Instruments.uni-trend.com

USG3000M/USG5000M Series RF Analog Signal Generators

User Manual

This document applies to the following models:

USG3000M series

USG5000M series

V1.2

April 2025

Foreword

Thank you for choosing this UNI-T instrument. For safe and proper use this instrument, please read this manual carefully, especially the safety instructions session.

After reading this manual, it is recommended to keep the manual in a convenient location, preferably near the device, for future reference.

Chapter 1 Instructions Manual

This manual outlines the safety requirements, installment and the operation of USG5000 series RF analog signal generator.

1.1 Inspecting Packaging and List

When you receive the instrument, please check the packaging and list by the following steps.

- Check whether the packing box and padding material have been compressed or damaged by external forces and inspect the appearance of the instrument. If you have any questions about the product or need consulting services, please contact the distributor or local office.
- Carefully take out the article and check it with the packing instructions.

1.2 Safety Instructions

This chapter contains information and warnings that must be observed. Ensure that the instrument is operated under safe conditions. In addition to the safety precautions indicated in this chapter, you must also follow accepted safety procedures.

Safety Precautions	
Warning	**Please follow these guidelines to avoid possible electric shock and risk to personal safety.**
	Users must adhere to standard safety precautions during the operation, servicing, and maintenance of this device. UNI-T will not be liable for any personal safety and property loss caused by the user's failure following the safety precautions. This device is designed for professional users and responsible organizations for measurement purposes. Do not use this device in any manner not specified by the manufacturer. This device is intended for indoor use only, unless otherwise stated in the product manual.
Safety Statements	
Warning	**“Warning” indicates the presence of a hazard. It warns users to pay attention to a certain operation process, operation method or similar. Personal injury or death may occur if the rules in the “Warning” statement are not properly executed or observed. Do not proceed to the next step until you fully understand and meet the conditions stated in the “Warning” statement.**
Caution	**“Caution” indicates the presence of a hazard. It warns users to**

	pay attention to a certain operation process, operation method or similar. Product damage or loss of important data may occur if the rules in the "Caution" statement are not properly executed or observed. Do not proceed to the next step until you fully understand and meet the conditions stated in the "Caution" statement.	
Note	**"Note" indicates important information. It reminds users to pay attention to procedures, methods, and conditions, etc. The contents of "Note" should be highlighted if necessary.**	
Safety Signs		
	Danger	It indicates danger of electric shock, which may cause personal injury or death.
	Warning	It indicates that there are factors you should be cautious of to prevent personal injury or product damage.
	Caution	It indicates danger, which may cause damage to this device or other equipment if you fail to follow a certain procedure or condition. If the "Caution" sign is present, all conditions must be met before you proceed to operation.
	Note	It indicates potential problems, which may cause failure of this device if you fail to follow a certain procedure or condition. If the "Note" sign is present, all conditions must be met before this device will function properly.
	AC	Alternating current of device. Please check the region's voltage range.
	DC	Direct current device. Please check the region's voltage range.
	Grounding	Frame and chassis grounding terminal
	Grounding	Protective grounding terminal
	Grounding	Measurement grounding terminal
	OFF	Main power off
	ON	Main power on
	Power	Standby power supply: When the power switch is turned off, this device is not completely disconnected from the AC power supply.
CAT I	Secondary electrical circuit connected to wall sockets through transformers or similar equipment, such as electronic instruments and electronic equipment; electronic equipment with protective measures, and any high-voltage and low-voltage circuits, such as the copier in the	

		office.
CAT II		Primary electrical circuit of the electrical equipment connected to the indoor socket via the power cord, such as mobile tools, home appliances, etc. Household appliances, portable tools (e.g., electric drill), household sockets, sockets more than 10 meters away from CAT III circuit or sockets more than 20 meters away from CAT IV circuit.
CAT III		Primary circuit of large equipment directly connected to the distribution board and circuit between the distribution board and the socket (three-phase distributor circuit includes a single commercial lighting circuit). Fixed equipment, such as multi-phase motor and multi-phase fuse box; lighting equipment and lines inside large buildings; machine tools and power distribution boards at industrial sites (workshops).
CAT IV		Three-phase public power unit and outdoor power supply line equipment. Equipment designed to "initial connection," such as power distribution system of power station, power instrument, front-end overload protection, and any outdoor transmission line.
CE	**Certification**	CE indicates a registered trademark of EU.
Intertek 4007682	**Certification**	Conforms to UL STD 61010-1 and 61010-2-030. Certified to CSA STD C22.2 No.61010-1 and 61010-2-030.
	Waste	Do not place equipment and accessories in the trash. Items must be properly disposed of in accordance with local regulations.
40	**EEUP**	This environment-friendly use period (EFUP) mark indicates that dangerous or toxic substances will not leak or cause damage within this indicated time period. The environmentally friendly use period of this product is 40 years, during which it can be used safely. Upon expiration of this period, it should enter the recycling system.
Safety Requirements		
Warning		
Preparation before use		Please connect this device to AC power supply with the power cable provided. The AC input voltage of the line reaches the rated value of this device. See the product manual for specific rated value. The line voltage switch of this device matches the line voltage. The line voltage of the line fuse of this device is correct. This device is not intended for measuring the main circuit.
Check all terminal rated values		Please check all rated values and marking instructions on the product to avoid fire and the impact of excessive current. Please consult the product manual for detailed rated values before connection.

Use the power cord properly	You can only use the special power cord for the instrument approved by the local and state standards. Please check whether the insulation layer of the cord is damaged, or the cord is exposed, and test whether the cord is conductive. If the cord is damaged, please replace it before using the instrument.
Instrument Grounding	To avoid electric shock, the grounding conductor must be connected to the ground. This product is grounded through the grounding conductor of the power supply. Please be sure to ground this product before it is powered on.
AC power supply	Please use the AC power supply specified for this device. Please use the power cord approved by your country and confirm that the insulation layer is not damaged.
Electrostatic prevention	This device may be damaged by static electricity, so it should be tested in the anti-static area if possible. Before the power cable is connected to this device, the internal and external conductors should be grounded briefly to release static electricity. The protection grade of this device is 4 kV for contact discharge and 8 kV for air discharge.
Measurement accessories	Measurement accessories designated as lower-grade, which are not applicable to main power supply measurement, CAT II, CAT III, or CAT IV circuit measurement. Probe subassemblies and accessories within the range of IEC 61010-031 and current sensors within the range of IEC 61010-2-032 can meet its requirements.
Use the input / output port of this device properly	Please use the input / output ports provided by this device in a proper manner. Do not load any input signal at the output port of this device. Do not load any signal that does not reach the rated value at the input port of this device. The probe or other connection accessories should be effectively grounded to avoid product damage or abnormal function. Please refer to the product manual for the rated value of the input / output port of this device.
Power fuse	Please use a power fuse of exact specification. If the fuse needs to be replaced, it must be replaced with another one that meets the specified specifications by the maintenance personnel authorized by UNI-T.
Disassembly and cleaning	There are no components available for operators inside. Do not remove the protective cover. Qualified personnel must conduct maintenance.
Service environment	This device should be used indoors in a clean and dry environment with ambient temperature from 0 °C to +40 °C. Do not use this device in explosive, dusty, or high humidity conditions.
Do not operate in	Do not use this device in a humid environment to avoid the risk of internal

humid environment	short circuit or electric shock.
Do not operate in flammable and explosive environment	Do not use this device in a flammable and explosive environment to avoid product damage or personal injury.
Caution	
Abnormality	If this device may be faulty, please contact the authorized maintenance personnel of UNI-T for testing. Any maintenance, adjustment or parts replacement must be done by the relevant personnel of UNI-T.
Cooling	Do not block the ventilation holes at the side and back of this device. Do not allow any external objects to enter this device via ventilation holes. Please ensure adequate ventilation and leave a gap of at least 15 cm on both sides, front and back of this device.
Safe transportation	Please transport this device safely to prevent it from sliding, which may damage the buttons, knobs, or interfaces on the instrument panel.
Proper ventilation	Insufficient ventilation will cause the device temperature to rise, thus causing damage to this device. Please keep proper ventilation during use, and regularly check the vents and fans.
Keep clean and dry	Please take actions to avoid dust or moisture in the air affecting the performance of this device. Please keep the product surface clean and dry.
Note	
Calibration	The recommended calibration period is one year. Calibration should only be conducted by qualified personnel.

1.3 Environmental Requirements

This instrument is suitable for the following environment.

- Indoor use
- Pollution degree 2
- Overvoltage category: This product should be connected to a power supply that meets Overvoltage Category II. This is a typical requirement for connecting devices via power cords and plugs.
- In operating: altitude lower than 3000 meters; in non-operating: altitude lower than 15000 meters.
- Unless otherwise specified, operating temperature is 10°C to +40°C; storage temperature is -20°C to + 60°C.

- In operating, humidity temperature below to +35°C, ≤ 90% RH. (Relative humidity); in non-operating, humidity temperature is +35°C to +40°C, ≤ 60% RH.

There is ventilation opening on the rear panel and side panel of the instrument. So please keep the air flowing through the vents of the instrument housing. To prevent excessive dust from blocking the vents, please clean the instrument housing regularly. The housing is not waterproof, please disconnect the power supply first and then wipe the housing with a dry cloth or a slightly moistened soft cloth.

1.4 Connecting Power Supply

The specification of the AC power supply is as shown in the following table.

Voltage Range	Frequency
100 - 240 V AC (Fluctuations ±10%)	50/60 Hz
100 - 120 V AC (Fluctuations ±10%)	400 Hz

The maximum power consumption of the instrument does not exceed 75 W.

Please use the attached power cord to connect to the power port.

Connecting to the service cable:

This instrument is a Class I safety product. The supplied power cables have reliable performance in terms of case grounding. This spectrum analyzer is equipped with a three-prong power cable that meets international safety standards. It provides good case grounding performance for the specifications of your country or region.

Please install the AC power cable as follows:

- Ensure the power cable is in good condition.
- Leave enough space to connect the power cord.
- Plug the attached three-prong power cable into a well-grounded power socket.

1.5 Electrostatic Requirements

Electrostatic discharge may cause damage to components. Components can be damaged invisibly by electrostatic discharge during transportation, storage and use.

The following measure can reduce the damage of electrostatic discharge.

- Testing in anti-static area as far as possible.
- Before connecting the power cable to the instrument, inner and outer conductors of the instrument should be briefly grounded to discharge static electricity.
- Ensure all the instruments are properly grounded to prevent the accumulation of static.

1.6 Preparation Work

1. Connect the power supply wire, plug the power socket into the protective grounding socket; adjust the alignment jig according to your view.
2. Press the switch button on the front panel to boot up the instrument.

1.7 Usage Tip

Activate the Option

If you want to activate an option, you need to input the secret key for the option. Please contact the UNI-T office to purchase it.

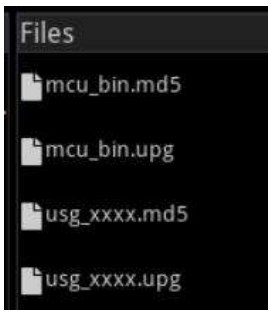
Refer to the following steps to activate the option you have purchased:

1. Save the secret key into a USB drive and insert it into the signal analyzer.
2. Press the Utility →System Info key to open the system menu and view basic and optional information.
3. In the system information window, press Add License key below the option information table, open the "Add License" dialog box, find the license file in the U disk in the dialog box, select the license file ,and check the box;
4. Update the status of the option in the selection information table.

Firmware update

After downloading the firmware upgrade package on the official website, please follow the following steps to upgrade:

1. Unpack the upgrade package to the root of your USB drive, which contains four files: mcu_bin.md5, mcu_bin.upg, usg_xxxx.md5, and usg_xxxx.upg, as shown below:



2. Insert the U disk into the USB interface of the front panel of the device, then press the File System button at the bottom left of the screen, open File System → U disk → Upgrade package → select the mcu_bin.upg file, and click Load in the menu on the right panel of the screen to confirm the upgrade.After the first upgrade package is completed, the device will be restarted automatically.After the device is restarted, press the power

switch on the front panel to restart the device;

3. After the device is restarted,open the File System → U disk → Upgrade package → select usg_xxxx.upg file, click Load in the right panel menu of the screen, and confirm the upgrade. After the second upgrade package is completed, the device will be restarted automatically again.After the device is restarted, press the power switch on the front panel to restart the device, and the upgrade is completed.

Note

Use FAT32 format U disk to copy the upgrade package. Keep the power supply state during the upgrade process, keep the U disk stable, and do not do other operations to prevent the equipment from working properly due to the failure of upgrade.

1.8 Remote Control

USG5000M series RF analog signal generator can be used to communicate with a computer via USB, LAN and GPIB interfaces. Users can use SCPI (Standard Commands for Programmable Instruments) through USB or LAN, in combination with programming languages or NI-VISA, to remotely control the instrument and operate other programmable instruments that also support SCPI.

For detailed information about installation, remote control modes, and programming, please refer to the *USG Series Signal Generators Programming Manual* on the official website: http://www.uni-trend.com.

1.9 Help Information

USG5000M series RF analog signal generator has a built-in help system for each function key and menu control key. Click the Help system of the Function Interface : open the help navigation and view the help information of the keys.

Chapter 2 USG5000M Series Overview

USG5000M series RF signal generator, the output frequency range covers 9 kHz to 22 GHz. This product is equipped with analog demodulation capabilities for AM, FM, and ΦM, as well as pulse modulation, impulse train generation, and power meter function. USG5000M series offers convenient operation, superior technical specifications, and an intuitive graphical display, making it a versatile tool for learning, testing, and enhancing work efficiency.

The operation of the system is the same for both the USG5000M and USG3000M series; however, the hardware configurations and system parameters differ between the two. This manual introduces the user interface and descriptions of various keys for the USG5000M series. For different models, the parameter configurations and ranges for each key menu may vary. Please refer to the respective data sheets for specific parameter configurations.

2.1 Output Specifications

Channel	RF	LF
Setting range	-135 dBm to 25 dBm	1 mVpp to 2Vpp (50Ω)
Waveform	Sine	Sine, Square, Pulse, Ramp, Arb, DC, Noise
Modulation	AM, FM, ΦM, Pulse	AM, FM, ΦM, Pulse, ASK, FSK, PSK, and QAM
Sweep Manner	Step frequency sweep, list frequency sweep, step amplitude sweep, and list amplitude sweep	Logarithmic frequency sweep, linear frequency sweep, and step frequency sweep

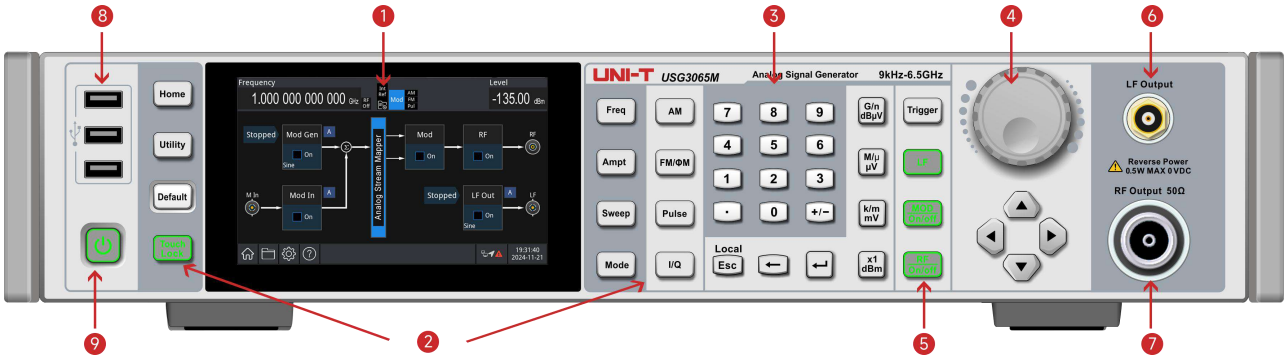
2.2 Panel and Keys

2.2.1 Front Panel

The product front panel is shown in the following figure, it is simple, intuitive and easy to use.

