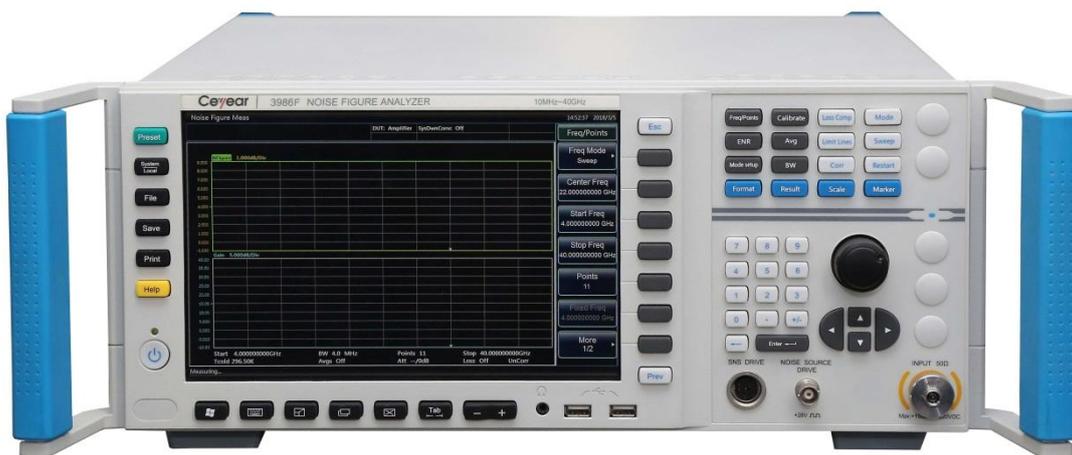




3986 Series Noise Figure Analyzer Quick Start Guide



China Electronics Technology Instruments Co. Ltd

This manual is suitable for the following models of noise figure analyzer:

- 3986A Noise Figure Analyzer (10MHz~4GHz)
- 3986D Noise Figure Analyzer (10MHz~18GHz)
- 3986E Noise Figure Analyzer (10MHz~26.5GHz)
- 3986F Noise Figure Analyzer (10MHz~40GHz)
- 3986H Noise Figure Analyzer (10MHz~50GHz)

Options:

- 3986-H01, 16603/16604 series noise source: used as a noise power standard for noise figure measurements.
- 3986-H02, 711XX series high-performance co-axial adapter: used to connect the noise source to the noise figure analyzer.
- 3986-H03, multi-core cable: used for smart noise source driver interface and noise source connection of noise figure analyzer.
- 3986-H04, BNC(m)-BNC(m): used for connection of normal noise source driver interface and standard noise source for noise figure analyzer
- 3986-H05, aluminum alloy transportation case: high-strength, lightweight aluminum alloy transportation case that comes with handle and wheels for ease of transport.
- 3986-H98, English kit: English display, English manual, English interface, and English operating system.

Version:	A.1, December 2017, China Electronics Technology Instruments Co., Ltd
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Foreword

Thank you for choosing the 3986 series noise figure analyzer developed and manufactured by CETI!

We are devoted to providing for you high-quality products and first-class after-sales service with your most concerns and demands in mind. Our consistent aim is providing excellent quality and good service, and this is our sincere commitment for all users.

Manual No.

AV2.735.1011SK

Version

A.1 2017.12

China Electronics Technology
Instruments Co., Ltd

Manual Authorization

This manual may be subject to change without notice. CETI reserves all the rights to the final explanation for all the information and terminologies referred to in this manual.

This manual is the property of CETI. Without CETI's permission, any organizations or individuals shall neither alter nor duplicate/transmit this manual for profits; otherwise, CETI reserves the right to pursue any liabilities therefrom.

Product Warranty

The warranty for this product is 18 months from the day of delivery. Instrument manufacturer will repair or replace the damaged parts according to the actual situation in the warranty period. In order to ship the product back to the manufacturer for repairs, the user must pay shipping and handling fees. After maintenance and repair, the manufacturer will ship the product back to the user along with reimbursement of the shipping and handling fees.

Product Quality Certification

This product is certified to fulfill the standards indicated in this manual from the day of delivery. Calibration measurements have been carried out based on national standards. Related information is available to the user for reference.

Quality/Environmental Management

The quality and environmental management systems have always been implemented during development, manufacturing and test of this product. China Electronics Technology Instruments Co.,

Ltd. has been properly qualified and certified by ISO 9001 and ISO 14001 management system standards.

Safety Precautions

WARNING

WARNING indicates a danger. It reminds the user to be cautious of a certain operation process, operation method or the similar. Failure to follow the rules or operate correctly may result in the personal injury. The conditions indicated by WARNING should be fully understood and met before the next operation.

Attention

CAUTION indicates an important information rather than danger. It reminds the user to be cautious of a certain operation process, operation method or the similar. Failure to follow the rules or operate correctly may cause the damage to the instrument or loss of important data. The conditions indicated by CAUTION should be fully understood and met before the next operation.

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1 About This Manual

This chapter introduces the functions, compositions, and main content in the Quick Start Guide of 3986 series noise figure analyzer as well as other related documents provided to the user.

- [About this manual.....1](#)
- [Related Documents.....1](#)

1.1 About This Manual

This manual introduces the basic functions and operation methods of 3986 Series Noise Figure Analyzer. It describes the preparations before power-on, system setup, features of the front and rear panels, basic operation methods, operation examples, and simple troubleshooting methods of the instrument so as to help you to know and master its operating methods and key use points as soon as possible. To facilitate your familiarity with the instrument, please read this manual carefully before operating the instrument, and then follow the instructions of manual.

The chapters included in Quick Start Guide are as follows:

- **Preparation for Use**

This chapter introduces the pre-operation inspection, operating system configuration, initialization configuration and instrument appearance description of 3986 Series Noise Figure Analyzer to enable the user to get ready for the correct and safe operation of the instrument.

- **Typical Applications**

Based on the common use and importance of the instrument functions, the operating examples are introduced in details (for example, the applications of basic amplifier measurement, up/down converter measurement, system down converter mode and loss compensation function) so that the user can be familiar with the use of 3986 Series Noise Figure Analyzer as soon as possible.

- **Getting Help**

Basic fault diagnosis, solutions and repair methods are introduced in this Chapter.

1.2 Related Documents

The documents related to the 3986 series noise figure analyzer include:

- Quick Start Guide
- User Manual
- Programming Manual
- Online support

Quick Start Guide

1.2 Related Documents

This guidebook introduces the instrument configuration and the basic operating methods to start up measurement so that the user can quickly understand the characteristics of the instrument, master its basic setup and operating methods. The main chapters of this guidebook are as follows:

- About This Manual
- Preparation for Use
- Typical Applications
- Getting Help

User Manual

This manual introduces the basic function and operational procedures of the 3986 series noise figure analyzer. It describes the safety precautions, how to get started, operation guide, button categories and menu items, remote control, troubleshooting and fault repair, technical standards and testing protocols, etc. to help you quickly familiarize with and understand the operation and main features of the apparatus.

Main chapters included in this manual are as follows:

- About This Manual
- Overview
- Start Guide
- Operation Guide
- Button categories and menu items
- Remote Control
- Fault Diagnosis and Repair
- Specifications and Test Methods
- Appendixes

Programming Manual

This manual describes the basics of remote control programming, basics of SCPI, SCPIs, examples of programming, and I/O driver library. The purpose of this manual is to guide the user how to quickly and comprehensively master the program control commands and program control methods of the instrument.

Its main chapters are as follows:

- Remote Control
- SCPI
- Programming Examples
- Error Description
- Appendixes

Online support

Online help is integrated with the product in order to provide quick navigation and enable convenient access by local and remote users. The contents are the same as those in the user manual.

2 Preparation before Use

- Preparations before operation.....3
- Configuration of operating system.....14
- Instrument Appearance.....22

2.1 Preparation before Operation

This chapter introduces the attention that should be paid before carrying out the initial setup of 3986 Series Noise Figure Analyzer.

- Unpacking.....4
- Instrument Placement and Installation.....5
- Powering On/Off.....5
- Correct Use of Connectors.....9
- User Inspection.....11
- Online Help.....13



Prevent personal injury and damage to the instrument.

To avoid the electric shock, fire and personal injury:

- 1) Please do not disassemble the casing of the instrument;
 - 2) Do not attempt to dismantle or modify any part not described in this manual. In case that the user disassemble the analyzer without approval and cause the electromagnetic shielding performance degradation and component damages that affect the reliability within the warranty period, we will not provide free repairs;
 - 3) Please read related content in [“2.2 Guidelines for Safe Use”](#) and the safety cautions for operations below carefully and pay attention to related requirements for specific operating environment in technical specifications.
-

Attention

Electrostatic protection:

Pay attention to the anti-static countermeasures in the workplace to avoid damage to the instrument. For the details, please read carefully the relevant content in Section [“2.2 Safety Guide”](#) of the User Manual.

Attention

During instrument operation, please pay attention to the following aspects:

An improper operating position or measurement setting can damage the instrument or appliances connected to it. Before powering on the instrument, please pay attention to the followings:

- 1) A minimum distance of 15cm shall be kept between the analyzer and walls and all fan vents shall be kept unobstructed to ensure the fan blades will not be blocked and the heat emission holes not be obstructed;
 - 2) Keep the instrument dry;
 - 3) Place the instrument horizontally and reasonably;
 - 4) Ensure that the surrounding temperature is in accordance with the requirements in the technical specifications;
 - 5) The power of input signal shall not exceed the rating.
-

NOTE

Effect of electromagnetic interference (EMI):

The electromagnetic interference can affect the measurement results; therefore, it is necessary to:

- 1) Select appropriate shielded cables, for example, double-shielded radio frequency/network connection cables.
 - 2) Always use a protective sleeve to cover a cable connection port not used temporarily.
 - 3) Refer to the EMC class identified in the technical specifications.
-

2.1.1 Unpacking

2.1.1.1 Visual inspection

Step 1. Check if the packaging box and shockproof package are broken; if so, keep the outer package and continue to check in accordance with the following steps;

Step 2. Unpack and check if the main unit and accessories are broken;

Step 3. Check the following items against Table 2.1 carefully;

Step 4. If the outer packing box, instrument or any attached item is damaged or incorrect, it is forbidden to power on! Please contact our service hotline provided in this manual and we will repair or replace them quickly as appropriate.

2.1.1.2 Model configuration

Table 2.1 Packing List of 3986 Series Noise Figure Analyzer

Item	Quantity	Function
Main unit		
3986	1	—
Standard parts		
3-core power cord	1	—
USB mouse	1	—
User Manual	1	—
Programming Manual	1	—
Packing list	1	—
Noise source option		
16603	1	—
16604	1	—

2.1.2 Setup and installation of the instrument

To ensure the normal functions of 3986 Series Noise Figure Analyzer, you should pay attention to the following aspects:

- 1) The operating place should meet the requirements for the operating environment, heat dissipation and electrostatic protection measures. For the details, refer to Section [“3.1.1.2 Environmental Requirements”](#) of the User Manual;
- 2) The placement and installation should meet the operating requirements of a desktop instrument: The instrument should be placed horizontally on a table with an anti-static mat.

Attention

Handling: As the instrument and its packing carton are heavy, they should be moved by two persons at the same time and be handled with care.

2.1.3 Powering On/Off

2.1.3.1 Notes before Powering On

It is necessary to check the following items before powering on the instrument:

1) Confirmation of power supply parameters

3986 Series Noise Figure Analyzer is equipped with a built-in 220VAC power module (using 220VAC power supply) or 110V/220V adaptive AC power module (optional, using 110VAC or 220VAC power supply; the internal AC power module is adaptive to external AC power supply voltage for automatic switching of working modes). Therefore, please check the power supply requirements indicated on the

2.1 Preparation before Operation

rear panel before using the Noise Figure Analyzer. The requirements for external power supply for the normal operation of the Noise Figure Analyzer are listed in Table 2.2.

Table 2.2 Requirements for Power Supply of Series 3986

Power Supply Parameter	Applicable Scope	
Voltage, frequency	220V±10%, 50~60Hz	110V±10%, 50~60Hz/400Hz
Power consumption (power-on)	<250W	<250W
Power consumption (standby)	<20W	<20W

NOTE

To prevent mutual interference of power supplies:

In order to prevent damages of the instrument hardware due to the mutual interference of several devices via power supplies, especially peak pulses generated by high power equipment, it is recommended to use the 220VAC or 110VAC regulated power supply.

2) Confirmation and connection of power cord

3986 Series Noise Figure Analyzer is equipped with a port in compliance with the national safety standard for 3-core power cords. Before energizing the Noise Figure Analyzer, it must be confirmed that **the protective ground wire in the power cord has been reliably grounded**; either floating or improper grounding can cause the instrument to be destroyed or injuries to the operator. It is prohibited to use a power cord without a protective ground. When connected to a suitable power socket, the power cord realizes grounding of the instrument enclosure. The power cord should be rated at ≥250V for voltage and ≥6A for current.

▲ WARNING

Grounding

Poor or incorrect grounding may cause instrument damage and even personal injury. Before energizing the Noise Figure Analyzer, it must be ensured that the power supply is properly grounded.

Please use the power socket with a protective ground. Do not replace the protective ground wire with an external cable, power cord or autotransformer without grounding protection. If an autotransformer must be used, the common port must be connected to the protective ground wire of the power port.

When connecting the instrument to the power cord:

Step 1. Check if the power cord is damaged;

2.1 Preparation before Operation

Step 2. Use the power cord to connect the rear panel power plug and the properly-grounded 3-core power socket.

2.1.3.2 First Powering On

The methods and precautions for instrument power-on/power-off are as follows:

1) Connection of power supply

Please confirm the power supply parameters and the power cord before powering on for the first time. For the details, refer to Section “[2.1.3.1 Precautions Before Powering On](#)” of this Quick Start Guide.

Step 1. When connecting the power supply, connect one end of the power cord supplied with the Noise Figure Analyzer in the packaging box or a 2.1-core power cord as required to the power port on the rear panel of the analyzer, as shown in Fig. 2.1; the required voltage parameter is indicated beside the port to remind users to use specified voltage; The other end of the power cord should be connected to the required AC power;



110V/220V Adaptive AC Power Module

220V AC Power Module

Fig. 2.1 Power Port on Rear Panel of Series 3986

Step 2. Turn on the power switch of the rear panel, as shown in Fig. 2.2, and check if the standby indicator above the power switch of front panel lights up in yellow;

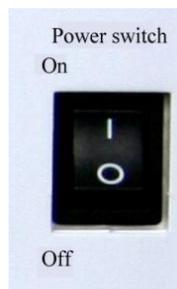


Fig. 2.2 Power Switch on Rear Panel of Series 3986

Step 3. Turn on the power button on the front panel: Do not connect any equipment to the noise figure analyzer before power-on. If everything is OK, power on the instrument, and the indicator lamp on the power button on the front panel will turn green as shown in Fig.2.3.

2.1 Preparation before Operation



Fig. 2.3 Power Switch on Front Panel of Series 3986

2) Power on/off

a) Power-on

- Step 1.** Turn on the power switch in the lower left corner of the front panel, and the power LED above the power switch will change from yellow to green;
- Step 2.** The noise figure analyzer will display stepwise the information about the instrument's startup process in the user interface on its front panel: First display transiently the name and logo of the manufacturer, and then enter the operating system menu. There are two options in the menu. In case of normal use, the user does not need to operate the menu. After the timer reaches "0", Windows 7 will start automatically;
- Step 3.** After Windows 7 starts up successfully, the system will automatically run the initialization program of the noise figure analyzer, show the master operating interface of the noise figure analyzer, and then **the instrument will be in an operable state.**

Attention

System startup:

The control platform of a Windows 7 computer will be used for this instrument. During BIOS self-test and Windows loading, the user does not need to intervene. Don't cut off power halfway or modify the setup options in BIOS.

NOTE

10MHz time base and warm-up

During the cold start (started from full shut-down status), 3986 Series Noise Figure Analyzer shall be warmed up for a period of time to enable the analyzer to reach the operating temperature at 10MHz time base. If the analyzer starts from standby mode, it does not require the time base warm-up. When the specifications are tested, the instrument should warm up for 0.5h (please refer to the relevant instructions for specifications in the specifications for details).

b) Power-off

- Step 1.** Turn off the power switch on the bottom left of front panel. Then the analyzer goes into the shut-down process (software and hardware may need some time to process before power-off)

2.1 Preparation before Operation

and after several seconds, the analyzer powers off when the indicator above the power switch turns from green to yellow;

Step 2. Turn the power switch on the rear panel to OFF position or disconnect the power supply of the analyzer.

Attention

Analyzer power-off:

During normal operation, the analyzer shall only be powered off by operating the power switch of the front panel. Do not operate the power switch of the rear panel or disconnect the power supply directly, or otherwise the analyzer cannot go into the power-off status, which may damage the analyzer or cause the current status/measurement data being lost. Please shut down the analyzer properly.

3) Disconnection of power supply

In abnormal conditions, the analyzer shall be power off to avoid causing personal injuries. At this time, just disconnect the power cord (from the AC power outlet or rear panel power outlet of the instrument). Therefore, a sufficient operating space should be reserved during instrument operation so that the power supply can be disconnected directly when necessary.

2.1.4 Correct Use of Connectors

Connectors are often used in various tests by analyzer and when connecting them, the followings shall be noted:

2.1.4.1 Check of connectors

It is necessary to wear an anti-static wrist strap when checking the connectors. It is recommended to use a magnifier to check:

- 1) the electroplated surface for wear and deep scratches;
- 2) the thread for deformation;
- 3) the thread and joint surface for metallic particles;
- 4) the inner conductor for bending and breakage;
- 5) Whether the threaded sleeve of the connector is rotated improperly.



2.1 Preparation before Operation

Check the connectors to prevent damaging the analyzer ports:

Any damaged connector may damage the good connector connected to it even for the first time of measuring connection, and to protect the ports of the analyzer, the connector to be used shall be checked before connection.

