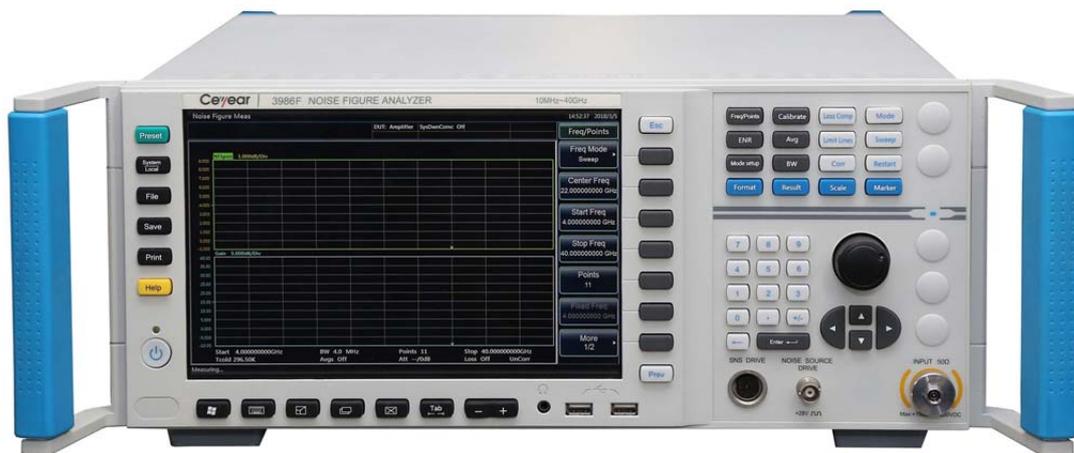


# Ceyear

## 3986 Series

# Noise Figure Analyzers

(10 MHz ~ 50 GHz)



**Wide frequency coverage**

**High-sensitivity reception and high-precision measurement performance**

**Dual-channel HD display**

**Amplifier, up converter and down converter measurement mode**

**Comprehensive loss compensation function**

**Flexible file and table processing functions**

**Dual noise source drive**

**China Electronics Technology Instruments Co., Ltd.**



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## Product Overview

3986 Series Noise Figure Analyzers include 3986A (10 MHz~4 GHz), 3986D (10 MHz~18 GHz), 3986E (10 MHz~26.5 GHz), 3986F (10 MHz~40 GHz) and 3986H (10 MHz~50 GHz). Features of the product include wide-range frequency coverage, high-sensitivity reception, friendly user interface, big screen dual channel HD display, various external interfaces, and dual noise source drive etc. It can measure the noise figure and gain of amplifiers, up converters and down converters, as well as to support automatic measurement of noise figure of multi-stage converters. Guide interfaces are intuitive for setting measurement modes. The comprehensive loss compensation function can compensate loss induced in measurement channel before and/or after the device under test by means of fixed or table forms. The built-in noise figure measurement uncertainty calculator does quantitative analysis of the uncertainty of measurement noise figure. Limit line function that provides test passed/failed notification simplifies the determination of passed/failed test. User friendly features make it easy for engineering technicians to set measurements correctly, to observe and save measurement results in different forms. They can be widely used in R&D, manufacturing, testing and technical assurance tests of electronic equipment for radar, communication, navigation etc.