USG5000M

USG3000M



1. Display Screen

   The 5-inch capacitive touch screen clearly distinguishes function menus, control statuses, and other important information using distinct color tones. Parameter adjustments and output controls are accessible through the touch screen, and the user-friendly system interface enhances human-computer interaction, improving work efficiency.

2. Function Key

   The function buttons are Home, Utility,Sweep, AM, FM/ΦM, and Pulse.

   Pressing the Home button returns to the home page; the MOD On/Off button enables RF modulation; the Sweep button enables RF sweep; the AM button configures the AM setting for RF; the FM/ΦM button configures the FM/ΦM setting for RF; the Pulse button configures the pulse setting for RF; and the Utility button is used to set the auxiliary functions.

3. Numerical Keyboard

   Digit keys 0 to 9 are used for entering required parameters, along with the decimal point (“.”), the symbol key (“+/-”), and unit keys. The left arrow key backspaces to delete the previous digit in the current entry.

4. Multifunction Rotary Knob / Arrow Keys

The multifunction rotary knob is used to change values (rotate clockwise to increase the number) or function as an arrow key. Press the knob to select a function or confirm a setting. When using the multifunction rotary knob and arrow key to set parameters, they can be used to switch between digit positions, clear the previous digit, or move the cursor left or right.

5. RF/LF/MOD Output Button

   Press the RF button to control the RF signal output; press the LF button to control the LF signal output; press the MOD button to enable or disable each modulation mode. The key backlight turns on when the key is enabled and turns off when it is disabled.

6. LF Channel

   LF output port , the port has backlight function, the port has signal output when the backlight is lit, otherwise there is no signal output.

7. RF Channel

   RF output port , the port has backlight function, the port has signal output when the backlight is lit, otherwise there is no signal output.

8. USB Port

   This port is used to connect an external USB storage device. Through this interface, arbitrary waveform data files saved on the USB device can be read or imported. Alternatively, the instrument's system can be upgraded using this interface to ensure that the function/arbitrary waveform generator program is updated to the latest version.

9. Power Switch button

   Press the power switch button to turn on the instrument, press it again to turn it off.

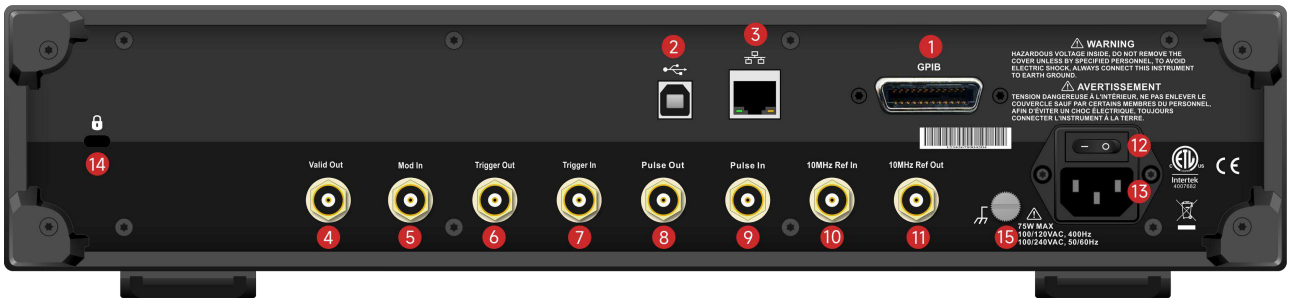
Note

The LF channel output interface has overvoltage protective function, it will be generated when one of the following conditions is met.

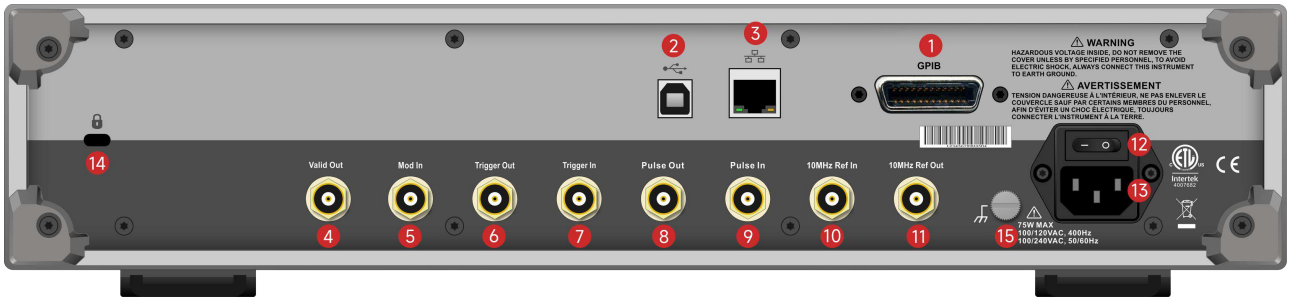
- The amplitude of the instrument is less than or equal to 4 Vpp; the input voltage is larger than | ± 3 V | ; the frequency is less than 10 kHz.
- When the overvoltage protective function is triggered, the channel will automatically disable the output.

2.2.2 Rear Panel

USG5000M



USG3000M



1. GPIB Port

   This port is used to connect the signal generator to a PC, allowing control of the instrument through PC software with GPIB cable.

2. USB Port

   This port is used to connect the signal generator to a PC, allowing control of the instrument through PC software with USB cable.

3. Local Area Network (LAN)

   This port connects the instrument to a PC through ethernet or remote control.

4. Valid Output Port

   Valid output provides a pulse signal. When the user modifies parameters such as frequency or amplitude, valid outputs a high pulse signal. After parameter settings are completed, valid outputs a low pulse signal.

5. External Analog Modulation Input Port

   For RF AM, FM, and phase modulation, when the modulation source is set to external or internal+external, the modulation signal is input through the external analog modulation input. The corresponding modulation depth, frequency deviation, phase deviation, or duty cycle deviation is controlled by the 4Vpp high resistance signal level applied to the external analog modulation input.

6. Trigger Signal Output Port

   When performing LF scanning, if the trigger output is enabled, the trigger signal (a square wave)

can be output through the connector and is compatible with TTL levels. This connector can also output the synchronization signal when RF pulse modulation is used.

7. External Trigger Signal Input Port

When the sweep trigger mode is set to “external” for either RF or LF, this port receives a TTL pulse with the specified polarity as the trigger signal.

8. Pulse Signal Output Port

When performing pulse modulation, this port outputs the pulse signal generated by the internal generator.

9. Pulse Signal Input Port

When the pulse mode is set to external trigger, external trigger pulse pair, gating, or external pulse, this port is used to input an external pulse signal.

10. External 10MHz Input Port

Establish synchronization between multiple generators or with an external 10 MHz clock signal. If the instrument detects an external 10 MHz clock signal at the [10MHz IN] connector (input requirements: 10 MHz frequency and the amplitude is ≥0dBm/50Ω), it will automatically switch to this signal as the external clock source, indicated by the first icon Ext Ref in the status bar. In automatic mode, if the external clock source is lost, out of range, or disconnected, the instrument will automatically revert to the internal clock, and the icon Ext Ref will update to Int Ref.

11. Internal 10MHz Output Port

Establish synchronization between multiple signal generators or the output of a 10 MHz reference clock signal to an external source.

12. Main Power Supply Switch

When the power supply switch is set to “I”, the instrument power is connected. When the power switch is set to “O”, the instrument is disconnected (the power button on the front panel does not function).

13. AC Power Input Port

For the AC power specifications of the USG5000 series, refer to the Connecting Power Supply section.

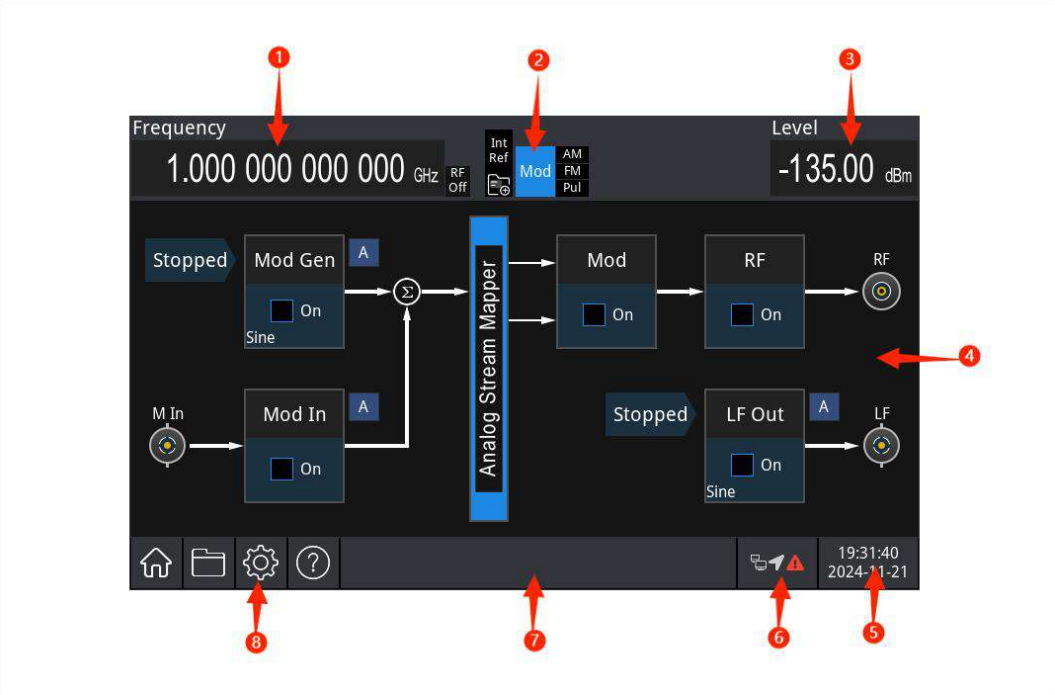
14. Safety Lock

The safety lock (sold separately) is used to secure the instrument in a fixed position.

15. Ground Terminal

The ground terminal provides an electrical connection point for attaching an antistatic wrist strap to reduce electrostatic discharge (ESD) when handling or connecting the DUT.

2.2.3 Function Interface



1. RF Frequency (Display Frequency): By selecting this parameter, users can directly set the RF frequency. This differs from the frequency output setting in the frequency menu, RF Frequency (Display Frequency) = Frequency Output + Frequency Offset.
2. Status Bar

   RF: Displays RF output state. Gray indicates that the output is disabled, while blue indicates that the output is enabled.

   ExtRef: Indicates that the signal generator is using the external 10MHz reference input.

   AM/FM/Pul: Indicates the current modulation function in use. Gray indicates that the current modulation is disabled, while blue indicates that the current modulation is enabled.
3. RF (Display Amplitude): By selecting this parameter, you can directly set the RF amplitude. This differs from the amplitude output setting in the frequency menu, RF Amplitude (Display Amplitude) = Amplitude Output + Amplitude Offset.
4. Parameter Setting Area

   Modulation source: Controls the internal modulation source for RF, including enabling/disabling the internal modulation source, setting modulation wave, modulation frequency, modulation amplitude, and modulation phase.

   Modulation input: Controls the external modulation source for RF, including enabling/disabling the external modulation input and setting the load for the external modulation source.

   Analog modulation: Controls the RF modulation parameters, including enabling/disabling modulation and setting amplitude modulation (AM), frequency modulation (FM), phase modulation (ΦM), and pulse modulation (Pulse).

RF: Controls the RF carrier waves, including enabling/disabling RF output, setting frequency, amplitude, sweep, and power meter.

Function generation: Controls the LF signals, including enabling/disabling LF output, setting LF carrier waves, sweep, and modulation parameters.

5. Date and time: Displays day and time.
6. Connection type: Displays the connection device state, such as mouse, U disk, USB flash drive, and screen lock.
7. System log dialog box: Click on the blank area on the right side of the file storage section to access the system log, view local runtime logs, alarms, notifications, and other information.
8. Function setting: Screenshot, file system, setup system, and help system.

   Hom page : Click on this key to return to the home page, double-click on this key to take a screenshot and save it to the instrument.

File system : In the file system, users can save, copy, move, delete, load, and rename files, including sweep list files, pulse string files, screenshots, state files, arbitrary files, and other files.

System information : View basic and optional information about the instrument.

Help system : Open the help navigation.

2.2.4 Touch Operation

RF analog signal generator is equipped with a 5-inch capacitive touchscreen that supports several gestures:

- Tap a parameter or menu on the screen to edit the selected parameter.
- Swipe left or right to switch menus
- Swipe up or down to scroll through the menu.

Note: The menu can only be scrolled down when a scroll bar appears on the right side of the screen. If no scroll bar is visible, only the current page is displayed.

Chapter 3 Quick Start

3.1Output RF Signal

3.1.1 Set Output Frequency

Default RF wave configuration: A continuous wave with 1 GHz frequency, amplitude -135 dBm.

The specific steps to change the frequency to 2.5 MHz are as follows.

Press the Freq key, use the numerical keyboard to enter 2.5, and then select GHz as the unit for the parameter.

3.1.2 Set Frequency Offset

Default RF wave configuration: The frequency offset is 0 Hz.

The specific steps to change the frequency offset to 100 kHz are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Freq→Freq Offset key, use the numerical keyboard to enter 100, select kHz as the unit for the parameter, and then click Freq Offset key to enable this setting.

Note: The multifunction knob and arrow keys can also be used together to set this parameter.

3.1.3 Set Reference Frequency

Default RF wave configuration: The reference frequency is 0 Hz.

The specific steps to change the reference frequency to 200 MHz are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Freq→Freq Ref key, use the numerical keyboard to enter 200, select MHz as the unit for the parameter, and then click Freq Ref key to enable this setting.

3.1.4 Set Phase Offset

Default RF wave configuration: The phase offset is 0°.

The specific steps to change the phase offset to 90° are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Freq→Phase Offset key, use the numerical keyboard to enter 90, and then select deg as the unit for the parameter.

3.1.5 Set Reference Phase

Default RF wave configuration: The phase offset is 0°.

The specific steps to change the reference phase to 180° are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Freq→Phase Ref

key, use the numerical keyboard to enter 180, select deg as the unit for the parameter, and then click Phase Ref key to enable this setting.