2.1.4.2 Connection

The connectors should be checked and cleaned before measurement and connection to ensure that they are clean and undamaged. It is necessary to wear an anti-static wrist strap during connection. The correct connection methods and procedures are as follows:

Step 1. As shown in Figure 2.4, align the axes of the two interconnecting devices to ensure that the pins of the male connector have slipped concentrically into the socket of the female connector;



Fig. 2.4 Diagram - Connecting Connector

Step 2. As shown in Figure 2.5, move the two connectors straight to each other so that they can be connected smoothly, rotate the threaded sleeves of the connectors (Note: Don't rotate the connector itself) until they are tightened. There should be no relative rotation between the connectors during the connection;

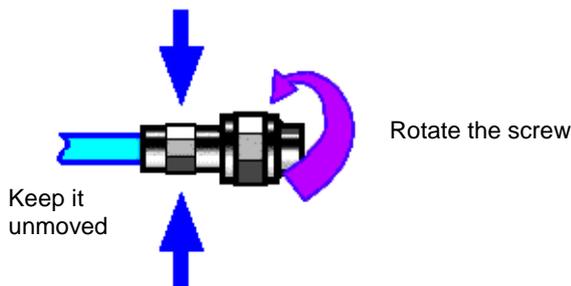


Fig. 2.5 Diagram - Rotating Connector

Step 3. As shown in Figure 2.6, use a torque wrench to complete the final connection. It should be noted that the torque wrench should not exceed the starting kick point. An auxiliary wrench can be used to prevent the connectors from rotation.

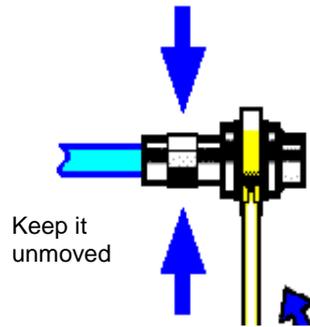


Fig. 2.6 Diagram - Use of Wrench

2.1.4.3 Disconnection

- Step 1.** Support the connectors to prevent any of the connectors from being twisted, shaken or bent;
- Step 2.** Use one open end wrench to prevent the main body of the connectors from rotating;
- Step 3.** Use another wrench to loosen the threaded sleeve;
- Step 4.** Loosen the screw by hand until the connection is completely broken;
- Step 5.** Separate the connectors by pulling them apart in parallel.

2.1.4.4 Use of torque wrench

The torque wrench should be used as indicated in Figure 2.7. Please pay attention to the following points when using the torque wrench:

- 1) Confirm that the torque of the torque wrench is set correctly before use;
- 2) Ensure that the angle between the torque wrench and the other wrench (used to support the connector or cable) is less than 90° before applying a force;
- 3) Hold the end of torque wrench's handle and apply force perpendicular to the handle until reach the break point of torque wrench.

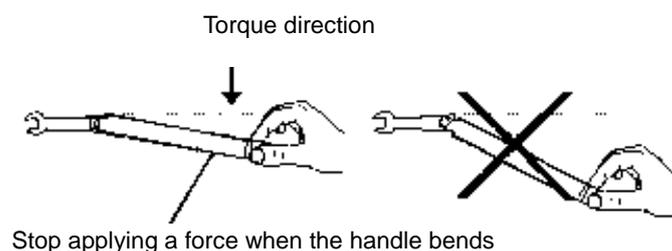


Fig. 2.7 Use of Torque Wrench

2.1.5 User checks

3986 Series Noise Figure Analyzer shall be checked, after being powered on for the first time, whether it is working properly for subsequent measurements.

2 Preparation before Use

2.1 Preparation before Operation

2.1.5.1 Function Verification

After preheating the 3986 Series Noise Figure Analyzer, connect the noise figure analyzer and the noise source as shown in Figure 2.8.

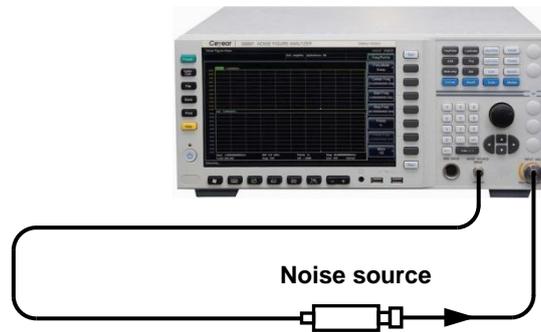


Figure 2.8 Connections of the Normal Noise Source and the Noise Figure Analyzer

Set the instrument as follows:

- Step 1.** Set the starting frequency of the instrument as 10MHz and its ending frequency as 4GHz, and then observe whether the noise figure test curve shown on the instrument is normal or not and whether the measured values of the noise figure meet the requirements of the noise figure indexes of the instrument;
- Step 2.** Set the starting frequency of the instrument as 4GHz and the corresponding ending frequency as 18/26.5/40/50GHz according to its type, and then observe whether the noise figure test curve shown on the instrument is normal or not and whether the measured values of the noise figure meet the requirements of the noise figure indexes of the instrument;
- Step 3.** Press the **【Calibrate】** key to enter the calibration menu, and then press the [Calibrate] key twice to calibrate the instrument. After the calibration, the displayed value of the noise figure and that of gain are close to 0dB.

2.1.5.2 Selftest

Self-test is not necessary every time the instrument is turned on. Self-test is only needed to be done when the analyzer works abnormally.

- Step 1.** Press **【System/Local】** key to enter the system menu;
- Step 2.** Select the [Self-test] from the soft menu to access the self-test interface;
- Step 3.** Select the items to be tested and click [Start] soft menu to start the test, and the test results are shown in the column Result, as shown in Fig. 2.9. Check the test results: all passed indicates the analyzer works normally; any failed item indicates the analyzer work abnormally in the corresponding aspect, please contact our service hotline provided in this manual and we will repair or replace them quickly as appropriate. After the above two steps are successfully completed, the analyzer is ready for operate.

2.1 Preparation before Operation

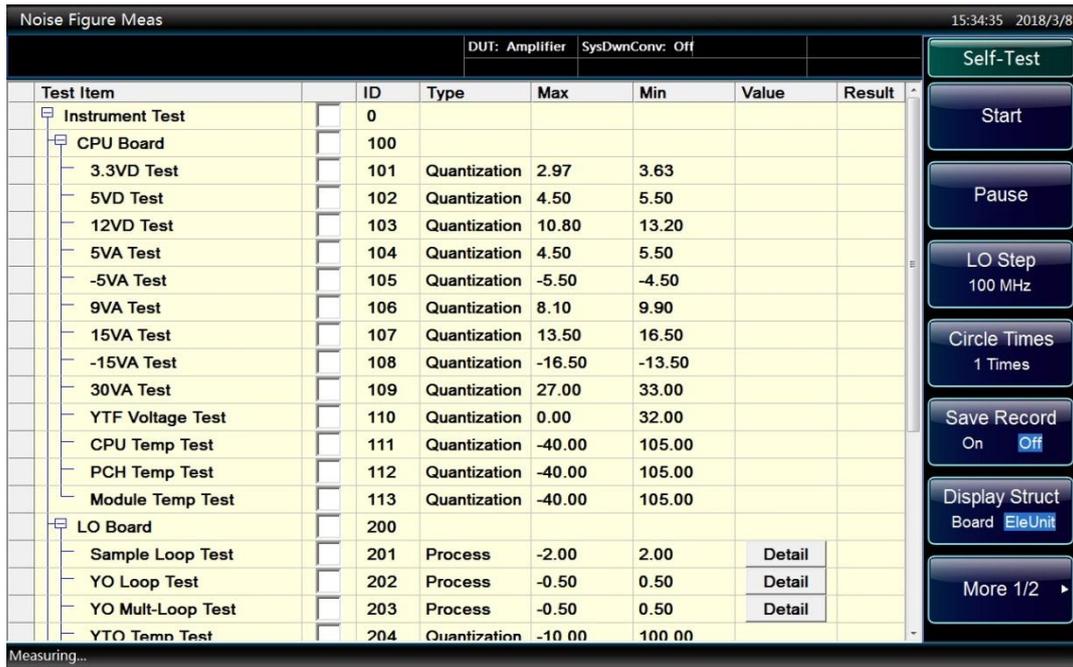


Fig. 2.9 Self Test Screen of Series 3986

2.1.6 Online Help

The 3986 Series Noise Figure Analyzer has the function of online help. Press the yellow key of **【Help】** key, and you can pull up the on-line help files shown in Figure 2.10.

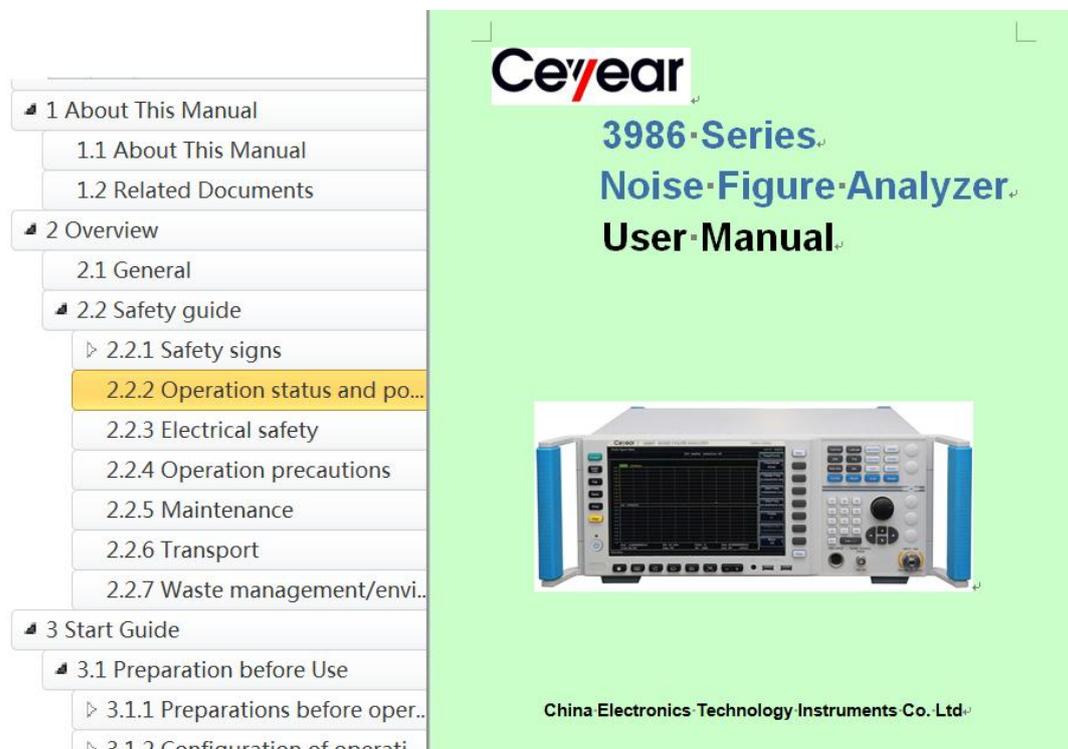


Figure 2.10 Online Help Interface of 3986 Series

NOTE

Hard keys on the front panel and soft keys of the menu are described in the following forms:

- 1) Hard key: 【XXX】 , XXX denotes the name of the hard key;
- 2) Soft menu key: [XXX], XXX denotes the name of the soft key.

If a soft key entry corresponds to several statuses, the selected entry will have a blue background to indicate its status is active. e.g: [Sweep Mode Cont **Single**] indicates the single sweeping is active.

2.2 Operating System Configuration

This section describes the OS of 3986 Series Noise Figure Analyzer and its configuration and maintenance. To ensure the normal operation of software functions, the following instructions for the analyzer’s OS below shall be referenced.

- Instrument Software Specification.....14
- Usage of Windows 7.....14
- Configuration of Windows 7.....15
- System Security and Maintenance of Windows 7.....20
- System Backup and Recovery.....21

2.2.1 Instrument Software Specification

The operating system of the host software of the 3986 Series Noise Figure Analyzer is Windows 7, which has been installed and configured according to the characteristic requirements of the noise figure analyzer.

2.2.2 Usage of Windows 7

The administrator account has the permissions to:

- 1) install third-party software;
- 2) configure network and printer;
- 3) read and write any files on the hard disk;
- 4) add and delete user accounts and passwords;
- 5) reconfigure Windows settings;
- 6) run other applications.

Attention**Third-party software may affect the analyzer's performance:**

3986 Series Noise Figure Analyzer is equipped with open Windows environment, and installing other third-party software may affect the analyzer's performance. Only software tested by the manufacturer and compatible with the main unit software can be run.

2.2.3 Configuration of Windows 7

Before delivery, the operating system of 3986 Series Noise Figure Analyzer has been optimized to the best configuration, and any changes in the OS settings may cause a decrease in the performance of the analyzer. Generally, no changes need to be made for Windows OS settings.

Attention**Change of system settings may cause problems:**

In case that the any problems in use of the analyzer or system crash due to changes of system settings, users can use the system recovery tool of the analyzer to recover the OS and applications, or contact our service hotline provided in this manual and we will solve the problems as quickly as possible.

2.2.3.1 Configuration of USB Devices

3986 Series Noise Figure Analyzer is provided with USB ports on front and rear panels for connecting USB devices directly. If there are no enough USB ports, USB hubs may be used to meet the demands.

Following USB devices can be connected to the analyzer:

- 1) Hot-plug USB memory for updating data;
- 2) CD-ROM drive, easy for firmware program installation;
- 3) Keyboard and mouse for editing data and operating the analyzer;
- 4) Printer for outputting measurement results.

The Windows 7 operating system supports plug-and-play devices, so it is convenient to install USB devices, and when a device is connected to USB port, Windows 7 will automatically search for matching device drivers. If no available driver is found, the system will prompt to find the driver directory to complete the installation.

If an USB device is removed from USB port, Windows 7 system will automatically detect a change in hardware configuration, and the plug of USB device will not affect the analyzer's working state; the method for connecting USB devices is described below:

2.2 Operating System Configuration

1) Connecting memory or CD-ROM drive

If the memory or CD-ROM drive is installed successfully, Windows 7 system will prompt “The device has been installed successfully and is ready to use” and automatically display the path name and prompt (e.g. “D:”).

2) Connecting keyboard

Windows 7 system will automatically detect the USB keyboard connected to the analyzer and default the input language as Chinese(ZH)-Simplified-US; the keyboard properties can be configured via [Start]→[Control Panel]→[Language and Region]→[Keyboard and Language] menus and buttons.

3) Connecting mouse

Windows 7 system will automatically detect the mouse connected to the analyzer; the mouse properties can be configured via [Start]→[Control Panel]→[Mouse] menu and buttons.

4) Connecting printer

Use Windows Control Panel to configure printers. Using an external USB mouse and an external USB keyboard makes the printer configuration easier. If you need to install a new printer, you only need to install the printer’s driver. The printer manufacturer will provide the printer installer. The driver program can be installed via an external USB CD drive.

2.2.3.2 GPIB Configuration

The user may need to modify the GPIB address when building a system with a noise figure analyzer. The GPIB address of the machine is 8 by default. The method to change the GPIB address is as follows: Press【System/Local】→[Interface Config]→[GPIB Address] and go to the screen shown in Fig. 3.10; you can change the address in “GPIB Addr” box with numeric keys on the front panel.

2.2 Operating System Configuration

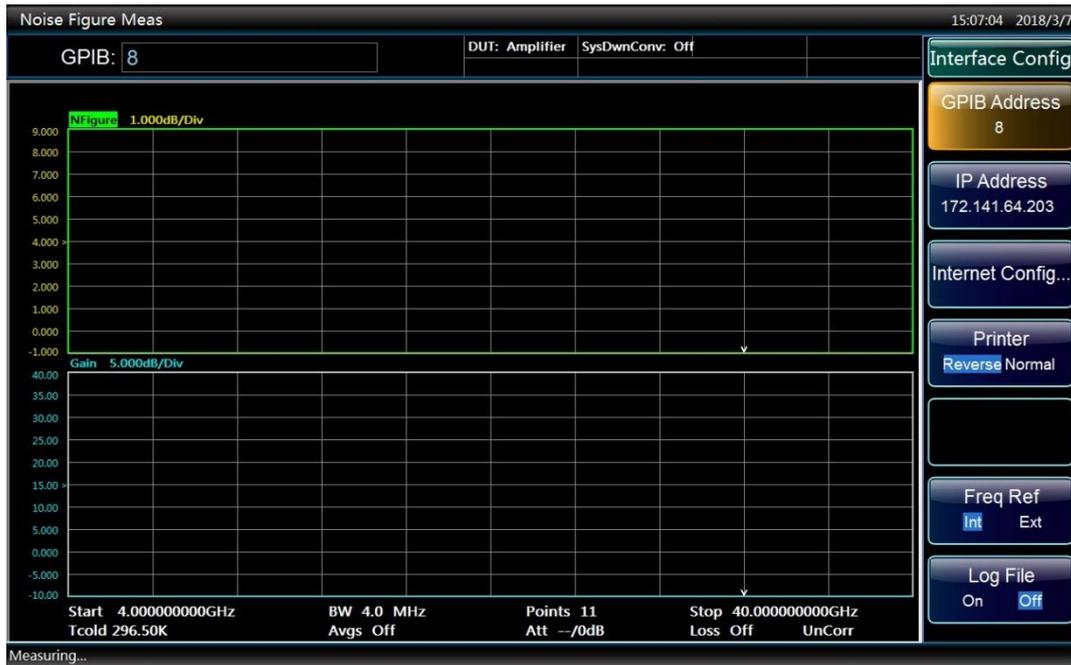


Fig. 2.11 Change GPIB Address

2.2.3.3 Network Configuration

1) Changing host name

The host name (computer name) of the 3986 Series Noise Figure Analyzer has been preset as "3986-PC" before leaving the factory. In order to avoid network renaming in case of connecting several 3986 series analyzers, the user can change the host name by itself. The steps for changing the host name are as follows (refer to the Help file of Microsoft Windows 7):

- Step 1.** Click the [Start] menu, select [Computer], and then right click the mouse for [Properties] → [Change Settings] → [Change] as shown in Figure 2.12;
- Step 2.** Enter the new host name in the "Computer Name" box, click [OK] and then restart the instrument.

