ADVANTEST

ADVANTEST CORPORATION

R3681 Series OPT80

C/N Measurement Software

User's Guide

MANUAL NUMBER FOE-8440162A00

Applicable Models
R3681
R3671

First printing April 16, 2004
Printed in Japan

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. INTRODUCTION

This chapter describes the contents of this guide and the product overview of the R3681 series signal analyzer option 80 C/N measurement software to help the user get the most out of this guide.

1.1 Organization of This Document

This document is organized into the following chapters:

For more information on the basic operations, functions, and remote programming of the R3681 series signal analyzer, refer to Section 1.3, "Other Manuals Pertaining to This Instrument."

Chapter 1. INTRODUCTION	Introduces you to the organization of this document and a product overview to help you get the most out of this document.
Chapter 2. QUICK START	The basic operations of this software are described by using simple measurement examples.
Chapter 3. MENU MAP, FUNCTIONAL EXPLANATION	Explains the menu configuration and function of the soft keys.
Chapter 4. SCPI COMMAND REFERENCE	Describes the SCPI commands.
APPENDIX	Provides the following information: • How to Calculate the Phase Jitter • Error Code

1.2 C/N Measurement Software Product Overview

The R3681 series signal analyzer option 80 C/N measurement software provides a function that displays the offset frequency, which deviates from the carrier frequency, in the horizontal axis by log scale and displays the phase noise in the vertical axis. This function is useful for the development and troubleshooting of the oscillator and frequency synthesizer.

- The phase noise at an offset frequency of 10 Hz to 1 GHz, which deviates from the carrier frequency, can be measured and can be displayed for the log frequency of up to 8 decades.
- C/N can be measured by using the signal track function to track the carrier frequency.
- The RMS value of the phase jitter can be calculated.

1.3 Other Manuals Pertaining to This Instrument

Available manuals pertaining to this instrument include:
Keep this guide in the binder that is provided for the R3681 series user's guide as a reference.

- User's Guide (Part Code: {ER3681SERIES/U}, English)
  Contains information prerequisite to using the R3681 Series Signal Analyzer, ranging from setup to basic operation, applied measurement, functionality, specifications, and maintenance.
- Programming Guide (Part Code: {ER3681SERIES/P}, English)
  Covers programming information to use the R3681 Series Signal Analyzer to automate measurement sequences, including a remote control overview, SCPI command references, and sample application programs.
- Performance Test Guide (Part Code: {ER3681SERIES/T}, English)
  Covers information necessary to verify the performance of the R3681 Series Signal Analyzer, including performance test procedures and specifications.

1.4 Accessories

.

Table 1-1 Standard Accessories

Name	Model	Quantity	Remarks
R3681 Series OPT80 User's Guide	ER3681OPT80	1	English version

1.5 Conventions of Notation Used in This Document

In this document, panel keys, on-screen buttons and menus are represented by the following symbols:

On-panel hard keys

Sample	Represents an on-panel hard key labeled "Sample." Example: **START**, **STOP**

On-screen system menus

[Sample]	Represents an on-screen menu, tab, button or dialog box that is labeled "Sample" and that is selected or executed when touched. Example: **[File]** menu, **[Normal]** tab, **[Option]** button

On-screen function buttons

{Sample}	Represents an on-screen function button labeled "Sample." Example: **{FREQ}** button, **{SWEEP}** button

On-screen side menu

Sample	Represents an on-screen side menu key labeled "Sample." Example: **Center** key, **Span** key

On-screen system menu key operation

[File]→[Save As...]	Indicates a touch on the **[File]** menu followed by a choice of **[Save As...]**.

Sequential key operation

{FREQ}, **Center**	Indicates a touch on the **{FREQ}** button followed by a touch on the **Center** key.

Toggle key operation

ΔMarker On/Off	(On)	Indicates a touch on the **ΔMarker On/Off** key to turn on the ΔMarker.

1.6 Trademarks and Registered Trademarks

- Microsoft® and Windows® are trademarks or registered trademarks of Microsoft Corporation in the United States and other countries.
- Other product and company names referenced herein are trademarks or registered trademarks of their respective owners.

2. QUICK START

This chapter describes the basic operations of this software by using the measurement example of the X-band signal source phase noise.

2.1 How to Operate the R3681 Series Signal Analyzer

For more information on the basic operations of the R3681 series signal analyzer, refer to the R3681 series user's guide.

2.1.1 Phase Noise Measurement

In this example, the phase noise of a signal shown in Figure 2-1 is measured.

To use the phase noise measurement function, the operation mode of the R3681 series signal analyzer must be set to the Spectrum Analyzer mode.

1. Select **[Spectrum Analyzer]** in the **[Config]** menu.
2. Display the signal, of which the phase noise is measured, in the center of the screen. If the signal frequency is 3.5 GHz or higher, tune the peak of the preselector. To tune the peak of the preselector, touch **{SEARCH}** and **{FREQ}** in the function bar, and touch **Presel Tune** and **Auto Tune** in the soft menu bar. The peak is tuned automatically.

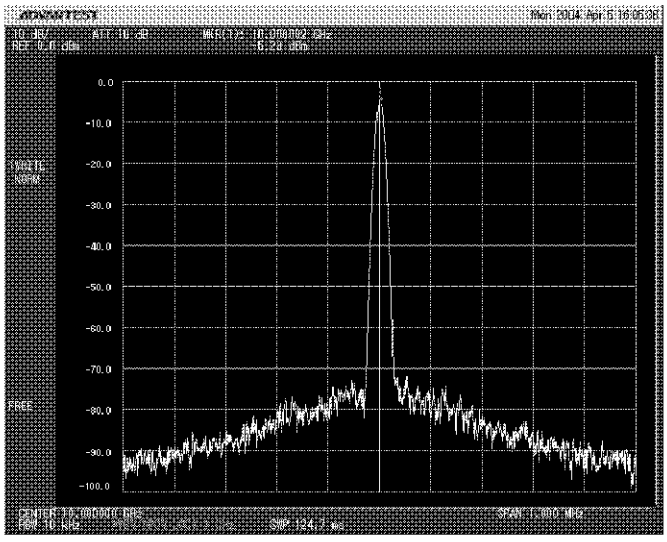


Figure 2-1 Spectrum

3. Touch **{MENU2}** and **{MEAS}** in the function bar and touch **Phase Noise** in the menu bar to set the phase noise measurement function to on. The waveform shown in Figure 2-2 is displayed.