3.1.6 Set Internal TB Calibration

Default RF wave configuration: The internal TB calibration is 0 ppb.

The specific steps to change the internal TB calibration to 30 ppb are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Freq→ Inner TB calibration key, use the numerical keyboard to enter 30, and then select ppb as the unit for the parameter.

3.1.7 Set Reference Source

Default RF wave configuration: The reference source is Auto.

The specific steps to change the reference source to internal are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Freq → Ref Oscillator →Internal key to complete this setting.

3.1.8 Set Output Amplitude

Default RF wave configuration: The amplitude is -135 dBm.

The specific steps to change the amplitude to 0 dBm are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Ampt→Ampt key, use the numerical keyboard to enter 0, and then select dBm as the unit for the parameter.

3.1.9 Set Output Amplitude Offset

Default RF wave configuration: The amplitude offset is 0 dB.

The specific steps to change the phase offset to 10 dB are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF → Ampt→Ampt Offset key, use the numerical keyboard to enter 10, and then select Ampt Offset as the unit for the parameter.

3.1.10 Set Reference Amplitude

Default RF wave configuration: The reference amplitude is 0 dB.

The specific steps to change the reference amplitude to 20 dB are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF → Ampt→Ampt Ref key, use the numerical keyboard to enter 20, select dBm as the unit for the parameter, and then click Ampt Ref key to enable this setting.

3.1.11 Set User-defined Maximum Power

Default RF wave configuration: The user-defined maximum power is 25 dBm.

The specific steps to change the customized maximum power to 20 dB are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Ampt→User Power Max key, use the numerical keyboard to enter 20, select dBm as the unit for the parameter, and then click User Power Max key to enable this setting.

3.1.12 Set Attenuation

Default RF wave configuration: The attenuation is 25 dB.

The specific steps to change the attenuation to 10 dB are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Ampt→ Set Atten key, use the numerical keyboard to enter 10, and then select dB as the unit for the parameter.

3.1.13 Set ALC

Default RF wave configuration: The ALC (Automatic Level Control) is Auto.

The specific steps to change the ALC state to auto are as follows.

Press the Home key in the analog stream mapper on the screen, press the RF →Ampt→ ALC State key, and select Auto in the drop-down menu to complete the setting.

3.2 Output LF Signal

3.2.1 Set Output Frequency

Default LF signal wave configuration: A sine wave (high resistance) with 500 kHz frequency, amplitude 2 Vpp (peak to peak).

The specific steps to change the frequency to 2.5 MHz are as follows.

Press the Home key in the analog stream mapper on the screen, press the LF Out →LF Base →Freq key, use the numerical keyboard to enter 2.5, and then select MHz as the unit for the parameter.

3.2.2 Set Output Amplitude

Default LF signal wave configuration: A sine wave (high resistance) with amplitude 2 Vpp (peak to peak).

The specific steps to change the amplitude to 300 mVpp are as follows.

Press the Home key in the analog stream mapper on the screen, press the LF Out →LF Base →Ampt key, use the numerical keyboard to enter 300, and then select mVpp as the unit for the parameter.

3.2.3 Set DC Offset Voltage

Default LF signal wave configuration: The DC offset voltage is a sine wave 0 V (high resistance).

The specific steps to change the DC offset voltage to -150 mV are as follows.

Press the Home key in the analog stream mapper on the screen, press the LF Out →LF Base →DC Offset key, use the numerical keyboard to enter -150, and then select mVpp as the unit for the parameter.

Note: The multifunction knob and arrow keys can also be used together to set this parameter.

3.2.4 Set Phase

Default LF signal wave configuration: The phase is 0°.

The specific steps to change the phase to 90° are as follows.

Press the Home key in the analog stream mapper on the screen, press the LF Out →LF Base →Phase key, use the numerical keyboard to enter 90, and then select deg as the unit for the parameter.

3.2.5 Set Duty Ratio for Square Wave

Default LF signal square wave configuration: Frequency of 500 kHz with a 50% duty cycle.

The specific steps to change the duty ratio to 25% are as follows.

Press the Home key in the analog stream mapper on the screen, press the LF Out →LF Base →Type key, in the drop-down menu to select the square wave, press the Duty key, use the numerical keyboard to enter 25, and then select % as the unit for the parameter.

3.2.6 Set Symmetry for ramp wave

Default LF signal ramp wave configuration: Frequency of 500 kHz with a symmetry 50%.

The specific steps to change the symmetry to 75% are as follows.

Press the Home key in the analog stream mapper on the screen, press the LF Out →LF Base →Type key, in the drop-down menu to select the ramp wave, press the Symmetry key, use the numerical keyboard to enter 75, and then select % as the unit for the parameter.

3.2.7 Set Arbitrary Wave

Default LF signal arbitrary wave configuration: Frequency of 500 kHz with the arbitrary waveform file set to "ACosH.bsv."

The specific steps to set arbitrary waveform file to"ACosH.bsv" are as follows.

Press the Home key in the analog stream mapper on the screen, press the LF Out →LF Base →Type key, in the drop-down menu to select the arbitrary wave, press the Arb wave file key, double-click

select the file folder“Common”in the file window, and select the file “AbsSine.bsv” to import the arbitrary wave.

3.3 Auxiliary Function

The auxiliary function (Utility) can access the system information and set the system, network, and default setting. The specific functions are described below.

3.3.1 System Information

Press the Utility →System Info or RF Info key to open the system menu and view basic and optional information.

1. Basic information: Product name, manufacturer, model, serial number, software version, intermediate frequency hardware version, RF hardware version, intermediate frequency logic version, and RF logic version.
2. Optional information: Optional version and optional status.
3. RF information: Name, version number, and serial number (SN).

3.3.2 System Configuration

Press the Utility →Setting key to open the setting menu to configure the basic and network settings.

1. Basic Settings

   Language: Simplified Chinese, English, and German

   Time format: 12-hour and 24-hour

   Date/Time: Tap the area to open the settings box. Slide the number up or down to adjust the value, then tap “√” to confirm and close the settings box when finished. Picture format: Set the format for saved screenshots to either BMP or PNG.

   User state: The system configuration can be exported.

   Backlight: Slide the scroll bar to adjust the screen backlight.

   Screenshot inverse: Enable to save screenshots with inverse colors.

2. Network Settings

   Adapter: LAN (Local area network) switch. Tap the checkbox “□” to enable this function, indicating that LAN is active.

   DHCP: Tap the checkbox “□” to enable DHCP (Dynamic host configuration protocol). If the checkbox “□”is not checked, manual settings are applied.

   IPV4 address: The format of the IP address is nnn.nnn.nnn.nnn. The range of the first nnn is from 1 to 223. The range of the other three nnn is from 0 to 255. It is recommended to consult your network administrator for an available IP address.

Subnet mask: The format of the subnet mask is nnn.nnn.nnn.nnn. The range of nnn is from 0 to 255. It is recommended to consult your network administrator for a subnet mask address.

Gateway address: The format of the gateway address is nnn.nnn.nnn.nnn. The range of the first nnn is from 1 to 255. The range of the other three nnn is from 0 to 255. It is recommended to consult your network administrator for an available gateway address.

MAC address: The physical address used to identify the location of the network device, also known as the hardware address. It is 48 bits (6 bytes) in length, composed of hexadecimal numbers, and divided into two parts: the first 24 bits and the last 24 bits. The format is xx-xx-xx-xx-xx-xx. The first 24 bits are called the Organizationally Unique Identifier (OUI), while the last 24 bits are allocated by the manufacturer and are referred to as the Extended Identifier.

3. Interface Settings

Web login username: Set the username to log in to the browser. The web address is http://IP, in which the IP address is the IPv4 address set by the network, for example, http://192.168.20.117.

Web login password: Set the username to log in to the browser. After successful login, you can control the instrument, execute SCPI commands, network settings and other operations on the browser.

Once the web login username and password are set, the device can be remotely controlled using a PC or mobile terminal's web browser, mimicking the touchscreen/mouse clickable display function, just like a physical instrument, and the operation is as follows

(1) LAN access

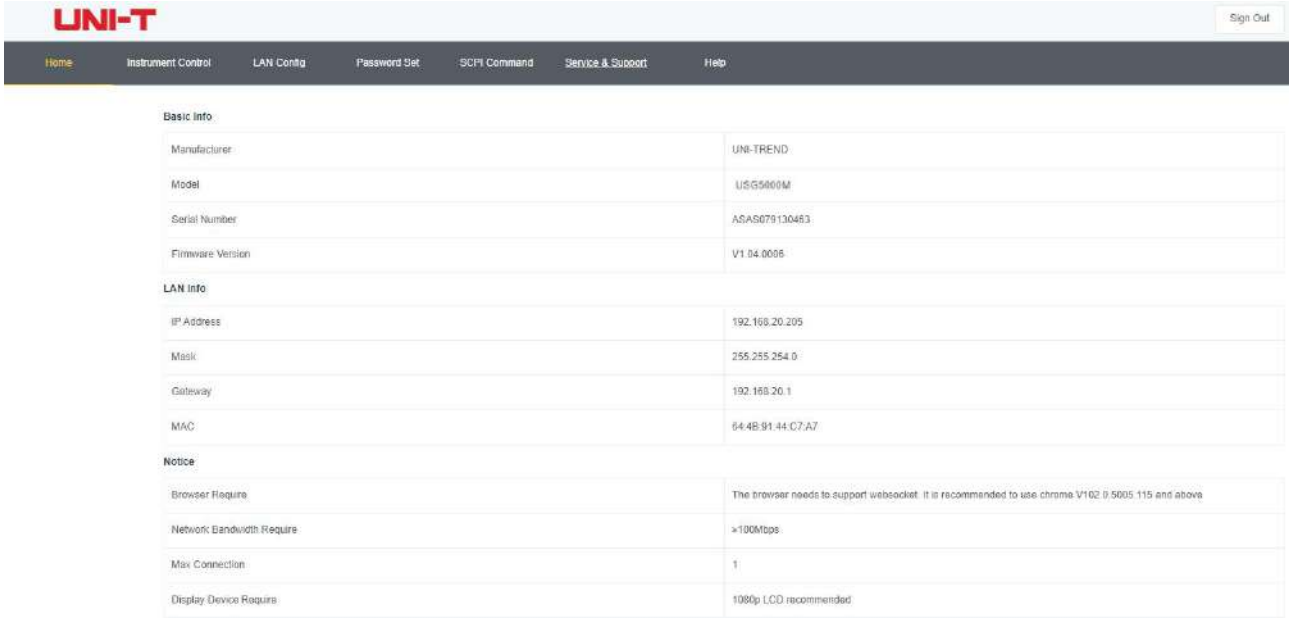
The computer and the signal analyzer are required to be in the same LAN and can ping each other. View the signal generator's local IP via the signal analyzer system-setting menu, and then access the signal analyzer by accessing the http://ip port in a browser.

Example:

Computer IP: 192.168.21.131

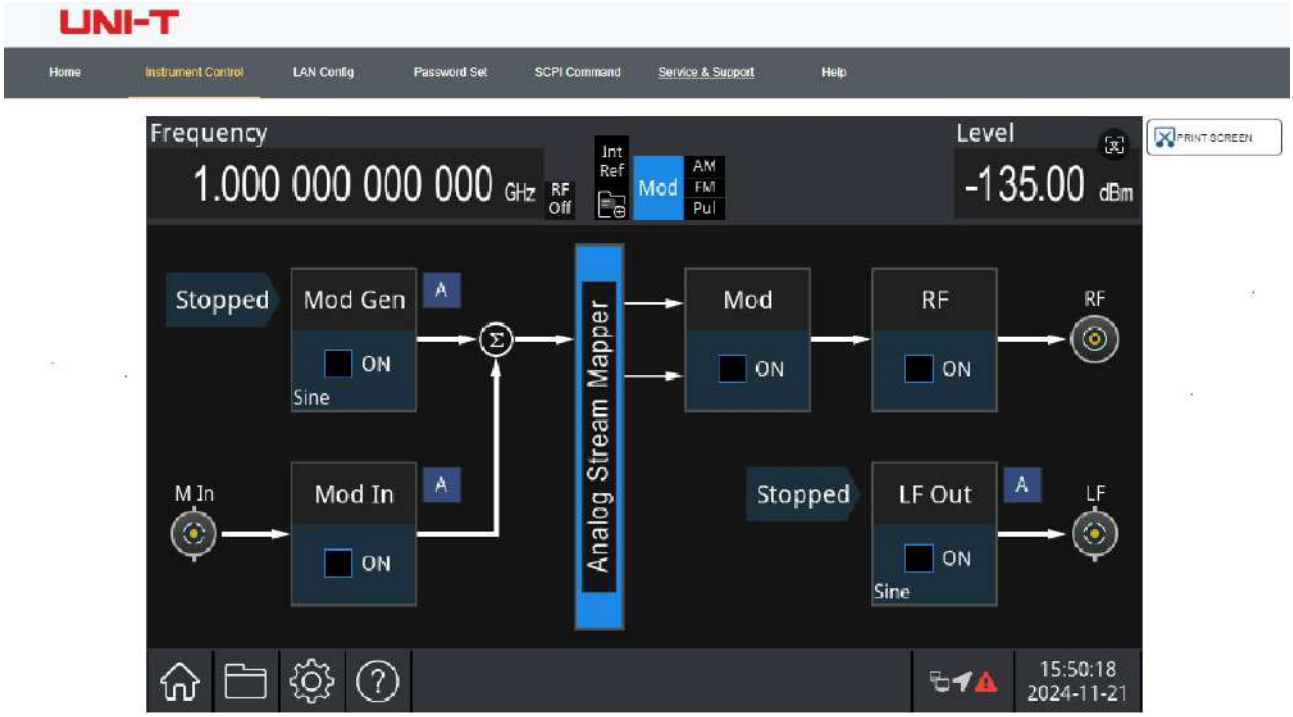
Signal generator IP: 192.168.20.117

Use 192.168.20.117 to access the signal generator in the computer browser, view the basic information, and perform operations such as instrument control, network settings, password settings, and SCPI command control, as shown in the following figure.



Web Basic Information

When viewing instrument control, network settings, password settings, and SCPI command control, you need to log in. For the username and password required to log in, see Web Login Username and Web Login Password in API settings. After logging in, view and control the signal analyzer, as shown in the following figure.



Web Instrument Control

Operations that can be performed on the touch screen of a physical instrument, such as selecting a menu panel, clicking function keys, entering numbers and characters, dragging a mark, etc., can also be operated on this web page, and the screen can also be printed.

(2) Extranet access

a. The signal generator is plugged into a network cable and the network is connected to the Internet

b. Enable the Ftp proxy service on the server.