2 Preparation before Use

2.2 Operating System Configuration

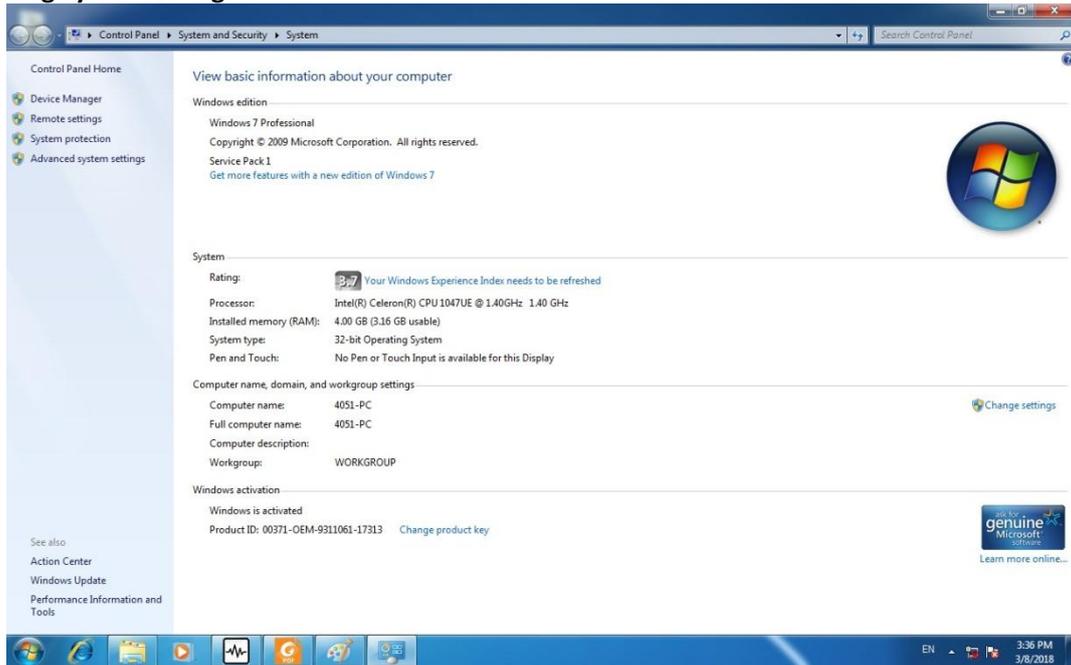


Fig. 2.12 Change Host Name

2) Configuration of IP Address, Subnet Mask and Default Gateway

Click **【System/Local】** → [Interface Configuration] → [Network Configuration] to pop-up the page of Network Connection Setting. Double-click [Local Connection 2] → [Internet Protocol Version 4(TCP/IPv4)] → [Properties] as shown in Figure 2.13 to modify the native IP address, subnet mask and default gateway.

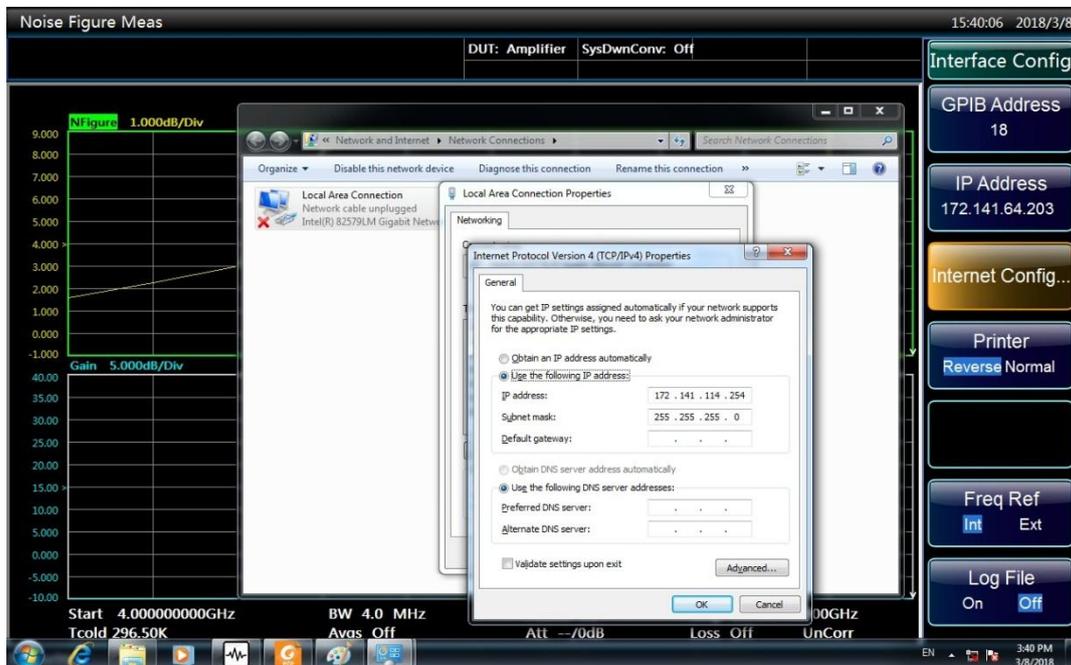


Fig. 2.13 Configuring IP Address, Subnet Mask and Default Gateway

3) Changing system firewall settings

2.2 Operating System Configuration

The firewall is used to prevent unauthorized users from operating the instrument remotely. Therefore, it is recommended by the manufacturer to open the firewall protection. Before delivery, 3986 Series Noise Figure Analyzer has been set to enable firewall protection for port connections related to system and all remote operations.

Only the administrator has the permission to change the firewall settings.

2.2.3.4 BIOS Configuration

Settings have been configured for the analyzer in BIOS.

Attention

The BIOS settings cannot be changed:

As the noise figure analyzer has been set in BIOS, the user should not modify the settings in BIOS, otherwise it will cause abnormal startup or operation of the instrument.

2.2.3.5 External Monitor

An external monitor (or projector) can be connected to the “Display Port” connector on the rear panel of the analyzer as described below:

Step 1. Connect the external monitor to the “Display Port” connector on the rear panel of 3986 Series analyzer;

Step 2. The analyzer has been set to Automatic Dual-View and other display modes can be selected via the GPU Settings on the bottom right of the system task bar;

Step 3. Click [Graph] → [Output to] in GPU Settings to select the device to display:

- 1) “Monitor”: only displaying via external monitor;
- 2) “Built-in display”: only displaying via the analyzer’s LCD screen;
- 3) “Clone display”: displaying via LCD screen and external monitor.

Step 4. If necessary, change the screen resolution to be used.

2.2.3.6 Date/Time Configuration

Date/time is displayed on the status bar at the top right of the 3986 Series Noise Figure Analyzer operation interface and the file storage will synchronize the storage time information; users can set the date/time in Windows 7 system.

2.2 Operating System Configuration

2.2.4 System Security and Maintenance of Windows 7

2.2.4.1 Anti-virus Software

Installing antivirus software may have some negative effects on the performance of the instrument, and it is strongly advised that users do not to use the instrument as a common computer to browse or transfer documents so as not to get infected with virus.

Before using USB mobile storage devices, a computer with the latest antivirus software should be used to process these mobile devices to kill virus may exist and ensure that they do not become a viral carrier. Once the system platform of the noise figure analyzer is infected with viruses, the viruses will have a negative impact on the operation and use of the instrument. It is recommended that the user should carry out the system recovery in such a case. For the details of system recovery operation, refer to the relevant content in Section [“2.2.4.2 System Maintenance”](#).

2.2.4.2 System Maintenance

1) Windows 7 Backup

It is suggested that the user should backup the system regularly, and the instrument data and system can be completely backed up by using the "System Recovery Tool" of this instrument. For the specific operation, refer to "System Backup and Recovery".

Before using the analyzer for other purposes other than normal use such as long-term Internet connection and installing third-party software, it is recommended to backup the analyzer system to avoid accidental inflection of virus and other operations harmful to the system.

The Windows 7 operating system has the same data backup function that can backup all data on the analyzer and create a system disk that can be used to restore Windows in case of serious failure. For more information, refer to the Help and Reference functions of Windows 7. Additionally, third party backup software can be used, but there is a need to ensure that this software does not conflict with the analyzer's system software. It is recommended to backup the system data on external devices such as a network hard drive or USB hard drive.

2) Windows 7 system recovery

Windows 7 has the system recovery function that can restore the system to the state of a previous moment. However, the built-in system backup recovery function of Window cannot work successfully every time, so it's not recommended to use this backup program.

2.2.4.3 Hard Disk Partitioning and Use

The hard disk has three partitions: "C:", "D:" and "E:".

2.2 Operating System Configuration

Windows 7 OS and the analyzer's applications are installed in Disk C. Third-party software can also be installed in Disk C. Disk C is the only disk for backup and recovery.

Disk D is mainly used for the key response program KeyMap and storage of user data.

Disk E is mainly used to store data, including software data stored by users and system backup of Disk C. Backup data in Disk E can be copied to external storage media so that even the hard drive needs to be replaced; only the backup data will be recovered to the new hard drive.

2.2.5 System Backup and Recovery

2.2.5.1 Operating System or Data Recovery of the Hard Disk

The analyzer's hard drive recovery system can be used to fix software errors on Disk C (may be caused by loss of system files or data) or recover the original factory data.

Recovery of original factory data will affect the following entries:

- 1) User-defined Windows 7 settings, such as newly added user accounts, need to be reset after system recovery;
- 2) Other third-party software installed by users needs to be re-installed after system recovery.

Using the data recovery function to repair hard drive errors may result in the loss of data or files, so the data generated during measurements should be stored in a Disk E; it is recommended to periodically transfer the data to a computer or other storage media through local network connections.

2.2.5.2 How to Use the Recovery Program of the Instrument

Step 1. Check if the analyzer is shut down;

Step 2. Plug a standard keyboard into the PS/2 interface on the rear panel;

Step 3. Switch on the analyzer and after the display of system information, an OS menu with timer appears:

[Windows 7]

[System Recovery Tool]

When the timer counts down to 0, use the Up/down arrows on the standard keyboard to highlight the [System Recovery Tool] and press Enter after selecting it.

Step 4. Perform the recovery in the recovery program screen as below:

- 1) Select the first option [GHOST, DISKGEN, PQMAGIC, MHDD, DOS], wait and go to the next operation prompt screen;
- 2) Select the third option [GHOST11.2], wait and go to the GHOST11.2 screen, and press Enter when the dialog box with [OK] button;

2 Preparation before Use

2.3 Instrument Appearance

- 3) Select [Local]→[Partition]→[From Image]; in the Open Files dialog box, press Tab to activate “File name” box to input “E:\SystemGhost.GHO”;
- 4) In the Select Source Partition and Select File dialog box pops up, press Tab to switch to [OK] and press Enter; in the Select Destination Device dialog box pops up, press Tab to switch to [OK] and press Enter; in the Select Destination Partition dialog box pops up, select the first partition, press Tab to switch to [OK] and press Enter;
- 5) In the Warning and Confirmation dialog box, select [Yes] and press Enter;
- 6) The the system recovery finishes, reboot as prompted.

Step 5. After the analyzer reboots, the system will be restored to the status of last backup.

2.3 Instrument Appearance

This section introduces the components and their functions of the front panel, the rear panel and the operating interface of the 3986 Series Noise Figure Analyzer.

- [Front Panel.....22](#)
- [Operating Interface.....28](#)
- [Back Panel32](#)

2.3.1 Front panel

This section describes components of the front panel of 3986 Series Noise Figure Analyzer and their functions, as shown in Fig. 2.14.

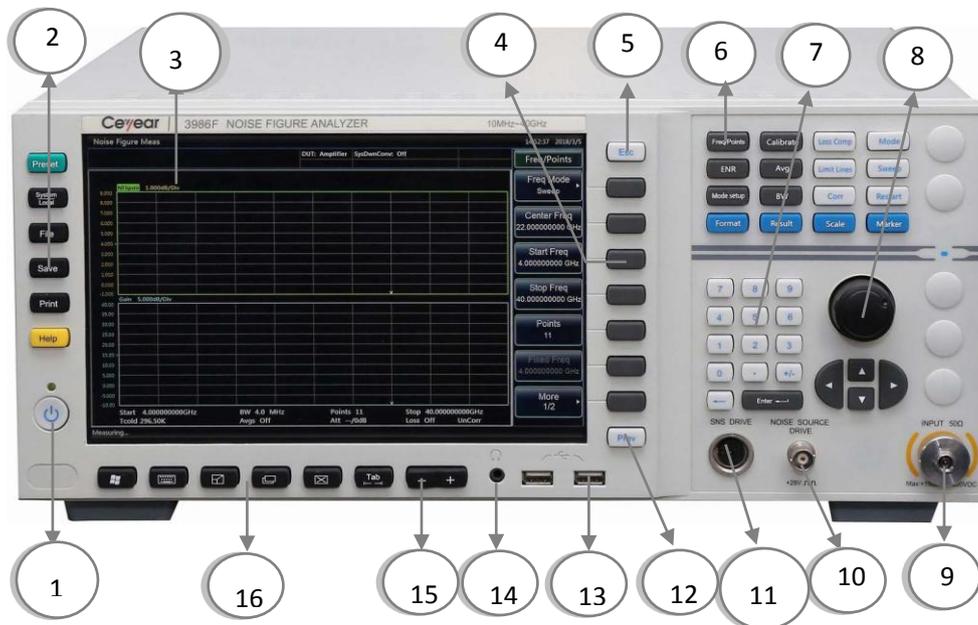


Figure 2.14 The Front Panel of Series 3986

- | | | |
|-----------------------------|----------------------------------|--------------------|
| 1. Power button | 7. Numeric key area | 13. USB port |
| 2. System function keys | 8. Knob and arrow keys | 14. Headphone jack |
| 3. Display screen | 9. Input ports | 15. Volume key |
| 4. Soft keys | 10. Reference Noise Source Drive | 16. Window keys |
| 5. Cancel key | 11. Smart Noise Source Drive | |
| 6. Measurement setting keys | 12. Back key | |

2.3 Instrument Appearance

2.3.1.1 Power button

The power button locates at the bottom left of front panel and is used to start and shut down the analyzer.

2.3.1.2 System function keys

The keys within the system function key area are used to set the functions of the system level as shown in Table 2.3.

Table 2.3 Instruction of System Function Keys

Key Name	Function description:
Preset	Restore the analyzer to the default status.
System/Local	Provide functions related to system settings such as: error list, reset, calibration, self-test, configuration information.
File	Provide functions for storage and calling of files.
Save	To save the screen files.
Print	To customize print output, select and configure printers.
Help	To show online help.

2.3.1.3 Display screen

All measurement results are displayed on the screen of front panel. Additionally, the screen also displays status and setting information and enables you to switch between different measurement tasks.

2.3.1.4 Soft keys

There are seven dark gray keys not identified, called “soft key”. The corresponding commands of these soft keys are dynamic, and the displayed functions depend on the current selected mode and measurement and are directly related to the recently used keys. Press a soft key and its corresponding function is highlighted. The soft key menu corresponding to **【Frequency/Points】** key is shown in Fig. 2.15.

2.3 Instrument Appearance



Fig. 2.15 Soft Key Menu

1) Select soft key

- 1) Press the corresponding soft key on the right directly;
- 2) Use the mouse pointer to click the key on the screen.

2) Navigate in soft key menu

- 1) [Menu1/2] indicates that the menu contains a few softkeys that cannot be displayed at a time. Press the menu, the next group of soft keys appears;
- 2) If the softkey tab contains a symbol of “▶”, it means there is a submenu with more softkeys. Press the soft key, the sub-menu appears;
- 3) The key **【Prev】** used to go back to the parent menu.

3) Soft key operations

By pressing the corresponding softkey, you can carry out one of the following tasks:

- 1) open a dialog box to input data;
- 2) open or close a function;
- 3) open a sub-menu (only for soft key with the symbol “▶”).

4) Soft key status identified with colors

The soft key selected will be highlighted. If a function of the analyzer cannot be used temporarily due to a specific setting, the related soft key will be disabled and the text will be grayed.

2.3 Instrument Appearance**2.3.1.5 【Esc】 key**

This key is used to exit from any functional operation without changing the current parameters, including: canceling the active function, quitting the numeric operation and exiting from the file dialog box.

2.3.1.6 Measurement setting keys

The measurement setting keys provides most common measurement settings and functions, as shown in Table 2.4.

Table 2.4 Measurement Setting Keys

Key Name	Functional Description
Freq/Points	Press this key to go to setting menus such as Freq Mode, Center Freq, Start Freq, Stop Freq and Points.
Calibrate	Press this key to go to the Calibrate menu. In the Calibrate menu, press the [Calibrate] soft key twice to perform the calibration program. The calibration function is used for the noise figure measurement with second-order correction, which is to deduct the analyzer's noise to get the noise figure and gain of device under test (DUT).
ENR	Press this key to go to the ENR setting and editing menu.
Avg	Press this key to go to the Average setting menu.
Mode Setup	Press this key to go to the Mode Setup menu, including DUT Setup, Ext OL Config, Uncertainty Calculator and Extend Setup.
BW	To set the measuring bandwidth.
Loss Comp	Press this key to go to the Loss Comp menu.
Mode	Used for analyzer's function extension and defaulted as standalone mode.
Limit Lines	Press this key to go to the Limit Line Setup menu; the limit line is used to mark the boundary of trace.
Sweep	Press this key to go to the Sweep setting menu.
Corr	Press this key to open or close the measurement correction. The default status depends on whether a calibration is performed previously; if calibrated, the default value is Correction On; if not, the default value is Correction Off.
Restart	If this key is pressed during measurement, the current measurement will be stopped and a new measurement started.
Format	Press this key to select the display format of measurement data, including graph, table and tester.
Result	Press this key to go to the Trace setting menu. Measurement and display results includes noise figure, gain, Y-factor, Teffective, PHot and PCold.
Scale	Press this key to specify units and display limit for each active measurement result.
Marker	Press this key to go to corresponding marker setting menu.

2.3 Instrument Appearance

2.3.1.7 Numeric keys



To input numeric parameters. Including the following keys:

1) **Number pad**

To input numbers in editing dialog box.

2) **Decimal point**

To insert a decimal point “.” at the cursor position.

3) **Symbol key**

To change the symbol of numeric parameters. To input a “-” symbol at the cursor position when inputing numeric parameters.

4) **【←】 key**

To delete the input to the left of cursor.

5) **【Enter↵】 key**

To terminate the input of the dimensionless numbers and set the new values.

2.3.1.8 Knob and arrow keys

1) **Knob Functions:**



- 1) To increase (clockwise) or decrease (counterclockwise) the instrument parameters by specified steps when inputing numbers;
- 2) To move the marker on screen and display trace positions;
- 3) It works similarly with the **【Enter↵】** key when pressed.

2) **【▲】 and 【▼】 keys**

To increase or reduce the instrument parameters in the numeric editing dialog box;

3) 【◀】 and 【▶】 keys

- 1) To move the cursor in alphanumeric value editing dialog boxes;
- 2) To scroll forward and backward the list items in the list;
- 3) To move the selection bar horizontally in tables.

2.3.1.9 INPUT (50Ω)

The measurement&calibration of the analyzer's noise figure and measurement of DUT's noise figure and gain can be performed by connecting the noise source or DUT's output via an adapter or cable to the analyzer's input port.