## Main Features

**Wide frequency coverage**

**High-sensitivity reception and high-precision measurement performance**

**Chinese and English operation interface, big screen dual channel HD display**

**Amplifier, Up converter and down converter measurement mode**

**Single sideband and double sideband measurement function**

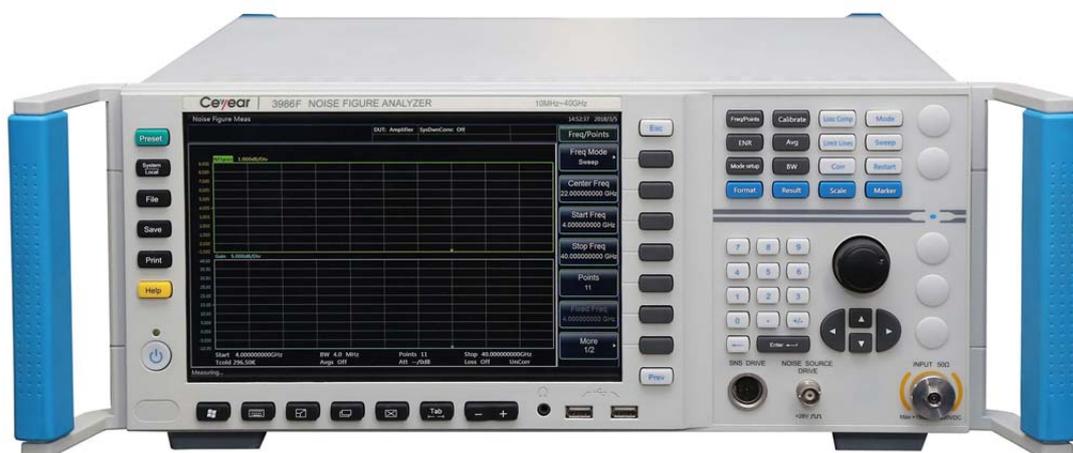
**Comprehensive loss compensation function**

**Flexible file and table processing functions**

**Passed/failed test notification limit line function**

**Various external interfaces**

**Dual noise source drive**



3986 Series Noise Figure Analyzers

### Wide frequency coverage

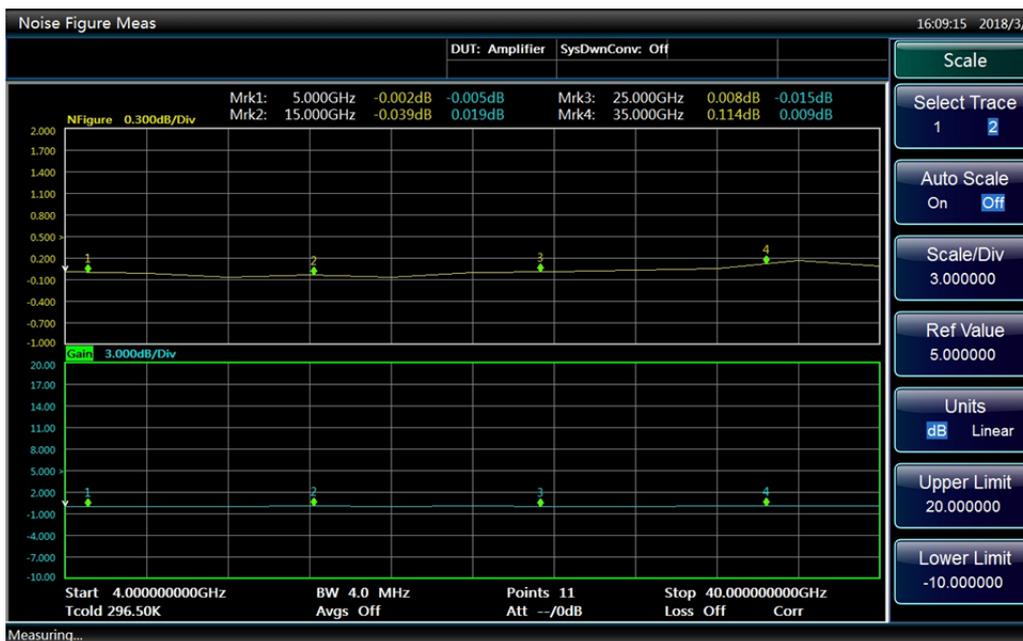
The coaxial integrated frequency of 3986 series Noise Figure Analyzers covers the range of 10 MHz~50 GHz, where 5 frequency range configurations are selectable for different user's test demand of different band. With external MMW extended frequency modules, the noise figure measurement frequency range can be extended to 110GHz.

### High-sensitivity reception and high-precision measurement performance

The optimum reception sensitivity precedes -170 dBm/Hz, and the full-band reception sensitivity precedes -162 dBm/Hz. It adopts automatic adjustment and precise calibration technologies, which improve the channel gain. And the linearity within the range of noise power measurement precedes ±0.1 dB.