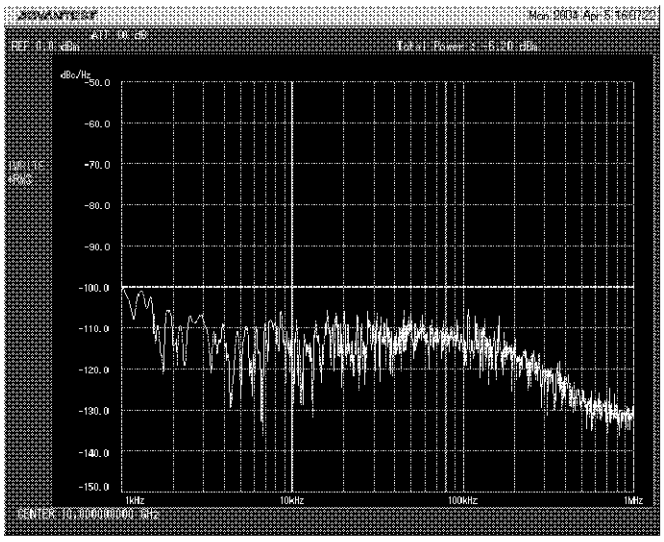


Figure 2-2 Phase Noise

4. Touch **Start Offset** in the soft menu bar. The lower limit of the offset frequency in the current phase noise measurement is displayed in the entry box and can be changed. In this example, set the lower limit to 100 Hz.

5. Touch **Stop Offset** in the soft menu bar. The upper limit of the offset frequency in the current phase noise measurement is displayed in the entry box and can be changed. In this example, set the upper limit to 10 MHz.

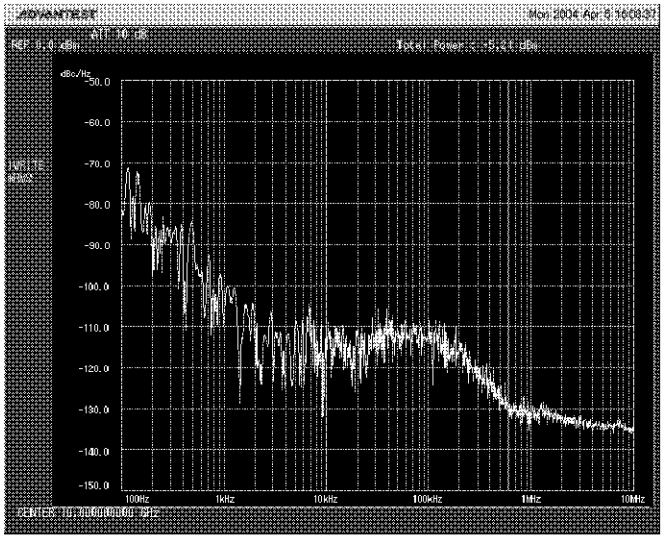


Figure 2-3 Phase Noise Measurement Range Setting

6. To reduce the noise component, the smoothing function is used.
To use the smoothing function, touch **{MENU2}** and **{MEAS}** in the function bar and touch **Smoothing** (On) in the soft menu bar. The smoothing function is set to on and the currently-set smoothing value is displayed in the entry box and can be changed. In this example, set the smoothing value to 2 %.

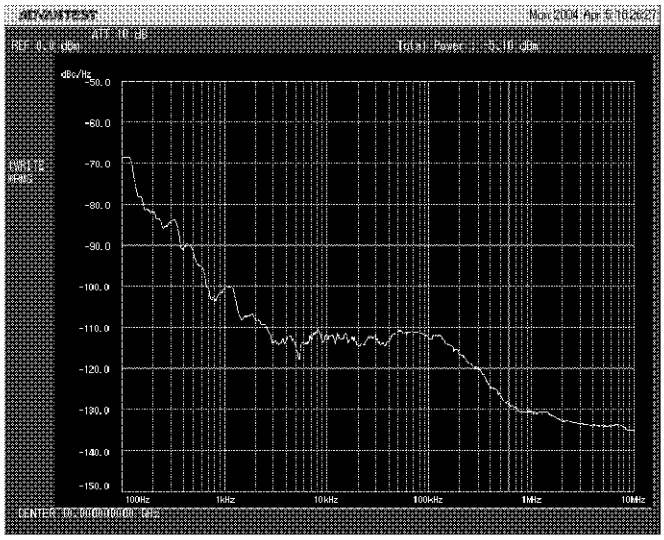


Figure 2-4 Smoothing Effect

7. If the trace average function is used with the smoothing function, the waveform can be averaged.
To use the trace average function, touch **{MENU1}** and **{TRACE}** in the function bar and touch **Average** in the soft menu bar The currently-set number of times that averaging is performed is displayed in the entry box and can be changed. In this example, set the number to 5.

8. If the marker is used, the phase noise at each offset frequency can be read.
To use the marker, touch **{MKR}** in the function bar and **Marker** in the soft menu bar. An entry box is displayed. Set 100 Hz.

9. More than one maker can be displayed.
To display more than one marker, touch **Marker Setup**, **Maker No.2**, and **Marker ON** in the soft menu bar. The second marker (marker 2) is displayed. Set 1 kHz from the entry box.

10. Multiple markers can be displayed as shown in Figure 2-5 by repeating step 9.

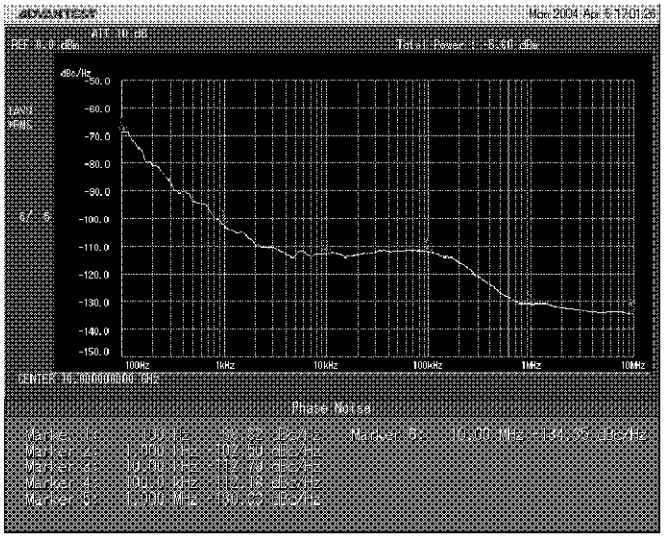


Figure 2-5 Reading the Phase Noise by Using Multiple Markers

11. To set the phase noise measurement function to off, touch **{MENU2}** and **{MEAS}** in the function bar and touch **Phase Noise** in the soft menu bar. The soft menu for the phase noise measurement function is displayed. Touch **Phase Noise Off**.

2.1.2 Jitter Calculation

This software can calculate the phase-jitter RMS value.