Attention

Do not overload the input port and the input signal shall not exceed the maximum allowable value. The RF power level input by the analyzer's RF port shall not exceed +15dBm, and the DC voltage input shall not exceed $\pm 20V$. If the above conditions are not met, the front parts of the analyzer's internal receiver will be damaged first.

2.3.1.10 Noise Source Drive

+28V pulse voltage is provided for standard noise sources. When there is +28V output, switch on the noise source; when there is no +28V output, switch off the noise source.

2.3.1.11 SNS Drive

The smart noise source drive & communication port is provided to load ENR data, monitoring ambient temperature and switching on/off smart noise sources.

2.3.1.12 【Prev】 key

Press the 【Prev】 key to go back to parent menu of the soft menu.

2.3.1.13 USB interface

Standard Type A USB2.0 port. To connect USB peripherals such as keyboard, mouse, CD driver and hard drive.

2.3.1.14 Headphone jack

To connect headphone

2.3.1.15 【- +】 key

Volume key to adjust headphone volume.

2.3 Instrument Appearance

2.3.1.16 Window keys

Icons and function description of window keys are listed in Table 2.5.

Table 2.5 Measurement Setting Keys

Icon	Name	Function description
	Start Menu of Windows system key	To display Windows “Start” menu to perform other operations or settings. Once this key is pressed, the measurement control program will lose the focus resulting in the keyboard of front panel unavailable; press this key again to close “Start” menu and enable the measurement control program get the focus again.
	Virtual Keyboard key	To switch between the screen keyboard and the display interface.
	Window key	To switch between the single display window and the double display window.
	Activated Trace Switch key	To switch the active states of a Trace.
	Close key	To close the measuring procedure.
	Tab key	To switch among different areas of Windows dialog box to activate functions.

2.3.2 Operating Interface

This section introduces the types and their related description of the display information within the graphics area of the 3986 Series Noise Figure Analyzer. Figure 2.16 shows the measurement display interface of the noise figure analyzer. Each information area will be marked and described in details below. The description of the operating interface is shown in Table 2.6.

2.3 Instrument Appearance

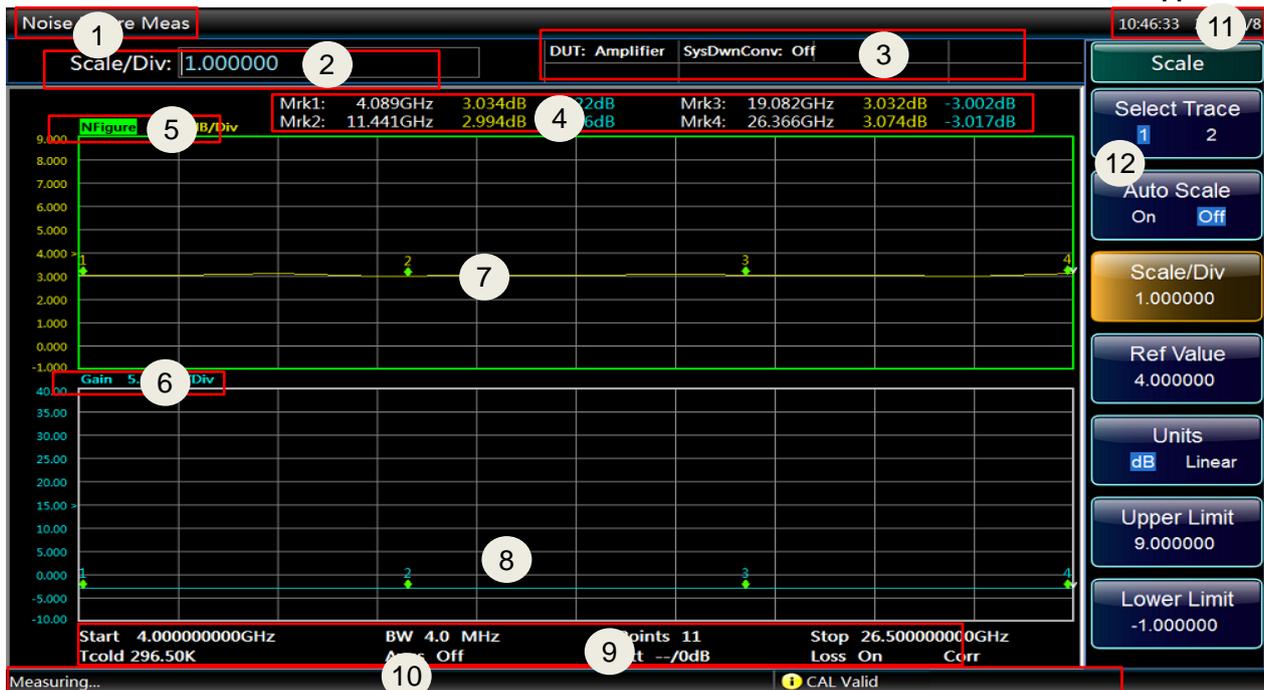


Fig. 2.16 Measurement display of 3986 series NFA

Table 2.6 Display annotation item description

Graphic Number	Function description
1	Title bar, displaying the currently active function
2	Result input area, for entering measurement setup data
3	Mode setup column, showing the current mode information, such as DUT type, sideband, LO control, LO mode, frequency property and so on
4	Marker display column
5	Upper graph measurement result, controlled by [Result - Trc 1] menu key
6	Lower graph measurement result, controlled by [Result - Trc 2] menu key
7	Result - Trc 1 measurement
8	Result - Trc 2 measurement
9	Measurement setup information display bar; this example displays the start frequency, bandwidth, points, stop frequency, cold temperature, average, attenuation, compensation, correction state, etc.
10	Instrument status bar, displaying the measurement progress, instrument status and error information
11	Time and date display
12	Soft key menu, displaying the menu corresponding to the latest operation.

2.3.2.1 Title bar

The title bar displays the currently active function.

2 Preparation before Use

2.3 Instrument Appearance

2.3.2.2 Result input area

Scale/Div: 1.000000

It is used to enter result(s) for the currently active function.

2.3.2.3 Mode setup column

To display the related information about the instrument settings for the user to view, as shown in Table 2.7.

DUT: Amplifier	SysDwnConv: Off
----------------	-----------------

Table 2.7 Description of the Mode Setting Display Area

Information Content	Corresponding setup option	
DUT	Amplifier	SysDwnConv: Off
		SysDwnConv: On
	DownConv	
	UpConvr	
Sideband	LSB	
	USB	
	DSB	
LO mode	Fixed	
	Variable	
Ext LO Ctrl	On	
	Off	
Freq Context	RF-Input or IF-Input	

2.3.2.4 Frequency marker column

This column displays the trace 1 and trace 2 results on X and Y axes when markers are activated under graph mode.

Mrk1:	4.000GHz	1.547dB	--	Mrk3:	4.000GHz	1.547dB	--
Mrk2:	4.000GHz	1.547dB	--	Mrk4:	4.000GHz	1.547dB	--

2.3.2.5 Upper graph measurement result

The upper graph measurement result can be selected through the [Result - Trc 1] menu. The options include noise figure, gain, Y-factor, Teffective, PHot and PCold.

2.3.2.6 Lower graph measurement result

The lower graph measurement result can be selected through the [Result - Trc 2] menu. The options include Noise Figure, Gain, Y-factor, Teffective, PHot and PCold.

2.3 Instrument Appearance

2.3.2.7 Result -Trc 1 Display Area

The trace result related to the upper graph measurement result.

2.3.2.8 Result -Trc 2 Display Area

The trace result related to the lower graph measurement result.

2.3.2.9 Measurement setup information

Start	4.000000000GHz	BW	4.0 MHz	Points	11	Stop	40.000000000GHz
Tcold	296.50K	Avg	Off	Att	--/0dB	Loss	Off
						UnCorr	

The settings of general-purpose hardware are described in Table 2.8.

Table 2.8 Measurement setup information description

Information Content	Meaning
Start	Display the start frequency of sweep measurement.
BW	Measurement bandwidth; this noise figure analyzer has 6 options: 4MHz, 2MHz, 1MHz, 400kHz, 200kHz and 100kHz.
Points	Display the number of measurement frequency points. The number of sweep measurement points ranges from 2 to 401, and the default is 11.
Stop	Display the stop frequency of sweep measurement.
Tcold	Display the ambient temperature during measurement. When being connected to a smart noise source (SNS), the noise figure analyzer can monitor the ambient temperature and update this value.
Avg	The number of averages
Att	Display the value of RF/microwave input attenuation.
Loss	Display the compensation status, On or Off.
UnCorr	Display the measurement correction state, corrected or uncorrected.

2.3.2.10 Instrument status bar

To display the instrument status and errors (if any) in the status bar at the bottom of the chart.

1) Measurement progress

Measuring...

To display the progress of the current operation in the status bar at the bottom left of the chart.

2) Calibration state

 CAL Valid

Display the calibration as valid. If any error or abnormality is detected, error code and information will be displayed.

2 Preparation before Use

2.3 Instrument Appearance

2.3.2.11 Time and date display

20:10:00 2017/8/30

To display the time and date at the top right corner of the display screen.

2.3.2.12 Softkey Menu

Display the menu corresponding to the latest operation.

2.3.3 Rear panel

This section describes components of the rear panel of 3986 Series Noise Figure Analyzer and their functions, as shown in Fig. 2.17.

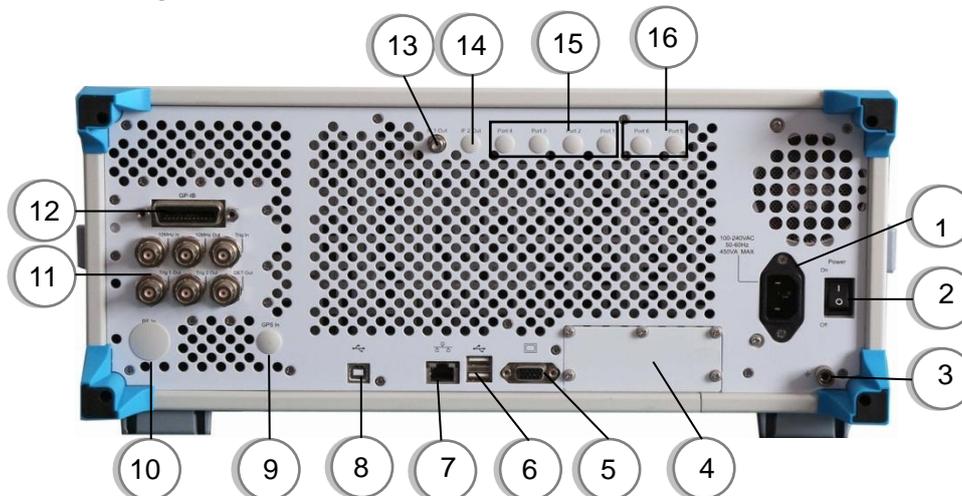


Fig. 3.15 Rear Panel of 3986 Series Noise Figure Analyzer

- | | | |
|--------------------------|---------------------------------|-----------------------|
| 1. Power input port | 7. LAN interface | 13. IF output 1 |
| 2. Power switch | 8. USB slave port | 14. IF output 2 |
| 3. Grounding terminal | 9. Positioning antenna input | 15. Wideband output |
| 4. Option module | 10. Rear panel RF input | 16. Narrowband output |
| 5. External monitor port | 11. Rear panel BNC input/output | |
| 6. USB interface | 12. GPIB interface | |

2.3.3.1 Power input port

Instrument AC power input.

2.3.3.2 Power switch

Master power switch of the analyzer.

2.3.3.3 Grounding terminal

For reliable grounding of the analyzer.

2.3 Instrument Appearance**2.3.3.4 Option module**

Not available for this series.

2.3.3.5 External monitor port

VGA port, to connect external VGA monitor.

2.3.3.6 USB interface

Standard Type A USB2.0 port. To connect USB peripherals such as keyboard, mouse, CD driver and hard drive.

2.3.3.7 LAN interface

RJ45 interface, TCP/IP interface, 10/100/1000M adaptive, which can be used for remote operation.

2.3.3.8 USB slave port

Type B USB2.0 port. USB TMC linked to external computer-based equipment controller to control the analyzer and high-speed data transfer.

2.3.3.9 Positioning antenna input

Not available for this series.

2.3.3.10 Rear panel RF input

Optional port depending on the analyzer's frequency range, used for input connections when building test system.

2.3.3.11 BNC Inputs and Outputs on the Back Panel

BNC ports on the rear panel and their descriptions are shown in Table 2.9 and Fig. 2.18.

Table 2.9 Measurement Setting Keys

Port name	Port description
10MHz In	BNC female, used for 10MHz reference signal input, amplitude greater than 0dBm required.
10MHz Out	BNC female, used for internal 10MHz reference signal output. Used to lock the frequency of other test equipment to the analyzer's frequency reference.
Trig In	BNC female, used for external trigger signal input of the rear panel, input voltage range [-5V, +5V], not available for this series.
Trig 1 Out	BNC female, TTL level, trigger signal output for synchronizing other test equipment. Output signal types configurable via input/output menu, not available for this series.
Trig 2 Out	BNC female, TTL level, trigger signal output for synchronizing other test equipment. Output signal types configurable via input/output menu, not available for this series.
DET Out	BNC female, used for video detection signal output, not available for this series.

2.3 Instrument Appearance

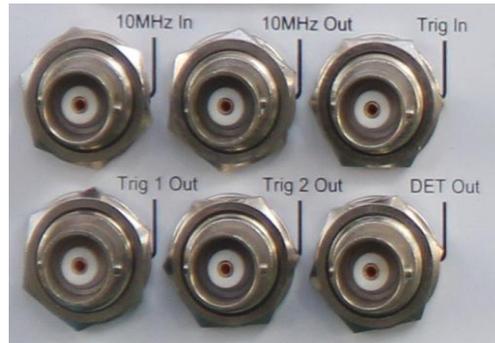


Figure 2.18 BNC Interface Inputs and Outputs on the Back Panel

2.3.3.12 GPIB interface

Standard IEEE488 interface, support SCPI language. To be used for a remotely controlled noise figure analyzer.

2.3.3.13 IF output 1

To output a second IF signal for channel test. This function of the noise figure analyzer is not available now.

2.3.3.14 IF output 2

To output a third IF signal for channel test. This function of the noise figure analyzer is not available now.

2.3.3.15 Wideband output

The noise figure analyzer does not support this interface function. This function of the noise figure analyzer is not available now.

2.3.3.16 Narrowband output

The noise figure analyzer does not support this interface function. This function of the noise figure analyzer is not available now.

3 Typical Applications

● Basic Amplifier Mode.....	35
● Up/Down Conversion Mode.....	40
● System Down Conversion Mode.....	49
● Loss Compensation Function.....	59
● Limit Line Function.....	64

The 3986 series noise figure analyzer can cover a frequency range of 10MHz to 50GHz. It contains a highly sensitive receiver, user-friendly interface, high-definition dual-channel display, an abundance of external connection ports, dual-noise source driver, etc. It is able to measure the noise figure of amplifiers, downconverters and upconverters; supports the measurement of multi-stage converters; and supports extended frequency range measurements. With complete loss compensation function, the loss in the measurement channel can be compensated by means of fixed and/or table form before and/or after the device under test, which would greatly benefit precise measurement of noise figure of automatic test system or microwave chips. The limit lines function provides pass/fail notification to simplify pass/fail assessment. The product can be applied to microwave and millimeter wave amplifiers, mixers, attenuators and other components to measure noise figure and gain, and is suitable for scientific research, production, testing, and technical security evaluation in such fields as radar, communication and navigation.

A mechanical switch is built at the input port of the 3986D/E/F/H series noise figure analyzer to switch the frequency range between 10MHz to 4GHz and 4GHz to 18/26.5/40/50GHz. The mechanical switch has a limited service life. To maximize the reliable life of the switch, please avoid frequencies setting across 4 GHz as much as possible.

3.1 Basic Amplifier Mode

● Calibrate.....	36
● Measure.....	38

The basic amplifier measurement is the most commonly used measurement mode of the noise figure analyzer, which is used for measuring DUTs without frequency conversion, such as amplifiers, attenuators and filters, isolators, and etc. And the frequency range of the selected noise figure analyzer can cover the operating frequency range of the DUT.

This section describes the basic noise figure measurement and various related operations with the attenuator measurement as the example. In the example, the frequency range of the attenuator is 1GHz~4GHz, and its technical specifications are shown in Table 3.1.

3.1 Basic Amplifier Mode

Table 3.1 Technical Specifications of Attenuator

Frequency range	Typical Gain	Typical noise figure
1GHz~4GHz	-3dB	3dB

3.1.1 Calibration

The first step is to calibrate the noise figure analyzer for noise figure measurement with second-order correction.