### Chinese and English operation interface with big screen dual-channel HD display

Chinese and English operation interface with 10.1 inch big screen LCD monitor that can display in three formats, i.e. graphs, tables and meter display. In the form of graph display, it can display in combination the measurement results of two arbitrary parameters which change along with frequency, such as noise figure, Y factor, gain, and equivalent input noise temperature.

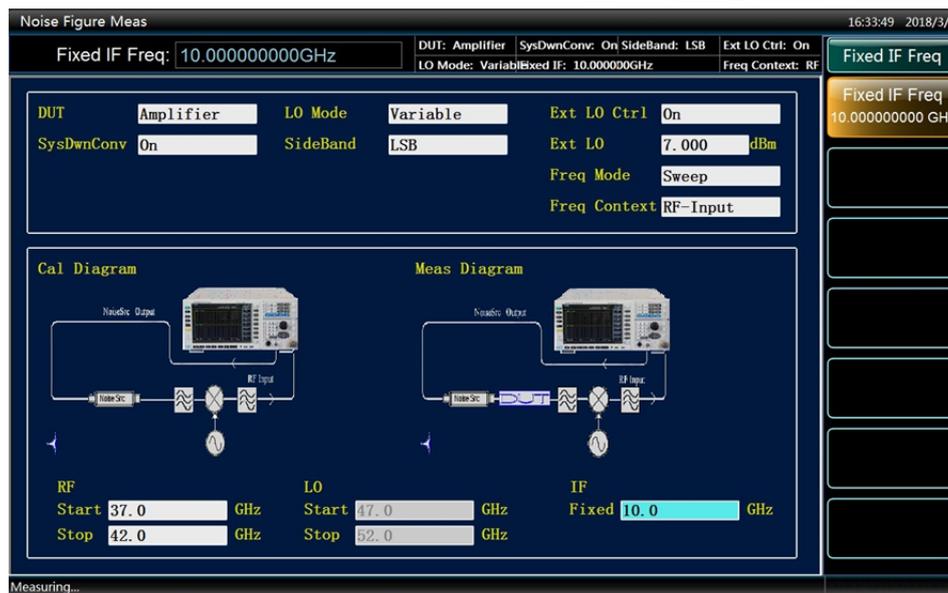


### Amplifier, up converter and down converter measurement mode

Basic amplifier measurement mode is used for noise figure and gain measurement of the device under test, which falls in the amplifier category within the frequency range of the Noise Figure Analyzers. The extended frequency range measurement in the down converter mode is used for noise figure and gain measurement of amplifier, of which the frequency exceeds the frequency range of the Noise Figure Analyzers.

They have noise figure and gain measurement functions of up converters and down converters, as well as to support automatic scanning measurement of noise figure of multi-stage converters.

Interface setting in measurement mode is intuitive. All measurement settings corresponding to measurement mode can be done in the same test interface.



### Single sideband and double sideband measurement function

It has the capacity of setting, controlling and data processing for the measurement of single sideband (including upper sideband and lower sideband) and double sideband. During noise figure measurement, the sideband setting must be the same as that is actually applied of the device under test.

### Comprehensive loss compensation functions

Loss in the measurement channel can be compensated by means of fixed or table form before and/or after the measurement, which would greatly benefit precise measurement of noise figure of automatic test system or microwave chips.

### Flexible file and table processing functions

The types of files and tables that can be processed by 3986 Series Noise Figure Analyzers include limit lines, excess noise ratio table, trace file, state file, frequency list, loss compensation table and screen images. For user data process purposes, files and tables can be edited, saved, loaded, and deleted.

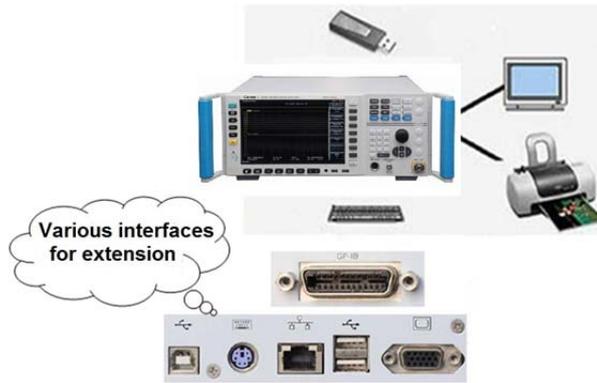
### Passed/failed test notification limit line function

Limit line function of test passed/failed notification simplifies passed/failed test for the use of production line. Types of limit lines include upper limits and lower limits. A pair of upper and lower limit lines could be set individually for each display channel. When measurement results exceed limit range, the instrument would prompt "Limit Line Failed" notification in red.



