Hz, 13.1Hz, 6.56Hz
POSitive / NEGative	80MHz	13.8MHz, 6.88MHz, 3.44MHz
	25.6MHz	3.44MHz, 1.72MHz, 859kHz
	1.6MHz	215kHz, 107kHz, 53.7kHz
	200kHz	26.9kHz, 13.4kHz, 6.71kHz
	25kHz	3.36kHz, 1.68kHz, 839Hz
	3.125kHz	420Hz, 210Hz, 105Hz

NOTE When the width is set to the whole measurement frequency range (the maximum one for each range), the setting value of the VIDeo:THReshold command indicates the threshold of the input signal power (Power trigger).

In the POSitive/NEGative mode, the setting value of the FREQuency:CENTer command doesn't necessarily mean the center of the band range. In this case, the value nearest to the setting value of the FREQuency:CENTer that can be set is selected as the center frequency of the band.

IN/OUT width updated in firmware A.03.10.

5. Press **Setup** > **Video Trigger** > **Minimum Power Level**.

6. Enter the minimum power level of the video trigger in the data entry field that appears in the upper part of the screen.
7. This setting is restricted to the range of Narrow Band measurement that is determined by the target frequency and frequency range.

   The setting is enabled when you select **Narrow Video** (or **Narrow2 Video**) from the trigger source options.

Confirming the Result of Frequency Transient (Wide Band) Measurement

Follow the steps below to confirm the results of the DUT's frequency transient (Wide Band) measurement, using the E5052B's transient measurement window.

Selecting Frequency Transient (Wide Band) Measurement Trace

1. Press the **Trace Next** key to select the measurement trace for the frequency transient (Wide Band). You can confirm which trace is selected by viewing the cursor displayed to the left of the trace title.

   NOTE You can also click on the measurement trace of the frequency transient (Wide Band) for confirmation.

Setting Frequency Format and Sensitivity Aperture

You can select the unit (frequency format) used in the frequency trace screen and set the sensitivity aperture.

1. Press **Format** > **Frequency Format**.
2. Select an appropriate frequency format from the softkey menu list. The available options are as follows. The initial setting is "Hz."

Format List

Softkey	Overview
Hz	Displays the measurement frequency data.
ΔHz	Displays the difference subtracted from reference frequency.
%	Displays the difference subtracted from reference frequency in percent.
ppm	Displays the difference subtracted from reference frequency in ppm.

3. Press **Format** > **Frequency Reference**. (This setting will be used when either "Hz", "%", "ppm" is selected for the frequency format.)

4. *Enter* the frequency reference value in the data entry field that appears in the upper part of the screen. The unit is Hz.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

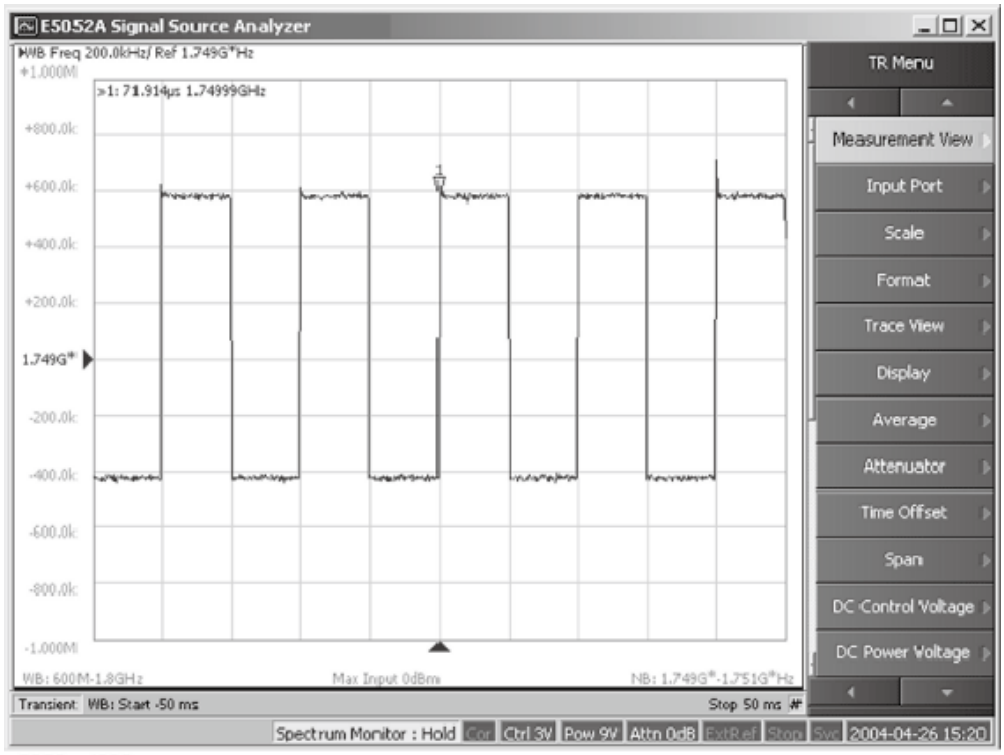
Setting Attenuator

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (frequency transient wide band)



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Linearity Evaluation of Chirped FM Signal

Confirming the Result of Frequency Transient (Narrow Band) Measurement

Follow the steps below to confirm the results of the DUT's frequency transient (Narrow Band) measurement by using the E5052B's transient measurement window.

NOTE You can use the Narrow2 Band when Narrow-Narrow measurement mode is selected.

Selecting Frequency Transient (Narrow Band) Measurement Trace

1. Press the **Trace/Next** key to select the measurement trace for the frequency transient (Narrow Band). You can confirm which trace is selected by viewing the cursor which is displayed in the left to the trace title.

NOTE You can also click on the measurement trace of the frequency transient (Narrow Band) for confirmation.

Setting Frequency Format and Sensitivity Aperture

You can select the unit (frequency format) used in the frequency trace screen and set the sensitivity aperture.

1. Press **Format** > **Frequency Format**.
2. Select an appropriate frequency format from the softkey menu list. The available options are as follows. The initial setting is "Hz".

Format List

Softkey	Overview
Hz	Displays the measurement frequency data.
ΔHz	Displays the difference subtracted from reference frequency.
%	Displays the difference subtracted from reference frequency in percent.
ppm	Displays the difference subtracted from reference frequency in ppm.

3. Press **Format** > **Frequency Reference**. (This setting will be used when either "ΔHz", "%", "ppm" is selected for the frequency format.)
4. Enter the frequency reference value in the data entry field that appears in the upper part of the screen. The unit is Hz.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

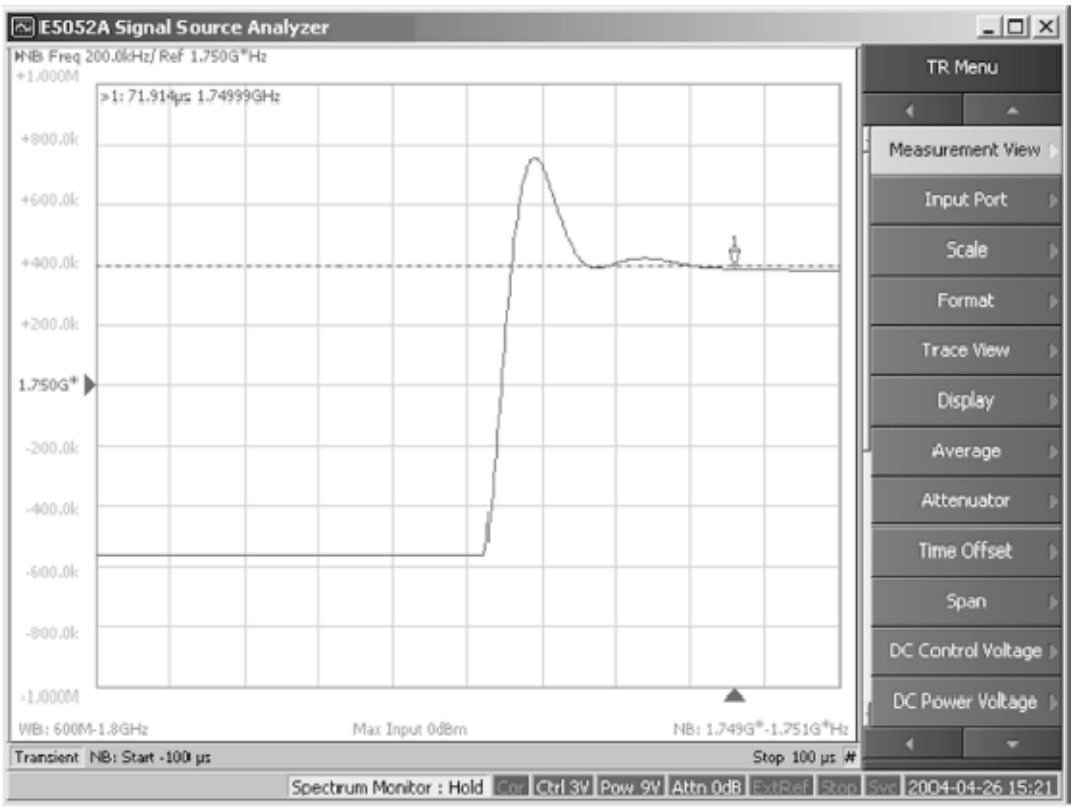
Setting Attenuator

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (frequency transient narrow band)



e5052auj310

Linearity Evaluation of Chirped FM Signal

Confirming Result of Power Transient Measurement

Follow the steps below to confirm the results of the DUT's power transient measurement by using the E5052B's transient measurement window.

Selecting Power Transient Measurement Trace

1. Press the **Trace Next** key to select the power transient measurement trace. You can confirm which trace is selected by viewing the cursor that is displayed to the left of the trace title.