- Step 1.** Turn on the power switch on the front panel and wait for the startup program of the instrument to be activated. For better measurement accuracy, it is recommended to warm up the noise figure analyzer for more than 30 minutes;
- Step 2.** Press the green **【Preset】** key to restore the noise figure analyzer to the factory default state;
- Step 3.** Input the value of excess noise ratio of the noise source to be used according to the operating instructions in Section [“3.3.5 ENR input”](#) of the User Manual;
- Step 4.** Press the **【Freq/Points】** key to set the measurement frequency parameters:
- 1) Freq Mode - Sweep, which is the default frequency mode for noise figure analyzer.
 - 2) Start Freq - 1GHz.
 - 3) Stop Freq - 4GHz.
 - 4) Points - 11, the default value of the noise figure analyzer is 11.
- Step 5.** Press the **【Avg】** key and the [Average] menu key to set the [Average On Off] mode, press the numeric key to input the average number "2", and press [OK] key to complete the input;
- Step 6.** Press the **【Corr】** key to set RF Min Cal Att and RF Max Cal Att as required. The default RF Min Cal Att is 0dB while the RF Max Cal Att is 20dB. This step can be omitted when the default attenuation is used;

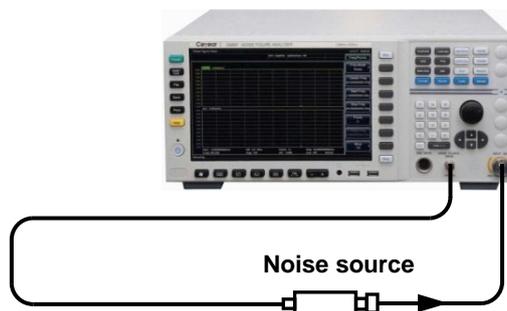


Figure 3.1 Diagram of Calibration Connection with Normal Noise Source

- Step7.** As shown in Figure 3.1, connect the noise source drive input end to the 28V noise source drive port on the noise figure analyzer panel with a BNC cable. (When a smart noise source is used, connect to the smart noise source drive port on the noise figure analyzer panel with a multi-core cable), and connect the noise source output to the input port (50Ω) of the noise figure analyzer;

3.1 Basic Amplifier Mode

Step 8. Press **【Calibrate】** key to enter the Calibrate menu, and press the [Calibrate] menu key twice for calibration;

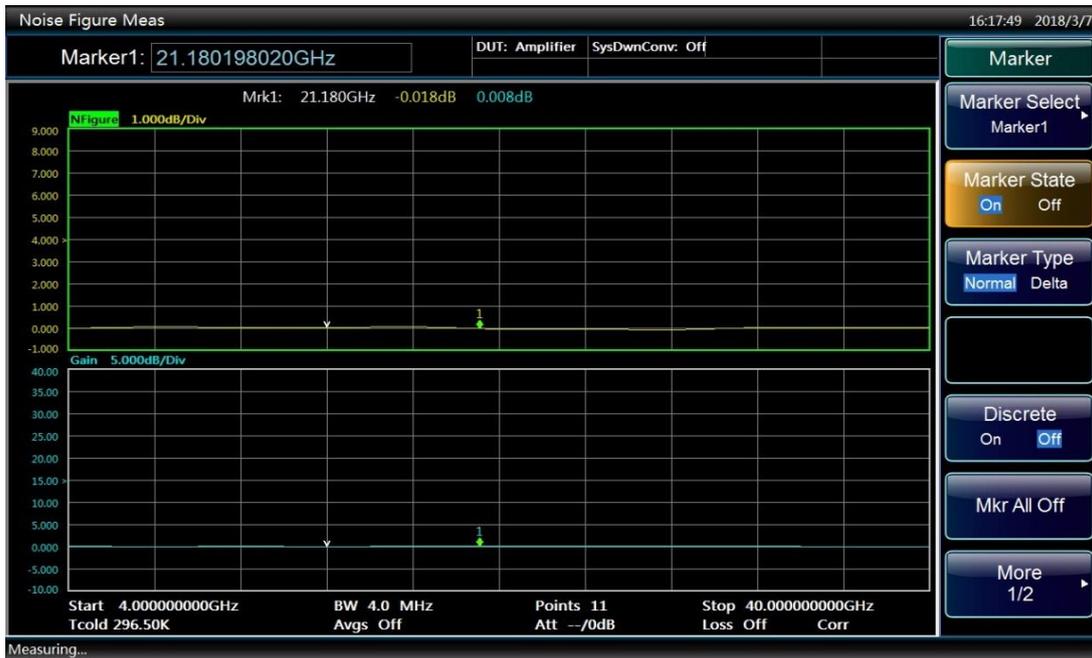


Figure 3.2 Typical Graph Display Result after Calibration

After the calibration is completed, the correction status at the bottom of the display screen will change from "Uncorr" to "Corr" automatically. If the DUT is not connected, the displayed values of noise figure and gain are close to 0dB. The graph display is as shown in Figure 3.2, while table display is as shown in Figure 3.3. Since the excitation is a white noise signal, the calibrated display values of noise figure and gain will jitter up and down around 0dB.



Figure 3.2 Typical Table Display Result after Calibration

3.1 Basic Amplifier Mode

3.1.2 Measure

Measure the noise figure after calibration:

- Step 1.** Disconnect the noise source from Input Port (50Ω) of the noise figure analyzer;
- Step 2.** Connect the output of the device under test to Input Port (50Ω) of the noise figure analyzer;
- Step 3.** Connect the output of the noise source to the input of the device under test as shown in Figure 3.4. After the connection is completed, the measurement result will be displayed on the display screen of the noise figure analyzer. The graph display result is as shown in Figure 3.5.

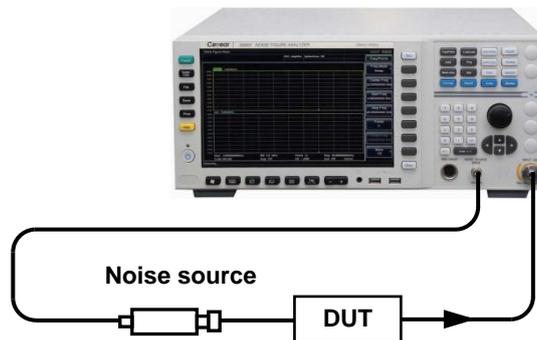


Figure 3.4 Connect DUT for Measurement



Figure 3.5 Graph Display of Measurement Results

- Step 4.** Press the **[Format]** key, **[Display Format]** menu key and the **[Table]** menu key on the front panel to select the table display mode. The displayed result is shown in Figure 3.6.

3.1 Basic Amplifier Mode



Figure 3.6 Table Display of Measurement Results

The results shown in Figure 3.5 and Figure 3.6 indicate that the noise figure of the device under test is 3.0dB and its gain is about -3dB, which meet the technical index requirements described in Table 3.1.

3.2 Up/Downconverter Mode

NOTE

The measurable gain range of the noise figure analyzer is -20dB~+40dB. If the gain of the device under test exceeds the optimum gain range of the noise figure analyzer, add an attenuator after the device under test and use the loss compensation function of the noise figure analyzer to improve the measurement accuracy and range.

⚠ WARNING

Prevent damages to the instrument:

When measuring the active DUTs of the amplifier class, the power supplies of the DUT and the noise figure analyzer must be in common ground connection, otherwise front-end components of the internal receiver of the noise figure analyzer may be damaged.

3.2 Up/Downconverter Mode

- Variable LO and fixed IF40
- Fixed LO and variable IF46

DUT is a downconverter set, such as the downconverter or receiver, and the downconverter measurement mode shall be selected. DUT is a upconverter set, such as the upconverter or transmitter, and the upconverter measurement mode shall be selected.

Downconverter means that the output frequency (IF) is lower than the input frequency (RF).

Upconverter means that the output frequency (IF) is higher than the input frequency (RF).

Attention

For the upconverter and downconverter measurement, the output frequency (IF) of DUT shall be within the frequency range covered by noise figure analyzer. The Up/Down Conversion Measurement Mode includes the single-stage converter and complex multistage conversion receiver links.

3.2.1 Variable LO and Fixed IF

This section takes the downconverter as an example to describe how to perform the upconverter and downconverter noise figure measurement and various related operations. In this example, downconverter works in the fixed IF and variable local oscillator mode. The fixed IF is set as 1.0GHz, and the RF is set as 3.7GHz~4.2GHz. The noise figure is measured with the lower sideband. A 4.7 GHz~5.2GHz local oscillator for sweep is required and a 4.4GHz low-pass filter is used to filter out the upper sideband (image frequency sideband). The relevant frequency information is as shown in Fig.3.7.

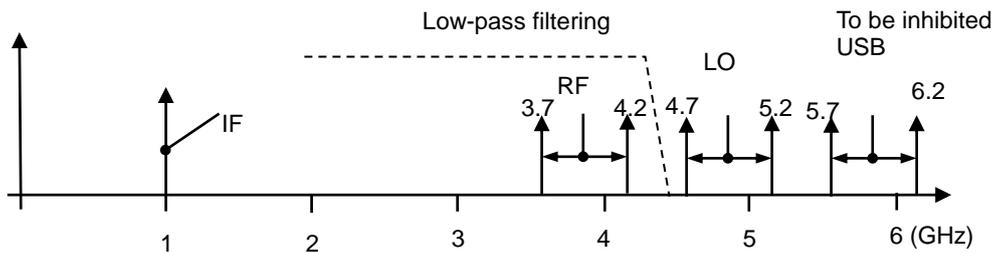


Fig. 3.7 Variable local oscillator, fixed IF and lower sideband

In the given example, the noise figure analyzer performs the lower sideband noise figure measurement under the Variable Local Oscillator Fixed IF Mode and the noise figure analyzer is locked at the fixed IF point.

The corresponding step settings of this example may be modified to perform the measurement in the fixed LO and variable IF mode. In addition, the corresponding settings may also be modified based on this example for the measurement in the upper sideband and double sideband mode. For several other measurement modes, how to modify the example steps and settings is explained and illustrated.

Attention

Influence of local oscillator leakage on the variable frequency DUT measurement:

The power of the local oscillator is usually much higher than the maximum RF input signal used in the mixer operation. Compared with the noise level involved in the noise figure measurement, the power leakage level of the local oscillator from the mixer output is higher. Therefore, when measuring the noise of a device like a frequency converter, the user needs to consider the leakage effect of the local oscillator.

3.2.1.1 Lower Sideband Measurement

Measurement steps:

1) Initial setup for measurement

- Step 1.** Open the 3986 Series Noise Figure Analyzer and the local oscillator source, preheat the measurement system for a period of time as recommended so as to obtain accurate measurement results;
- Step 2.** Use the noise figure analyzer to control the output frequency and power of the local oscillator, if necessary, to lock the noise figure analyzer and the local oscillator source at the same frequency reference (see the following instructions);

3.2 Up/Downconverter Mode

NOTE

To lock the noise figure analyzer 3986 and local oscillator source at the same reference frequency, the 10MHz reference input or output at the rear panel of noise figure analyzer shall be connected to the 10MHz reference output or input of local oscillator source.

- Step 3.** Press the green **【Preset】** key to restore the noise figure analyzer to the factory default state;
- Step 4.** Load the value of excess noise ratio of the noise source;
- Step 5.** Set the local oscillator IP address on the noise figure analyzer 3986;
- Step 6.** Set the local oscillator source IP address (the local oscillator source address shall be same with the local oscillator address which is set on the noise figure analyzer);
- Step 7.** Connect the system (sometimes the corresponding filter shall be connected for the single-sideband measurement).

2) Select the mode and make the appropriate mode setting

- Step 1.** Press the **【Mode Setup】** key to enter the Mode Setup menu;
 - Step 2.** Press [DUT Setup] menu key and [Downconv] menu key to select the downconverter measurement mode. When this measurement mode is selected, the system downconverter setup is disabled, i.e, the system downconverter mode is not available in the downconverter measurement mode;
 - Step 3.** Enable the LO mode setup, and select the "Variable";
 - Step 4.** Activate the sideband setup option and select the "LSB";
 - Step 5.** Enable the external LO control option, and set the external LO control to On or Off. In the variable LO mode, it is recommended to set it to On;
 - Step 6.** Activate the external LO power input box and input the external local oscillator power value with the numeric key and complete the input setting with the unit key;
-

NOTE

Downconverter works in the variable LO and fixed IF mode. When the external LO control option is set to "On", the noise figure analyzer can control the output frequency and power of external LO via the LAN. The LO output frequency simultaneously traces the RF frequency to achieve automatic sweep measurement. If the external LO control option is set to "Off", the user shall manually set the frequency and power value of external LO. The formula for local oscillator frequency are: $F_{LO}=F_{RF}+F_{IF}$ (LSB); $F_{LO}=F_{RF}-F_{IF}$ (USB); and $F_{LO}=F_{RF}$ (DSB).

- Step 7.** Activate the Frequency Mode Setup item and select the frequency mode as "Sweep";

3.2 Up/Downconverter Mode

- Step 8.** Activate the RF start frequency input box, input the measured frequency value 3.7 with the numeric key, and press [GHz] unit key to complete the input. Activate the RF stop frequency input box, input the measured frequency value 4.2 with the numeric key, and press [GHz] unit key to complete the input. Additionally, input the RF start frequency and stop frequency also by pressing the **【Freq/Points】** key to enter the Freq/Points menu;
- Step 9.** Activate the fixed IF frequency input box, input “1” with the numeric key, and press [GHz] unit key to complete the input. The mode setup interface is shown in Figure 3.8.

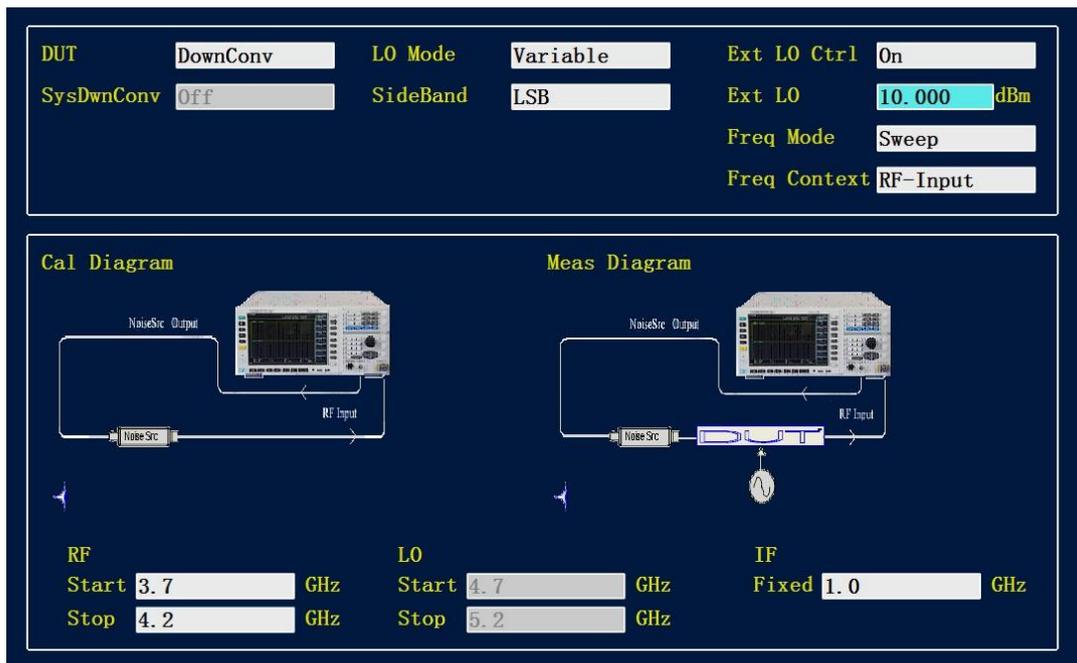


Fig.3.8 Mode Setup interface

3) Set the sweep point number and average value

- Step 1.** Press the **【Freq/Points】** key to enter the Freq/Points setup menu;
- Step 2.** Press [Points] menu key, input 21 with numeric key and press [Enter] menu key to complete the input;
- Step 3.** Press **【Avg】** key, and press [Average] menu key to set [Average ON/OFF] mode (it defaults to be "Off");
- Step 4.** Input average number "4" with numeric key and press [Enter] menu key to complete the input.

4) Calibration

Under this mode, the calibration connection of the system is the same as that for the Basic Amplifier Mode. Connect the output of the noise source directly to the RF Input Port (50Ω) of the 3986 Series Noise Figure Analyzer as shown in Figure 3.9.

3.2 Up/Downconverter Mode

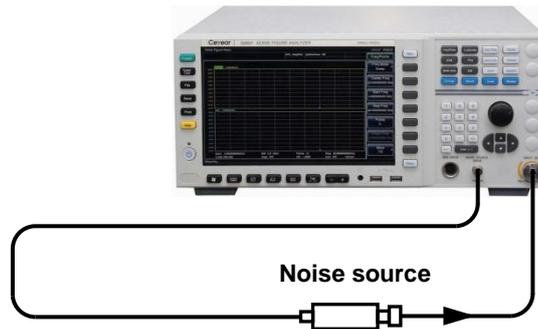


Fig 3.9 Scheme Diagram of Calibration Connection

Step 1. Press **【Calibrate】** key to enter the calibration menu;

Step 2. Press [Calibrate] menu key twice to calibrate. The first time you press the [Calibrate] key, you will be prompted to press it again. After the calibration is completed, the typical results after calibration are displayed in the table format as shown in Fig.3.10;



Fig.3.10 Typical calibrated results at the downconverter measurement mode

Attention

In the upconverter and downconverter measurement mode, if the DUT is not connected after the calibration, the gain and noise figure values are generally not zero. The reason is that the excess noise ratio corresponding to the upconverter and downconverter IF frequency is called by noise figure analyzer during calibration; and after the calibration is completed, the excess noise ratio is switched into the value corresponding to the RF frequency. In addition, if the RF or IF filter is added after calibration, the measurement error introduced by additional filter shall be corrected with the loss compensation function

5) Measurement

For the noise figure and gain measurement for the error correction as shown in Fig.3.11, connect the DUT to the system and measure it. The measurement values of noise figure and gain are as shown in Fig. 3.12.

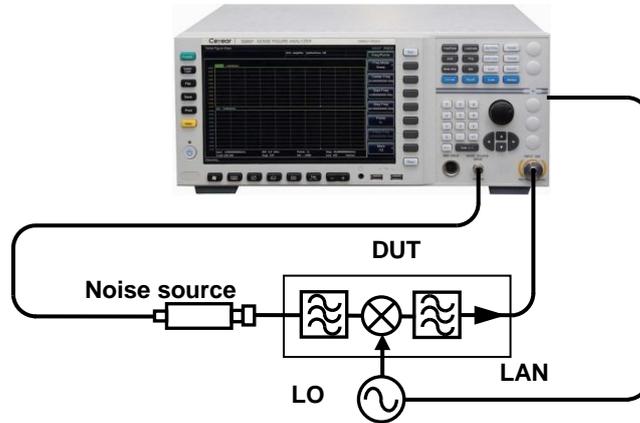


Fig.3.11 Schematic Diagram of Measurement Connection



Fig.3.12 Typical measurement values at the downconverter measurement mode

3.2.1.2 Upper Sideband Measurement

The steps of the upper sideband measurement are basically the same as those of the lower sideband measurement, but a filter is needed to filter out the image frequency component of the lower sideband. During the mode setting, you need to select the sideband as "USB".

3.2 Up/Downconverter Mode

3.2.1.3 Double sideband measurement

The steps of the double sideband measurement are basically the same as those of the lower sideband measurement, but the RF Input Port of the up/down converter does not need an image rejection filter. During the mode setting, you need to select the sideband as “DSB”. In the double sideband measurement mode, it is recommended to set the DUT to the low IF output in order to obtain an approximate accurate noise figure measurement value.

Attention

In the upconverter measurement mode, there are only two sideband settings, i.e. the upper sideband and lower sideband, and the LO frequency calculation formula is: $F_{LO}=F_{RF}+F_{IF}$ (LSB) and $F_{LO}=F_{IF}-F_{RF}$ (USB).

3.2.2 Fixed LO and variable IF

3.2.2.1 Lower Sideband Measurement

Under this measurement mode, the local oscillator of the mixer under test is locked at a frequency point, the noise figure analyzer works within the IF range, and the fixed LO and the down converter convert the RF range to the sweep IF range which can be received by the noise figure analyzer.