1. Touch **{MENU2}** and **{MEAS}** in the function bar and touch **Phase Noise** in the soft menu bar to set the phase noise measurement function to on.

2. Under the conditions shown in Figure 2-3, touch **RMS Jitter**, **RMS Jitter** (On) in the soft menu bar. The jitter calculation range shown in Figure 2-6 is displayed.

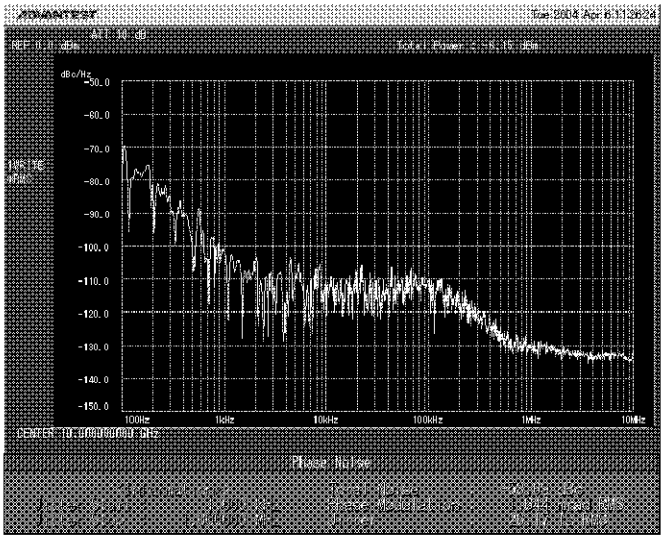


Figure 2-6 Jitter Calculation Example

3. The range in which the jitter is calculated can be set by touching **Jitter Start** and **Jitter Stop** in the soft menu bar.

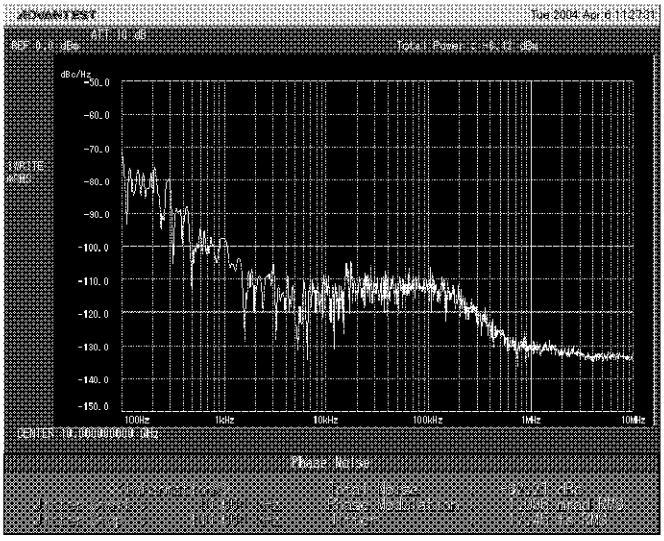


Figure 2-7 Jitter Calculation Range Setting

4. The unit in which the jitter is displayed can be changed by touching **Units** in the soft menu bar.

5. To close the jitter display, touch **RMS Jitter** (Off) in the soft menu bar.

2.1.3 Resolution Setting for the Phase Noise Measurement

When the phase noise, which is close to the spurious, is measured, the effect of the spurious signal can be reduced by increasing the resolution in the phase noise measurement.

1. Touch **{MENU2}** and **{MEAS}** in the function bar and touch **Phase Noise** in the menu bar to set the phase noise measurement function to on.

2. An example in Figure 2-8 shows that the phase noise at a 10-kHz offset frequency cannot be measured correctly because of the spurious signal effect.

Figure 2-8 In Low Resolution Mode

3. The phase noise is measured in the high resolution by touching **More2/2** and **Resolution** (High) in the soft menu bar.
Figure 2-9 shows that the phase noise at the 10-kHz offset frequency that was masked by the spurious signal is now measured correctly.

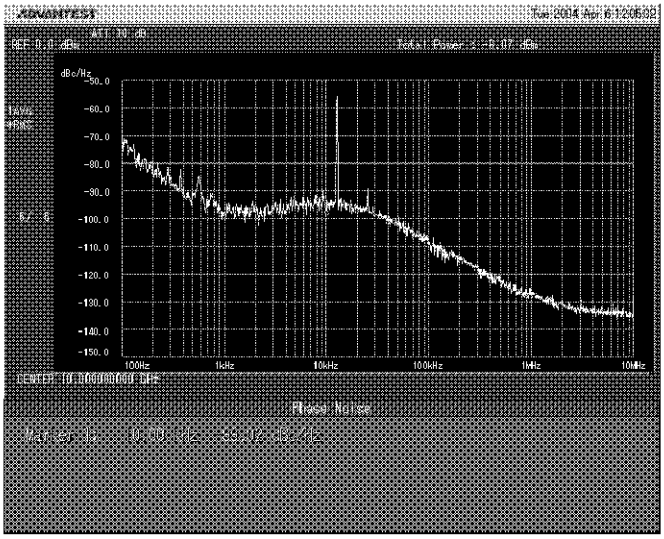


Figure 2-9 In High Resolution Mode

3. MENU MAP, FUNCTIONAL EXPLANATION

This chapter describes the configurations and functions of the soft keys displayed on the touch screen.

MEMO:

- **[.....]** ***Used to enclose a menu name, key name, item name in the dialog box, button name, or the name of selected items in lists and menus.***
- **{....}** ***Shows a function button on the function bar.***
- ***Shows a soft key on the soft menu bar.***
- ***A dialog box is surrounded by a broken line.***
- ***Operations are supposed to be made through a touch screen, and "touch" means to press a button or a key.***

3.1 Menu Index

3.2 Menu Bar

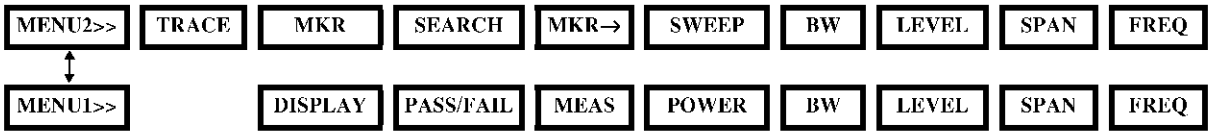
The menu bar contains the following menus:

[File]	[System]	[Config]	[Modulation]	[Cal]	[Special]

To use the phase noise measurement function, select **[Spectrum Analyzer]** from the **[Config]** menu.