### Various external interfaces

Various external interfaces enable high re-usability. Smart interfaces like GP-IB, LAN, USB and VGA can enable user function extension and reconstruction of the test system.



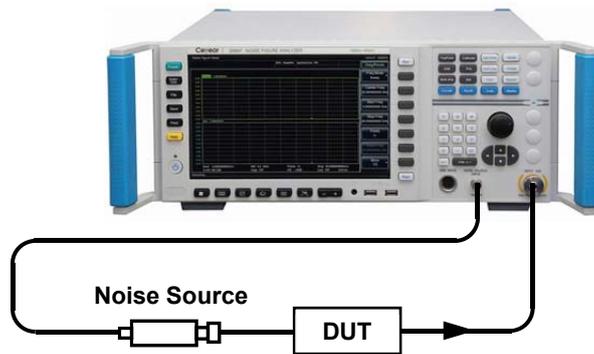
### Dual noise source drive

Standard and smart noise source drive interfaces provided. Standard noise source drive interface that provides +28 V pulse drive voltage to support noise sources from multiple manufacturers. It's highly compatible. Noise Figure Analyzers can identify the connection of smart noise source and load excess noise ratio data automatically. It can also detect changes of environment temperature for temperature correction of noise figure to improve speed and accuracy of measurement.

## Typical Applications

### Basic amplifier measurement

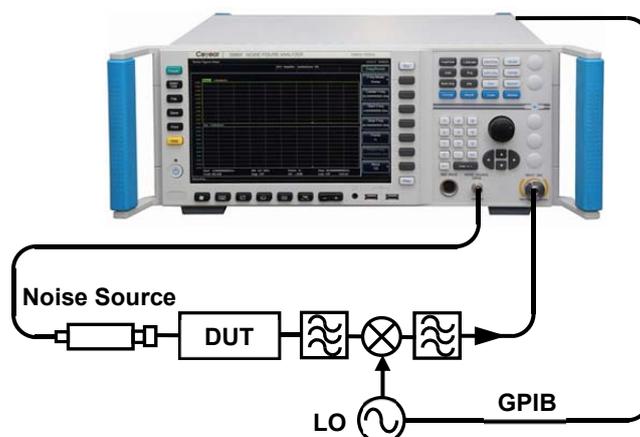
Basic amplifier measurement is the most common measurement mode. It's used for noise figure and gain measurement of the device under tests without frequency conversion (including active or passive linear units or systems like amplifiers, filters, and isolators).



Measurement Setup

### System down converter measurement mode

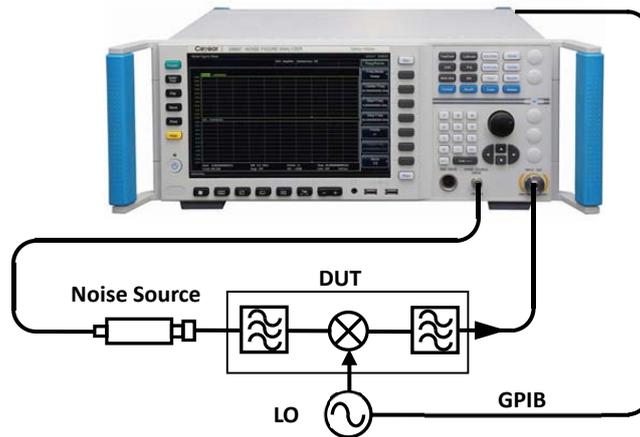
The down converter mode focuses on extended frequency range measurement of amplifier. When the frequency range of an amplifier exceeds that of the Noise Figure Analyzers, extended frequency range measurement of the noise figure is realized by an external mixer. External mixer is used during calibration and measurement as a part of the test system. To reduce the uncertainty of noise figure measurement, frequency conversion loss and noise figure of the chosen mixer should be as small as possible. Besides, the intermediate frequency output port of the mixer should be well isolated to local oscillation signals.