   NOTE You can also click on the measurement trace of the power transient for confirmation.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

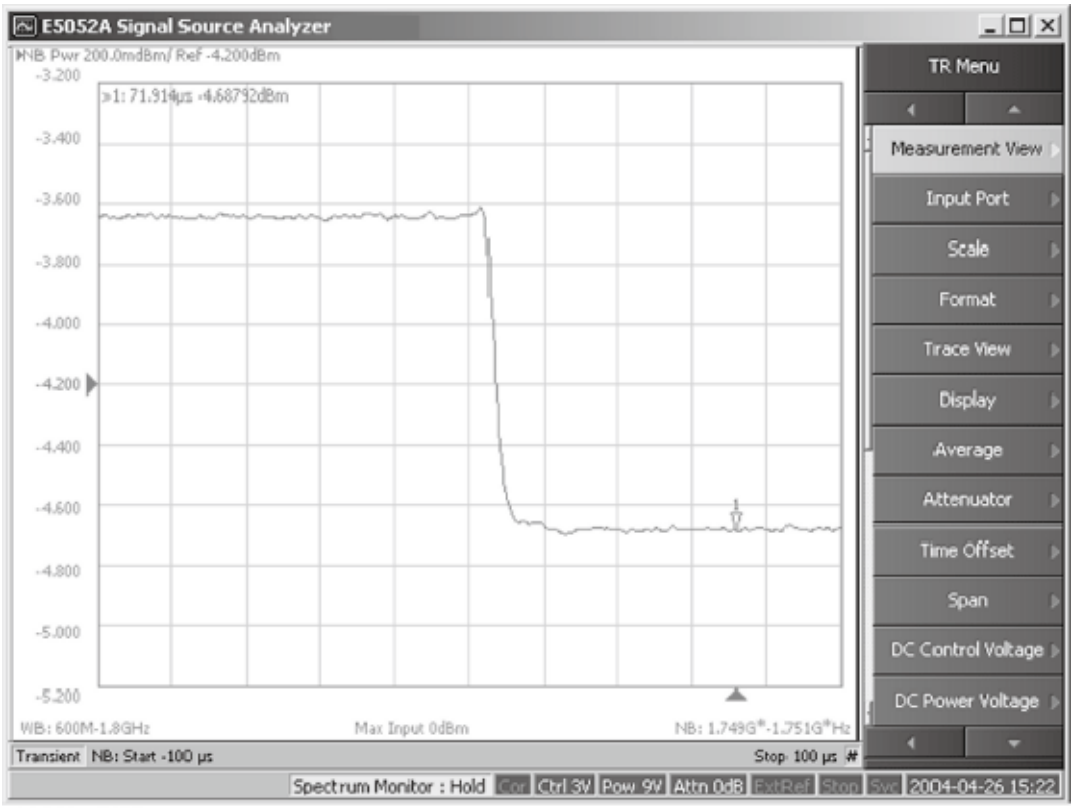
Setting Attenuator

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (power transient)



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Confirming Result of Phase Transient Measurement

Follow the steps below to confirm the results of the DUT's phase transient measurement by using the E5052B's transient measurement window.

Selecting Phase Transient Trace

1. Press the **Trace/Next** key to select the phase transient measurement trace. You can confirm which measurement trace is selected by viewing the cursor that is displayed to the left of the trace title.

   NOTE You can also click on the phase transient measurement trace for confirmation.

Using the phase reference frequency

The instrument calculates the phase deviation within the Narrow Band measurement range based on the frequency transient (Narrow Band) measurement result. The phase reference function sets the reference value of frequency to calculate the phase transient.

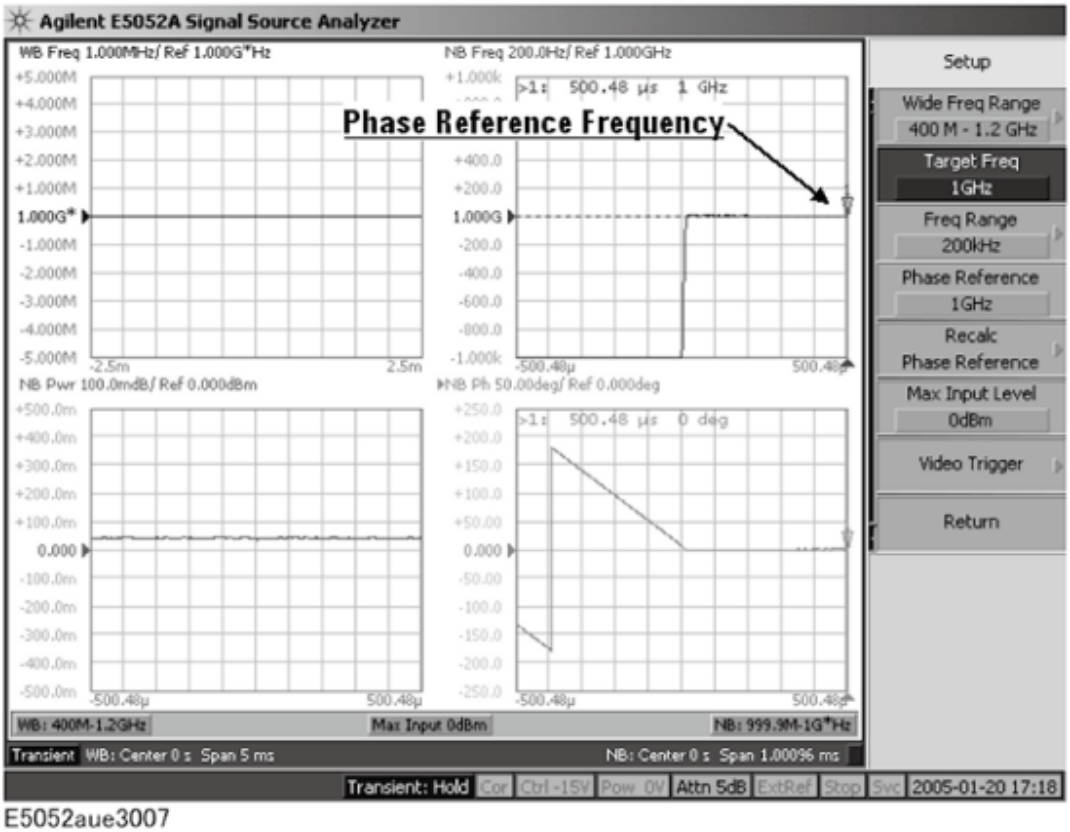
In case the target frequency is equal to the final frequency (the right most measurement data obtained in the frequency transient (Narrow Band)

measurement) of the DUT, it can be used as the phase reference frequency. If the target frequency is deviated from the final frequency of the DUT, use the actual frequency measured at the right end of measurement point as set the phase reference frequency. Then the phase data over time starts from zero at the right end of the measurement point, and the phase data maintains as long as the measured frequency stays at the phase reference frequency.

1. Press **Setup** > **Phase Reference**.
2. Enter the phase reference value, then measure the phase transient data again.

Defining Phase Reference Frequency

Confirming Result of Power Transient Measurement



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NOTE The phase reference frequency is restricted to the range of Narrow Band measurement that is determined by the target frequency and frequency range.

The **Marker -> Phase Reference** function automatically sets the phase reference frequency based on the actual frequency data where the active marker is located at the frequency over time trace.

Adjust Phase Reference by Specifying Value of X-Axis

You can set the measurement value of the X-Axis value you specified to the phase reference (phase 0). Follow the steps below.

1. Press **Format** > **Phase X Reference**
2. Enter the X-Axis value (position) set as the phase reference in the data entry field that appears in the upper part of the screen.

   You can also use the marker. Move the marker to the position of the phase reference and press **Format** > **Marker -> Phase X Reference**

Adjust Phase Reference at Averaged Value in Specified Span

When you measure the signal with larger trace noise repeatedly, the observed trace may go up and down on the display. This function enables to reduce it. The phase reference position is set at the point where the averaged phase of the specified X span becomes 0. The phase offset is calculated from all of points within the specified X span.

Note for calculation of the phase offset

- If the specified Phase X Reference is lower than the start point, the start point is set as Phase X Reference.
- If the specified Phase X Reference is higher than the stop point, the stop point is set as phase X Reference.
- If there are no measurement points in the specified X Reference Span, the averaged phase is calculated to use the interpolated data between the closest both side measurement points.

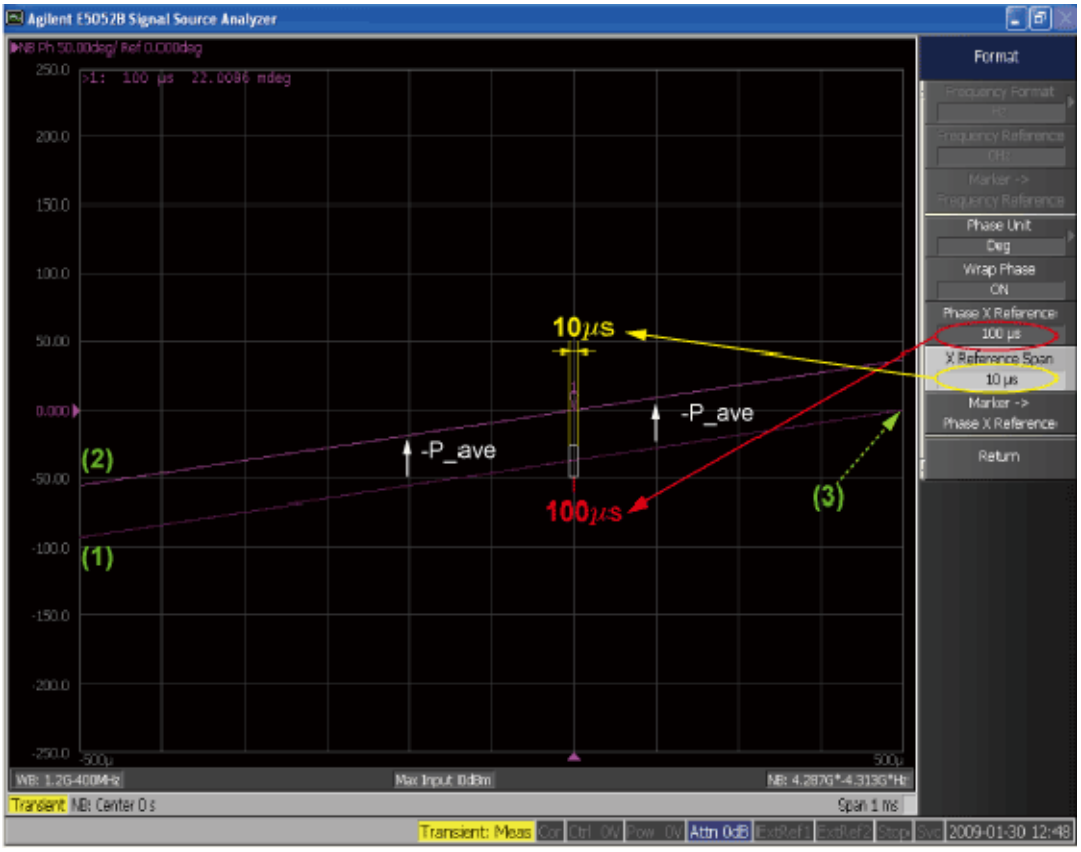
Follow the steps below.

1. Press **Format** > **Phase X Reference**.
2. Enter the X-Axis value (position) set as the phase reference in the data entry field that appears in the upper part of the screen.