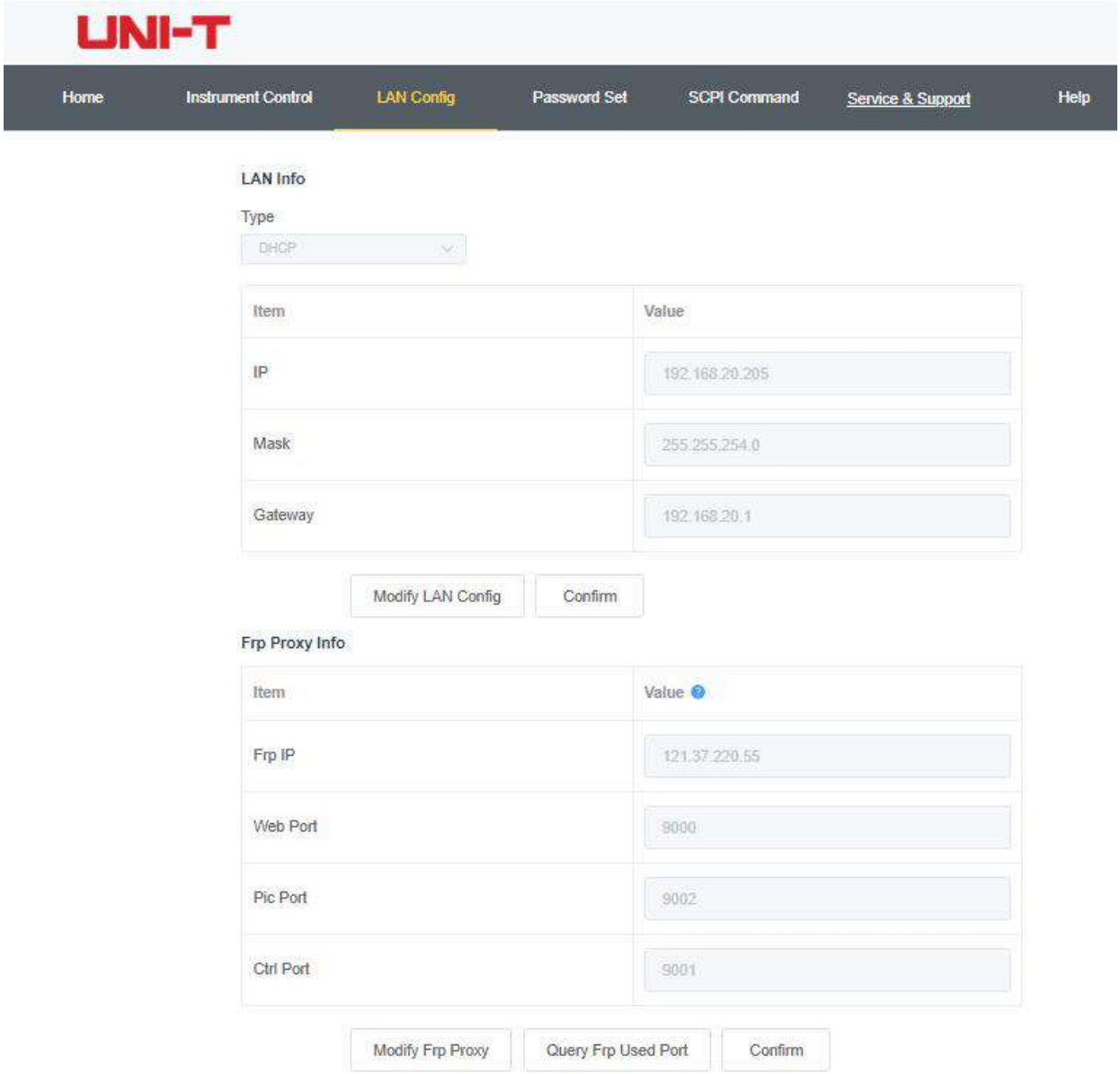
c. Configure the signal generator Ftp proxy IP and port.

d. Browser access proxy http://IP: web_port port to access the signal generator, the access interface is the same as the above.

Note: The Instrument uses Ftp intranet penetration mode to achieve external network access, and the Ftp version is 0.34.0. The machine has Ftp-0.34.0 client, it needs to be used with the server, the server needs to open the Ftp server, and the Ftp server port connected by the client is 7000, so the server needs to be configured bind_port = 7000.

(3) Network setting

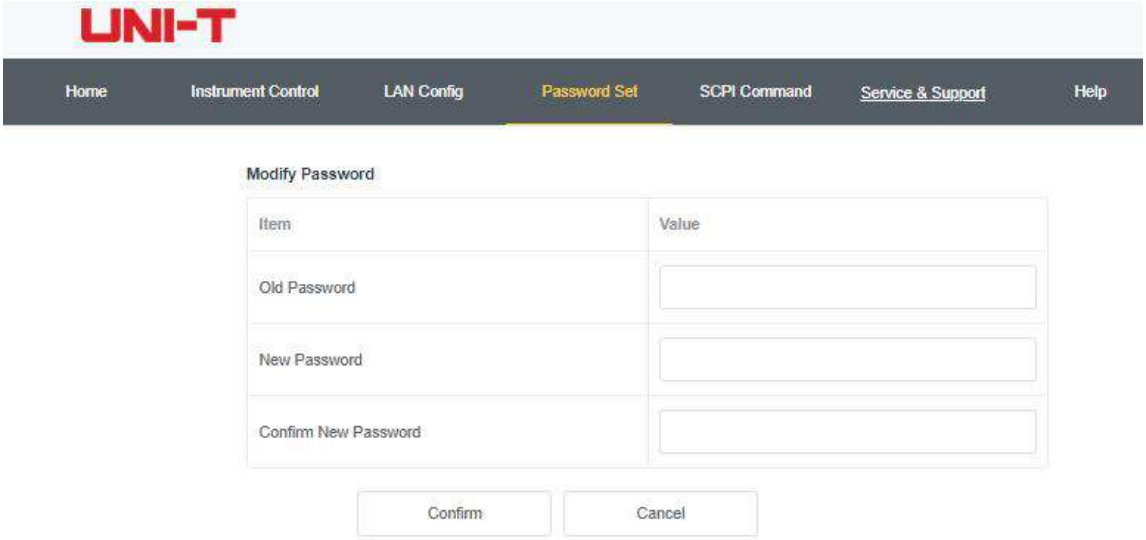
Set and modify the network information of the signal generator and the Ftp agent, as shown in the following figure.



Web Network Settings

(4) Password settings

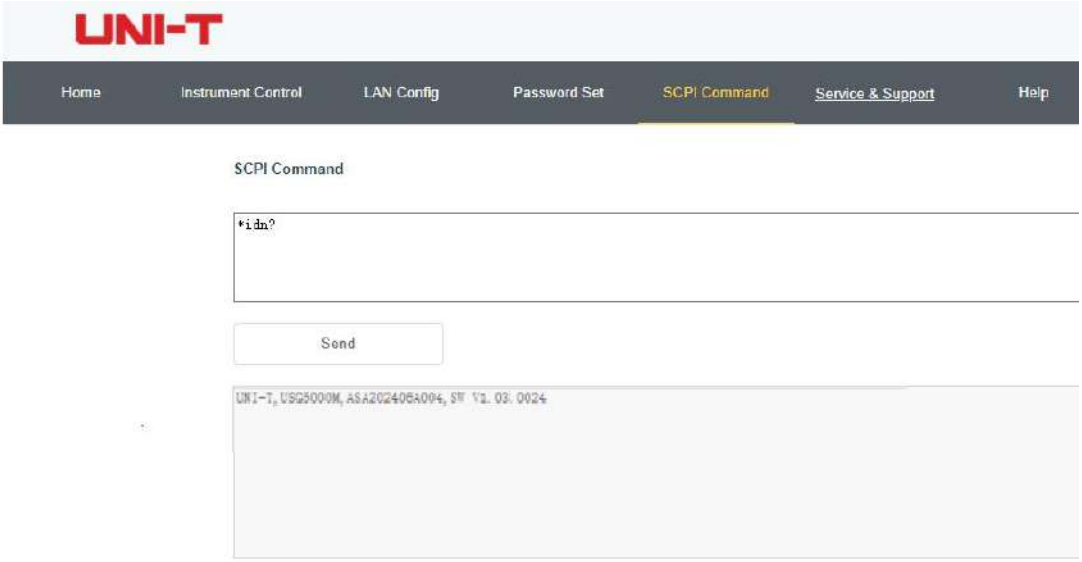
Set and modify the web login password of the signal generator, as shown in the following figure. The original password can be viewed under the Physical Instrument ->Utility->Setting-> Interface Settings.



Web Password Settings

(5) SCPI Command

Execute the SCPI command, as shown in the following figure, enter the command in the SCPI command edit box, click the "Send Command" key, and print the execution result to the report column below.



SCPI Command Control

3.3.3 Restore Default

Press the Utility → Defaults key to open the default setting menu.

1. Restore: Reset the signal generator system settings to the default state.
2. Data: Delete all saved data on the signal generator.
3. All: Restore all settings to the default state and delete user data.

3.3.4 GPIB Setting

Press the Utility →GPIB Bus key to open the GPIB setting menu to set the GPIB address.

Chapter 4 Advanced Application

Both low-frequency (LF) and radio-frequency (RF) channels can output modulated waveforms independently, as each is output through a separate channel.

This chapter introduces 12 types of modulation, including AM, FM, ΦM, and pulse modulation for RF, as well as AM, FM, ΦM, Pulse, ASK, FSK, PSK, and QAM for LF. Alternatively, it covers RF scanning waveforms, LF scanning waveforms, and power meter functions. Press the MOD On/Off key enables RF modulation, and the MOD On/Off key backlight will light up; press it again exits RF modulation, and the MOD On/Off key backlight will turn off.

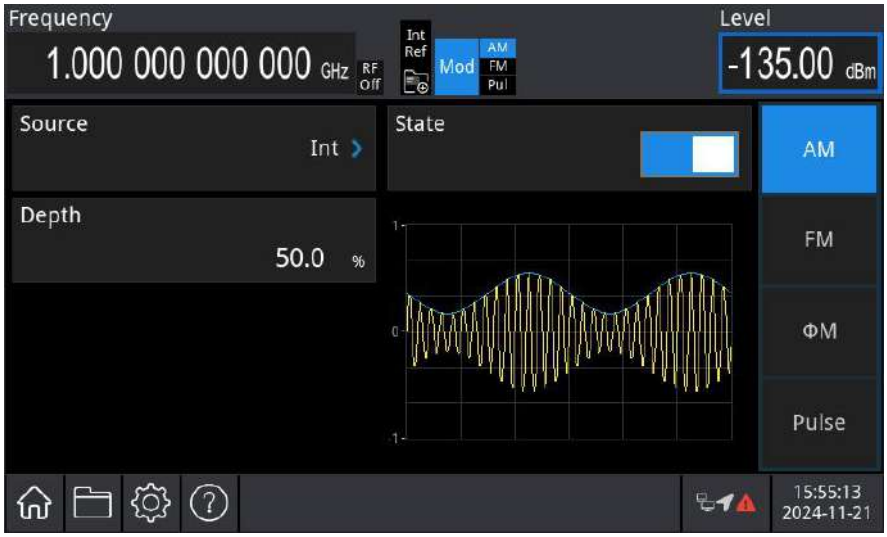
4.1 Modulation Wave Output

4.1.1 RF Amplitude Modulation (AM)

In AM mode, the modulated wave consists of the carrier wave and the modulation wave. The amplitude of the carrier wave changes with the amplitude of the modulation wave.

Select Amplitude Modulation (AM)

Press the Home key in the analog stream mapper on the screen, check the analog modulation ON, and press the Mod →AM →State key to enable AM mode. The instrument will output the modulated waveform according to the current modulation wave and the carrier wave.



Carrier Wave Frequency

Each carrier wave has a different frequency, with a default frequency of 1 GHz. The frequencies of each carrier wave are shown in the following table.

Frequency							
USG3045M/M-P		USG3065M/M-P		USG5014M/M-P		USG5022M-P	
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
9 kHz	4.5 GHz	9 kHz	6.5 GHz	9 kHz	14 GHz	9 kHz	22 GHz

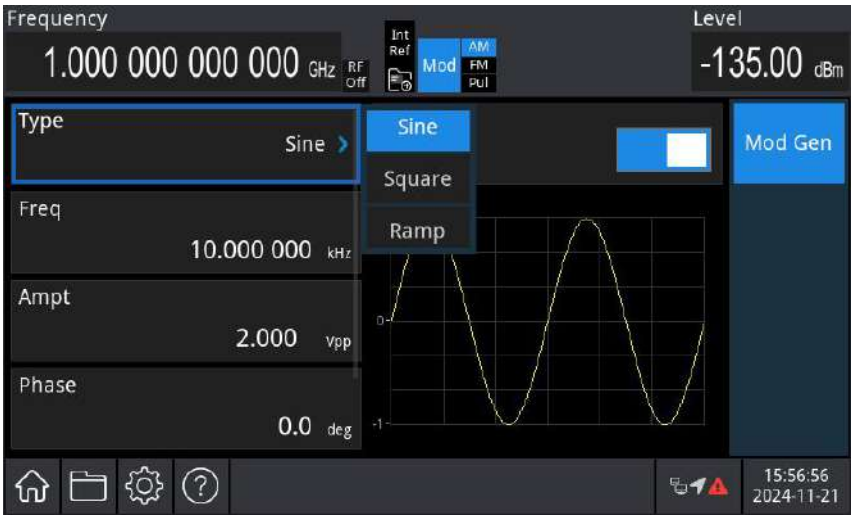
Press the Freq key to set the carrier wave frequency and use the numerical keyboard to enter the number and select the unit to complete this setting.

Select Modulation Wave

USG5000 series modulation source has three options: internal, external, and internal + external. The internal modulation source includes sine wave, square wave, and ramp wave, with the default internal modulation set to a sine wave.

After AM mode is enabled, the default modulation wave (sine wave) will be displayed. The modulation wave can be adjusted by pressing the Home → Source key, using the multi-function rotary knob in modulation source interface, or pressing the Type key to adjust the modulation wave.

- Square wave: Duty ration is 50%.
- ramp wave: Symmetry is 50%.



Set Modulation Frequency

Set the frequency for the modulation wave within a range of 1 mHz to 50 kHz (default: 10 kHz). After AM mode is enabled, the default modulation wave frequency of 10 kHz will be displayed. The modulation frequency can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Freq key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Set Modulation Depth

The modulation depth indicates the change in amplitude, expressed as a percentage. The AM

modulation depth can be set between 0% and 99%, with a default of 50%.

- When the modulation depth is 0%, the output is a constant amplitude at the carrier wave's amplitude.
- When the modulation depth is 99%, the output amplitude varies with the modulation waveform.