Measurement steps:

1) Initial setup for measurement

Step 1. Open the 3986 Series Noise Figure Analyzer and the local oscillator source, preheat the measurement system for a period of time as recommended so as to obtain accurate measurement results. Connect 10MHz reference if necessary;

NOTE

In order to lock the 3986 Series Noise Figure Analyzer and the local oscillator source at the same frequency reference, you need to connect the 10MHz reference output on the rear panel of the noise figure analyzer to the 10MHz reference input of the local oscillator source.

Step 2. Press the green **【Preset】** key to restore the noise figure analyzer to the factory default state;

Step 3. Load the value of excess noise ratio of the noise source;

Step 4. Connect the system (sometimes the corresponding filter shall be connected for the single-sideband measurement).

2) Select the mode and make the appropriate mode setting

Step 1. Press the **【Mode Setup】** key to enter the Mode Setup menu;

3.2 Up/Downconverter Mode

- Step 2.** Press [DUT Setup] menu key and [Downconv] menu key to select the downconverter measurement mode. When this measurement mode is selected, the system downconverter setup is disabled, i.e., the system downconverter mode is not available in the downconverter measurement mode;
- Step 3.** Enable the LO mode setup, and select "Fixed";
- Step 4.** Activate the sideband setup option and select the "LSB";
- Step 5.** Activate the external LO control options and select the external LO control mode as "On" or "Off". In LO fixed mode, the general setting is "Off";
- Step 6.** Activate the external LO power input box and input the external local oscillator power value with the numeric key and complete the input setting with the unit key. If the LO control mode is set to "Off", user shall manually set the output frequency and power of local oscillator source.

Attention

Whether the upconverter and downconverter work under the fixed LO and variable IF mode or not. Generally, it is not necessary to control the output frequency and power of local oscillator source with the noise figure analyzer. However, the local oscillator frequency shall be input in the Mode Setup interface of noise figure analyzer.

- Step 7.** Activate the Frequency Mode Setup item and select the frequency mode as "Sweep";
- Step 8.** Select the measurement frequency type as "IF-input";
- Step 9.** Activate the IF start frequency and stop frequency input box, input the measured frequency value with the numeric key, and complete the input with unit key.

NOTE

Additionally, set the IF start frequency and stop frequency also by pressing the **【Freq/Points】** key to enter the Freq/Points menu.

NOTE

The downconverter works in the fixed LO and variable IF mode. Under the Mode Set boot interface, the measurement frequency type defaults to "IF-input". It is recommended that the user prefer the default setting. If the user sets the type of measurement frequency as "RF-input", the operation corresponds to the Step 9. Activate the RF start frequency and RF stop frequency input box, input the start frequency and stop frequency with numeric key and complete the input with unit key.

3.2 Up/Downconverter Mode

3) Set the sweep point number and average value

- Step 1.** Press the **【Freq/Points】** key to enter the Freq/Points setup menu;
- Step 2.** Press [Points] menu key, input the number of sweep points with numeric key and press [Enter] menu key to complete the input;
- Step 3.** Press **【Avg】** key, and press [Average] menu key to set [Average ON/OFF] as "ON";
- Step 4.** Input average number with numeric key and press [Enter] menu key to complete the input.

4) Calibration

Under this mode, the calibration connection is the same as that for the Basic Amplifier Mode. Connect the output of the noise source directly to the RF Input Port (50Ω) of the 3986 Series Noise Figure Analyzer as shown in Figure 3. 13 to carry out the calibration.

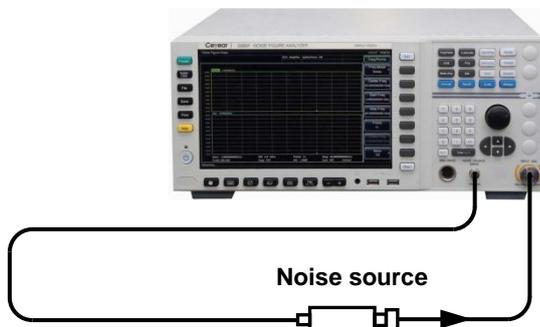


Fig.3.13 Schematic Diagram of Calibration Connection at the Downconverter Measurement Mode

- Step 1.** Press the **【Calibrate】** key to enter the Calibrate menu;
- Step 2.** Press [Calibrate] menu key twice to calibrate. The first time you press the [Calibrate] key, you will be prompted to press it again.

5) Measurement

For the noise figure and gain measurement for the error correction as shown in Fig.3.14, connect the DUT to the system and measure it.

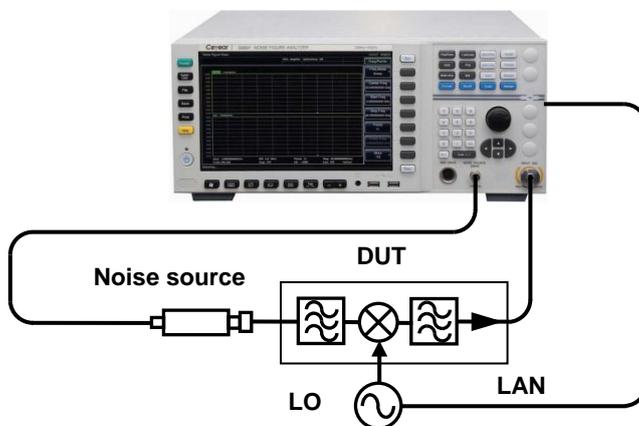


Fig.3.14 Schematic Diagram of Measurement Connection at the Downconverter Measurement Mode

3.2.2.2 Upper Sideband Measurement

The steps for upper sideband measurement are same as those of lower sideband. However, it is generally required to provide a filter which filters the image frequency component of lower sideband. In the mode setup, the "USB" shall be selected.

3.2.2.3 Double sideband measurement

The steps of the Double Sideband Measurement are the same as those of the Lower Sideband Measurement. The RF input port of the up/down converter does not need an image rejection filter. During the mode setting, you need to select "DSB" in the sideband option.

3.3 System DownConverter Mode

- [Variable LO and fixed IF.....49](#)
- [Fixed LO and variable IF.....56](#)

In the system downconverter mode, the system downconverter is used to extend the frequency range of noise figure analyzer. When the frequency range of DUT is beyond the frequency range of noise figure analyzer, configure the system downconverter and noise figure analyzer composition test system to conduct the extended-frequency measurement of noise figure.

System downconverter is part of test system for calibration and measurement setup. During the correction process, measure the total noise performance of the system downconverter and noise figure analyzer. Therefore, obtain the accurate measurement value of DUT by performing the error correcting measurement. The excess noise ratio data for the same frequency range is used for both the calibration process and measurement process.

3.3.1 Variable LO and Fixed IF

This section takes the amplifier within 37GHz~42GHz as an example to describe how to perform the noise figure measurement under the downconverter mode and various related operations.

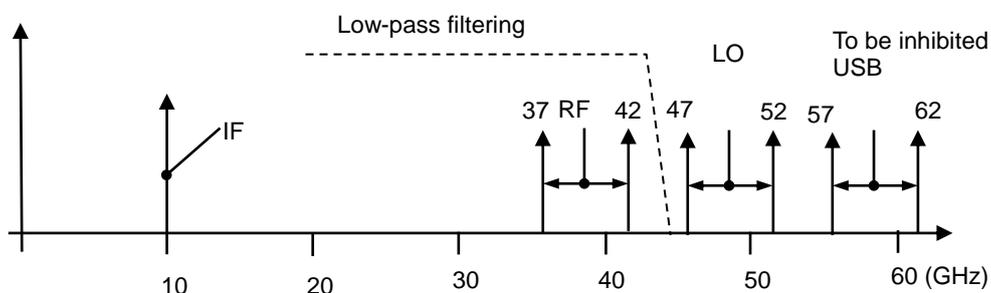


Figure 3.15 Lower Sideband Measurement Under the Variable Local Oscillator Fixed IF Mode

In the illustrated example, the system downconverter works in the variable local oscillator and fixed IF mode. The local oscillator sweeps according to the change of RF input, and measures the noise figure

3.3 System DownConverter Mode

and gain of DUT. With the fixed IF at 10GHz and RF within 37GHz-42GHz, the local oscillator frequency range within 47GHz-52GHz is obtained, the image frequency sideband within 57GHz-62GHz shall be inhibited. The frequency information is as shown in Fig.4.41.

The main technical specifications of amplifier in the example are as shown in Table 3.2. This example can be modified to realize the lower sideband measurement under the fixed LO Variable IF Mode. In addition, the lower sideband measurement and the double sideband measurement can also be carried out in this example. The change in the operating steps for each method is explained accordingly.

Table 3.2 Main Technical Indexes of the Amplifier

Frequency range	Typical Gain	Typical noise figure
37GHz to 42GHz	-2.7dB	3dB

3.3.1.1 Lower Sideband Measurement

Measurement steps:

1) Initial setup for measurement

- Step 1.** Turn on noise figure analyzer 3986 and local oscillator source, preheat the test system according to the recommended period in order to obtain the accurate measurement value;
- Step 2.** If necessary, control the local oscillator source output frequency and power with the noise figure analyzer and lock the noise figure analyzer and local oscillator source at the same reference frequency. Please refer to the following explanation;

NOTE

In order to lock the 3986 Series Noise Figure Analyzer and the local oscillator source at the same frequency reference, you need to connect the 10MHz reference output on the rear panel of the noise figure analyzer to the 10MHz reference input of the local oscillator source.

- Step 3.** Press **【Preset】** key to preset the analyzer to the ex-factory setup;
- Step 4.** Load the value of excess noise ratio of the noise source;
- Step 5.** Set the local oscillator IPaddress on the noise figure analyzer 3986;
- Step 6.** Set the local oscillator source IP address (the local oscillator source IP address shall be same with the local oscillator address which is set on the noise figure analyzer);
- Step 7.** Connect the system (sometimes the corresponding filter shall be connected for the single-sideband measurement).

2) Select the mode and make the appropriate mode setting

- Step 1.** Press the **【Mode Setup】** key to enter the Mode Setup menu;

3.3 System DownConverter Mode

- Step 2.** Press [DUT Setup] menu key and [Amplifier] menu key to select the amplifier measurement mode;
- Step 3.** Activate the system downconverter setup item in the Mode Setup interface and set the system downconverter to "On" status;
- Step 4.** Enable the LO mode setup, and select the "Variable";
- Step 5.** Activate the sideband setup option and select the "LSB";
- Step 6.** Enable the external LO control option, and set the external LO control to On or Off. In the variable LO mode, it is recommended to set it to On;
- Step 7.** Activate the external LO power input box and input the external local oscillator power value with the numeric key and complete the input setting with the unit key;

NOTE

System downconverter works in the variable LO and fixed IF mode, when the external LO control option is set to "On", the noise figure analyzer can control the output frequency and power of external LO via the LAN. The LO output frequency simultaneously traces the RF frequency to achieve automatic sweep measurement. If the external LO control option is set to "Off", the user shall manually set the frequency and power value of external LO. The formula for local oscillator frequency are: $F_{LO}=F_{RF}+F_{IF}(\text{LSB})$; $F_{LO}=F_{RF}-F_{IF}(\text{USB})$; and $F_{LO}=F_{RF}(\text{DSB})$.

- Step 8.** Activate the Frequency Mode Setup item and select the frequency mode as "Sweep";
- Step 9.** Activate the RF start frequency input box, input "37" with the numeric key, and press [GHz] unit key to complete the input. Activate the RF stop frequency input box, input "42" with the numeric key, and press [GHz] unit key to complete the input;
- Step 10.** Activate the Fixed IF input box, enter "10" with the numeric keys, and then press the [GHz] unit key to complete the input. The mode setup interface is shown in Figure 3.16.

3.3 System DownConverter Mode

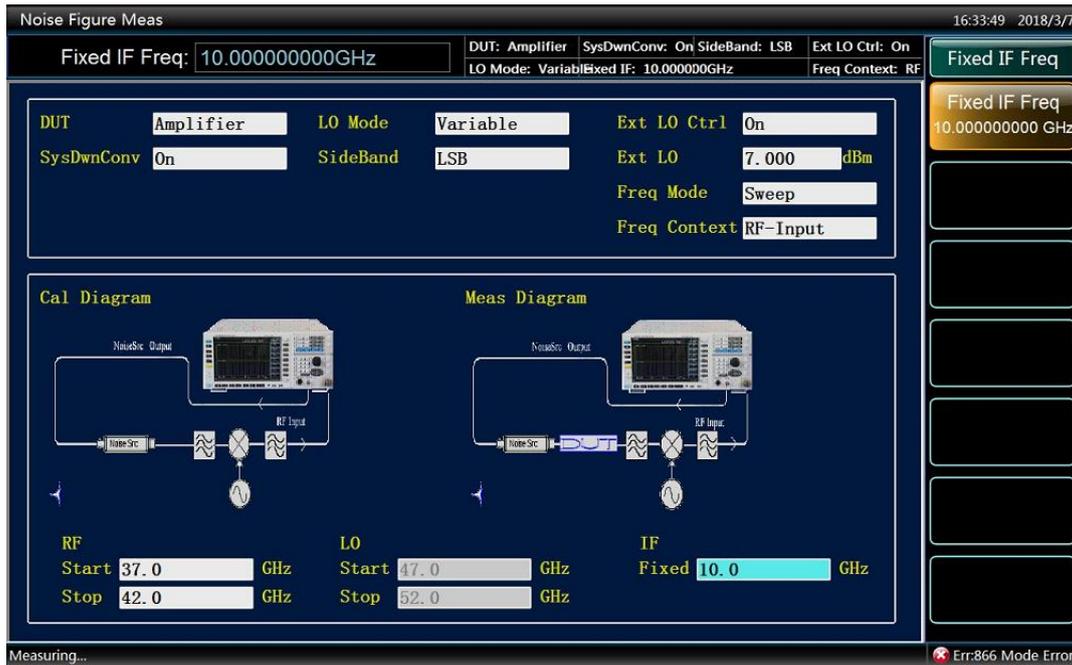


Fig. 3.16 Setting Interface of System downconverter Mode

NOTE

Additionally, set the RF start frequency and stop frequency also by pressing the **【Freq/Points】** key to enter the Freq/Points menu.

3) Set the sweep point number and average value

Step 1. Press the **【Freq/Points】** key to enter the Freq/Points setup menu;

Step 2. Press [Points] menu key, input 21 with numeric key and press [Enter] menu key to complete the input;

Step 3. Press **【Avg】** key, and press [Average] menu key to set [Average ON/OFF] as "ON";

Step 4. Input average number "8" with numeric key and press [Enter] menu key to complete the input.

4) Calibration

For the Lower Sideband Measurement, the calibration requires the local oscillator port of the mixer to be connected to the output of the local oscillator source, the output of the noise source to be connected to the low-pass filter for the the RF Input Port of the mixer which suppresses the image response, and the IF output of the mixer to be connected to the Input Port (50Ω) of the noise figure analyzer. The calibration connection is shown in Figure 3.17.

3.3 System DownConverter Mode

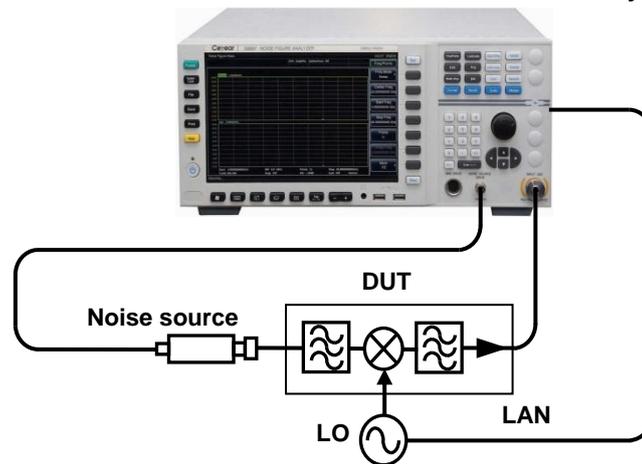


Fig.3.17 Schematic Diagram of Calibration Connection at the Downconverter Mode

- Step 1.** Press **【Calibrate】** key to enter the calibration menu;
- Step 2.** Press [Calibrate] menu key twice to calibrate. The first time you press the [Calibrate] key, you will be prompted to press it again. The typical results after calibration are displayed in table format as shown in Figure 3.18.

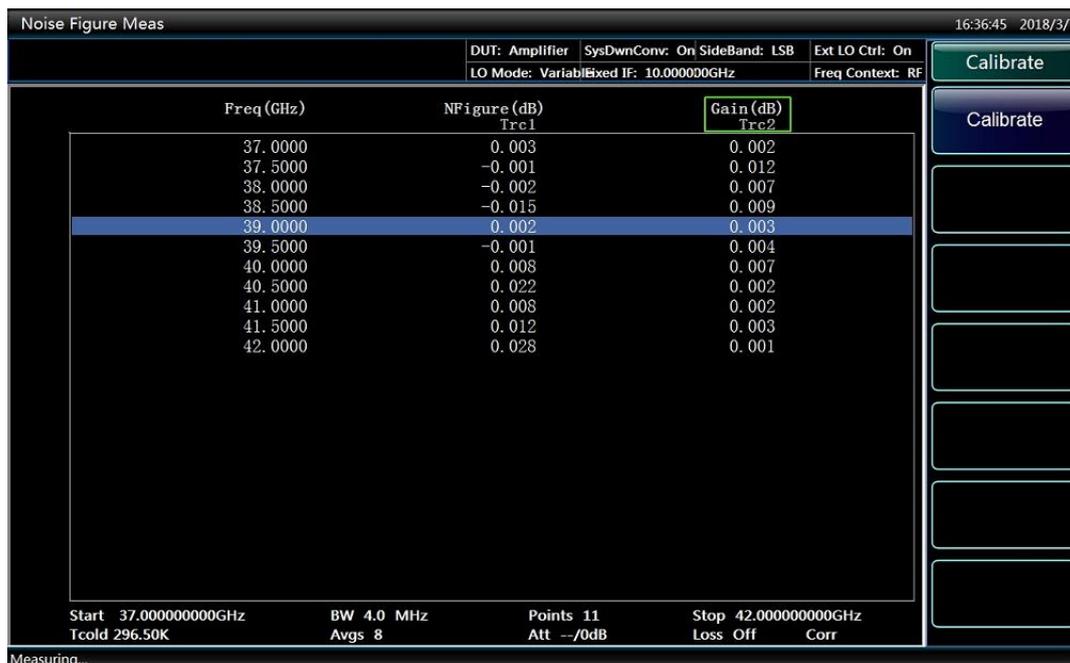


Figure 3.18 Typical Results after Calibration Displayed under the Downconverter Measurement Mode

5) Measurement

To carry out the noise figure and gain measurements after calibration, you need to connect the device under test to the system as shown in Figure 3.19. The measurement results of the noise figure and gain are shown in Figure 3.20.