   You can also use the marker. Move the marker to the position of the phase reference and press **Format** > **Marker -> Phase X Reference**.
3. Press **Format** > **X Reference Span**.
4. Enter the span value.

The phase offset is calculated from all of points within the specified X span by the step in the figure below.

Phase X Reference and X Reference Span



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(1) Calculate average phase (P_ave) in the specified range of default curve.

(2) Add offset value (-P_ave) to the default phase curve.

(3) Default phase zero point.

Using Phase Offset Frequency When Adjusting Phase Baseline Manually

If the actual measured frequency is different from the phase reference frequency you set, the recalc phase reference function also allows you to adjust the baseline of the phase transient data manually after a single measurement.

NOTE This function cannot be used when you select **Auto Reference** to **ON**.

1. Press **Setup** > **Recalc Phase Reference**.
2. Press **Phase Ref. Offset** to enter the offset frequency value relative to the phase reference frequency, and then the baseline of the phase transient data will be adjusted.

Using Recalculating Phase Data Function to Adjust Baseline of Phase Transient

Automatic Phase Reference Offset Setting

This function enables to set the phase reference offset automatically so that the specified point on X-axis becomes a reference position of phase measurement. This function calculates the phase reference offset by following method.

1. Average the measured frequency data in the specified span by X reference and X span (or N2 X reference and N2 X Span).
2. Subtract the phase reference frequency (**Phase Reference** under **Setup** key) from the averaged frequency value.
3. Set the phase reference offset at the above subtracted value.

Follow the steps bellow.

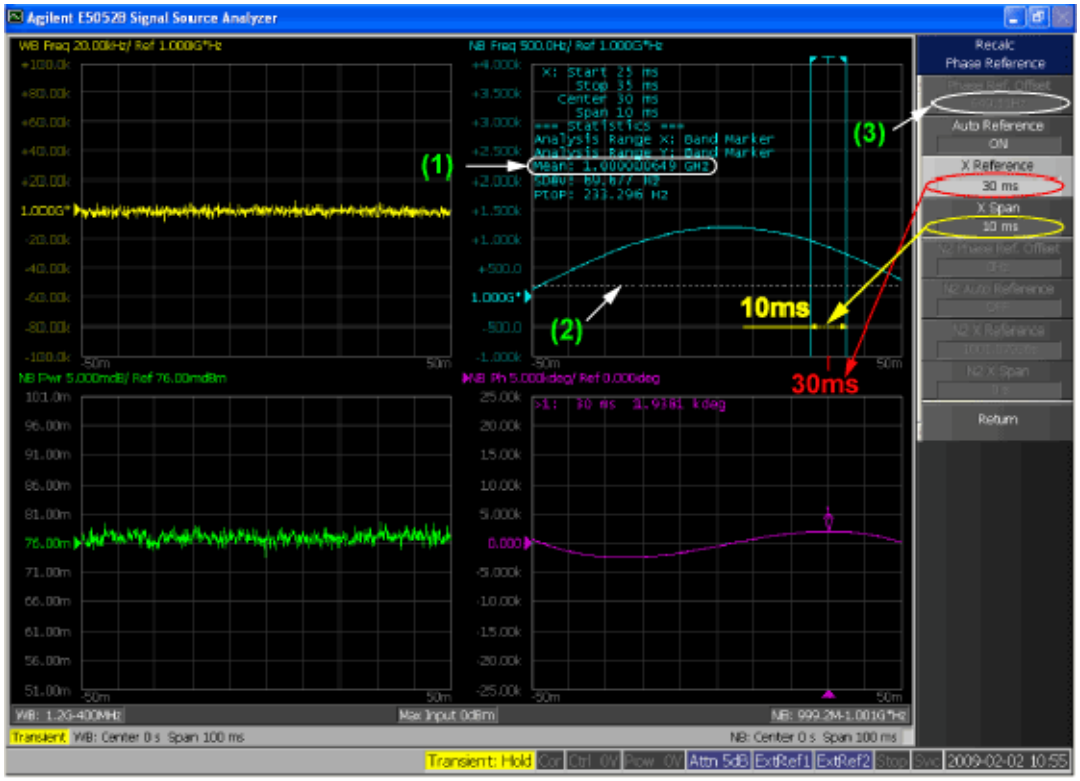
1. Press **Setup** > **Recalc Phase Reference** > **Auto Reference** > **ON**.
2. Press **X Reference**, then enter the X Reference value.
3. Press **X Span**, then enter the X Span value.

Follow the steps bellow when you use the Narrow2 band.

1. Press **Setup** > **N2 Recalc Phase Reference** > **Auto Reference** > **ON**.
2. Press **N2 X Reference**, then enter the X Reference value.
3. Press **N2 X Span**, then enter the X Span value.

Phase Reference Offset is specified by the step in the figure below.

Auto Reference : ON



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(1) Averaged frequency value

(2) Phase reference frequency

(3) Phase Ref. Offset : (1) - (2)

Setting Phase Unit and Wrap Phase

You can select the unit (phase unit) used in the phase transient measurement trace screen and specify the wrap phase.

1. Press **Format** > **Phase Unit**.
2. Select the appropriate format from the softkey menu list. You can select any of the three options: Deg, Rad or Grad.
3. Press **Format** > **Wrap Phase** to turn on/off the wrap phase function.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

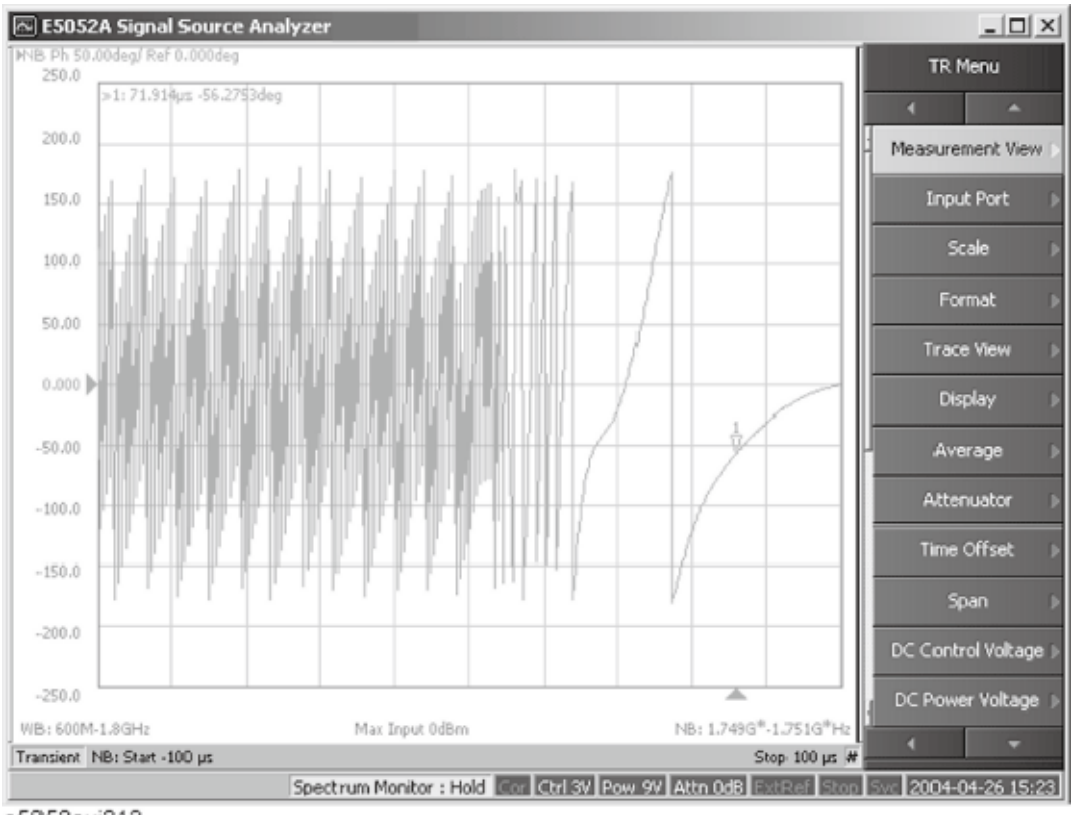
Setting Attenuator

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (phase transient)



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Baseband Noise Measurement

Baseband Noise Measurement

This functions measures the noise voltage of a source.

The following section describes the basic measurement and the topics about Baseband *Noise* Measurement:

- Setting Baseband Noise Measurement
- Confirming Result of Baseband Noise Measurement

Setting Baseband Noise Measurement

Follow the steps below to measure the baseband noise by using the E5052B's baseband noise measurement window.

Selecting Measurement Window

1. Press **Meas/View** > **Baseband Noise** to select the baseband measurement window.

   NOTE You can maximize the Baseband Noise measurement window by pressing the **Window Max** key while the window is selected. You can return to the original size when you press the **Window Max** key once again.

Setting Trigger

Setting Averaging Trigger

Discharge of DC Block Capacitor

E5052B has two types of Block capacitors. Press **Setup** > **Discharge DC Block Capacitor** to discharge the DC block capacitors.

NOTE This option is available only when trigger mode is set as baseband noise.

Setting IF Gain

"IF over flow" error may be displayed when baseband is distorted. On the other hand, internal noise level of the instrument may be significant in the measurement display when the DUT has a low-noise characteristics. In this case, follow the steps below to adjust the IF Gain value:

1. Press **Setup** > **IF Gain**.
2. Enter the IF Gain value in the data entry field that appears in the upper part of the screen.

   You can select the value from the options: 0 dB, 10 dB, 20 dB, 30 dB, 40 dB or 50 dB.

   NOTE With the Option 011 configured, available IF Gain options are 0 dB, 10 dB, 20dB and 30 dB.

Selecting Measurement Quality

1. Press **Setup** > **Measurement Quality**.
2. Select the appropriate quality level from the softkey menu list. The available options are Normal and Fast.

NOTE To obtain the outline of the measurement data, select "Fast" for the quality level. If you need more precise frequency resolution, select "Normal" for the quality level.

Selecting Cutoff Frequency

1. Press **Setup** > **Cutoff Frequency** > **Low** | **High**

NOTE Low Frequency DC Block capacitor 1410µF, High Frequency DC Block capacitor 10µF

Specifying Sweep Range for Offset Frequency

1. Press **Start/Center** (**Stop/Span**) > **Start**.
2. Select the sweep start value from the softkey menu list.

   You can select the value from the options: 1 Hz, 10 Hz, 100 Hz or 1 kHz.

NOTE When Cutoff frequency is High only 1kHz is available as the sweep range for offset frequency.