3.3 Function Bar

The function bar contains the following functions:

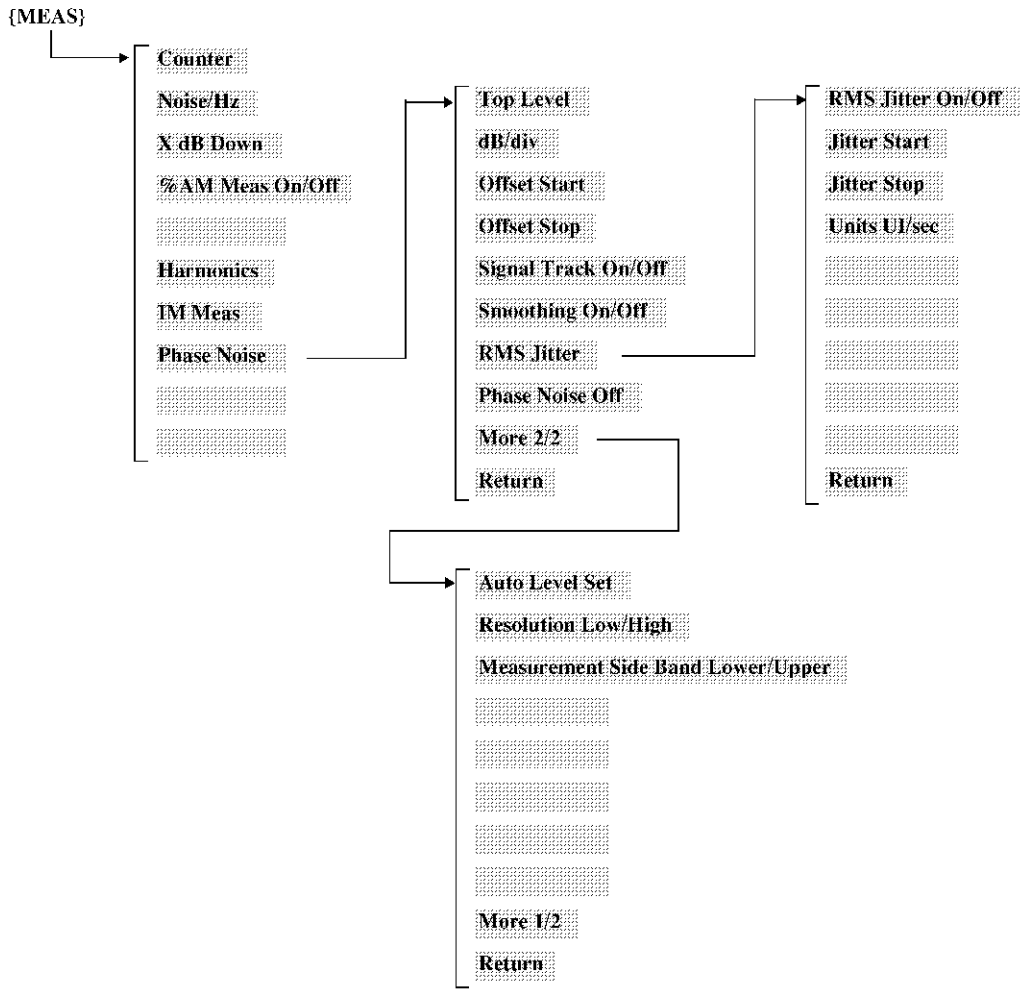


If a function button on the function bar is touched, the associated soft key is displayed on the side menu bar.
This section describes the phase noise measurement function.
For more information on other functions, refer to the R3681 series user's guide.

3.3.1 {MEAS}

If the **{MEAS}** button is touched, the menu that is related to general measurements is displayed. The phase noise measurement function menu is included in this menu.

The following shows the menu map:



Phase Noise — Displays the Phase Noise menu.
In this function, the current center frequency is used as a carrier frequency and the phase noise at the offset frequency from the carrier frequency is measured.

Top Level — Sets the reference level that is used in the graph when the phase noise is measured.

dB/div — Sets the dB/div that is used in the graph when the phase noise is measured.

Offset Start — Sets the lower limit value of the offset frequency.

Offset Stop Sets the upper limit value of the offset frequency.

Signal Track On/Off Switches the signal track function on and off.

On: Sets the signal track function to on and measures the signal by changing the center frequency to track the carrier frequency.

Off: Cancels the signal track function.

Smoothing On/Off Switches the smoothing function on and off.

On: Sets the smoothing function to on.
When this function is set to on, the phase noise measurement result is averaged by using the smoothing value data. Also, enables a value to be entered in smoothing value.

Off: Sets the smoothing function to off.

RMS Jitter Displays the RMS Jitter menu.

RMS Jitter On/Off Switches the RMS phase jitter calculation on and off.

On: Calculates the RMS phase jitter.

Off: Does not calculate the RMS phase jitter.

Jitter Start Sets the lower limit value of the RMS phase jitter calculation range.

Jitter Stop Sets the upper limit value of the RMS phase jitter calculation range.

Units UI/sec Sets the units of the RMS phase jitter measurement result.

UI: Sets the units of the RMS phase jitter to Unit Interval.

sec: Sets the units of the RMS phase jitter to sec.

Return Returns to the previous menu.

Phase Noise Off Turns off the phase noise measurement function.

Return Returns to the previous menu.

More 2/2 Displays the Phase Noise (2/2).

Auto Level Set Sets the ATT to its optimum value according to the carrier signal level.

Resolution Low/High Sets the measurement resolution.

Low: Performs the low resolution measurement.
The accuracy of the measurement result decreases but the measurement can be performed at high speed.

High: Performs the high resolution measurement.
The accuracy of the measurement result increases, but the measurement is performed at low speed.

Measurement Side Band Lower/Upper
Selects a side band.

Lower: Measures the lower side band.

	Upper: Measures the Higher side band.
More 1/2	Displays the Phase Noise menu (1/2).
Return	Returns to the previous menu.

4. SCPI COMMAND REFERENCE

This chapter describes the SCPI command reference for this instrument.

4.1 Command Reference Format

This section describes the format of explanations of each command described in this chapter.

Explanations of each command include the following items:

- Command
- Command syntax
- Function description
- Parameter
- Query reply
- Example
- Relevant command

- [Command syntax]

  The command syntax shows the syntax of a command sent from the external controller to this instrument. The syntax consists of a command part and a parameter part. The command part and parameter part are delimited by a space.

  When there are multiple parameters, they are delimited by commas (,). The three points (...) displayed between commas represent the parameter(s) omitted in the position.

  For example, the description <numeric value 1>,..., <numeric value 4> shows that four parameters,<numeric value 1>, <numeric value 2>, <numeric value 3>, and <numeric value 4>, are required.