3.3 System DownConverter Mode

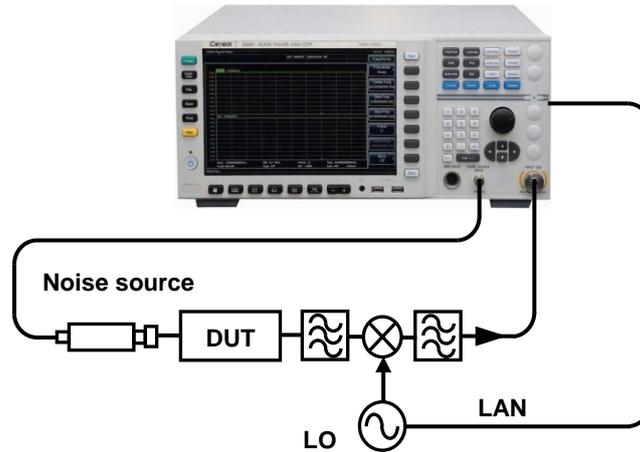


Fig.3.19 Schematic Diagram of Measurement Connection at the System Downconverter Mode



Fig.3.20 Typical Measurement Values at System Downconverter Measurement Mode

3.3.1.2 Upper Sideband Measurement

Upper sideband measurement setup is similar to the lower sideband measurement, but the filter shall be provided to inhibit the lower sideband image frequency signal. Follow the lower sideband setup steps, and set the sideband option to "USB" in the Mode Setup interface. System calibration and measurement connection are same as those for lower sideband, and the relevant frequency information is as shown in Fig.3.21.

3.3 System DownConverter Mode

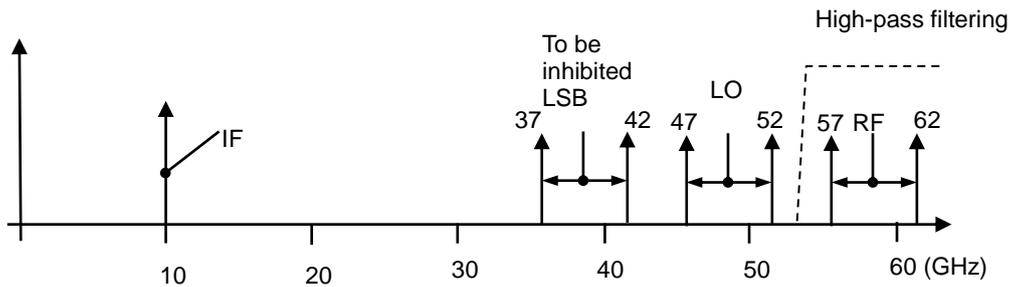


Figure 3.21 Upper Sideband Measurement under the Variable Local Oscillator Fixed IF Mode

3.3.1.3 Double sideband measurement

The steps for double sideband measurement are basically the same as those of lower sideband, but the image frequency inhibition filter is not required for the RF input end of downconverter. And set the sideband option to "DSB" in the Mode Setup interface. In the double sideband measurement mode, it is recommended to set the DUT to the low IF output in order to obtain an approximate accurate noise figure measurement value.

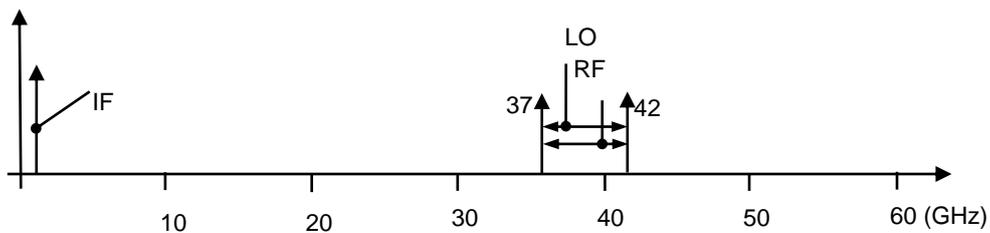


Figure 3.22 Double Sideband Measurement under the Variable Local Oscillator Fixed IF Mode

Example of double sideband measurement: RF frequency is set to 37GHz~42GHz, fixed IF to 1GHz, and the sideband to double sideband. The sweep range of local oscillator 37GHz~42GHz is obtained. Fig.3.22 shows the relevant frequency settings, and the calibration and measurement connections are as shown in Fig.3.23 and Fig.3.24.

Attention

Choose a low IF as far as possible to reduce the errors in the double sideband measurement which are caused by the difference of excess noise ratios between the upper sideband and the lower sideband, by the gain of the device under test in the two sidebands and by the nonlinear frequency response of the noise figure analyzer.

3.3 System DownConverter Mode

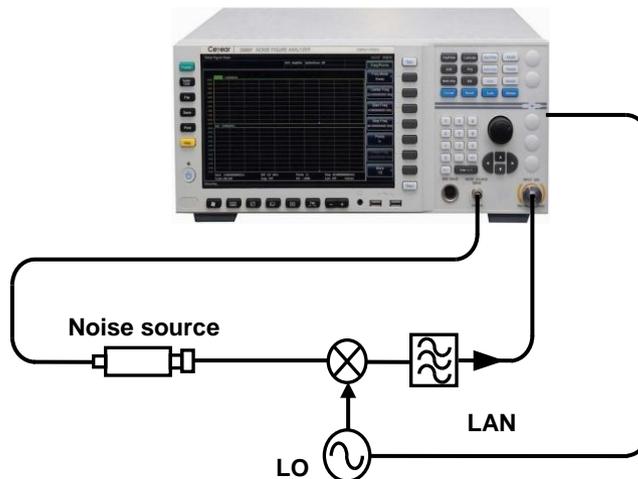


Fig.3.23 Scheme Diagram of Double Sideband Calibration Connection

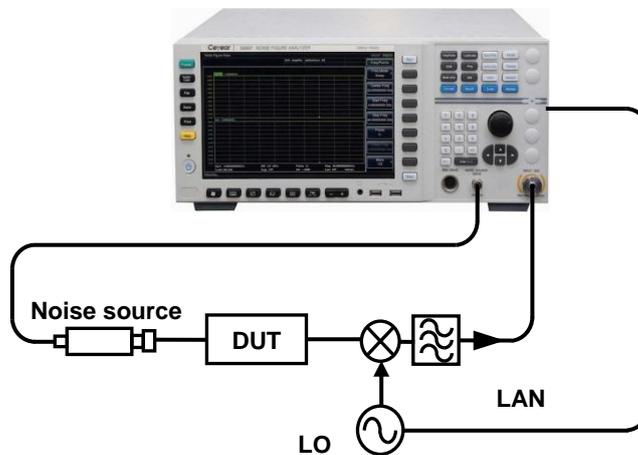


Fig.3.24 Schematic Diagram of Double Sideband Measurement

3.3.2 Fixed LO and Variable IF

3.3.2.1 Lower Sideband Measurement

For this measurement mode, the local oscillator is locked at a frequency point, the noise figure analyzer works in IF range of system downconverter, and the fixed LO and downconverter convert the RF frequency range to the IF range which can be received by the noise figure analyzer.

Measurement steps:

1) Initial setup for measurement

Step 1. Open the 3986 Series Noise Figure Analyzer and the local oscillator source, preheat the measurement system for a period of time as recommended so as to obtain accurate measurement results;

Step 2. Connect 10MHz reference if necessary;

NOTE

In order to lock the 3986 Series Noise Figure Analyzer and the local oscillator source at the same frequency reference, you need to connect the 10MHz reference output on the rear panel of the noise figure analyzer to the 10MHz reference input of the local oscillator source.

Step 3. Press **【Preset】** key to preset the analyzer to the factory default state;

Step 4. Load the value of excess noise ratio of the noise source;

Step 5. Connect the system (sometimes the corresponding filter shall be connected for the single-sideband measurement).

Attention

Under the fixed LO Mode, it is generally not necessary to control the output frequency and power of the local oscillator source by the noise figure analyzer, However, the frequency of local oscillator shall be input in the Mode Setup menu.

2) Select the mode and make the appropriate mode setting

Step 1. Press the **【Mode Setup】** key to enter the Mode Setup menu;

Step 2. Press [DUT Setup] menu key and [Amplifier] menu key to select the amplifier measurement mode;

Step 3. Activate the system downconverter setup item in the Mode Setup interface and set the system downconverter to "On" status;

Step 4. Enable the LO mode setup, and select "Fixed";

Step 5. Activate the sideband setup option and select the "LSB";

Step 6. Activate the external LO control options and set the external LO control mode as "Off" in LO fixed mode;

Step 7. Activate the external LO power input box and input the external local oscillator power value with the numeric key and complete the input setting with the unit key. If the external LO control is set to "Off", manually set the frequency and power value on the local oscillator source;

Step 8. Activate the Frequency Mode Setup item and select the frequency mode as "Sweep";

Step 9. Activate the RF start frequency and stop frequency input box, input the measured frequency value with the numeric key, and complete the input with unit key;

Step 10. Activate the fixed LO frequency input box, input the frequency of local oscillator with the numeric key, and press the corresponding unit key to complete the input;

3.3 System DownConverter Mode

3) Set the sweep point number and average value

- Step 1.** Press the **【Freq/Points】** key to enter the Freq/Points setup menu;
- Step 2.** Press [Points] menu key, input the number of sweep points with numeric key and press [Enter] menu key to complete the input;
- Step 3.** Press **【Avg】** key, and press [Average] menu key to set [Average ON/OFF] mode;
- Step 4.** Input average number with numeric key and press [Enter] menu key to complete the input.



In the downconverter measurement mode of variable IF system, only the single-sideband measurement mode can be selected. Therefore, the appropriate filter shall be selected to filter the unwanted sideband. The calibration in this mode is the same as that in the variable local oscillator single-sideband mode. It is necessary to ensure that the filter is placed for calibration and measurement.

4) Calibration

Perform the lower sideband measurement. During the calibration, connect the frequency mixer local oscillator port to the local oscillator source output end, and connect the noise source output end with the filter at frequency mixer RF input to inhibit the image frequency, and then connect the frequency mixer IF output end with the noise figure analyzer input port. If necessary, connect the IF output port of frequency mixer with the filter to inhibit the unwanted disturbing frequency component with the IF component. The calibration connection is as shown in Fig.3.25.

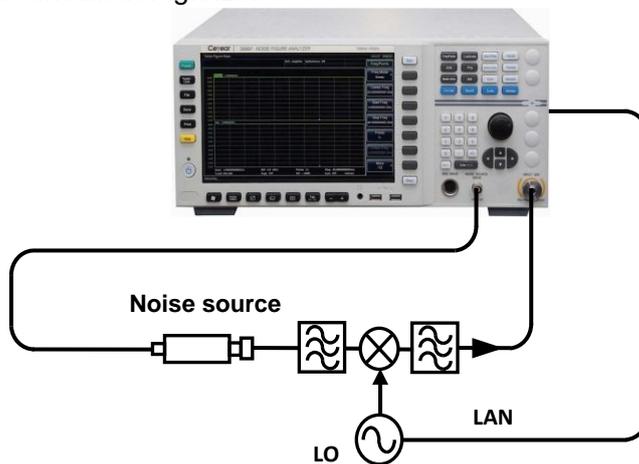


Fig.3.25 Schematic Diagram of Calibration Connection at System Downconverter Mode

- Step 1.** Press **【Calibrate】** key to enter the calibration menu;
- Step 2.** Press [Calibrate] menu key twice to calibrate. The first time you press the [Calibrate] key, you will be prompted to press it again.

5) Measurement

To carry out the noise figure and gain measurements after calibration, you need to connect the device under test to the system as shown in Figure 3.26.

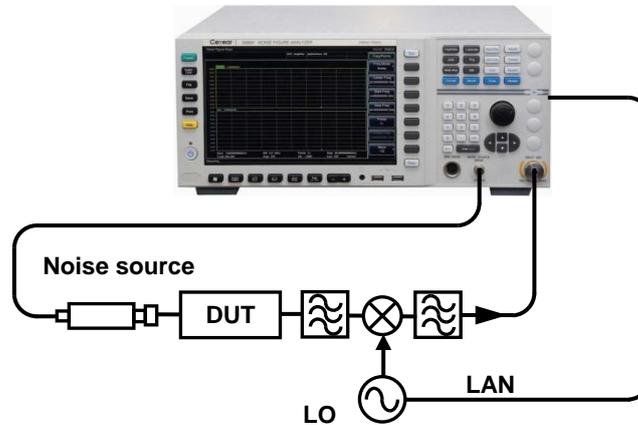


Fig.3.26 Schematic Diagram of Measurement Connection at the System Downconverter Mode

3.3.2.2 Upper Sideband Measurement

The steps for upper sideband measurement are same as those of lower sideband. However, it is generally required to provide a filter which filters the image frequency component of lower sideband. In the Mode Setup, the "Upper Sideband" shall be selected.

3.4 Loss Compensation Function

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- [Setting of the loss table.....60](#)
- [Setting of Loss Temperature.....63](#)

The Loss Compensation Function of the noise figure analyzer should be used to compensate the loss caused by the newly added cables and connectors after calibration in the test system. These losses may occur between noise source and DUT (Before DUT) and /or between DUT and noise figure analyzer input end (After DUT). A single fixed loss value may be specified for all frequencies, or set the loss table for the entire frequency range in which the frequency and loss correspond to each other. In table mode, a linearly interpolated value is used for the loss of each entry, and it also needs to specify a temperature value for all frequencies.

3.4.1 Typical Applications

- 1) For the amplifier with a waveguide input port, the coaxial adapter shall be equipped with the lossy waveguide during the measurement;
- 2) For the measurement of transistor noise figure, the input and output modulator shall be provided;

3.4 Loss Compensation Function

- 3) For the measurement of Non-50Ω system impedance DUT (eg. TV's tuner and amplifier), the impedance shall be transformed, and the attenuation and transformer for impedance matching shall be provided;
- 4) Compensation is provided to the fixed attenuation for improving the standing wave ratio;
- 5) Modify the double sideband measurement (receiver and frequency mixer) to get the approximate single-sideband result;
- 6) If DUT gain exceeds the gain measurement range of noise figure analyzer, the attenuation shall be added behind DUT. The loss compensation function shall be used to improve the measurement accuracy.

3.4.2 Setting of Fixed Loss Compensation

3.4.2.1 Setting of the Loss Compensation before the Device under Test

- Step 1.** Press **【Loss Comp】** key to enter the loss compensation menu;
- Step 2.** Press [Before DUT] menu key and [Fixed] menu key to select the compensation mode for the Before DUT fixed loss;
- Step 3.** Press [Fixed (Before)] menu key, input the loss value with numeric key, complete the input by pressing [dB] or [Linear] unit menu key or the **【Enter↵】** key. At this time, the corresponding unit is dB. The lower limit of loss is -100.000dB, the upper limit is 100.000dB, and the default is 0.000dB.

3.4.2.2 Setting of the Loss Compensation after the Device under Test

- Step 1.** Press **【Loss Comp】** key to enter the loss compensation menu;
- Step 2.** Press [After DUT] menu key and [Fixed] menu key to select the compensation mode for the After DUT fixed loss;
- Step 3.** Press [Fixed (After)] menu key, input the loss value with numeric key, complete the input by pressing [dB] or [Linear] unit menu key or the **【Enter↵】** key. At this time, the corresponding unit is dB. The lower limit of loss is -100.000dB, the upper limit is 100.000dB, and the default is 0.000dB.

3.4.3 Setting of the loss table

3.4.3.1 Setting of the loss table Before the Device under Test

- Step 1.** Press the **【Loss Comp】** key to enter the Loss Compensation menu;
- Step 2.** Press [Before DUT] menu key and [Table] menu key to select the table compensation mode for the Before DUT loss;

3.4 Loss Compensation Function

Step 3. Press [Loss Table] and [Before Table] menu key to enter the edit menu of loss table. Set the new loss table (see Section [“3.4.3.3 Creation of Loss Table”](#); or call the previously saved loss table by referring to Section [“3.3.4.2 File Saving/Calling Method”](#) of the User Manual.

3.4.3.2 Setting of the loss table After the Device under Test

Step 1. Press **【Loss Comp】** key to enter the loss compensation menu;

Step 2. Press [After DUT] menu key and [Table] menu key to select the table compensation mode for the After DUT loss;

Step 3. Press [Loss Table] and [After Table] menu key to enter the edit menu of loss table. Set the new loss table (see Section [“3.4.3.3 Creation of the Loss Table”](#); or call the previously saved loss table by referring to Section [“3.3.4.2 File Saving /Loading Method”](#) of the User Manual.

Attention

You can load a previously saved loss table, but you need to specify the type of the loss table as “Before LossComp Files (*.LOS)” or “After LossComp Files (*.LOS)” based on the compensation location. Refer to the introduction in Section [“3.3.4.2 File Saving/Loading Method”](#) of the User Manual.

3.4.3.3 Creation of Loss Table



Figure 3.27 Empty loss table

To establish a loss table, you need to follow these steps.

Step 1. Press the **【Loss Comp】** key to enter the Loss Compensation menu;

3.4 Loss Compensation Function

- Step 2.** Press [Before DUT] menu key and [Table] menu key to select the table compensation mode for the Before DUT loss;
- Step 3.** Press [Loss Table] and [Before Table] menu key to enter the edit menu of loss table. The menu items for table editing and browsing will appear at this time. For the details about how to use the table, refer to Section [“3.3.4.5 Table Processing”](#) of the User Manual. At the same time, the first loss frequency point in the table is activated. Please see Fig.3.27;
- Step 4.** Input the loss frequency value with numeric key, and complete the input with the unit menu key;
- Step 5.** After the frequency input, the activation entry will automatically move to the Loss Value field. Input the loss value and then press the corresponding [dB] or [Linear] unit key to complete the input. The results in the table are displayed in dB. You can also complete the input by pressing the **【Enter.↵】** Key, and the corresponding unit will be dB;

Attention

Loss value refers to the attenuation value of lossy device. In the measurement, if a 3dB attenuation is added before DUT, the loss of input is 3dB instead of -3dB.