3. Press **Stop/Span** (**Start/Center**) > **Stop**.
4. Select the sweep stop value from the softkey menu list.

   You can select the value from the options: 100 kHz, 1 MHz, 5 MHz, 10 MHz, 20 MHz, 40 MHz, 100MHz.

Setting Average Function and Correlation Number

About DC Voltage Setting and Protection

You can specify DC power/control which is applied to DUT. Refer to Setting DC power/DC control and protection for the setting procedure.

Confirming Result of Baseband Noise Measurement

Follow the steps below to confirm the results of the DUT's baseband noise measurement by using the E5052B's baseband noise measurement window.

NOTE To improve readability and reduce search time, few sections of this topic are combined with similar sections from other measurements in **Measurement** > **Common Settings**. Links to these new sections are provided in this topic.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

Setting Data Format

You can select the unit (format) used in the baseband measurement trace screen.

1. Press **Format** > **Format**.
2. Select the appropriate format from the softkey menu list. The available options are as follows.

Format List

Format
dBV / Hz
dBm / Hz
Volt / Hz

NOTE Volt/Hz format is added from the firmware revision A.03.10. The scale is linear for dBV/Hz, dBm/Hz and log for Volt/Hz. When Volt/Hz is selected, the unit of displayed result is Volt/√Hz. (The notation "Volt/Hz" is used in this help as the same as softkey label.)

Setting IF Gain

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

NOTE In this measurement, you cannot specify the sweep time. It will be determined automatically based on the selection of the offset frequency sweep range and the carrier frequency band.

Confirming Spurious

AM Noise Measurement

AM Noise Measurement

This section describes the following topics about AM *Noise* Measurement:

- Setting AM Noise Measurement
- Confirming Result of AM Noise Measurement

Setting AM Noise Measurement

Follow the steps below to measure the AM Noise by using the E5052B's AM Noise measurement window.

NOTE To improve readability and reduce search time, few sections of this topic are combined with similar sections from other measurements in **Measurement** > **Common Settings**. Links to these new sections are provided in this topic.

Selecting Measurement Window

1. Press **Meas/View** > **AM Noise** to select the AM Noise measurement window.

   NOTE You can maximize the AM Noise measurement window by pressing the **Window Max** key while the window is selected. You can return to the original size when you press the **Window Max** key once again.

Setting Trigger

Setting Averaging Trigger

Setting Attenuator

Selecting Carrier Frequency Band

1. Press **Setup** > **Frequency Band**.
2. Select the appropriate frequency band that contains the target carrier signal from the softkey menu list. The range of each frequency band is listed in the following table.

   NOTE Selectable frequency bands differ depending on whether the E5053A Microwave Downconverter is used and whether the RF input is direct input or Downconverter input. For setting of downconverter and external mixer, refer to Setting E5053A Microwave

Downconverter

Carrier Frequency Band	Standalone E5052B or Downconverter: OFF	Downconverter: ON & RF Input: E5052B Direct	Downconverter: ON & RF Input: Downconverter and External Mixer Not Used	Downconverter: ON & RF Input: Downconverter and External Mixer ON
60M - 111MHz	Y	Y	N	Y
109M - 1.5GHz	Y	Y	N	Y
250M - 3GHz	N	Y	N	N
250M - 7GHz	Y	N	N	Y
3G - 10GHz	N	N	Y	N
9G - 26.5GHz	N	N	Y	N

Auto Settings in Attenuator and Carrier Frequency Band

From firmware rev A.3.10, Frequency band and Input Attenuator can be setup to optimum value according to input signal through automatic setting.

NOTE It is enabled when **Trigger to AM Noise** is selected.

1. Press **Setup** > **Auto Setting**.
2. Carrier frequency band and Attenuator should be set to optimum value according to input signal.

Auto setting Parameter at each measurement status is as follows.

Measurement status (AM)	Freq Band	Attn	IF Gain
Downconverter=Off	Y	Y	N
Downconverter=On, RF Input=E5052B Direct	Y	Y	N
Downconverter=On, RF Input=Downconverter, Ext.Mixer=Off	User set	10dB	N
Downconverter=On, RF Input=DownConverter, Ext.Mixer=On	N	N	N

Specifying Nominal Frequency

Enter the nominal value of the carrier frequency.

1. Press **Setup** > **Nominal Frequency**.
2. Enter the value of the nominal frequency in the data entry field displayed in the upper part of the screen.

NOTE When the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to Not Used, the function to search for the carrier signal in the specified carrier frequency band and reflect the result to the nominal frequency is available.

NOTE You need to specify nominal frequency only when the downconverter is available.

NOTE The carrier search function is to detect the input signal frequency with the selected carrier frequency band for the downconverter RF IN (i.e. 3 to 10 GHz or 9 to 26.5 GHz) and reflect the result to the nominal frequency.

See also Executing Carrier Search Function.

Selecting Measurement Quality

1. Press **Setup** > **Measurement Quality**.
2. Select the appropriate quality level from the softkey menu list. The available options are Normal and Fast.

NOTE To obtain the outline of the measurement data, select "Fast" for the quality level. If you need more precise frequency resolution, select "Normal" for the quality level.

Selecting Measurement Mode

You can select the High-speed measurement mode or Normal-speed measurement mode with the following steps.

1. Press **Setup** > **Fast Measurement** > **ON** | **OFF**

NOTE ON indicates High-speed measurement mode. When this mode is selected measurement is made only once with a single trigger.

OFF indicates Normal-speed measurement mode. In this mode measurement is made twice with a single trigger by changing internal settings as the internal spurious are reduced with software process.

Specifying Sweep Range for Offset Frequency

1. Press **Start/Center** (**Stop/Span**) > **Start**.
2. Select the sweep start value from the softkey menu list.

   You can select the value from the options: 1 Hz, 10 Hz, 100 Hz or 1 kHz.
3. Press **Stop/Span** (**Start/Center**) > **Stop**.
4. Select the sweep stop value from the softkey menu list.

   You can select the value from the options: 100 kHz, 1 MHz, 5 MHz, 10 MHz, 20 MHz, 40 MHz.

NOTE Sweep stop values that are selectable differ depending on the selection of the carrier frequency band.

- For 60 M - 111 MHz

  100 kHz, 1 MHz, 5 MHz, 10MHz, 20MHz
- For frequency bands other than above

  100 kHz, 1 MHz, 5 MHz, 10 MHz, 20 MHz, 40 MHz

NOTE The number of measurement points varies depending on the setting value for the sweep range.

Relation Table for Measurement Points and Sweep Range

Start/Stop	100 kHz	1 MHz	5 MHz	10 MHz	20 MHz	40 MHz
1 Hz	646	775	865	904	943	982
10 Hz	517	646	736	775	814	853
100 Hz	388	517	607	646	685	724
1 kHz	259	388	478	517	556	595

NOTE For AM Noise measurement, you cannot use the center value or span value for log sweep.

Setting Average Function and Correlation Number

About DC Voltage Setting and Protection

You can specify DC power/control that is applied to DUT. Refer to Setting DC power/DC control and protection for the setting procedure.

About Auto Frequency Control Function

If this function is turned on, the E5052B will adjust the control voltage automatically so that the output signal frequency from the DUT may keep the specified value. For the setting procedure, refer to the Auto Frequency Control Function.

Confirming Result of AM Noise Measurement

Follow the steps below to confirm the results of the DUT's AM noise measurement by using the E5052B's AM noise measurement window.

NOTE To improve readability and reduce search time, few sections of this topic are combined with similar sections from other measurements in **Measurement** > **Common Settings**. Links to these new sections are provided in this topic.

Setting Scale of Measurement Trace (manual setting)

Setting Scale of Measurement Trace (automatic setting)

Setting Trace Offset (manual setting)

Setting Trace Offset (Y-Axis marker setting)

Setting X-Axis Scale (manual setting)

Setting X-Axis Scale (X-Axis band marker setting)

Setting Attenuator

Setting Format

Format options are not available for AM Noise measurement.

Executing Carrier Search Function

When the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to Not Used, the function to search for the carrier signal in the specified carrier frequency band and reflect the result to the nominal frequency is available.

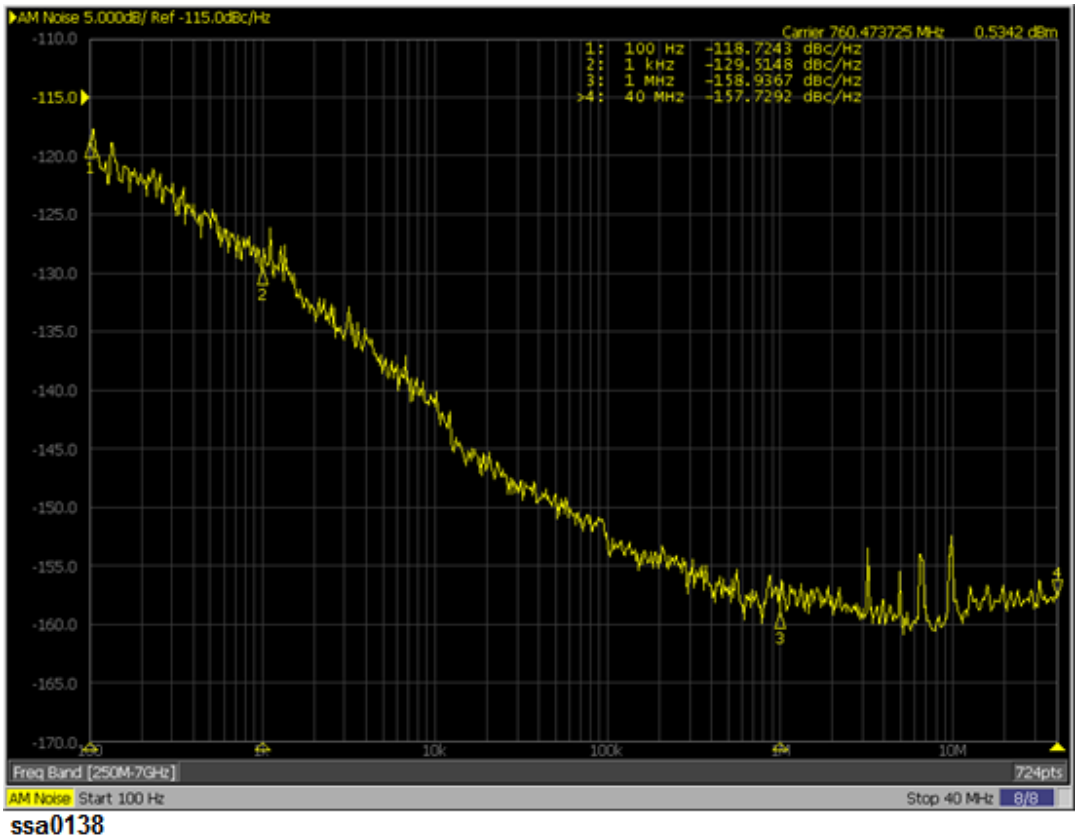
1. Press **Setup**.
2. Press **Carrier Search** to execute the carrier signal search.
3. The detected signal frequency is reflected on the nominal frequency.