  When the parameter is a character string type such as <character string>,<character string 1>, the parameter must be enclosed in double quotation marks (" "). When the parameter is <block>, it shows the block format data.

  The part written in lowercase alphabetical characters in the syntax shows that it can be omitted.

  For example, ":CALibration:CABLe" can be abbreviated to ":CAL:CABL".

  The marks used in the syntax are defined as follows:

< >:	Shows a parameter required for sending a command
[ ] :	Shows that the command is optional It can be omitted
{ }:	Shows that only one item is required to be selected from multiple items
|:	Written in curly brackets {..} and used as a delimiter for multiple items
<ch>:	Written in the command header and shows the target input channel number of the command The channel number can be omitted. However, when it is written, the channel number 1 is selected

<screen>: Written in the command header and shows the target screen number of the command
The screen number can be omitted. However, when it is written, a value from 1 to 4 is selected
|{1|2|3|4}|

<trace>: Written in the command header and shows the target trace number of the command
The trace number can be omitted. However, when it is written, a value from 1 to 2 is selected
|{1|2}|

For example, when a syntax below is specified, :CALC:CORR:EDEL:TIME 0.1 and :CALCULATE1:SELECTED:CORR:EDEL:TIME 25E-3 are valid.

Syntax: CALCulate{|1|2|3|4}[:SELected]:CORRection:EDELay:TIME <numeric value>

- [Function description]
  The usage of commands and operation of this instrument when they are executed.

- [Parameter]
  Describes a parameter required for sending a command.
  When the parameter is a numeric type or a character (string) type, it is enclosed in angle brackets (< >).
  When the parameter is an optional type, it is enclosed in curly brackets { }.
  In this manual, parameter types are described in the following formats:

  < int >: A numeric value that can be input in the format NR1, NR2, or NR3 and rounded to an integer in this instrument

  < real >: A numeric value that can be input in the format NR1, NR2, or NR3 and rounded to a valid-digit real number in this instrument

  < bool >: String of OFF|ON

  < str >: A character string or alphanumeric symbols enclosed in quotation (' ') or double quotation (" ") marks

  < block >: Block data type
  The content of data is an 8-bit binary data array

  < type >: Character data selected from multiple types

- [Query reply]
  When there is a query reply to the command, the data format used for reading the query is described.
  Each parameter to be read is enclosed in curly brackets { }. When multiple items delimited by a vertical bar (|) exist in curly brackets { }, only one of those items is read out. When multiple parameters are read out, they are delimited by commas (,). The three points (...) displayed between commas represent the data omitted in the position. For example, the description <numeric value 1>,..., <numeric value 4> shows that four parameters <numeric value 1>, <numeric value 2>, <numeric value 3>, and <numeric value 4> are read.
  When the parameter to be read is enclosed in square brackets [ ], the parameter may be omitted, depending on the measurement result, etc.

When the parameter to be read is a value in a unit, the description like "Unit: dBm" is added to display the unit of the parameter value. However, only when the parameter is described in a level unit "dBm", the level unit selected at that time will be applied to the parameter.

- [Example]

  Simple use examples of commands are described.

  Use examples of commands are described in Visual Basic language, using the GPIB programming interface of National Instruments.

  The function OutputMsgs( ) used in the sentence example is a function used for displaying the query result, etc. Implement in accordance with the application.

- [Relevant commands]

  Describes the relevant commands when there are relevant commands.

4.2 Sense Commands

This section describes the Sense subsystem.
Basic setting commands such as frequency and sweep time setting are defined in the Sense subsystem.

Command	Function	Reference page
[:SENSe<ch>]		
:PNOise		
:STARt	Sets the start offset frequency.	4-5
:STOP	Sets the stop offset frequency.	4-5
:STRack	Sets the signal track function to on and off.	4-6
:SMOothing	Sets the smoothing value.	4-6
:STATe	Sets the smoothing function to on and off.	4-7
:JITTer		
:STATe	Sets the RMS jitter calculation function to on and off.	4-7
:STARt	Sets the start frequency of the RMS jitter calculation.	4-8
:STOP	Sets the stop frequency of the RMS jitter calculation.	4-8
:RESolution	Sets the phase noise measurement resolution.	4-9
:BAND	Sets the phase noise measurement offset frequency.	4-9

4.2.1 [:SENSe<ch>]:PNOise:STARt

- [Command syntax] [:SENSe<ch>]:PNOise:STARt < real >
  [:SENSe<ch>|:PNOise:STARt?
- [Function description] Sets the start offset frequency.
  Sets the start offset frequency.
  Start offset frequency values that can be set are not sequential.
  Therefore, if a parameter value that was sent cannot be set as a start offset value, the nearest available start value is selected.
- [Parameter] < real > = Setting start offset frequency (GHz/MHz/kHz/Hz)
- |Query reply| NR3 (real number value in Hz)
- [Usage example] Call ibwrt (analyzer%, ":PNO:STAR 1KHZ") ' Set start offset.
  Call ibwrt (analyzer%, ":PNO:STOP 1MHZ") ' Set stop offset.
- |Relevant command| [:SENSe<ch>|:PNOise:STOP

4.2.2 [:SENSe<ch>]:PNOise:STOP

- |Command syntax| [:SENSe<ch>|:PNOise:STOP < real >
  [:SENSe<ch>]:PNOise:STOP?
- |Function description| Sets the stop offset frequency.
  Sets the stop offset frequency.
  Stop offset frequency values that can be set are not sequential.
  Therefore, if a parameter value that was sent cannot be set as a stop offset value, the nearest available stop value is selected.
- [Parameter] < real > = Setting stop offset frequency (GHz/MHz/kHz/Hz)
- [Query reply] NR3 (real number value in Hz)
- |Usage example| Call ibwrt (analyzer%, ":PNO:STAR 1KHZ") ' Set start offset.
  Call ibwrt (analyzer%, ":PNO:STOP 1MHZ") ' Set stop offset.
- [Relevant command] [:SENSe<ch>]:PNOise:STARt

4.2.3 [:SENSe<ch>]:PNOise:STRack

- [Command syntax] [:SENSe<ch>]:PNOise:STRack < bool >
  [:SENSe<ch>]:PNOise:STRack?
- [Function description] Sets the signal track function to on and off.
  Sets the signal track function to on and off.
  The signal track function tracks a moving signal and always sets it to the carrier frequency position.
- |Parameter| < bool > = { OFF | ON }
  ON: Sets the signal track function to on.
  OFF: Sets the signal track function to off.
- [Query reply] { OFF | ON }
- |Usage example| Call ibwrt (analyzer%, ":PNO:STR ON")
- |Relevant command|