-
- Step 6.** After the loss value input, the activated entry will automatically move to the next frequency point;
- Step 7.** Repeat Steps 4 to 6 until you have inputted all the required compensation frequency/loss values. An example of a loss table after the data input is shown in Figure 3.28;
- Step 8.** Press the **【File】** key to enter the File Operating menu if you want to save the loss table for later calling after inputting the loss compensation data. For the details of saving the loss compensation file, refer to the introduction in Section [“ 3.3.4.2 File Saving/Loading Method”](#) of the User Manual;
- Step 9.** After the input of loss table, press **【Loss Comp】** key to return to the loss compensation setting menu.

3.4 Loss Compensation Function



Fig.3.28 Loss Table after Data Input

This example shows how to create a "Before Table". If you need to input "After Table", please follow the steps above, just change the "Before DUT" operation to "After DUT" operation.

Attention

The loss compensation frequency in the "Before Table" is expressed with the input frequency of DUT, and the frequency value in the "After Table" with the output frequency of DUT. This is very important for the DUT measurement of frequency conversion or system downconverter mode.

3.4.4 Setting of Loss Temperature

3.4.4.1 Setting of the Loss Temperature before the Device under Test

- Step 1.** Press **【Loss Comp】** key to enter the loss compensation menu;
- Step 2.** Press [Before DUT] menu key and [Fixed] or [Table] menu key to select the loss compensation mode;
- Step 3.** Press [Temp(Before)] menu key, input temperature value with the numeric key, press the corresponding [K], [C] or [F] unit menu key to complete the input. The value input with the [C] or [F] menu key is automatically converted to display in K. You can also press the **【Enter↵】** key to end the input, and the corresponding unit will be K. The lower limit of temperature is 0.0K, upper limit is 296,50000.00K, and default is 290.00K.

3.5 Limit Line

3.4.4.2 Setting of the Loss Temperature After the Device Under Test

- Step 1.** Press **【Loss Comp】** key to enter the loss compensation menu;
- Step 2.** Press [After DUT] menu key and [Fixed] or [Table] menu key to select the loss compensation mode;
- Step 3.** Press [Temp(After)] menu key, input temperature value with the numeric key, press the corresponding [K], [C] or [F] unit menu key to complete the input. The value input with the [C] or [F] menu key is automatically converted to display in K. You can also press the **【Enter↵】** key to end the input, and the corresponding unit will be K. The lower limit of temperature is 0.0K, upper limit is 296,50000.00K, and default is 290K.

3.5 Limit Line

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- [Setting of Limit Line Type.....64](#)
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- [Enabling of Limit Line Test.....67](#)
- [Display of Limit Lines67](#)
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Limit line is used to mark the upper limit or lower limit of activated trace. By setting the limit line, the noise figure analyzer will automatically send the prompt that the limit line fails when the measurement trace exceeds the limit line. Two limit lines may be applied to a trace, for example specified upper limit and lower limit.

Noise figure analyzer 3986 contains four independent limit lines, which can be used for trace 1, trace 2, and can be set as upper limit or lower limit.

3.5.1 Setting of the Number of Limit Lines

Limit line 1 is set as the default limit line.

- Step 1.** Press **【Limit Lines】** key to enter the limit line menu;
- Step 2.** Press [Limit Line] menu key;
- Step 3.** Press [LimitLine 1], [LimitLine 2], [LimitLine 3] or [LimitLine 4] menu key and select the number of limit line to activate the setting.

3.5.2 Setting of Limit Line Type

The limit line may be set to upper limit or lower limit and select the application trace according to the settings of limit line.

- Step 1.** Press **【Limit Lines】** key to enter the limit line menu;
- Step 2.** Press [Limit Line] menu key;

3.5 Limit Line

- Step 3.** Press [LimitLine 1], [LimitLine 2], [LimitLine 3] or [LimitLine 4] to change the number of limit line. Limit line 1 is set as the default limit line;
- Step 4.** Press [Type] menu key, select [Type Upper Lower] or [Type Upper Lower]. Set the limit line type to upper or lower;
- Step 5.** Press [Test Trace], select [Trace 1] or [Trace 2]. Trace 1 is the default value.

3.5.3 Creation of Limit Line Table

To create a limit line, you need to specify the frequency, the corresponding value of the limit line, and whether to connect to the previous limit line point or not.

- Step 1.** Press the **【limit Lines】** key to enter the Limit Line menu;
- Step 2.** Set the limit lines by referring to the introduction in Section [“3.5.2 Setting of limit Line Type”](#);
- Step 3.** Press the [Edit] menu key, and a limit line editing interface will appear at this time and the first frequency point in the table will be the activation entry as shown in Figure 3.29;



Fig.3.29 Limit Line Table

- Step 4.** Input the first frequency value with the numeric keypad and complete the input with the unit key;
- Step 5.** The activated entry will automatically move to the limit line number column. Input the limit value with the numeric keypad, and press [Enter] menu key to complete the input;
- Step 6.** The activated entry will automatically move to the connection bar, press **【▲】** or **【▼】** arrow keys or rotate the knob to change the connection to Yes or No as required, and then press **【▶】** direction key to edit the next frequency point;

3.5 Limit Line



Fig.3.31 Limit Line Connection

Step 8. Press the **【Prev】** key to go back to the Limit Line Operating menu. To save the Limit Line Table, you need to specify the code of the limit line, such as Limit Line 1, Limit Line 2, Limit Line 3 or Limit Line 4. For more details, refer to [“3.4 Implementation File Operation”](#) of the User Manual.

3.5.4 Enabling of Limit Line Test

Only after setting up the limit line type as well as the test Trace, and establishing the limit line by following the above steps, can the function of Limit Line Test be enabled. Set the Trace test based on the limit line. If you want to obtain the report results, select [Test **ON** OFF]; if the test results fail, the words of “Limit Line Failure” will appear in the position shown in Figure 3.32. Each of the four limit lines needs to be set separately.



Fig.3.32 Limit Line Failure indicator

Step 1. Press the **【Limit Lines】** key to enter the Limit Line Operation menu;

Step 2. Press [Test **ON** OFF] to enable the Limit Line Measurement Function.

3.5.5 Display of Limit Lines

Select the limit line display only after setting the limit line type and test trace and establishing the limit line according to the above steps.

3.5 Limit Line

NOTE

Limit line may only be displayed in the graphic display format.

To display the limit line in the graphic format, select the display to "On" state; if you do not want to display the limit line in the graphic format, select the display to "Off" state. Four limit lines shall be set separately.

Step 1. Press the **【Limit Lines】** key to enter the Limit Line Operation menu;

Step 2. Press [Display] menu key to set the display to "On" state, i.e. the limit line is displayed on the screen.

3.5.6 Disabling All Limiting Lines

Step 1. Press the **【Limit Lines】** key to enter the Limit Line Operation menu;

Step 2. Press [Disable All Limits] menu key to disable all limit lines displayed on the screen.

4 Getting Help

In most cases, problems arise because of hardware/software malfunction or inappropriate use by the operator. If there is a problem with the instrument, please look at the error information and save it first, and then analyze the possible causes and sort out the problem in advance by referring to the methods provided in Section [“4.1 Basic Inspection”](#) and Section [“4.2 Help Information”](#) of this chapter. Alternatively, you can contact our customer service center and provide the collected error information, and we will help you solve the problems as quickly as possible. For more details, please refer to the contact information provided in this manual or visit our web site: www.ceyear.com to find the contact information of the technical support center nearest to you.

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4.1 Basic check

If the device malfunctions, please check the following:

- 1) Is the power outlet working?
- 2) Is the noise figure analyzer turned on? Check whether the green LED next to the power button is lit up. Check for noise from the internal fan to determine whether the cooling system is functioning properly;
- 3) If any other device, cable, or connector is used in conjunction with the noise figure analyzer, ensure that they are properly connected and are functioning normally;
- 4) If the noise figure analyzer cannot communicate via LAN, check the yellow LED next to the LAN interface on the rear panel, and if the LED does not flicker, check the LAN cable and its connection.

If the noise figure analyzer cannot fully load or run its operating system, or the application of the instrument cannot be successfully started, the problem may be caused by hard disk damage; if the noise figure analyzer has been running for a long time during startup but cannot complete the startup, operate as shown in Section [“3.1.2.4 System Security and Maintenance of Windows 7”](#) of the User Manual.

- 1) When encountering a problem for the first time, check the measurement procedures. Have all settings been configured properly?
- 2) If the noise figure analyzer is not operating properly, please set [Reset] to “Factory” mode, then press the **【Preset】** button to revert the device to a previous known state;
- 3) Are the measurements being performed and the result consistent with the performance index and characteristics of the noise figure analyzer? Refer to the related performance index data in Chapter [“8 Technical Indexes and Test Methods”](#) of the User Manual for the noise figure analyzer.

4.2 Helpful information

4.2 Helpful information

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- [Abnormal Trace Display.....73](#)

The following section lists common problems and solutions to these problems, categorized by function. This section is a guide on how to diagnose and handle issues that you may encounter while using the 3986 series noise figure analyzer. If necessary, please provide accurate feedback to the manufacturer with regards to the issues and we will assist you in finding a solution as quickly as we can.

4.2.1 Problems during Startup

If the 3986 Series Noise Figure Analyzer fails during startup, the failure may involve many aspects such as power supply, processor hardware and instrument settings. This section will go through the power-on procedure of the 3986 series noise figure analyzer and analyze the possible causes of problems during the start-up process. The whole startup of the instrument may take approximately 3 minutes. The startup time varies slightly from hardware configuration to hardware configuration, from installation option to installation option, and from measurement application number to measurement application number of the instrument.

4.2.1.1 Lighting failure of yellow readiness indicator lamp

Plug the device into the power outlet and turn on the power from the rear panel. The power indicator at the bottom left hand corner of the front panel will turn yellow. If the yellow readiness indicator lamp is not lit , first check whether the power switch on the rear panel of the noise figure analyzer is in the “ON” state or not, and then check whether the voltage value and the frequency value of the power supply meet the operating power parameter requirements of the 3986 Series Noise Figure Analyzer. For specific requirements, refer to Section [“3.1.1.3 Power On/Off”](#) of the User Manual. If the power supply parameters meet the requirements, the problem may be caused by the instrument power failure. Please contact our customer service center and provide details on the error or malfunction. We will aid you as quickly as we can to solve the problem.

4.2.1.2 Lighting failure of green power indicator lamp

Push the power button on the bottom left hand corner on the front panel to turn on the device. At this time, the power indicator should turn from yellow to green. If the power indicator does not turn green, there may be an issue with the power source. If the power indicator switches between the stand-by yellow light and the power-on green light, ruling out the possibility of problems with the power supply, the device may be experiencing an abnormal internal load. Please contact our customer service center and provide details on the error or malfunction. We will aid you as quickly as we can to solve the problem.

4.2.1.3 Fan work failure

When the 3986 noise figure analyzer is powered on, all fans within the device should start working. If none of the fans work, it could be due to a problem of the power source. If individual fans are not working, then the error may be related to the fans themselves. Please contact our customer service center and provide details on the error or malfunction. We will aid you as quickly as we can to solve the problem.

4.2.1.4 Blank screen

The screen may not display because of several reasons. If the three above-mentioned issues have been resolved, please continue to the following steps:

- Step 1.** Connect a CRT display device properly to the monitor connector on the rear connector and turn it on. Wait 30 seconds. If the CRT is displaying properly, then the BIOS parameters may have been modified. Turn off the computer, connect a PS/2 keyboard and turn on the computer again. Push the **【F2】** button on the keyboard until the BIOS configuration interface appears. Select [Load Setup Defaults] from the [Exit] to restore the factory BIOS configuration. Save and restart the device. If the device interface is still not displaying properly, there may be a fault with the LCD-related components of the device. Please contact our customer service center and provide details on the error or malfunction. We will aid you as quickly as we can to solve the problem;
- Step 2.** If after connecting the CRT, the display is still functioning properly, there may be a problem with the device hardware. Please contact our customer service center and provide details on the error or malfunction. We will aid you as quickly as we can to solve the problem.

4.2.1.5 BIOS Test Crash

If the noise figure analyzer remains in the display processor information state after turning on the power, then the BIOS test has crashed. Please follow these steps:

- Step 1.** Check whether you have connected a standard keyboard to the instrument and have paused the BIOS detection. If not, proceed to the next step;
- Step 2.** Power off and then connect a PS/2 interface standard keyboard to the instrument. Power on, long press the **【F2】** key on the standard keyboard until entering the BIOS Setup interface, select the [Load Setup Defaults] option in the [Exit] tab, call the factory setup in the BIOS, select [Save] and then restart. If the problem is still unresolved, there may be a failure of the instrument hardware. Contact our customer service center according to the contact information provided in this guidebook and provide the error information you have collected. We will help you to solve the problem as quickly as possible.

4.2 Helpful information

4.2.1.6 Failure to find system disk

If the system is unable to find the hard disk after the noise figure analyzer has been turned on, please turn off the power on the back of the device and turn it back on after 1 to 2 minutes. Then, turn on the power on the front panel of the device to check whether the system disk could be found. If the disk is still not found, connect a PS/2 keyboard to enter the BIOS settings and check whether the IDE device exists. If it does not exist, there may be a malfunction in the hard disk of the apparatus. Please contact the customer service center and provide relevant information on the error. We will aid you in solving the problem as quickly as possible.

4.2.1.7 Windows boot failure

After the processor information has appeared, an operating systems menu appears with a timer where you may select Windows 7 start-up and system recovery tools. The default selection is Windows 7 system start-up. If you need to access system recovery, before the timer reaches 0, select “One-key GHOST V2011.07.01” using the up and down arrows, then press [Confirm].

During the Windows start-up process, if a blue screen appears, the start-up crashes, or the process restarts, please follow these steps:

- Step 1.** First, ensure that there is no external USB drive connected to the apparatus;
- Step 2.** Restart the noise figure analyzer. If the system starts normally and the error does not reappear frequently, then it was a random start-up malfunction encountered by Windows and the device can be used as usual. Otherwise, please continue to the next step;
- Step 3.** Power off and then connect a PS/2 interface standard keyboard to the instrument. Turn on the computer and push the **【F2】** button on the keyboard until the BIOS configuration interface appears. Select the [Load Setup Defaults] option from the [Exit] tab to restore the factory BIOS configuration. Save and restart. If the problem is solved, it indicates that the BIOS settings have been changed. Otherwise, there may be a problem with the device system. Please continue to the next step;
- Step 4.** Power off and then connect a PS/2 interface standard keyboard to the instrument. Turn on the computer and select the recovery option from the operating systems menu (before performing operating system recovery, please refer to the relevant notes on system recovery in this manual and contact the manufacturer). Perform system recovery by following the instructions. For specific operating steps, refer to [“3.1.2.5 System Backup and Recovery”](#) of the User Manual;
- Step 5.** If the device is unable to undergo proper system recovery, there may be a malfunction of the hard drive. Please contact the customer service center using the information provided in the

manual and provide detailed information on the relevant error. We will assist you in solving the problem as quickly as possible.

4.2.2 Abnormal Trace Curve Display

When the 3986 series noise figure analyzer enters the measurement interface and has completed all start-up and calibration processes, the device goes into normal scan test mode. The interface displays a continuously refreshing track. However, if certain parameters are configured incorrectly, then users may not see the anticipated track. If the track does not refresh normally, please first check the following settings.

4.2.2.1 Instrument Connection Check

When a normal noise source is used, connect the noise source drive input end to the 28V noise source drive port on the noise figure analyzer panel with a BNC cable, and connect the noise source output to the input port (50Ω) of the noise figure analyzer.

When a smart noise source is used, connect the noise source to the smart noise source drive port on the noise figure analyzer panel with a multi-core cable, and connect the noise source output to the input port (50Ω) of the noise figure analyzer.

4.2.2.2 Trace refresh failure

If the noise figure track (default device setting) does not refresh on the interface, please refer to the following steps:

Step 1. Press the **【Sweep】** key, set [Sweep Mode] as “Continuous”;

Step 2. Check again to see whether the track refreshes. If the cursor does not move, try to restart the system. If the problem is still not solved, please contact the customer service center using the information provided in the manual and provide detailed information on the relevant error. We will assist you in solving the problem as quickly as possible.

4.2.2.3 Abnormal noise figure trace display

If the noise figure curve of this instrument cannot be displayed properly and is beyond the technical index range required in Chapter [“8 Specifications and Test Methods”](#) of the User Manual, there may be a failure of the hardware circuit of the noise figure analyzer. Contact our customer service center according to the contact information provided in this guidebook and provide the error information you have collected. We will help you to solve the problem as soon as possible.

4.3 Repair Method

4.3 Repair Method

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4.3.1 Contact us

If 3986 series noise figure analyzer has any fault, firstly observe and save the error information, and then analyze possible causes and eliminate and solve the problems according to methods described in section “[4.2 Help information](#)” to perform an initial troubleshooting procedure. Alternatively, you can contact our customer service center and provide the collected error information, and we will help you solve the problems as quickly as possible. Visit our website: www.ceyear.com, on which you can get the contact information about the nearest technical support.

Contact information:

Tel: +86-0532-86896691

E-mail: sales@ceyear.com

Postal code: 266555

Address: No.98 Xiangjiang Road, Qingdao City, China

4.3.2 Packaging and delivery

If you encounter a problem that is difficult to solve when using the noise figure analyzer, you can reach us via telephone or fax. If it is decided that the apparatus needs to be returned for repair, please package the noise figure analyzer using the original packaging material and box, and follow these steps:

- Step 1.** Include a detailed explanation of the problem that you've encountered when using the noise figure analyzer along with the apparatus in the packaging box;
- Step 2.** Use the original packaging material to package the instrument to minimize possible damage;
- Step 3.** Place pads in the corners of the box and put the device into the box;
- Step 4.** Seal the packing carton with adhesive tape and reinforce it with nylon belts;
- Step 5.** Attach a label on the box with “Fragile! No Touch! Handle with Care!” words;
- Step 6.** Please arrange the consignment as required for the precise instrument;
- Step 7.** Keep the copies of all the shipping documents.

Attention**Notes on packaging the noise figure analyzer:**

The use of other materials to package the noise figure analyzer may cause damage to the device. It is forbidden to use polystyrene beads as the packaging material because they can't fully protect the instrument and may damage the instrument after being sucked into the instrument fan by the static electricity.

NOTE**Packaging and transporting the instrument**

When transporting or handling this instrument, please strictly observe the points for attention described in Section [“3.1.1.1 Unpacking”](#) of the User Manual.