Setting Smoothing

Confirming Measurement Points by Markers

1. Press **Marker** to display marker 1 on the screen.
2. Move marker 1 to the point you want to confirm and read the measurement value displayed in the upper part of the graph. To confirm multiple values, press **Marker** > **Marker x (x=1 to 10)**, which allows you to display up to marker 10.

Example of Measurement Screen (AM noise - offset frequency characteristics)



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NOTE In this measurement, you cannot specify the sweep time. It will be determined automatically based on the selection of the offset frequency sweep range and the carrier frequency band.

Confirming Spurious

Common Setting

Common Settings

- Application
- Auto Frequency Control Function
- Setting DC power/DC control and protection
- Setting Window Displays
- Setting Scale Parameters

- Setting Trace/View Parameters
- Setting Average Parameters
- Setting Trigger
- Setting External Trigger

Application

The E5052B provides two VBA applications that adds to the functionality of the E5052B. The two applications provided with E5052B are:

- mmWave
- Jitter

NOTE To use Jitter function, you need to separately purchase the E5001A SSA-J Precision Clock Jitter Analysis Software option.

Other topics about Common Settings

Auto Frequency Control Function

- Overview
- Specifying Auto Frequency Control Function

Other topics about Common Settings

Overview

The automatic frequency control (AFC) function can quickly set and maintain the DUT output frequency to the target frequency you want. It does this by controlling the internal DC control voltage and using the measurement results obtained by its internal frequency counter. The DC control voltage has to be turned on to use the AFC function.

The AFC status appears in the lower right corner of the measurement screen. Each background color indicates the respective AFC function.

Color	Status
Blue	The function is enabled.
Gray	The function is disabled. Check if the DC Control Output is turned **OFF**.

NOTE The AFC starts immediately before the measurement. During a single measurement, the DC control voltage is maintained. Therefore, the DC control voltage will not be changed even if the actual output frequency from the DUT drifts during the measurement.

Be sure to take this into consideration for the long time measurement, for example, by using the correlation function in the phase noise measurement.

When the external mixer is set to **OFF**, the auto frequency control function is not available.

Specifying Auto Frequency Control Function

1. Press **DC Control** > **Auto Freq Control**.
2. Press **Min Ctrl Voltage Limit**.
3. Enter the minimum allowance voltage for DC control to be used for the Auto Frequency Control function, in the data entry field that appears in the upper left of the screen.

   NOTE Comparing the value entered here with the value specified in Min Ctrl Voltage Limit under the **DC Control** menu, the E5052B will choose a higher value to apply the limit.
4. Press **Max Ctrl Voltage Limit**.
5. Enter the maximum allowance voltage for DC control to be used for the Auto Frequency Control function, in the data entry field that appears in the upper part of the screen.

   NOTE Comparing the value entered here with the value specified in **Max Ctrl Voltage Limit** under the **DC Control** menu, the E5052B will choose a lower value to apply the limit.
6. Press **Max Input Level**.
7. Enter the maximum level value of the measurement signal that is supplied from the Input port of the E5053A Microwave Downconverter in the Auto Frequency Control function, in the data entry field that appears in the upper part of the screen.

   NOTE With no settings other than the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to Not Used, setting maximum input level is available.

8. Press **Frequency Band**.

9. Select an appropriate frequency band that contains the target carrier signal, from the softkey menu list.

NOTE Selectable frequency bands differ depending on whether the E5053A Microwave Downconverter is used and whether the RF input is direct input or downconverter input.

Carrier Frequency Band	Standalone E5052B or Downconverter: OFF	Downconverter: ON & RF Input: E5052B Direct	Downconverter: ON & RF Input: Downconverter
10M - 1.5GHz	Y	Y	N
250M - 7GHz	Y	Y	N
3G - 10GHz	N	N	Y
9G - 26.5GHz	N	N	Y

10. Press **Target**.

11. Enter the target frequency of the output from the DUT in the data entry field that appears in the upper part of the screen. The unit is [Hz].

NOTE In the analyzer mode, the frequency band is automatically altered so that the input signal frequency is within the band when the actual input frequency crosses the band.

Also the E5053A downconverter is automatically controlled to offset the downconverter *LO* frequency to track the input signal frequency within the *IF* frequency being fed to the E5052B. Note that the maximum frequency step between the two adjacent measurement points may be limited due to the IF frequency range. Increase the number of measurement points for the E5052B to detect the input signal frequency within the IF frequency, when "Downconverter IF not found" error message is found.

12. Press **Tolerance**.

13. Enter the tolerance (an allowable range of difference between the target frequency and the actual frequency output from the DUT) in the data entry field that appears in the upper part of the screen. The unit is [Hz].

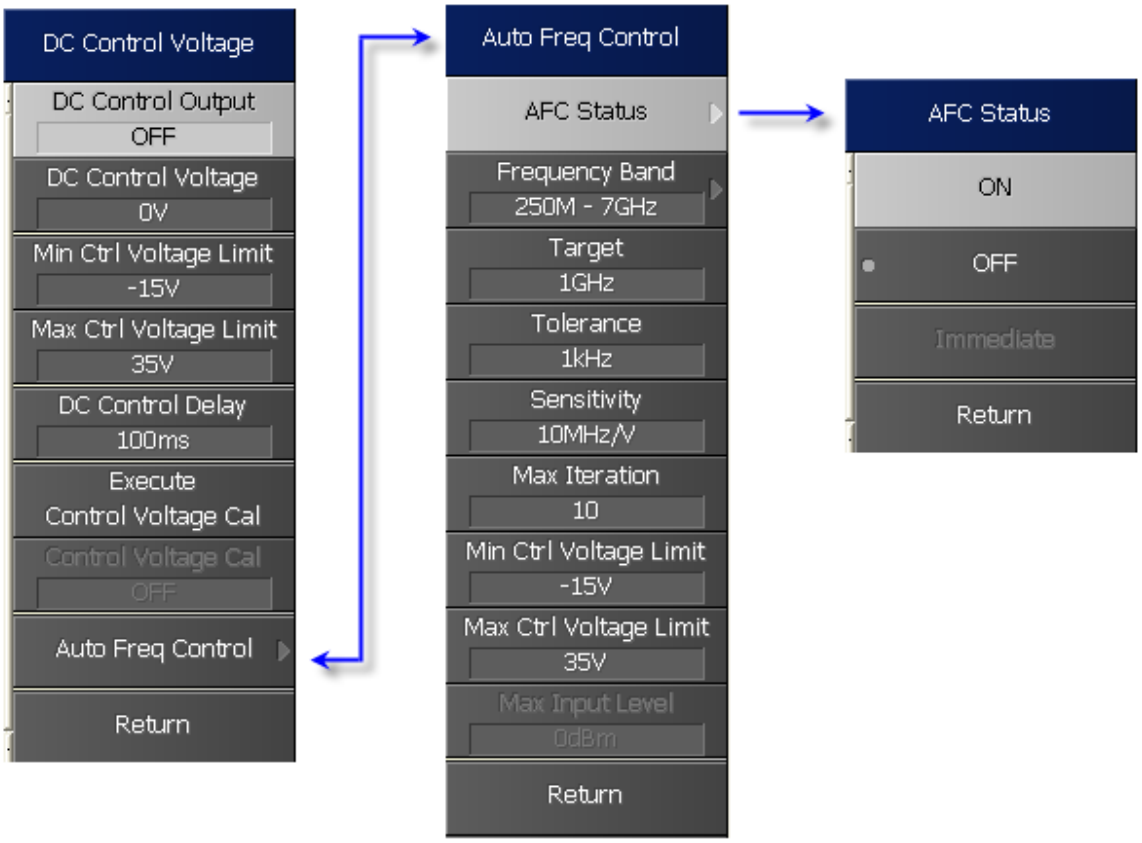
14. Press **Sensitivity**.

15. Enter an approximate control sensitivity of the DUT in the data entry field that appears in the upper part of the screen. The unit is [Hz/V].

16. Press **Max Iteration**.

17. Enter the maximum number of times to perform repetitive measurements and calculation (control -voltage setting loop) for determining the optimum control voltage, in the data entry field that appears in the upper part of the screen.

18. Press **AFC Status**.



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19. Select the status of the Auto Frequency Control function from the softkey menu list.

Softkey	Function
OFF	The Auto Frequency Control will not be performed.
ON	The Auto Frequency Control will be performed prior to each sweep.
Immediate	The Auto Frequency Control will be performed only once. If the status is changed this during sweep, the sweep will be interrupted and Auto Frequency Control will be performed.

NOTE The Auto Frequency Control can not be aborted during an operation.

NOTE The wait time specified in **DC Control** > **DC control Delay** is also applied for repetitive measurements to obtain the optimum control voltage during the execution of the Auto Frequency Control function.

NOTE When the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to Not Used, the operation differs depending on whether the **AFC Status** is **ON** or **Immediate**.

When executed before each sweep with the **ON** setting, the auto frequency control function is executed assuming that the input signal frequency is near the target frequency (within several hundred MHz). If the input signal is not near the target frequency, the auto frequency control function fails.

When executed with the **Immediate** setting, as the auto frequency control function is executed after detecting the input signal by searching for inside the frequency band that is set first in the execution, the auto frequency control function can be executed provided that the input signal is within the frequency band even if it is not near the target frequency.

As the input signal search is performed first, the time required to complete the auto frequency control function is elongated compared to when it is executed before each sweep with the **AFC Status ON** setting.

Setting DC power / DC control and protection

- Overview
- Setting DC Power
- Setting DC Control
- Applying DC Power/DC Control to DUT

Other topics about Common Settings

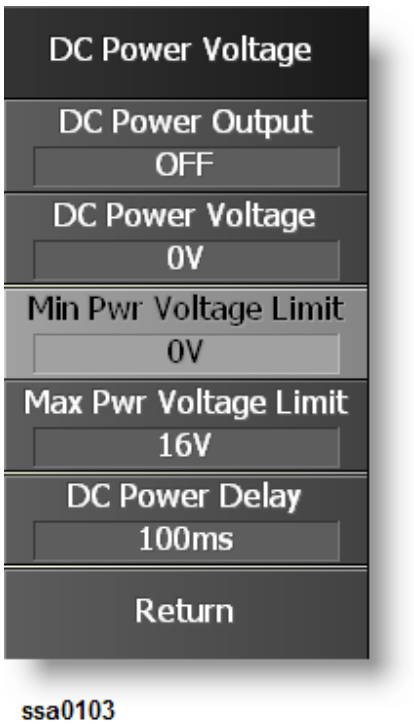
Overview

You can set the DC power or the DC control that is applied by the E5052B to the DUT not only to protect the DUT but also to perform stable measurements.