4.2.4 [:SENSe<ch>]:PNOise:SMOothing

- |Command syntax| [:SENSe<ch>]:PNOise:SMOothing < real >
  [:SENSe<ch>]:PNOise:SMOothing?
- |Function description| Sets the smoothing value.
  Sets the smoothing value in percent.
- [Parameter] < real > = Percentage of smoothing, settable range: 1-16.
- |Query reply| NR3 (real number value in %)
- [Usage example] Call ibwrt (analyzer%, ":PNO:SMO 2PCT")
  Call ibwrt (analyzer%, ":PNO:SMO:STAT ON")
- |Relevant command| [:SENSe<ch>]:PNOise:SMOothing:STATe

4.2.5 [:SENSe<ch>]:PNOise:SMOothing:STATe

- [Command syntax] [:SENSe<ch>]:PNOise:SMOothing:STATe < bool >
  [:SENSe<ch>|:PNOise:SMOothing:STATe?
- [Function description] Sets the smoothing function to on and off.
  Sets the smoothing function to on and off.
  The smoothing function averages the phase noise data in the range that is acquired by the trace point × the smoothing value/100.
- |Parameter| < bool > = { OFF | ON }
  ON: Sets the smoothing function to on.
  OFF: Sets the smoothing function to off.
- [Query reply] { OFF | ON }
- |Usage example| Call ibwrt (analyzer%, ":PNO:SMO 2PCT")
  Call ibwrt (analyzer%, ":PNO:SMO:STAT ON")
- [Relevant command] [:SENSe<ch>]:PNOise:SMOothing

4.2.6 [:SENSe<ch>]:PNOise:JITTer:STATe

- [Command syntax] [:SENSe<ch>]:PNOise:JITTer:STATe < bool >
  [:SENSe<ch>]:PNOise:JITTer:STATe?
- [Function description] Sets the RMS jitter calculation function to on and off.
  Sets the RMS jitter calculation function to on and off.
- [Parameter] < bool > = { OFF | ON }
  ON: Sets the jitter function to on.
  OFF: Sets the jitter function to off.
- |Query reply| { OFF | ON }
- [Usage example] Call ibwrt (analyzer%, ":PNO:JITT:STAT ON")
  Call ibwrt (analyzer%, ":PNO:JITT:STAR 1KHZ")
  Call ibwrt (analyzer%, ":PNO:JITT:STOP 10KHZ")
- [Relevant command] [:SENSe<ch>]:PNOise:JITTer:STARt
  [:SENSe<ch>]:PNOise:JITTer:STOP
  :UNIT<ch>:PNOise:JITTer

4.2.7 [:SENSe<ch>]:PNOise:JITTer:STARt

- [Command syntax] [:SENSe<ch>]:PNOise:JITTer:STARt < real >
  [:SENSe<ch>|:PNOise:JITTer:STARt?
- [Function description] Sets the start frequency of the RMS jitter calculation.
  Sets the start frequency of the RMS jitter calculation.
- |Parameter| < real > = Setting jitter calculation start frequency (GHz/MHz/kHz/Hz)
- [Query reply] NR3 (real number value in Hz)
- [Usage example] Call ibwrt (analyzer%, ":PNO:JITT:STAT ON")
  Call ibwrt (analyzer%, ":PNO:JITT:STAR 1KHZ")
  Call ibwrt (analyzer%, ":PNO:JITT:STOP 10KHZ")
- |Relevant command| [:SENSe<ch>|:PNOise:JITTer:STATe
  [:SENSe<ch>]:PNOise:JITTer:STOP
  :UNIT<ch>:PNOise:JITTer

4.2.8 [:SENSe<ch>]:PNOise:JITTer:STOP

- [Command syntax] [:SENSe<ch>]:PNOise:JITTer:STOP < real >
  [:SENSe<ch>|:PNOise:JITTer:STOP?
- [Function description] Sets the stop frequency of the RMS jitter calculation.
  Sets the stop frequency of the RMS jitter calculation.
- |Parameter| < real > = Setting jitter calculation stop frequency (GHz/MHz/kHz/Hz)
- [Query reply] NR3 (real number value in Hz)
- [Usage example] Call ibwrt (analyzer%, ":PNO:JITT:STAT ON")
  Call ibwrt (analyzer%, ":PNO:JITT:STAR 1KHZ")
  Call ibwrt (analyzer%, ":PNO:JITT:STOP 10KHZ")
- |Relevant command| [:SENSe<ch>|:PNOise:JITTer:STATe
  [:SENSe<ch>]:PNOise:JITTer:STARt
  :UNIT<ch>:PNOise:JITTer

4.2.9 [:SENSe<ch>]:PNOise:RESolution

- [Command syntax] [:SENSe<ch>]:PNOise:RESolution < type >
  [:SENSe<ch>|:PNOise:RESolution?
- [Function description] Sets the phase noise measurement resolution.
  Sets the phase noise measurement resolution.
  If Low is selected, the low resolution measurement is performed at high speed and if High is selected, the high resolution measurement is performed at low speed.
- [Parameter] < type > = { LOW | HIGH }
  LOW: Low resolution measurement
  HIGH: High resolution measurement
- |Query reply| { LOW | HIGH }
- [Usage example] Call ibwrt (analyzer%, ":PNO:RES HIGH")
- [Relevant command]

4.2.10 [:SENSe<ch>]:PNOise:BAND

- [Command syntax] [:SENSe<ch>]:PNOise:BAND < type >
  [:SENSe<ch>|:PNOise:BAND?
- [Function description] Sets the phase noise measurement offset frequency.
  Sets the phase noise measurement offset frequency to negative or positive.
- [Parameter] < type > = { LOWer | UPPer }
  LOWer: Measures the lower carrier frequency.
  UPPer: Measures the upper carrier frequency.
- |Query reply| { LOW | UPP }
- [Usage example] Call ibwrt (analyzer%, ":PNO:BAND UPP")
- [Relevant command]

4.3 Configure Commands

This section describes the Configure subsystem.
The commands used to enter each measurement mode are defined in the Configure subsystem.

Command	Function	Reference page
:CONFigure<ch> :PNOise	Enters the phase noise measurement mode.	4-10

4.3.1 :CONFigure<ch>:PNOise

- [Command syntax] :CONFigure<ch>:PNOise
- [Function description] Enters the phase noise measurement.
  Changes to the phase noise measurement mode.
  If any other measurement mode is used, the measurement mode terminates and enters the phase noise measurement mode.
- [Parameter] None
- [Query reply] None
- [Usage example] Call ibwrt (analyzer%, ":CONF:PNO")
- [Relevant command]

4.4 Measure/Read/Fetch Commands

This section describes the Measure, Read, and Fetch subsystems.