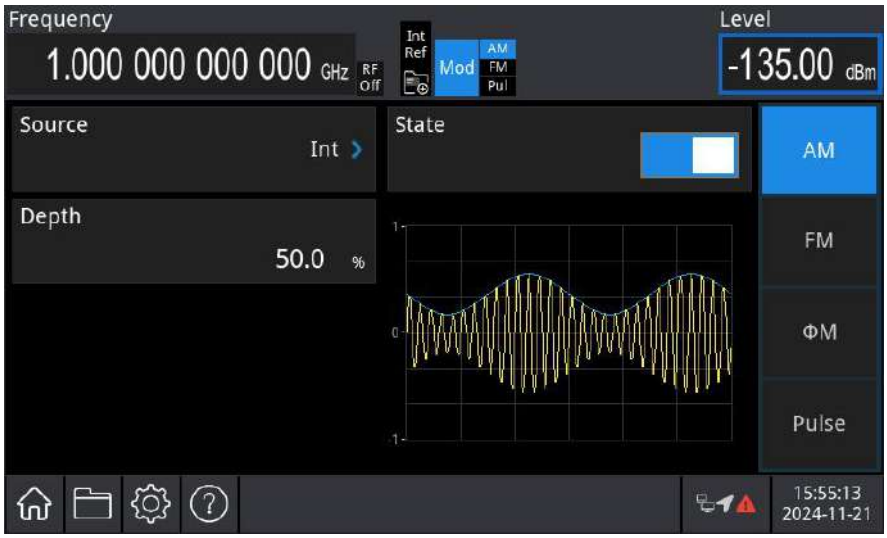
The modulation depth can be adjusted by using the multi-function rotary knob in analog modulation source interface or pressing the Depth key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Comprehensive Example

First, set the instrument to amplitude modulation (AM) mode. Then, configure a 20 kHz sine wave as the internal modulating signal, with a carrier signal frequency of 2 GHz and an amplitude of -20 dBm. Finally, set the modulation depth to 80%. The procedure is as follows.

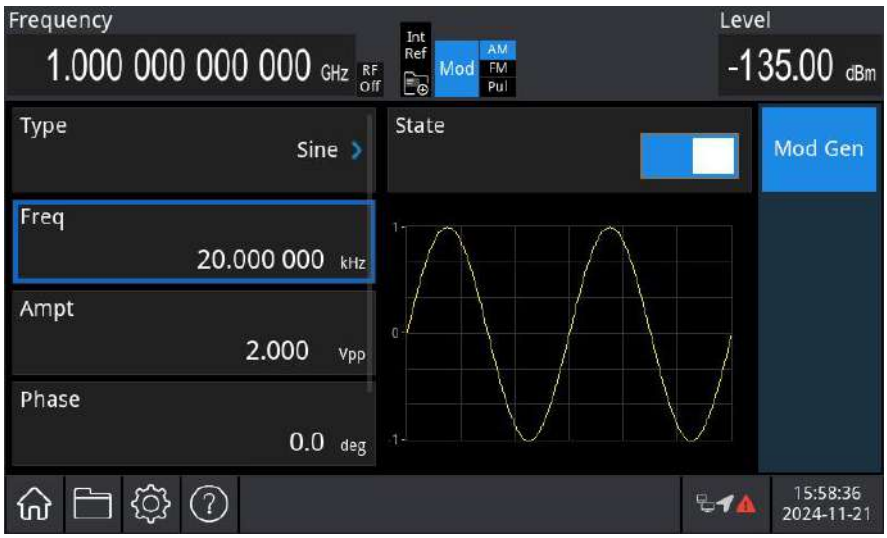
1) Enable AM Mode

Press the Home key in the analog stream mapper on the screen, check the analog modulation ON, and press the Mod →AM →State key to enable AM mode.



2) Set Modulation Signal

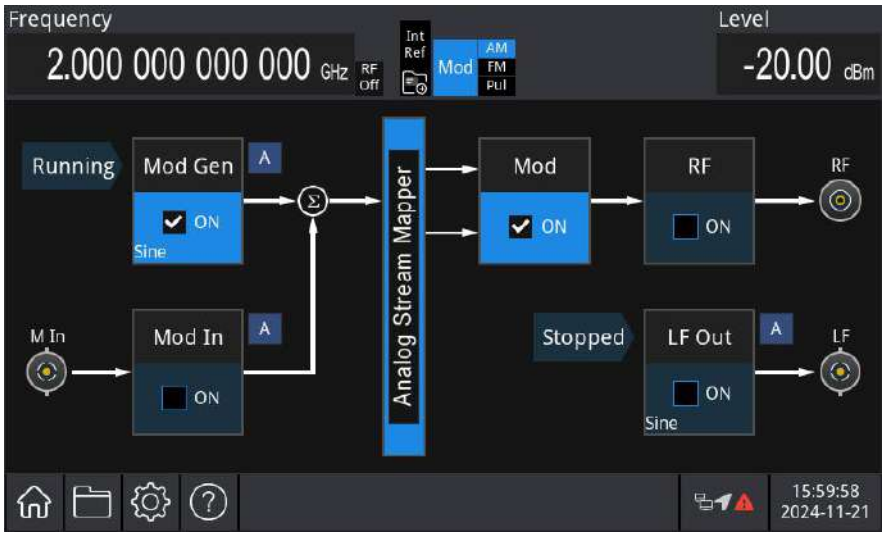
Press the Home key in the analog stream mapper on the screen, check the analog source ON, press the Source →Freq key, then use the numerical keyboard to enter 20 and select the unit kHz for this parameter.



3) Set Carrier Signal

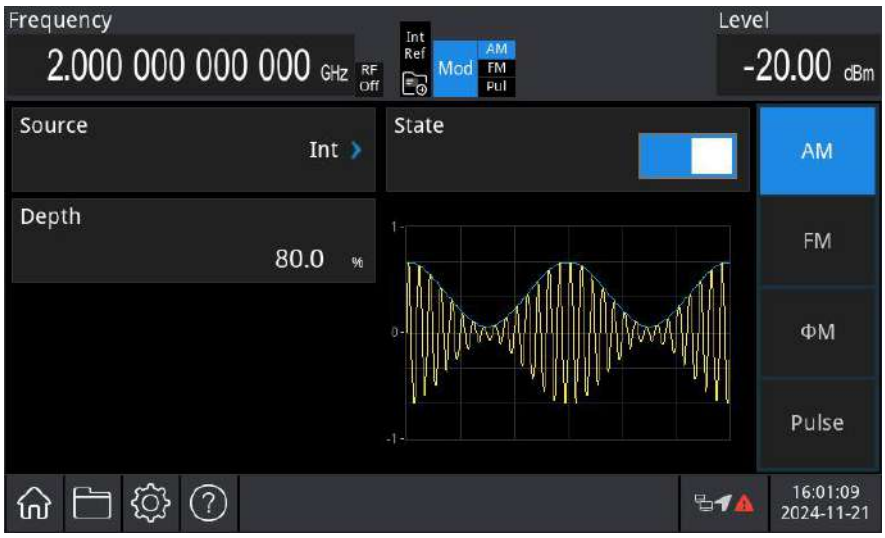
Press the Freq key to set the frequency, then use the numerical keyboard to enter 2 and select the unit GHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter -20 and select the unit dBm for this parameter, as shown in the following figure.



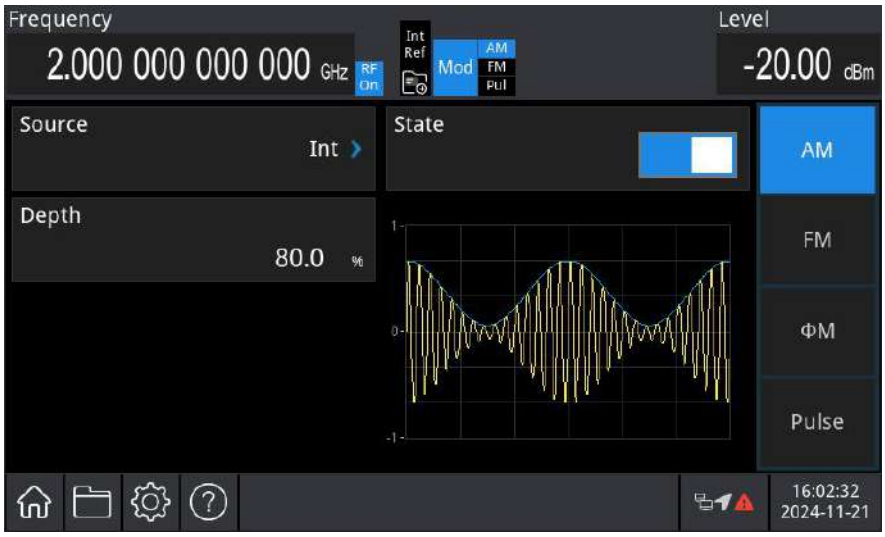
4) Set Modulation Depth

After setting the carrier parameters, press the Home key in the analog stream mapper on the screen, press the Mod key to open AM setting menu, press the Depth key, then use the numerical keyboard to enter 80 and select the unit % for this parameter.

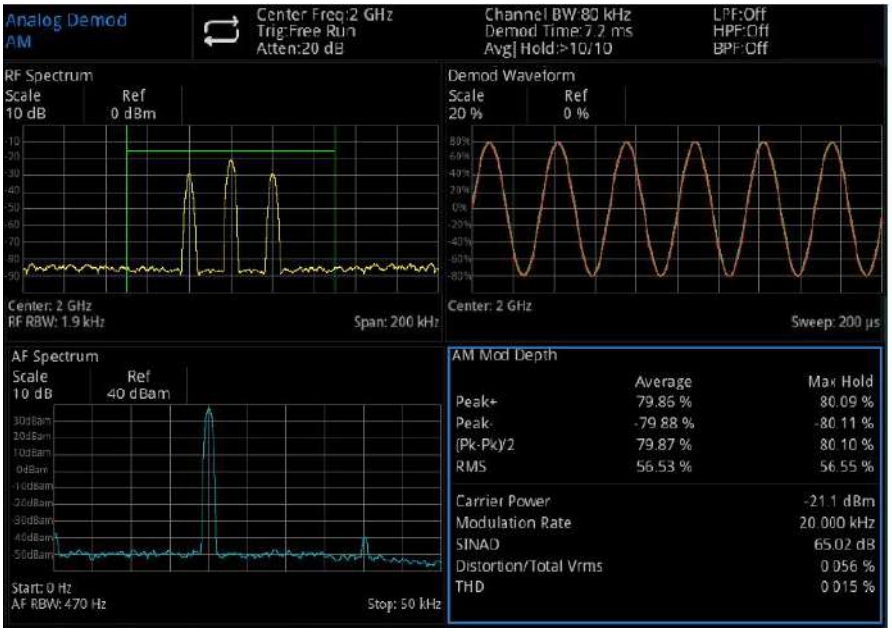


5) Enable Channel Output

Press the RF On/Off key on the front panel. If the key is illuminated, the channel output is enabled.



View the AM modulation waveform on a spectrum analyzer, as shown in the following figure.

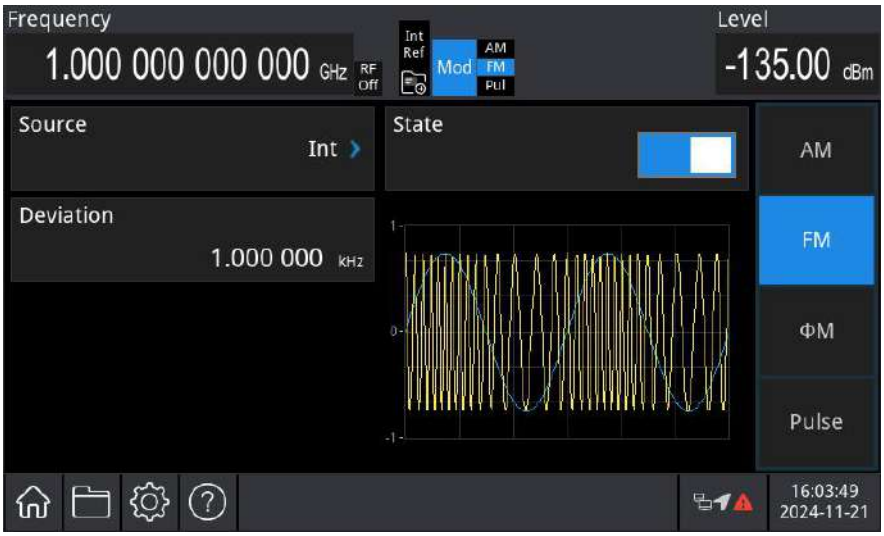


4.1.2 RF Frequency Modulation (FM)

In FM mode, the modulated wave consists of the carrier wave and the modulation wave. The frequency of the carrier wave changes with the amplitude of the modulation wave.

Select Frequency Modulation (FM)

Press the Home key in the analog stream mapper on the screen, check the analog modulation ON, and press the Mod →FM →State key to enable FM mode. The instrument will output the modulated waveform according to the current modulation wave and the carrier wave.



Set Carrier Wave

Refer to Carrier Wave Frequency in AM mode.

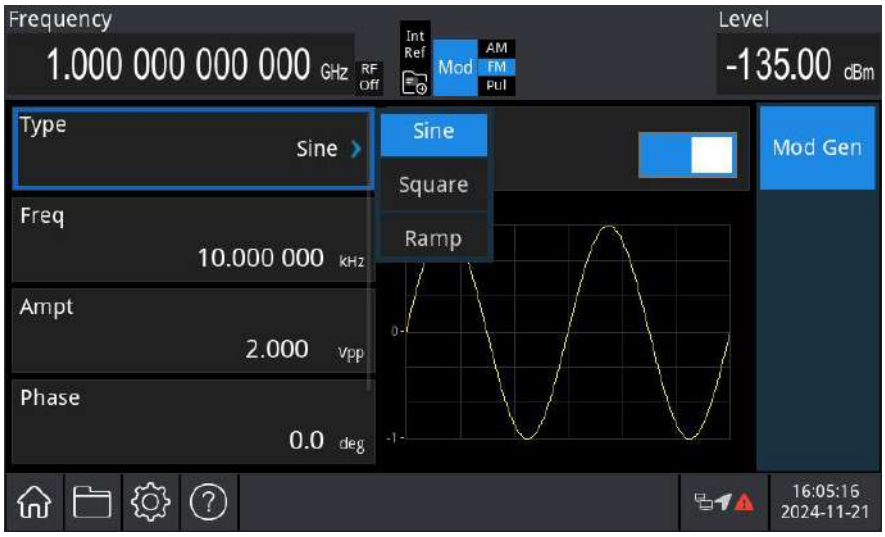
Select Modulation Wave

USG5000 series modulation source has three options: internal, external, and internal + external. The

internal modulation source includes sine wave, square wave, and ramp wave, with the default internal modulation set to a sine wave.

After FM mode is enabled, the default modulation wave (sine wave) will be displayed. The modulation wave can be adjusted by pressing the Home → Source key, using the multi-function rotary knob in modulation source interface, or pressing the Type key to adjust the modulation wave.

- Square wave: Duty ration is 50%.
- ramp wave: Symmetry is 50%.



Set Modulation Frequency

Set the frequency for the modulation wave within a range of 1 mHz to 50 kHz (default: 10 kHz). After FM mode is enabled, the default modulation wave frequency of 10 kHz will be displayed. The modulation frequency can be adjusted by using the multi-function rotary knob in analog modulation source interface or pressing the Freq key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Set Frequency Offset

Frequency offset indicates the deviation of the frequency-modulated wave relative to the carrier wave frequency. The FM frequency offset range can be set from a minimum of DC up to half of the current maximum carrier frequency. The default frequency offset is 1 kHz.