The E5052B allows you to set the maximum and minimum allowance levels of DC power/control that are applied to the DUT. This prevents excessive voltage from being applied to the DUT.

Follow the steps below to set the DC voltage and DC power for the DC control measurement.

Setting DC Power



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1. Press **DC Power** > **Max Pwr Voltage Limit**.
2. Enter the maximum allowance voltage of DC power in the data entry field that appears in the upper part of the screen.

3. Press **DC Power** > **Min Pwr Voltage Limit**.
4. Enter the minimum allowance voltage of DC power in the data entry field that appears in the upper part of the screen.
5. Press **DC Power** > **DC Power Delay**.
6. Enter the waiting time to suppress DC power until the first measurement is finished in the data entry field that appears in the upper part of the screen.
7. Press **DC Power** > **DC Power Voltage**.
8. Enter DC power in the data entry field that appears in the upper part of the screen.

Setting DC Control

1. Press **DC Control** > **Max Ctrl Voltage Limit**.
2. Enter the maximum allowance voltage of DC control in the data entry field that appears in the upper part of the screen.
3. Press **DC Control** > **Min Ctrl Voltage Limit**.
4. Enter the minimum allowance voltage of DC control in the data entry field that appears in the upper part of the screen.
5. Press **DC Control** > **DC Control Delay**.
6. Enter the waiting time to suppress DC control until the first measurement is finished in the data entry field that appears in the upper part of the screen.
7. Press **DC Control** > **DC Control Voltage**.
8. Enter DC control in the data entry field that appears in the upper part of the screen.

   Pressing **DC Control** > **Execute Control Voltage Cal** automatically turns on the DC control voltage calibration function. As necessary, press **DC Control** > **Control Voltage Cal** to turn ON/OFF the DC control voltage calibration function.

   NOTE You must perform this calibration every time you power on the instrument, since the DC control calibration is cleared when the power is turned off.

Applying DC Power/DC Control to DUT

1. Press **DC Power** > **DC Power Output** to turn ON/OFF the DC power output.

2. Press **DC Control** > **DC Control Output** to turn ON/OFF the DC control output.

Setting Window Displays

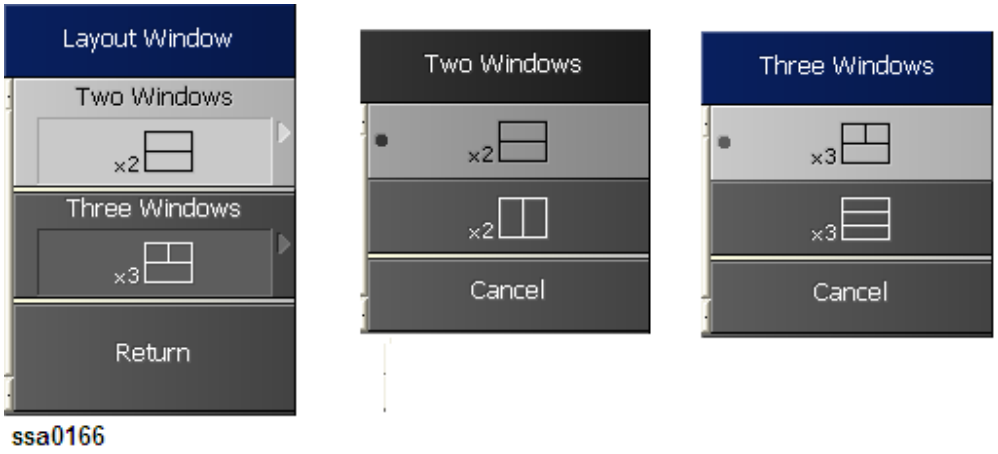
- Setting Window Layout
- Labeling a window
- Setting Display Magnification
- Resizing the Screen

Other topics about Common Settings

Setting Window Layout

When displaying two or three windows in the E5052B firmware, it is possible to specify screen layout using Layout Window option.

To use **Layout Windows** option, press **Measurement View** > **Show Window** > **Layout Window** > **Two Windows** | **Three Windows**



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NOTE **Layout Window** option is activated only when only two or three windows are displayed on the E5052B firmware.

If only two windows are visible (for example: **PN** and **BB**), then only the **Two Windows** option will be activated.

If only three windows are visible (for example: **AM**, **TR** and **FP**), then only the **Three Windows** option will be activated.

Labeling a window

It is possible to assign a unique name to a window/trace and display it on the screen. This feature is useful in saving and/or printing measurement result for future reference.

Labeling a window

1. Press **Window Next**/**Trace Next** keys to select the window/trace to be labeled.
2. Press **Trace/View** key.
3. Click **Trace Label**, then the title label input dialog box appears.

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4. Using the keys in the dialog box, type a label (for example: "**device 1**") and click **Enter**.

Editing Title Label

1. Press **Window Next**/**Trace Next** keys to select the window/trace to be labeled.
2. Press **Display** key.
3. Click **Edit Title Label**, then the title label input dialog box appears.
4. Using the keys in the dialog box, type a label and click **Enter**.
5. Click **Title Label** to turn on the title display. The title will appear within a frame at the top of the measurement window.

Setting Display Magnification

You can reset the display magnification to Small, Normal (default) or Large.

The selection procedure is as follows:

1. Press **System** > **Misc Setup** > **Display Setup** > **Magnification**.
2. Click **Normal**, **Small** or **Large**.

Resizing the Screen

You can resize the E5052B screen by minimizing, maximizing or restoring it to its original size.

The resizing procedure is as follows:

1. Click **Resize** at the top right corner of the screen.

2. A drop-down menu prompts and the available options are:

Softkey	Function
Restore	Restores the screen to its default size.
Minimize	Minimizes the screen.
Maximize	Displays the screen in full page size.

3. Click **Restore**, **Minimize** or **Maximize**.
4. When the screen is resized according to an option, its related softkey is disabled. For example, when the screen is displayed in full page size, **Maximize** is disabled.

Another option to minimize the E5052B screen is by using the **Softkey** and the procedure is as follows:

1. Press **Display**.
2. Click **Minimize E5052B**.

You can also hide and restore the **Menu Bar** of the E5052B screen and the procedure is as follows:

1. Press **Display**.
2. Click **E5052B Menu bar**.
3. Click **ON** to restore the menu bar.
4. Click **OFF** to hide the menu bar.

Setting Scale Parameters

- Setting Scale of Measurement Trace (automatic setting)
- Setting Scale of Measurement Trace (manual setting)
- Setting X-Axis Scale (manual setting)

- Setting X-Axis Scale (X-Axis band marker setting)
- Setting the scale by using the mouse

Other topics about Common Settings

The following two types of setting scale of measurement trace are available in the E5052B:

- Setting the scale using front panel keys.
- Setting the scale using the mouse.

For setting the scale using the mouse, see Setting the scale using the mouse. The procedure to set the scale using front panel keys are as follows.

Setting Scale of Measurement Trace (automatic setting)

You can use **Scale** > **Auto Scale** to set the scale of measurement trace automatically.

NOTE If you want the scale setting for Frequency Power and Transient measurement to be performed automatically for all the measurement traces, press **Scale** > **Auto Scale All**.

Setting Scale of Measurement Trace (manual setting)

Follow the steps below to set the scale of the measurement trace manually:

1. Press **Scale** > **Divisions**.
2. Enter the number of divisions by scale for the Y-Axis in the data entry field that appears in the upper part of the screen.
3. Press **Display** > **Y # of Digits**.
4. Select the number of digits for Y-Axis in the softkey menu. Available options are OFF, 4-digits, 8-digits, and 12-digits.

NOTE

Measurement	Note
Frequency power	Set the number of digits for Y-Axis display for each measurement mode. Therefore, when the number of digits for Y-Axis is changed in the frequency measurement, those for the RF Radio Frequency (from approximately 50 kHz to approximately 3 GHz, whenever a signal

	is radiated through the air), power measurement and the power supply DC current measurement are also changed.
Transient	Set the number of digits for Y-Axis display for each measurement mode. Therefore, when the number of digits for Y-Axis display is changed in the frequency transient (wide band) measurement, those for frequency transient (narrow band) measurement, power transient measurement and phase transient measurement are also automatically changed.
Baseband	The values of Scale top and Scale bottom can be set using **Scale** > **Top** and **Scale** > **Bottom**. Top sets the maximum value of Y-axis and Bottom sets the minimum value of Y-axis.

5. Press **Scale** > **Relative Y-Scale**.
6. Enter the value of Relative Y-Scale Position as ON/OFF.
7. Press **Scale** > **Reference Position**.
8. Enter the position of the scale reference line in the data entry field that appears in the upper part of the screen.

   The position of the scale reference line must be specified by any of the numbers assigned to the Y-Axis scale, from 0 (minimum scale) to the number of divisions (maximum scale).
9. Press **Scale** > **Reference Value**.
10. Enter the value of the scale reference line in the data entry field that appears in the upper part of the screen.

    NOTE The reference value unit varies depending upon the measurement menu and format setting.
11. Press **Scale** > **Marker -> Reference**.
12. Select the marker as a reference value. The value is determined by **Reference Value**.

13. Press **Scale** > **Progress Indicator**.
14. Enter the value of Progress Indicator as ON/OFF.
15. Press **Scale** > **Scale/Div**.
16. Enter the value per scale in the data entry field that appears in the upper part of the screen.

NOTE The unit varies depending upon the measurement menu and format setting.

Setting X-Axis Scale (manual setting)

Follow the steps below to set the maximum/minimum display values of the X-Axis. This is used when you want to enlarge a part of the displayed trace.

1. Press **Scale** > **X Axis** > **Auto** to turn On/Off the auto adjustment of the X-Axis scale.
2. Press **Scale** > **X Axis** > **Left**
3. Enter the display start value of the X-Axis in the data entry field that appears in the upper part of the screen.
4. Press **Scale** > **X Axis** > **Right**
5. Enter the display stop value of the X-Axis in the data entry field that appears in the upper part of the screen.
6. For USER measurement, additional values of **X Unit**, **Y Unit** & **X Axis Type** can be set.
7. Enter the label you want to provide in User Measurement X axis by pressing **Scale** > **X Unit**.
8. Enter the label you want to provide in User Measurement Y axis by pressing **Scale** > **Y Unit**.
9. Select the X axis type to Linear/Logarithmic by pressing **Scale** > **X Axis Type**.