This section describes only the Measure command. However, the Read command and Fetch command can also be used by replacing the command header part, MEASure, in the Measure command descriptions with READ or FETCh.

MEMO: ***The reply formats of the Measure, Read, and Fetch commands are the same.***
The difference between the Measure and Read, and Fetch commands is that the Measure and Read commands are used to execute measurements and the Fetch command is used to read result data.
Both the Measure and Read commands execute measurements. However, the initialization processes for the commands that are made when entering the measurement mode maybe different.
The differences, if any, are described in the function description given later.
If no descriptions are given, the initialization processes are the same.
If the Fetch command is issued without entering the corresponding measurement mode, a Query error occurs.

Command	Function	Reference page
:MEASure<ch> :PNOise		
:TPOWer?	Executes the phase noise measurement and reads Total Power.	4-11
:JITTer?	Executes the phase noise measurement and reads jitter.	4-12

4.4.1 :MEASure<ch>:PNOise:TPOWer?

- |Command syntax| :MEASure<ch>:PNOise:TPOWer?
- [Function description] Executes the phase noise measurement and reads total power.
  Executes the phase noise measurement. After the measurement, returns the total power measurement result.
- [Parameter] None
- [Query reply] NR3 (Real value total power value: Unit dBm)
- |Usage example| Result$ = Space$(1024)
  Call ibwrt (analyzer%, ":MEAS:PNO:TPOW?")
  Call ibrd (analyzer%, Result$)
- [Relevant command] :UNIT<ch>:POWer<screen>
  :READ<ch>:PNOise:TPOWer?
  :FETCh<ch>:PNOise:TPOWer?

4.4.2 :MEASure<ch>:PNOise:JITTer?

- [Command syntax] :MEASure<ch>:PNOise:JITTer?
- [Function description] Executes the phase noise measurement and reads the jitter calculation result.

  Executes the phase noise measurement. After the measurement, returns the jitter calculation result.
- |Parameter| None
- [Query reply] NR3, NR3, NR3

  Output order: Real value total noise: Unit dBc,
  Real value phase modulation: Unit rad,
  Real value jitter: Unit UI or sec
- [Usage example]

```
Result$ = Space$(1024)
Call ibwrt (analyzer%, ":MEAS:PNO:JITT?")
Call ibrd (analyzer%, Result$)
```

- |Relevant command| :UNIT<ch>:PNOise:JITTer?
  :READ<ch>:PNOise:TPOWer?
  :FETCh<ch>:PNOise:TPOWer?

4.5 Display Commands

This section describes the Display subsystem.
The commands related to the setting of screen display scale and annotation are defined in the Display subsystem.

Command	Function	Reference page
:DISPlay<ch> [:WINDow] :TRACe :Y [:SCALe] :PNOise		
:RLEVel	Sets the reference level used when the phase noise is measured.	4-13
:PDIVision	Sets the value per division used when the phase noise is measured.	4-14

4.5.1 :DISPlay<ch>[:WINDow]:TRACe:Y[:SCALe]:PNOise:RLEVel

- [Command syntax] :DISPlay<ch>:[:WINDow]:TRACe:Y[:SCALe]:PNOise:RLEVel <real>
  :DISPlay<ch>:[:WINDow]:TRACe:Y[:SCALe]:PNOise:RLEVel?
- [Function description] Sets the reference level used when the phase noise is measured.
  Sets the reference level used when the phase noise is measured.
- [Parameter] < real > = reference level value (dBc/Hz)
- [Query reply] NR3 (real number value in dBc/Hz)
- [Usage example] Call ibwrt (analyzer%, ":DISP:TRAC:Y:PNO:RLEV 0DB")
- [Relevant command]

4.5.2 :DISPlay<ch>[:WINDow]:TRACe:Y[:SCALe]:PNOise:PDIVision

- [Command syntax] :DISPlay<ch>:[:WINDow]:TRACe:Y[:SCALe]:PNOise:PDIVision < real >
  :DISPlay<ch>:[:WINDow]:TRACe:Y[:SCALe]:PNOise:PDIVision?
- [Function description] Sets the value per division used when the phase noise is measured.
  When the phase noise is measured, the value per division is set.
  Any value in the range from 1 dB/div to 20 dB/div can be set.
- |Parameter| < real > = dB value (dB) per division
  1 - 20
- |Query reply| NR3 (real number value in dB)
- [Usage example] Call ibwrt (analyzer%, ":DISP:TRAC:Y:PNO:PDIV 20DB")
- [Relevant command]

4.6 Unit Command

This section describes the Unit subsystem.
The command to set the level unit is defined in the Unit subsystem.

Command	Function	Reference page
:UNIT<ch> :PNOise :JITTer	Sets the unit of the jitter calculation result.	4-15

4.6.1 :UNIT<ch>:PNOise:JITTer

- [Command syntax] :UNIT<ch>:PNOise:JITTer <type>
  :UNIT<ch>:PNOise:JITTer?
- [Function description] Sets the unit of the jitter calculation result.
  Sets the unit of the jitter calculation result of the phase noise measurement.
- [Parameter] < type > = { UI | SEC }
  UI: Sets the unit of the jitter calculation result to UI.
  SEC: Sets the unit of the jitter calculation result to sec.
- |Query reply| { UI | SEC }
- [Usage example] Call ibwrt (analyzer%, ":UNIT:PNO:JITT SEC")
- [Relevant command]

APPENDIX

A.1 How to Calculate the Phase Jitter

This section describes the phase jitter measurement function that is built in this instrument.

The phase jitter measurement function used in this instrument measures RMS (root mean squared) phase jitters using the equation shown below. Where RMS phase jitter is $\Delta\theta_{RMS}$ [rad], the carrier power is Pc [W] and the sideband (SSB) power is Pn [W].

$$\Delta\theta_{RMS} = \sqrt{2\frac{P_n}{P_c}} \qquad (1)$$

In this instrument, carrier power Pc is measured first, power spectrum Pn is measured by summation between the start offset and stop offset frequencies and then $\Delta\theta_{RMS}$ is calculated from the expression (1). If the range between the start offset and stop offset frequencies must be divided due to a data acquisition problem, Pn is the sum of the powers within these ranges.