The frequency offset can be adjusted by using the multi-function rotary knob in modulation source interface, or pressing the Freq Offset key and using the numerical keyboard to enter the number and select the unit to complete this setting.

- For the range of Frequency Offset, see the maximum Frequency Offset description in the corresponding data manual of each model.

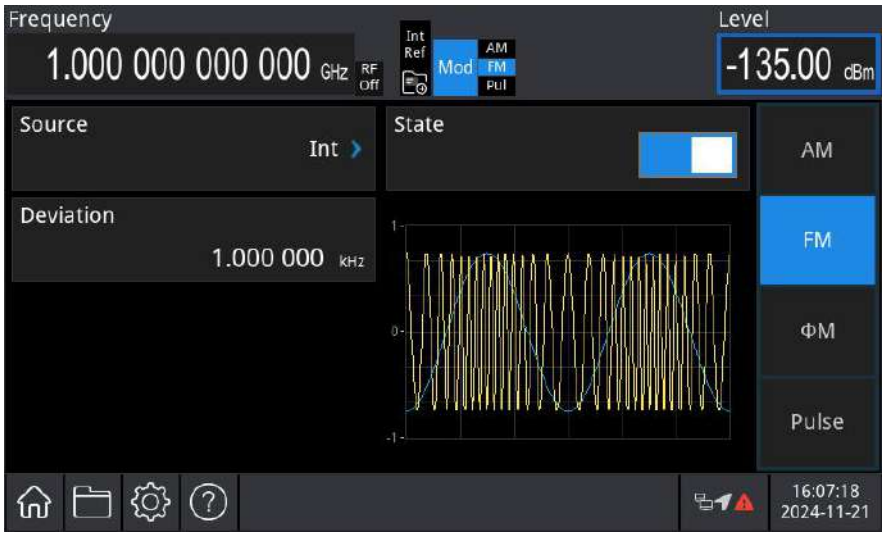
Comprehensive Example

First, set the instrument to frequency modulation (FM) mode. Then, configure a 20 kHz sine wave

as the internal modulating signal, with a carrier signal frequency of 2 GHz and an amplitude of -20 dBm. Finally, set the frequency offset to 200 kHz. The procedure is as follows.

1) Enable FM Mode

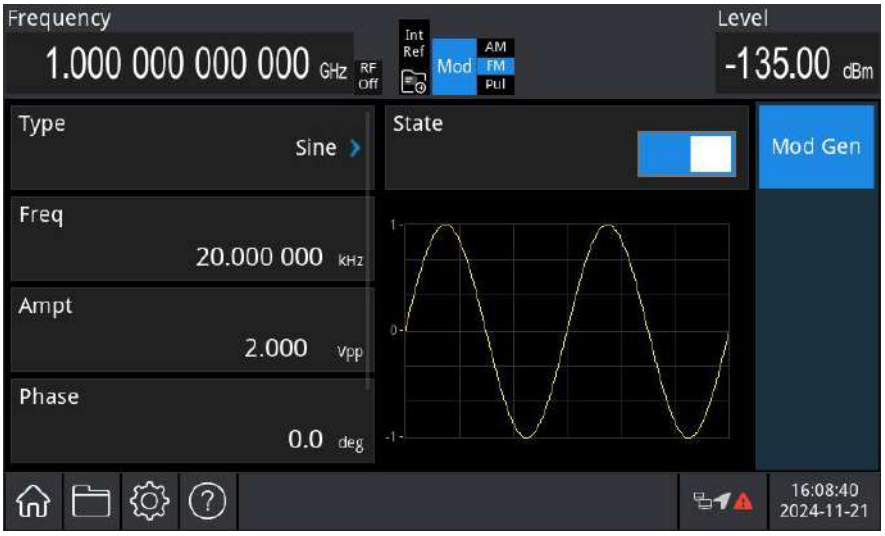
Press the Home key in the analog stream mapper on the screen, check the analog modulation ON, and press the Mod →FM →State key to enable FM mode.



2) Set Modulation Signal and Wave

Press the Home key in the analog stream mapper on the screen, check the analog source ON, press the Source →Freq key, then use the numerical keyboard to enter 20 and select the unit kHz for this parameter.

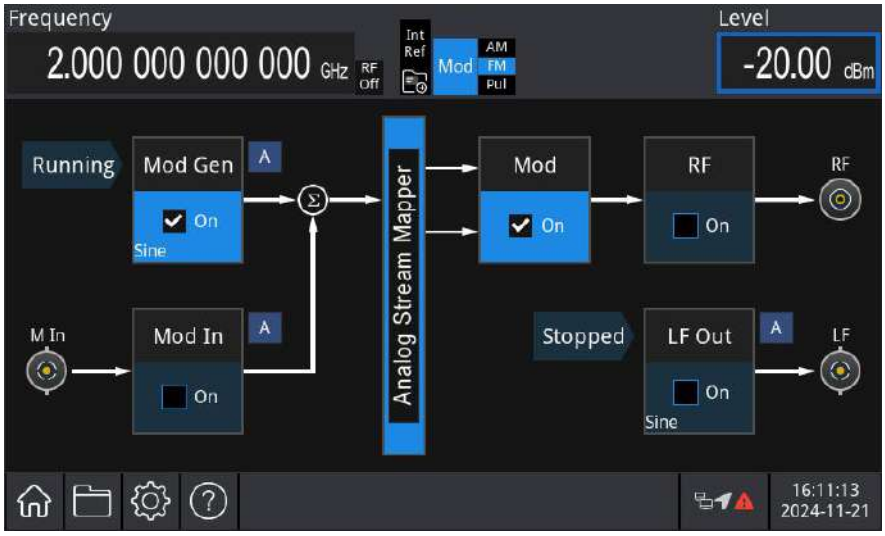
Press the Type key in the modulation source interface, then select the sine wave from the drop-down menu.



3) Set Carrier Signal

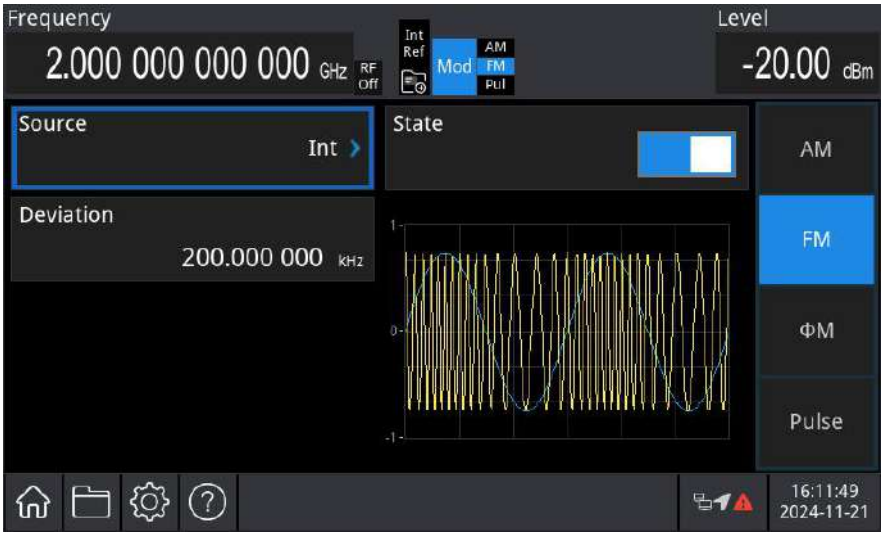
Press the Freq key to set the frequency, then use the numerical keyboard to enter 2 and select the unit GHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter -20 and select the unit dBm for this parameter, as shown in the following figure.



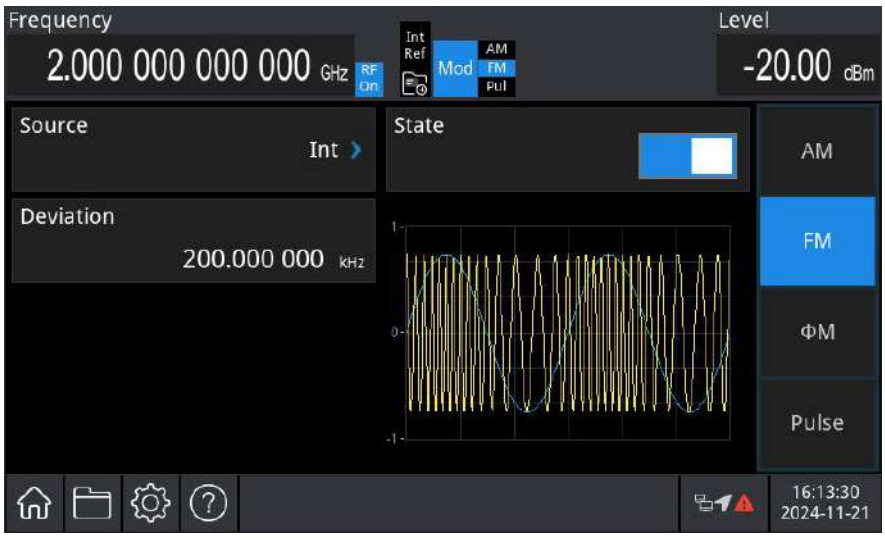
4) Set Frequency Offset

After setting the carrier parameters, press the Home key in the analog stream mapper on the screen, press the Mod key to open FM setting menu, press the Freq Offset key, then use the numerical keyboard to enter 200 and select the unit kHz for this parameter.

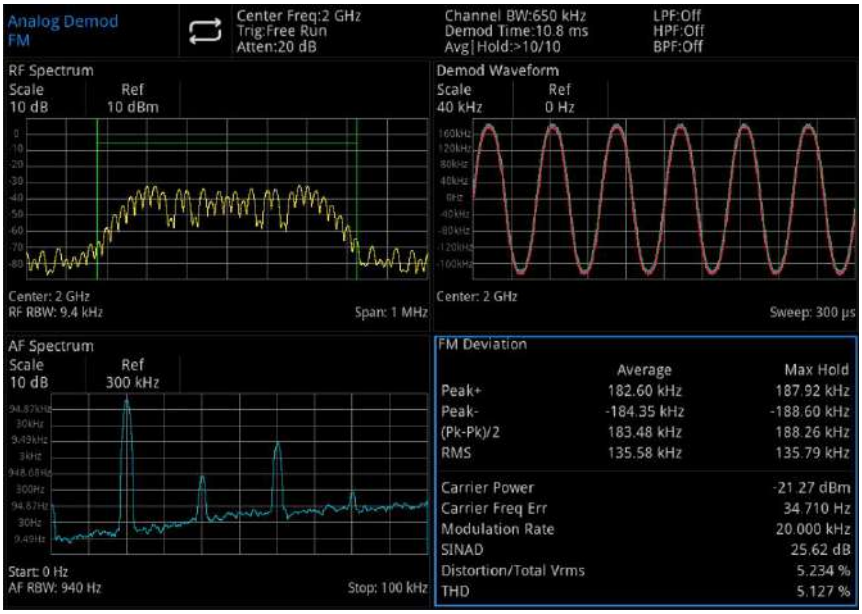


5) Enable Channel Output

Press the RF On/Off key on the front panel. If the key is illuminated, the channel output is enabled.



View the FM modulation waveform on a spectrum analyzer, as shown in the following figure.

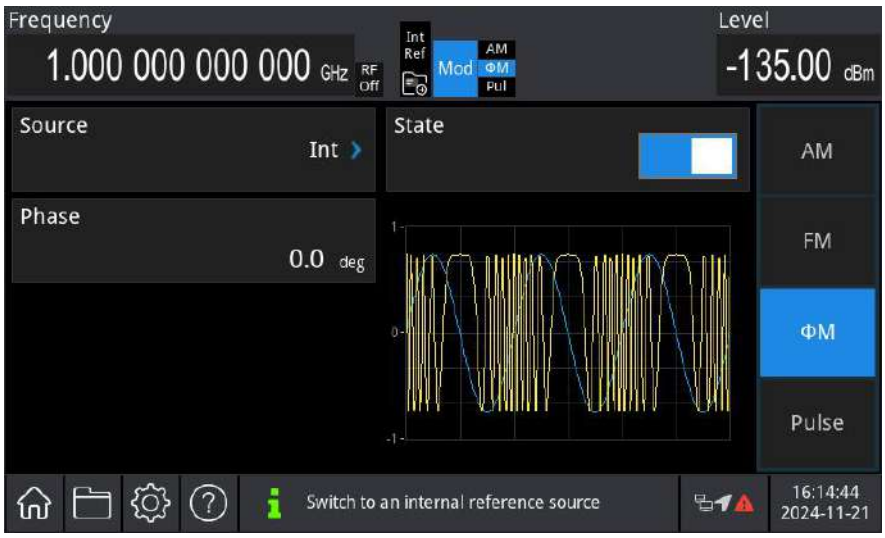


4.1.3 RF Phase Modulation (ΦM)

In ΦM mode, the modulated wave consists of the carrier wave and the modulation wave. The phase of the carrier wave changes with the amplitude of the modulation wave.

Select Phase Modulation (ΦM)

Press the Home key in the analog stream mapper on the screen, check the analog modulation ON, and press the Mod →ΦM →State key to enable ΦM mode. The instrument will output the modulated waveform according to the current modulation wave and the carrier wave.



Set Carrier Wave

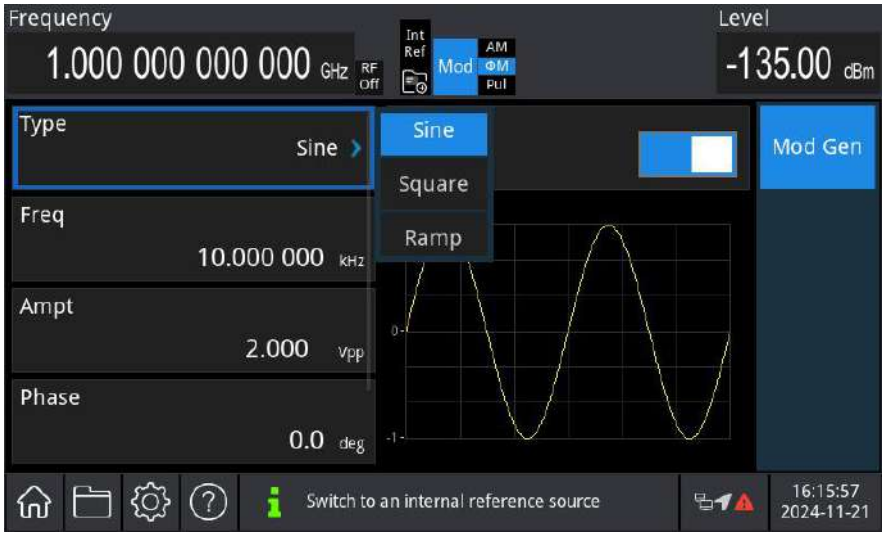
Refer to Carrier Wave Frequency in AM mode.

Select Modulation Wave

USG5000 series modulation source has three options: internal, external, and internal + external. The internal modulation source includes sine wave, square wave, and ramp wave, with the default internal modulation set to a sine wave.