NOTE The unit varies depending upon the measurement menu and format setting.

NOTE When you want to return the display start/stop values to the original ones, press **Scale** > **X Axis** - **Auto** to turn on the auto adjustment of the X-Axis scale.

Setting X-Axis Scale (X-Axis band marker setting)

When the band marker of the X-Axis is displayed, the X-Axis scale can be adjusted to the band marker setting. The procedure is as follows.

1. Press **Scale** > **X Axis** > **Band Marker -> X Axis**

Setting the scale using the mouse

The displayed area of measurement trace can be scaled by specifying the area with a mouse. This function also enables an auto scale.

NOTE When you use this function, you must connect the mouse to the E5052B.

NOTE In the Transient Measurement, specifying the area on the displayed measurement trace in the wide band enables to display the same area in narrow band. See the Setting the X axis,_Target Frequency or Frequency Range by using the mouse.

Zoom-in

1. Drag (Press) a right button on a mouse in the measurement trace area of display.
2. Move the mouse to the desired point with pressing the right button on the mouse. The rectangle frame is displayed.
3. Release the right button to specify the rectangle frame area. Dialog box for action for scale is displayed. (See the following table.)
4. Select the scale type in the dialog box.
5. Click the OK button.

NOTE If you selected to a small area, auto scale type is displayed.

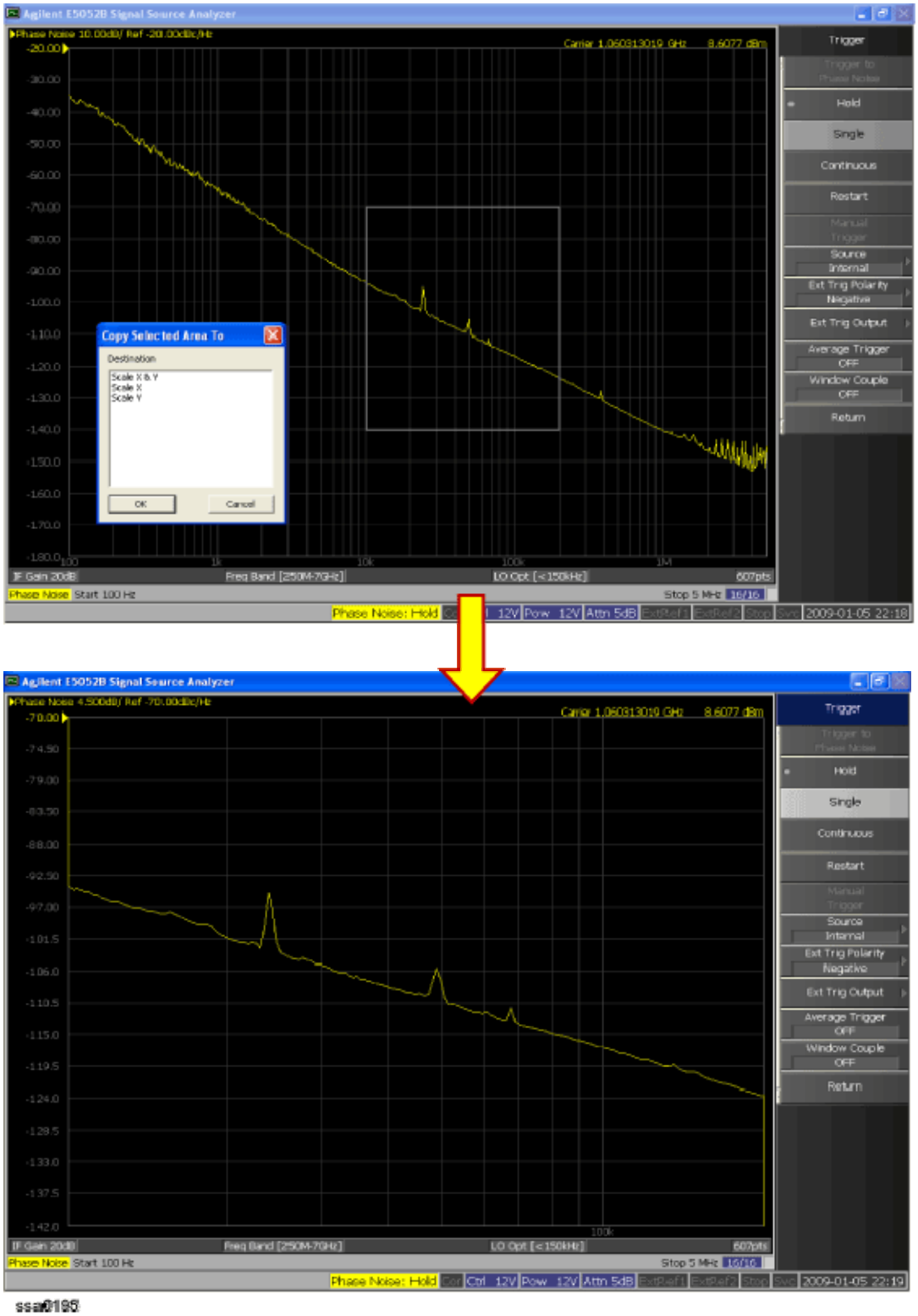
Zoom-out

1. Click a right button on a mouse in the measurement trace area of display.
2. Dialog box for action for auto scale is displayed. (See the following table.)
3. Select the auto scale type in the dialog box.
4. Click the OK button.

Selecting Basic Scale Type

Scale Type	Operation
Scale X & Y	The area of specified rectangle frame is enlarged to fit the full display area.
Scale X	The X axis of display is set at X axis of the specified rectangle frame. The scale for Y axis is not changed.
Scale Y	The Y axis of display is set at Y axis of the specified rectangle frame. The scale for X axis is not changed.
Auto Scale X & Y	Set the full scale for X axis and adjust the Y axis scale to fit the displayed trace data.
Auto Scale X	Set the full scale for X axis.
Auto Scale Y	Executing the auto scale on the Y axis.

The following figure is the example of the selected to "Scale X & Y".



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Setting Trace / View Parameters

- Setting Smoothing
- Setting Data Hold
- Setting Trace Offset (manual setting)
- Setting Trace Offset (Y-Axis marker setting)
- Setting Persistence
- Recall Memory/Data Trace

Other topics about Common Settings

Setting Smoothing

You can use the smoothing function to reduce the trace noise. Follow the steps below to use this function:

1. Press **Trace/View** > **Aperture**.
2. Enter the value of the smoothing aperture (%) in the data entry field that appears in the upper part of the screen.
3. Press **Trace/View** > **Smoothing** to turn on the smoothing function.

Setting Data Hold

You can use the Data Hold to hold the measurement data to Maximum or Minimum values. Follow the step below to use this function:

1. Press **Trace/View** > **Data Hold** > **Off** | **Maximum** | **Minimum**

Softkey	Description
Off	Data hold is not enabled
Maximum	Maximum is to keep holding the trace data with the maximum line.
Minimum	Minimum is to keep holding the trace data with the minimum line.

Setting Trace Offset (manual setting)

You can add an offset value to the displayed trace. Follow the steps below to use this function:

1. Press **Trace/View** > **Offset**

2. Enter the offset value to be added to the trace in the data entry field that appears in the upper part of the screen.

NOTE The unit varies depending upon the measurement menu.

Setting Trace Offset (Y-Axis marker setting)

When the marker is displayed, the value of the active marker is used as the offset value. The procedure is as follows.

Move the active marker to the position of the measurement value that you want to set as the reference.

1. Press **Trace/View** > **Marker->Offset**

NOTE Even when the reference marker mode is on and the active marker displays a Δ value, the value of the active marker is used as the offset value.

When the offset value has already been set, that value is overwritten.

When an active marker does not exist, this function is not available.

Setting Persistence

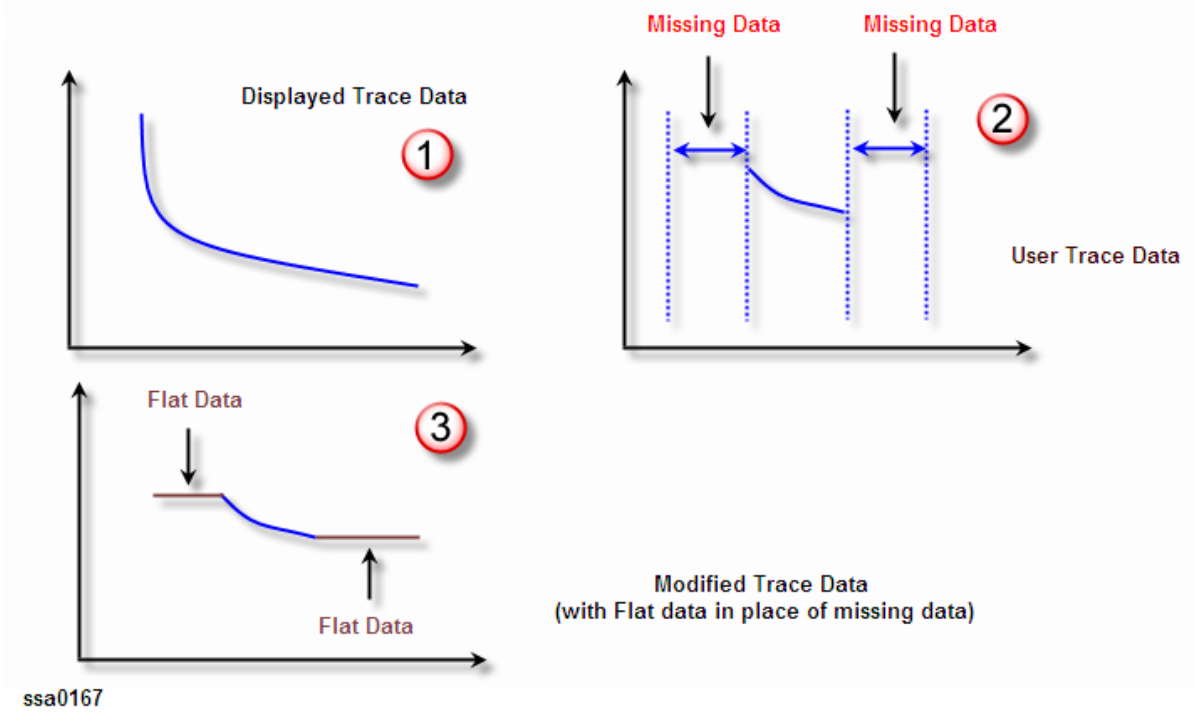
You can set Persistence Mode to On/Off and can clear Persistence data using the E5052B Persistence. Follow the steps below to use this function:

1. Press **Trace/View** > **Persistence**
2. Click **Persistence** > **Persistence Mode** to set persistence mode ON/OFF.
3. Click **Persistence** > **Clear Persistence Data** to clear persistence data.