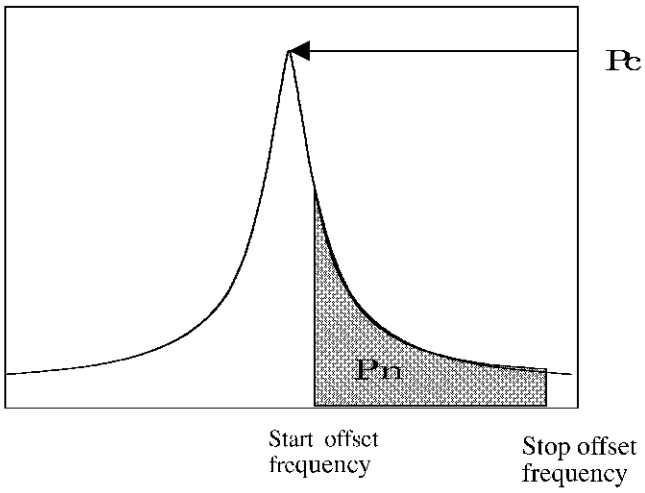


Figure A-1 RMS Phase Jitter Measurement Method

A.2 Error Message List

This section describes the error messages displayed on this instrument.
The list contains the following items of information.

- Error number
- Message text
- Cause of the error and action to take

Table A-1 Error Message List

Error number	Displayed message	Description
-1400	There is no data in the effective state.	This is a GPIB error. The requested data is not defined. Read the data after executing the measurement.
-2247	Not available. Phase Noise is ON.	Cannot be executed because the phase noise measurement mode is set.

IMPORTANT INFORMATION FOR ADVANTEST SOFTWARE

PLEASE READ CAREFULLY: This is an important notice for the software defined herein. Computer programs including any additions, modifications and updates thereof, operation manuals, and related materials provided by Advantest (hereafter referred to as "SOFTWARE"), included in or used with hardware produced by Advantest (hereafter referred to as "PRODUCTS").

SOFTWARE License

All rights in and to the SOFTWARE (including, but not limited to, copyright) shall be and remain vested in Advantest. Advantest hereby grants you a license to use the SOFTWARE only on or with Advantest PRODUCTS.

Restrictions

(1) You may not use the SOFTWARE for any purpose other than for the use of the PRODUCTS.
(2) You may not copy, modify, or change, all or any part of, the SOFTWARE without permission from Advantest.
(3) You may not reverse engineer, de-compile, or disassemble, all or any part of, the SOFTWARE.

Liability

Advantest shall have no liability (1) for any PRODUCT failures, which may arise out of any misuse (misuse is deemed to be use of the SOFTWARE for purposes other than it's intended use) of the SOFTWARE. (2) For any dispute between you and any third party for any reason whatsoever including, but not limited to, infringement of intellectual property rights.

LIMITED WARRANTY

1. Unless otherwise specifically agreed by Seller and Purchaser in writing, Advantest will warrant to the Purchaser that during the Warranty Period this Product (other than consumables included in the Product) will be free from defects in material and workmanship and shall conform to the specifications set forth in this Operation Manual.

2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

3. If the Product is found to be defective during the Warranty Period, Advantest will, at its option and in its sole and absolute discretion, either (a) repair the defective Product or part or component thereof or (b) replace the defective Product or part or component thereof, in either case at Advantest's sole cost and expense.

4. This limited warranty will not apply to defects or damage to the Product or any part or component thereof resulting from any of the following:

   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by Advantest or (ii) specifically recommended or authorized by Advantest and performed in accordance with Advantest 's instructions;

   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than Advantest or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by Advantest, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by Advantest;

   (e) incorporation in the Product of any parts or components (i) provided by Purchaser or (ii) provided by a third party at the request or direction of Purchaser or due to specifications or designs supplied by Purchaser (including, without limitation, any degradation in performance of such parts or components);

   (f) Advantest's incorporation or use of any specifications or designs supplied by Purchaser;

   (g) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war; or

   (h) any negligent act or omission of the Purchaser or any third party other than Advantest.

5. **EXCEPT TO THE EXTENT EXPRESSLY PROVIDED HEREIN, ADVANTEST HEREBY EXPRESSLY DISCLAIMS, AND THE PURCHASER HEREBY WAIVES, ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, (A) ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND (B) ANY WARRANTY OR REPRESENTATION AS TO THE VALIDITY, SCOPE, EFFECTIVENESS OR USEFULNESS OF ANY TECHNOLOGY OR ANY INVENTION.**

6. **THE REMEDY SET FORTH HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER FOR BREACH OF WARRANTY WITH RESPECT TO THE PRODUCT.**

7. **ADVANTEST WILL NOT HAVE ANY LIABILITY TO THE PURCHASER FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, INCLUDING, WITHOUT LIMITATION, LOSS OF ANTICIPATED PROFITS OR REVENUES, IN ANY AND ALL CIRCUMSTANCES, EVEN IF ADVANTEST HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE. TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

8. **OTHER THAN THE REMEDY FOR THE BREACH OF WARRANTY SET FORTH HEREIN, ADVANTEST SHALL NOT BE LIABLE FOR, AND HEREBY DISCLAIMS TO THE FULLEST EXTENT PERMITTED BY LAW ANY LIABILITY FOR, DAMAGES FOR PRODUCT FAILURE OR DEFECT, WHETHER ARISING OUT OF BREACH OF CONTRACT, TORT (INCLUDING, WITHOUT LIMITATION, NEGLEGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

CUSTOMER SERVICE DESCRIPTION

In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

SALES & SUPPORT OFFICES

Advantest Korea Co., Ltd.
22BF, Kyobo KangNam Tower,
1303-22, Seocho-Dong, Seocho-Ku, Seoul #137-070, Korea
Phone: +82-2-532-7071
Fax: +82-2-532-7132

Advantest (Suzhou) Co., Ltd.
Shanghai Branch Office:
Bldg. 6D, NO.1188 Gumei Road, Shanghai, China 201102 P.R.C.
Phone: +86-21-6485-2725
Fax: +86-21-6485-2726

Shanghai Branch Office:
406/F, Ying Building, Quantum Plaza, No. 23 Zhi Chun Road,
Hai Dian District, Beijing,
China 100083
Phone: +86-10-8235-3377
Fax: +86-10-8235-6717

Advantest (Singapore) Pte. Ltd.
438A Alexandra Road, #08-03/06
Alexandra Technopark Singapore 119967
Phone: +65-6274-3100
Fax: +65-6274-4055

Advantest America, Inc.
3201 Scott Boulevard, Suite, Santa Clara, CA 95054, U.S.A
Phone: +1-408-988-7700
Fax: +1-408-987-0691

ROHDE & SCHWARZ Europe GmbH
Mühldorfstraße 15 D-81671 München, Germany
(P.O.B. 80 14 60 D-81614 München, Germany)
Phone: +49-89-4129-13711
Fax: +49-89-4129-13723

ADVANTEST®

http://www.advantest.co.jp

ADVANTEST CORPORATION
Shin-Marunouchi Center Building, 1-6-2 Marunouchi, Chiyoda-ku, Tokyo 100-0005, Japan
Phone: +81-3-3214-7500