Measurement Setup

### Up/down converter measurement

The device under test is an up/down converter installation, up converter and transmitter or down converter and receiver for instance, then the output intermediate frequency would be in the frequency range of the Noise Figure Analyzers. During up/down converter measurement, 3986 series Noise Figure Analyzers provide two modes of settings, fixed intermediate frequency, variable local oscillation and fixed local oscillation, variable intermediate frequency, which are used for measuring the RF response characters and intermediate frequency response characters of the device under test, respectively.



Measurement Setup

## Technical Specifications

**Technical Specifications (spec.):** Unless clarified otherwise, calibrated instruments shall be placed within working temperature ranged from 0°C to 40°C for at least two hours before warming up for 30 minutes to ensure performance. The measurement of uncertainty is included. Unless clarified otherwise, data included herein are technical indicators.

**Typical Value (typ.):** indicates that 80% instruments can reach typical performance. The data is not assurance data and doesn't include uncertain factors during measurement. It's only valid at 25°C (room temperature).

**Nominal Value (nom.):** indicates anticipated average performance, and performances can't be tested through designed performance features or limited test means (e.g. 50 Ω connectors). Product performance labeled as nominal value is not included in product warranty. It is measured under room temperature (around 25°C).

**Measured Value (meas.):** indicates, to compare with anticipated performance, performance features measured during design stage. Such as amplitude drift variable through time. The data is not assurance data and is measured under room temperature (around 25°C).

Table 1 Technical Specifications

Major Technical Specifications	
Frequency Range	10 MHz~4 GHz/18 GHz/26.5 GHz/40 GHz/50 GHz
Accuracy of Frequency Reference	$\pm < 0.2 \text{ ppm}$ (23°C $\pm$ 3°C)
Accuracy of Frequency Tuning	$\pm <$ (Reference frequency error +100 kHz) 10 MHz~4 GHz
	$\pm <$ (Reference frequency error +400 kHz) 4 GHz~18/26.5/40/50 GHz
Noise Figure Measurement Range	0~30 dB (ENR: 12 dB~17 dB)
Noise Figure Measurement Uncertainty	$\pm < 0.1 \text{ dB}$
Gain Measurement Range	-20 dB~+40 dB
Gain Measurement Uncertainty	$\pm < 0.17 \text{ dB}$
Input VSWR	<1.90: 1      10 MHz $\leq$ f $\leq$ 4 GHz
	<2.10: 1      4 GHz<f $\leq$ 18 GHz
	<2.40: 1      18 GHz<f $\leq$ 26.5 GHz
	<2.40: 1      26.5 GHz<f $\leq$ 40 GHz
	<2.40: 1      40 GHz<f $\leq$ 50 GHz
Main Unit's Self Noise Figure	<8.0 dB      10 MHz $\leq$ f $\leq$ 4 GHz
	<7.5 dB      4 GHz<f $\leq$ 18 GHz
	<8.0 dB      18 GHz<f $\leq$ 26.5 GHz
	<10.0 dB      26.5 GHz<f $\leq$ 40 GHz
	<12.0 dB      40 GHz<f $\leq$ 50 GHz
Jitter (uneven)	<0.17 dB      (Y Factor Typical Value 5 dB)
Noise source drive voltage	<1.0 V      Noise source off
	+28.0 $\pm$ 0.10 V      Noise source on