After ΦM mode is enabled, the default modulation wave (sine wave) will be displayed. The modulation wave can be adjusted by pressing the Home → Source key, using the multi-function rotary knob in modulation source interface, or pressing the Type key to adjust the modulation wave.

- Square wave: Duty ration is 50%.
- ramp wave: Symmetry is 50%.



Set Modulation Frequency

Set the frequency for the modulation wave within a range of 1 mHz to 50 kHz (default: 10 kHz). After ΦM mode is enabled, the default modulation wave frequency of 10 kHz will be displayed. The

modulation wave can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Freq key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Set Phase Offset

Phase offset indicates the deviation of the phase-modulated wave relative to the carrier wave phase. The ΦM phase offset range can be set from 0° to 360°. The default frequency offset is 0°.

The phase offset can be adjusted by using the multi-function rotary knob in analog modulation source interface, or pressing the Phase Offset key and using the numerical keyboard to enter the number and select the unit to complete this setting.

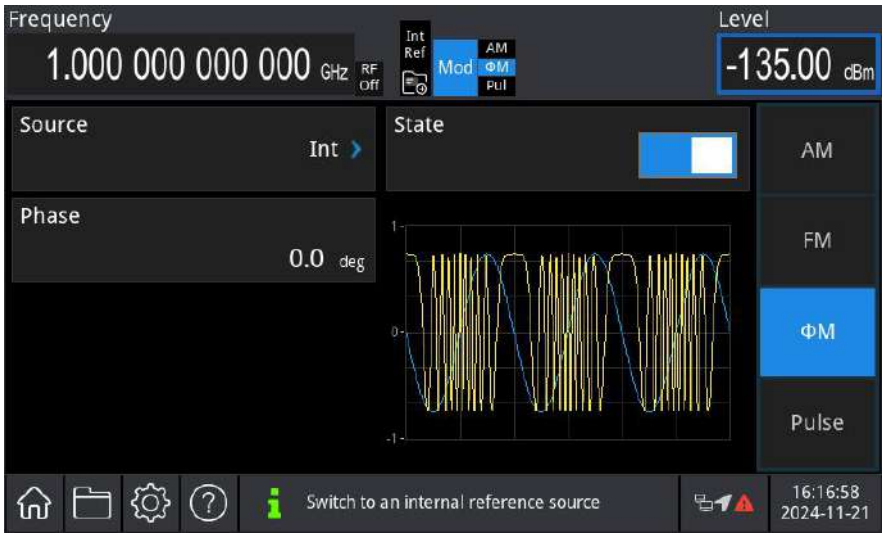
- For the range of Phase Offset, please refer to the maximum phase offset description in the corresponding data sheet of each model.

Comprehensive Example

First, set the instrument to phase modulation (ΦM) mode. Then, configure a 20 kHz sine wave as the internal modulating signal, with a carrier signal frequency of 3 GHz and an amplitude of -10 dBm. Finally, set the phase offset to 60°. The procedure is as follows.

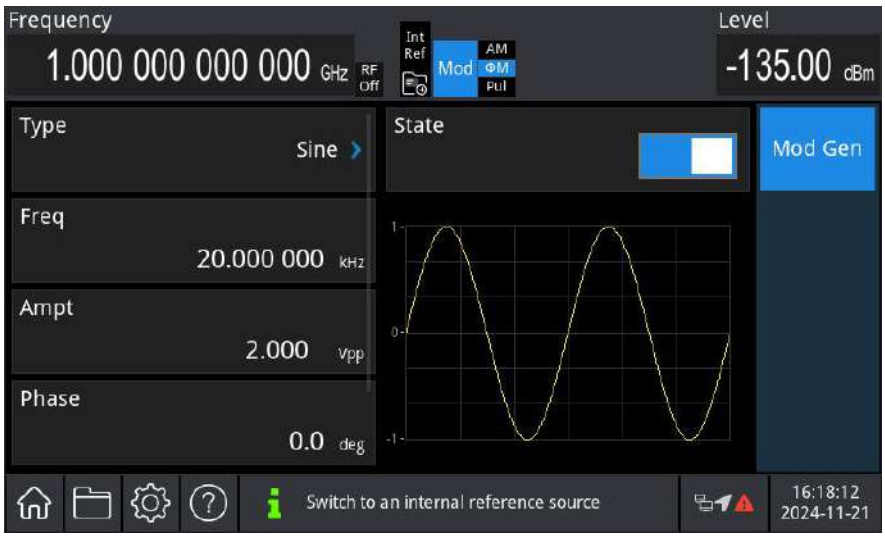
1) Enable ΦM Mode

Press the Home key in the analog stream mapper on the screen, check the analog modulation ON, and press the Mod →ΦM →State key to enable ΦM mode.



2) Set Modulation Signal

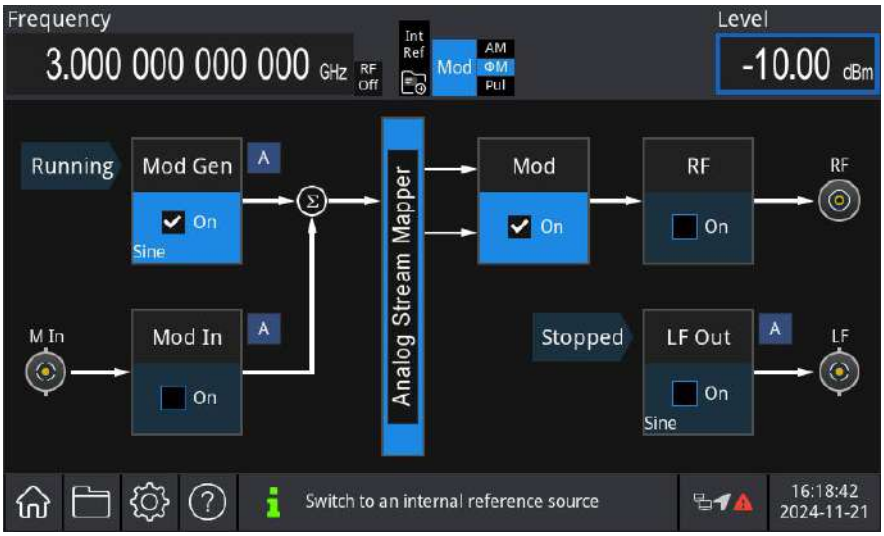
Press the Home key in the analog stream mapper on the screen, check the analog source ON, press the Source →Freq key, then use the numerical keyboard to enter 20 and select the unit kHz for this parameter.



3) Set Carrier Signal

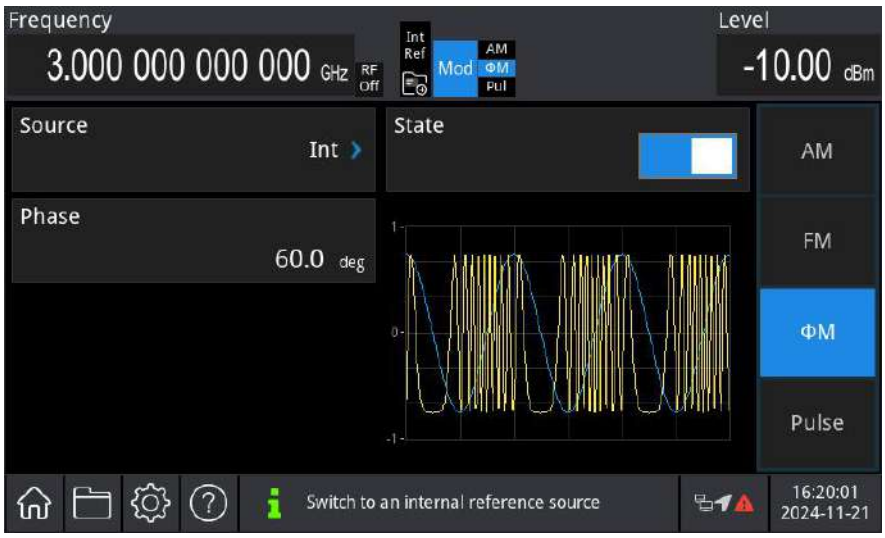
Press the Freq key to set the frequency, then use the numerical keyboard to enter 3 and select the unit GHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter -10 and select the unit dBm for this parameter, as shown in the following figure.



4) Set Phase Offset

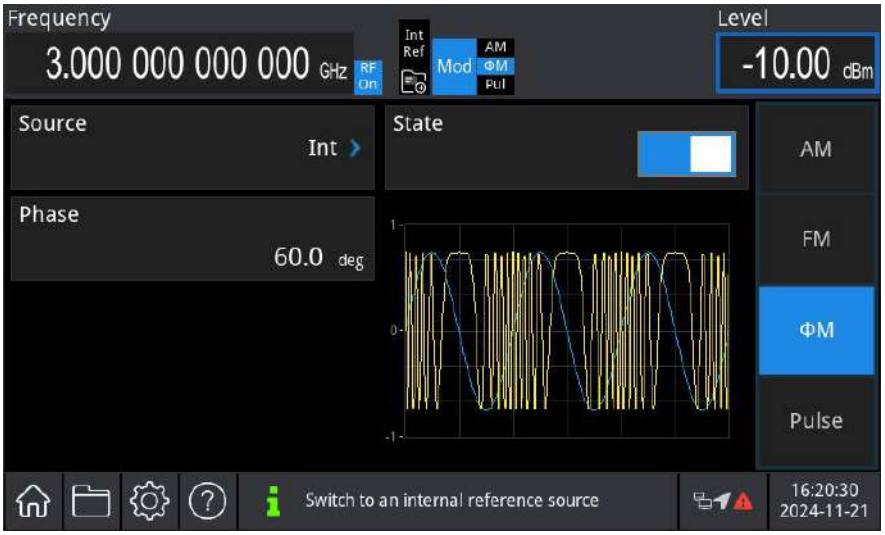
After setting the carrier parameters, press the Home key in the analog stream mapper on the screen, press the Mod key to open ΦM setting menu, press the Phase Offset key, then use the numerical keyboard to enter 60 and select the unit deg for this parameter.



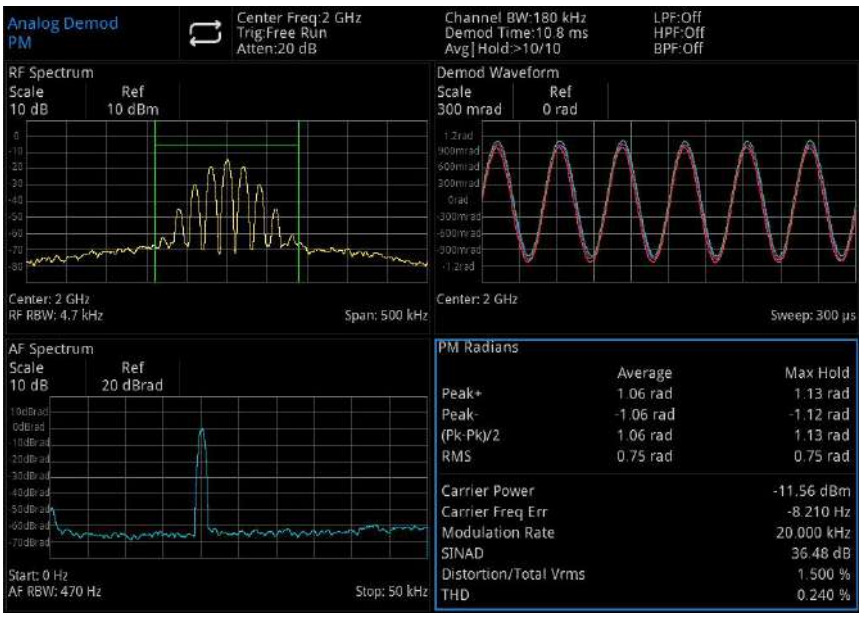
5) Enable Channel Output

Press the Home key in the analog stream mapper on the screen, check RF ON.

Press the RF On/Off key on the front panel. If the key is illuminated, the channel output is enabled.



View the ΦM modulation waveform on a spectrum analyzer, as shown in the following figure.



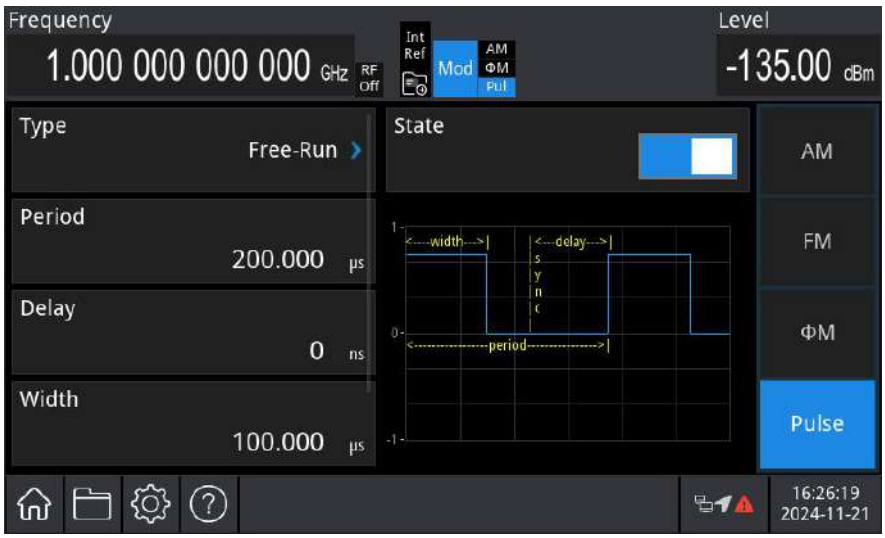
4.1.4 RF Pulse Modulation (Pulse)

Pulse modulation uses pulse signals as modulating signals to modulate RF carrier signals. USG5000M supports pulse modulation outputs controlled by internal and external triggers and offers a wide range of pulse modulation types, including free-running, square wave, external trigger, modulated pulse pairs, external trigger pulse pairs, gating pulse, external pulses, and pulse strings.

Select Pulse Modulation (Pulse)

1) Enable Pulse Mode

Press the Home key in the analog stream mapper on the screen, check the analog modulation ON, and press the Mod →Pulse →State key to enable Pulse mode. After the Pulse function is enabled, the instrument will output the pulse modulation signal according to the current settings.



2) Set Wave Frequency

The wave frequency specifies the signal frequency used during pulse modulation.

Note

The wave frequency is different from Pulse period. The Pulse period indicates the interval between the specified pulse modulations. The default frequency is 1 GHz. The frequencies of each model are shown in the following table.

Frequency							
USG3045M/M-P		USG3065M/M-P		USG5014M/M-P		USG5022M-P	
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
9 kHz	4.5 GHz	9 kHz	6.5 GHz	9 kHz	14 GHz	9 kHz	22 GHz

Press the Freq key to set the carrier wave frequency and use the numerical keyboard to enter the number and select the unit to complete this setting.