Recall Memory / Data Trace

Recall Memory/Data trace is a function to recall previously saved information (in trace data file) for memory or data traces. On recalling, if the File data and the value of X-Axis at the display point on the screen is different, the results are computed using interpolation (liner interpolation).

NOTE The range of the X-Axis remains in accordance with the displayed range. However, if there is no data within the effective (displayed) range of X-axis, the value is set as a flat value.



An error occurs in Data/memory trace recall when:

- Trace Data and displayed Data X-axis range is not overlapped.
- Data is having same frequency but different Y-axis value.
- The string is having additional characters in the middle of data.
- The row corresponding to X-axis value within data is not in an ascending parallel format.
- Either X or Y data is damaged in the process.
- # of NOP is the same. (Other setting is set with Error).

Recall Memory Trace

You can recall a previously saved memory trace data using Save/Recall option of E5052B. To recall a memory trace:

1. Press **Save/Recall** > **Recall Memory Trace...**
2. Select the memory trace file (.csv) to be recalled.
3. Click **Open**.

Recall Data Trace

You can recall a previously saved data trace data using Save/Recall option of E5052B. To recall a data trace:

1. Press **Save/Recall** > **Recall Data Trace...**

2. Select the data trace file (.csv) to be recalled.
3. Click **Open**.

Setting Average Parameters

- Setting Average Function
- Setting Averaging Trigger
- Setting Attenuator

Other topics about Common Settings

Setting Average Function

Follow the steps below to use the averaging function.

1. Press **Avg/BW** > **Avg Factor**.
2. Enter the number of times for averaging in the data entry field that appears in the upper part of the screen.
3. Press **Avg/BW** > **Averaging** to turn on the averaging function.

For Phase Noise, Segment Phase Noise, AM and BaseBand measurement follow the steps below to use the Correlation Number.

1. Press **Avg/BW** > **Correlation**.
2. Enter the value of the correlation number in the data entry field that appears in the upper part of the screen.

NOTE If it takes more than one second for one sweep, you will see a "|" character rotates on the measurement status, which indicates the measurement is in progress.

And if it takes more than two seconds for one sweep, under the conditions that the number of correlation is set to more than two, you will see the progress bar in the left of the measurement status.

For more details on cross-correlation technique, refer to Cross Correlation Technique.

For Spectrum Monitor measurement, follow the steps below to use averaging number and resolution bandwidth

1. Press **Avg/BW** > **Avg Factor**.

2. Enter the number of times for averaging in the data entry field that appears in the upper part of the screen.
3. Press **Avg/BW** > **Averaging Type** to select the averaging type. You can choose either **Log-Pwr Avg** or **Pwr Avg(RMS)**.
4. Press **Avg/BW** > **Averaging** to turn on the averaging function.
5. Press **Avg/BW** > **RBW**.
6. Enter the RBW value in the data entry field that appears in the upper part of the screen.

   You can select the value from the options: 1.53 Hz, 6.1 Hz, 24.4 Hz, 97.7 Hz, 391 Hz, 1.56 kHz, 6.25 kHz, 25 kHz, 100 kHz, 400 kHz, 1.6 MHz.

Setting Averaging Trigger

Follow the steps below to use the averaging trigger.

1. Press **Trigger** > **Average Trigger** to toggle **ON**/**OFF** the averaging trigger.

When the averaging trigger is set to ON, a single activation of the trigger system can perform the number of measurements set by the user as the averaging factor.

The following table shows how this function works by pressing **Trigger** > **Single** when the averaging trigger is on and off.

Averaging Trigger	Operation
ON	Executes state transitions among Waiting for Trigger, Trigger, and Measurement for the number of times set for averaging and then changes to the Hold state.
OFF	Enters Waiting for Trigger state once and then changes to the Hold state after measurement is completed.

NOTE The averaging function (Setting Average Function) must be set before enabling the averaging trigger.

Setting Attenuator

When the input level is very high, a message may appear to prompt you to adjust the attenuator. In this case, follow the steps below to adjust the attenuator.

1. Press **Attn** > **Input Attenuator** to enter the attenuator value in the data entry field that appears in the upper part of the screen.

You can select the value from the options: 0 dB, 5 dB, 10 dB, 15 dB, 20 dB, 25 dB, 30 dB or 35 dB. The appropriate input level is between 0 and 5 dBm, depending on the type of measurement or the characteristics of the DUT. Adjust the attenuator so that the input level of the RF port approximates this range.

Nominal Input Range	Attenuator (dB)
+ 15 dBm ~ + 20 dBm	35
+ 10 dBm ~ + 20 dBm	30
+ 5 dBm ~ + 20 dBm	25
0 dBm ~ + 20 dBm	20
- 5 dBm ~ + 20 dBm	15
- 10 dBm ~ + 15 dBm	10
- 15 dBm ~ + 10 dBm	5
- 20 dBm ~ + 5 dBm	0

NOTE When the downconverter is turned on, the RF input is set to Downconverter, and the external mixer is set to Not Used, the attenuator value is fixed to 10 dB.

Setting Trigger

- Overview
- Setting Trigger Coupling
- Setting Trigger Source

Other topics about Common Settings

Overview

The E5052B has seven measurement function: phase noise measurement, spectrum monitor measurement, frequency/power measurement, transient measurement, AM noise measurement, baseband noise measurement and segment phase noise measurement. Because individual measurements differ in their characteristics from one another, the E5052B’s each trigger is used exclusively for a single measurement function.

In other words, only one measurement function can be triggered at a time, and only this function can perform measurement at this time.

The E5052B has a trigger model for each measurement (Trigger System); however, only one triggered measurement can take place at a time. This is because the hardware and the trigger port are shared by seven instruments. For example, even if the continuous initiation mode is enabled for all measurements and the trigger source is set to Internal, only one triggered measurement takes place.

At the default setting, activating a measurement (**Window Next** or **Meas/View** > **Show Window**) is independent of the trigger distribution (**Trigger** > **Trigger to {measurement label}**). Even if you change the active window, the trigger is not applied to it until the trigger distribution is changed to the measurement. From the firmware revision A.03.20, the trigger distribution can be linked with the activated measurement (see trigger coupling). This function enables changing the trigger distribution automatically when you change the active window.

Setting Trigger Source

1. Press **Trigger** > **Source**.
2. Select the Trigger Source from the softkey menu list.
3. Press **Trigger** > **Trigger to {measurement label}** to send a trigger to the measurement. By default, **Continuous** is selected for sweep. You can also hold the trigger by selecting **Trigger** > **Hold** can provide a single trigger by selecting **Trigger** > **Single**.

Setting Trigger Coupling

This function couples the trigger mode with the active window. You can select the trigger mode coupled or trigger mode uncoupled with the following steps.

NOTE When trigger couple is on and trigger signal is entered continuously, the measurement is made immediately and the trace is overwritten after the active window is changed.
To avoid this, set trigger couple to **OFF**, or change the active window after the trigger is hold.

1. Press **Trigger** > **Window Couple** > **ON** |**OFF**. The default setting is **OFF**.

If you change the active window, the trigger mode changes. There is a possibility that active window changes because of the following operations.

- Execute the SCPI.DISPlay.WINDow.ACTive command.
- Execute the SCPI.DISPlay.xx.STATe command.
- Select the **Window Next** or **Meas/View** > **Show Window**.

- Click the measurement window on the screen.

NOTE Even if trigger mode is changed in SCPI.TRIGger.MODE command, the active window is not changed.

Setting External Trigger

- Overview
- Connecting to the External Trigger Input Connector
- Selecting Trigger Source
- Setting External Trigger Output

Other topics about Common Settings

Overview

When the trigger source is set to External, the input signal is regarded as the start trigger of measurement, which is transmitted to the external trigger input connector (Ext Trig) from the external instruments. When the connector detects more than 20 us of pulse transition upward or downward, a measurement starts. A TTL compatible signal is used as the trigger signal.

Follow the steps below to set up the external trigger.

Connecting to the External Trigger Input Connector

Connect the trigger output connector of the external instrument to the E5052B's EXT TRIG connector on the rear panel.

Selecting Trigger Source

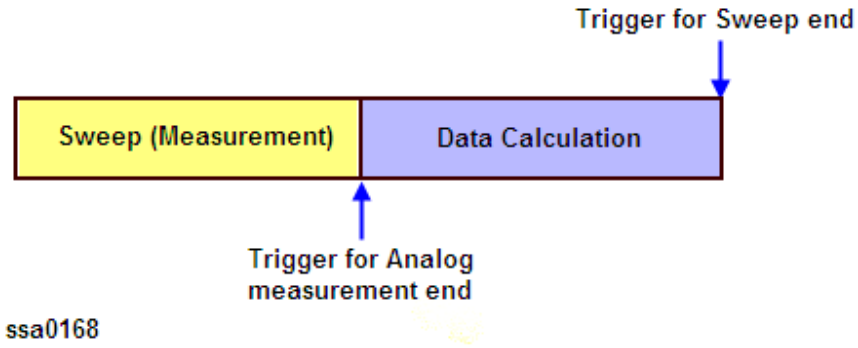
1. Press **Trigger** > **Source**.
2. Select **External** from the softkey menu list.
3. Press **Trigger** > **Ext Trig Polarity** to select the polarity of the external trigger. You can select either **Positive** (upward) or **Negative** (downward).

Setting External Trigger Output

1. Press **Trigger** > **Ext Trig Output**.
2. Select **State** > **ON** | **OFF** from the softkey menu list.
3. Select **Polarity** to select the polarity of the external trigger output. You can select either **Positive** or **Negative**.
4. Select **Selection** to set the trigger timing. You can select either **Sweep end** or **Analog meas end**.

NOTE **Sweep end** sets the trigger timing when the measurement and data calculation are completed as shown in the figure below.

Analog meas end sets the trigger timing after completing the analog measurement, and before calculating the data as shown in the figure below.



User Measurement

This topic describes settings for User measurement menu.

User Format

No options are available for Format in User measurement menu.

User Start/Center

No options are available for Start/Center in User measurement menu.

User Stop/Span

No options are available for Stop/Span in User measurement menu.

User Trigger

No options are available for Trigger in User measurement menu.

User Setup

No options are available for Setup in User measurement menu.