Table2 Product Features

General Technical Specifications		
<b>Temperature Range</b>	Operation: 0~+40°C Storage: -40~+70°C	
<b>Altitude Range</b>	4, 600 meters	
<b>Electromagnetic compatibility</b>	Comply with the following requirements of GJB 3947A-2009 provision 3.9.2: a) Conducted emission through CE102 power cable; b) Conducted susceptibility of CS101 power cable; c) Conducted susceptibility injected by CS114 harness; d) Radiated emission through RE102 electric field; e) Radiated susceptibility through RS103 electric field.	
<b>Safety</b>	Comply with safety certificate requirements of GJB 3947A-2009 provision 3.10. a) The resistance between power input end and the chassis (power switch on engaged position) shall be no less than 100 MΩ under standard atmosphere pressure and no less than 2 MΩ in damp environment. b) Apply 1500 VAC between the power input end and the chassis. And no symptom like breakdown, flash-over and flicker shall happen. c) In operation, leakage current between chassis and ground shall be no more than 3.5 mA.	
<b>Power requirements</b>	<b>Voltage and frequency (nominal value)</b>	220 V, 50 Hz; (99~121) Vrms, (50~60/440) Hz (198~242) Vrms, (50~60) Hz
	<b>Power consumption</b>	Max. power consumption: 250 W Max. standby: 20 W
<b>Monitor</b>	1280×800, XGA 10.1"	
<b>Data storage</b>	160 G solid state disk Support USB 2.0 standard storage units	
<b>Weight</b>	Net weight: less than 23 kg; Packaged shipping weight: 34 kg nominal value	
<b>Size</b>	Width×Height×Depth (mm)=426×177×460 (handle, bottom, pad and side strap excluded), allowed tolerance ±10 mm. Width×Height×Depth (mm)=510×190×534 (handle, bottom, pad and side strap included), allowed tolerance ±10 mm.	
<b>Warranty</b>	3986 Series Noise Figure Analyzers are under a standard warranty of 18 months.	
<b>Reliability</b>	MTBF ( $\theta_0$ ) ≥5000 h	
<b>Calibration interval</b>	A calibration interval of one year is recommended. Calibration service shall be provided by professional calibration institutions.	

Table3 Front Panel Interfaces

Front Panel Interfaces		
<b>RF input connector</b>	3986A	3.5 mm (m)
	3986D	3.5 mm (m)
	3986E	3.5 mm (m)
	3986F	2.4 mm (m)
	3986H	2.4 mm (m)
<b>Standard noise source drive output</b>	BNC female adapter	
<b>Smart noise source drive output</b>	Multi-core connector	
<b>USB2.0 interface</b>	For connecting mouse, keyboard, and updating software and backing up data.	

Table 4 Back Panel Interfaces

Back Panel Interfaces	
<b>Keyboard interface</b>	Standard PS/2 interface for connecting standard computer keyboard.
<b>Video interface</b>	VGA interface (15-core D-SUB adapter) for connecting monitors
<b>LAN interface</b>	StandardRJ-45 type, 1000Base-T for software update and remote control
<b>GP-IB Interface</b>	IEEE-488 Bus connector, 24-pin plug (GP-IB code: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, C0) for remote control
<b>USB2.0 interface</b>	For connecting mouse, keyboard, and updating software and backing up data.
<b>10 MHz reference input</b>	50 $\Omega$ impedance, BNC female adapter, amplitude range -5 dBm~+10 dBm
<b>10 MHz reference output</b>	50 $\Omega$ impedance, BNC female adapter, output amplitude $\geq 0$ dBm
<b>Trigger input</b>	BNC female adapter
<b>Trigger output1</b>	BNC female adapter
<b>Trigger output2</b>	BNC female adapter
<b>Detection output</b>	BNC female adapter

## Ordering Information

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

Standard Accessories	Description
1	Standard 3-phase power cord
2	USB mouse
3	User Manual
4	Programing Manual

Options	Description
Noise Source	
16603 series standard noise source	As standard noise power for noise figure measurement
16604 series smart noise source	
Coaxial adapter	
711XX series	For connection between noise source and adapter interface of noise figure analyzer
Cable	
BNC (m) -BNC (m)	For connection between standard noise source drive interface of noise figure analyzer and noise source
Multi-core cable	For connection between smart noise source drive interface of noise figure analyzer and noise source
Alloy shipping case	
3986-H01	High strength, lightweight alloy shipping case with handle and wheels for easier handling.
English suite	
3986-H98	English panel, English instructions, and English operation interfaces.

### Calibration and Warranty

Calibration	Description
R1282A R-50C-011-3	Calibration - 3 years
R1282A R-50C-011-5	Calibration - 5 years
Warranty	Description
One-year warranty	
R1280A R-51B-001-3C	Carry-in Service - 3 years



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