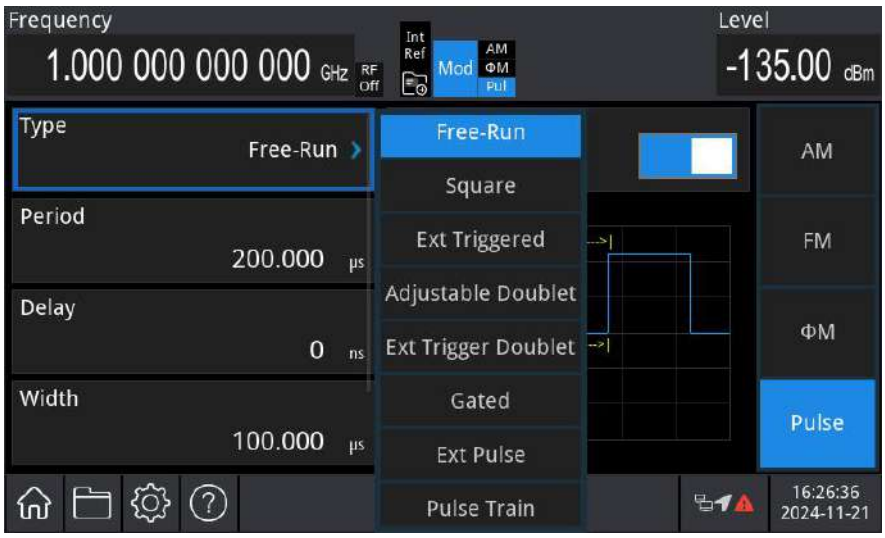
Pulse Type

USG5000M can output various types of pulse modulation, including free-running, square wave, external trigger, adjustable pulse pair, external trigger pulse pair, gating pulse, external pulse, and pulse train. The default type is free running.

1) Free running

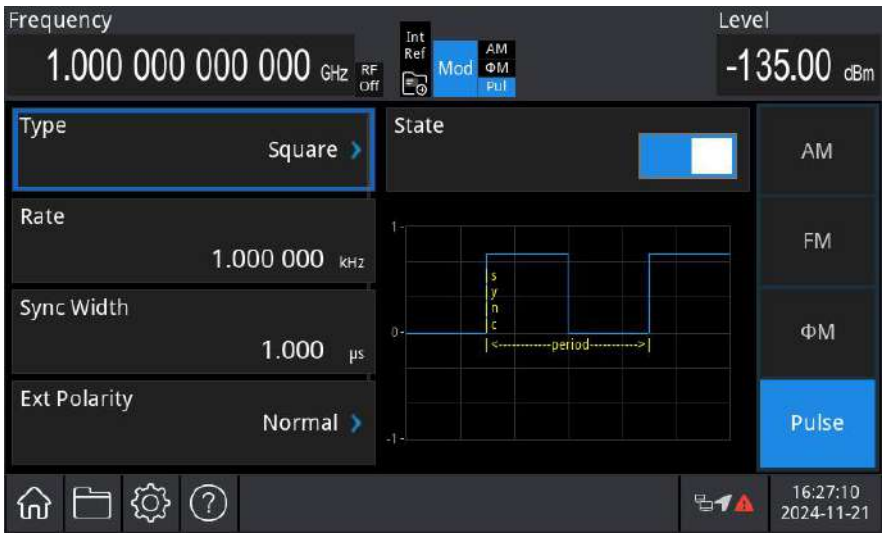
Press the Pulse Type key in the pulse interface to select the free running. The free-running refers to an internal free-running pulse train. In this mode, the instrument's internal pulse generator serves as the pulse modulation source and does not require an external pulse signal. Meanwhile, the internal automatic pulse trigger mode will activate and will not synchronize with other trigger signals.

The pulse modulation type can be changed in the pulse interface, as shown in the following figure. Alternatively, using the multi-function rotary knob and arrow keys or pressing the Type key to select the free running.



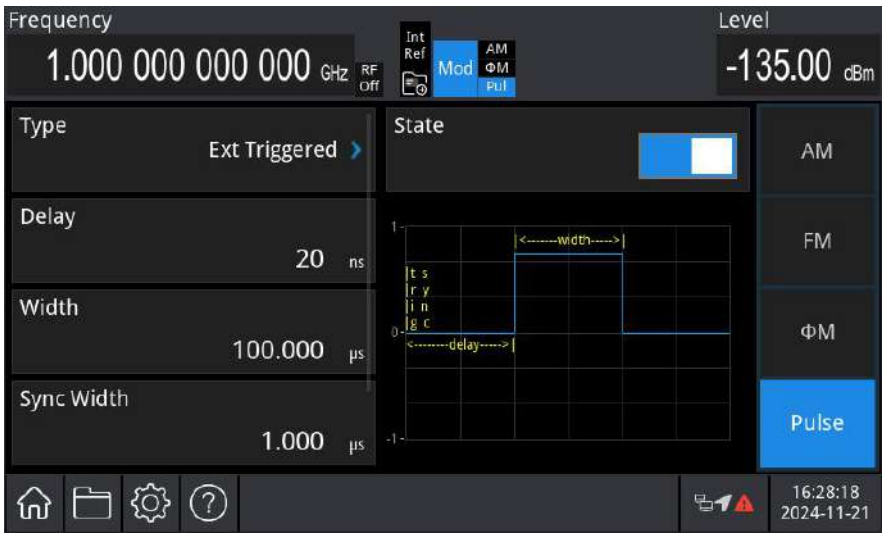
2) Square Wave

Press the Pulse Type key in the pulse interface to select square wave, where the internal free-running pulse train duty ratio is 50%.



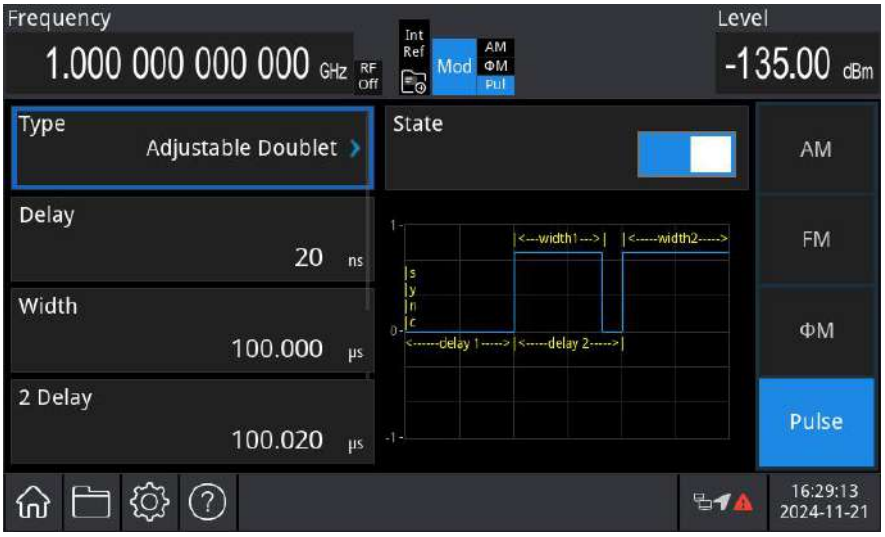
3) External Trigger

Press the Pulse Type key in the pulse interface to select the external trigger, which activates the external trigger mode, i.e., an internal pulse train. In this mode, the leading edge of the external pulse input signal is used to delay the pulse output from the internal pulse signal generator. The pulse modulation type can be changed in the pulse interface, as shown in the following figure. Alternatively, using the multi-function rotary knob and arrow keys or pressing the Type key to select the external trigger.



4) Adjustable Pulse Pair

Press the Pulse Type key in the pulse interface to select the adjustable pulse pair, which activates adjustable pulse pair mode, i.e., that is, two internal pulse trains are run freely. In this mode, both the first pulse and the second pulse are user-defined.

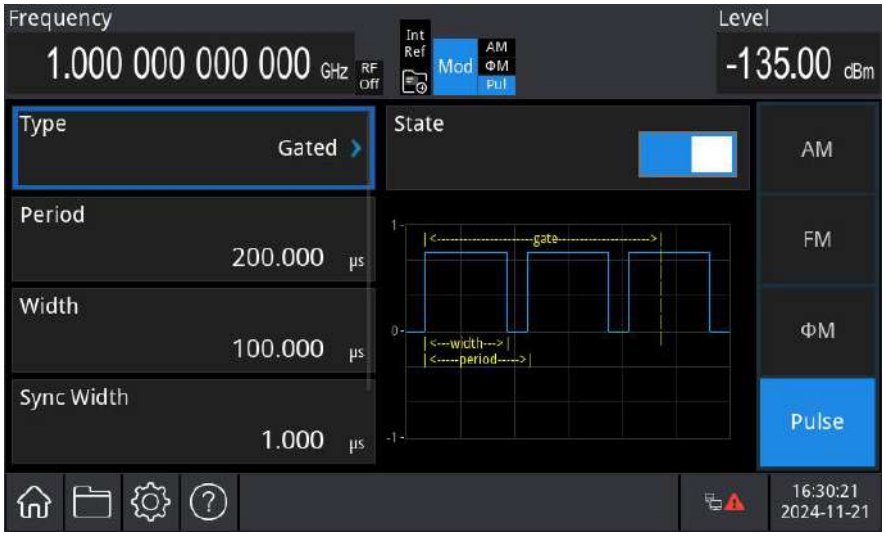


5) External Trigger Pulse Pair

Press the Pulse Type key in the pulse interface to select the external trigger adjustable pulse pair, which activates the external trigger adjustable pulse pair mode, i.e., each trigger event generates two internal pulse trains. In this mode, the first pulse follows the trigger signal; the second pulse is user-defined.

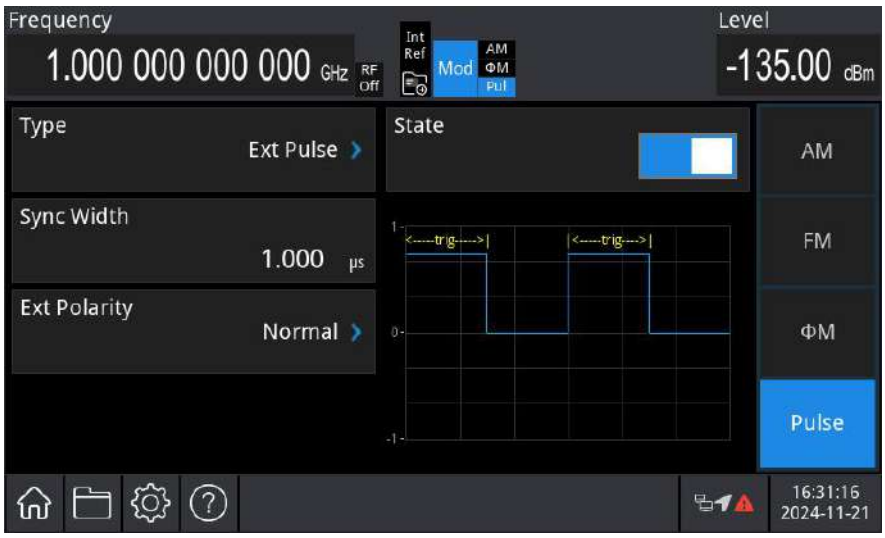
6) Gating

Press the Pulse Type key in the pulse interface to select the gating mode, which activates the gating mode, i.e., internal gating pulse train. In this mode, the internal pulse generator performs a logical AND operation with the externally input pulse signal.



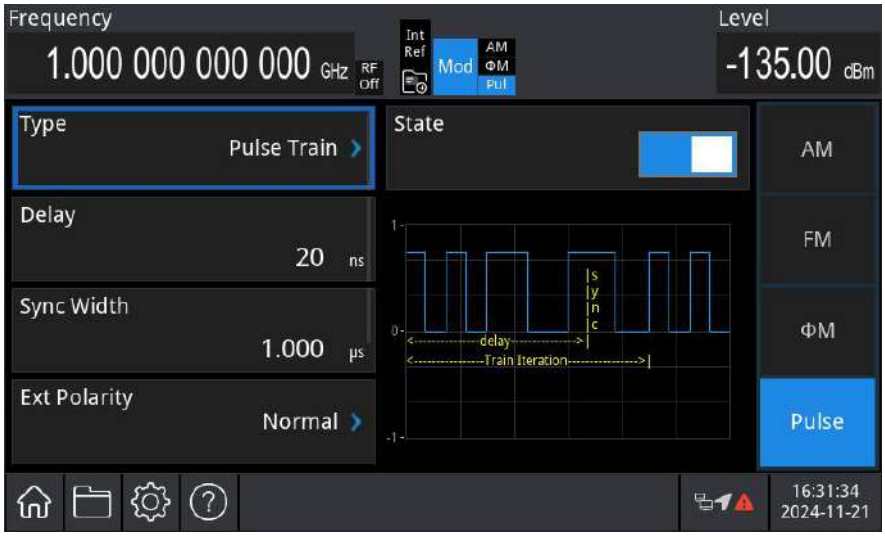
7) External Pulse

Press the Pulse Type key in the pulse interface to select the external pulse, which activates the external pulse mode, i.e., the external pulse signal from the pulse connector on the rear panel.



8) Pulse Train

Press the Pulse Type key in the pulse interface to select the pulse train, which activates the pulse train mode, i.e., an internal pulse train. In this mode, the pulse period can be manually edited.



Sync Pulse Width

The sync pulse width is used to set the pulse width of synchronization signal for pulse modulation output. This value cannot exceed the pulse width.

The pulse width can be adjusted by using the multi-function rotary knob in the pulse interface. Alternatively, pressing the Sync Width key, and using the numerical keyboard to enter the number and select the unit to complete this setting.

External Polarity

The external polarity is used to set how the signal generator responds to the external pulse signal. Press the Ext Polarity key in the pulse modulation interface to select either normal or inverse.

Rate

When the pulse type is set to square wave, the rate can be adjusted to define the frequency of the square wave.

The rate can be adjusted by using the multi-function rotary knob in the pulse interface. Alternatively, press the Rate key, and use the numerical keyboard to enter the number and select the unit to complete this setting.

Period

When the pulse type is set to free running or gating, the pulse period parameter becomes available, representing the period of the pulse signal generated internally by the signal generator. If the set period is shorter than the current pulse width, the pulse width will be automatically adjusted to match the current pulse period.

The period can be adjusted by using the multi-function rotary knob in the pulse interface. Alternatively, pressing the Period key, and using the numerical keyboard to enter the number and select the unit to complete this setting.

Delay

When the pulse type is set to free-running, external trigger, adjustable pulse pair, external trigger pulse pair, or pulse train, the pulse delay parameter becomes available. It defines the pulse delay for pulse modulation.

The maximum value that can be set depends on the current period and pulse width, and it cannot exceed the difference between the period and the pulse width.

The delay can be adjusted by using the multi-function rotary knob in the pulse interface. Alternatively, pressing the Delay key, and using the numerical keyboard to enter the number and select the unit to complete this setting.

Pulse Width

When the pulse type is set to free-running, external trigger, adjustable pulse pair, external trigger pulse pair, or gating, the pulse width parameter becomes available. It defines the pulse width of the pulse signal generated internally by the signal generator.

If the set pulse width is greater than the current pulse period, the pulse width will be automatically adjusted to less than or equal to the current pulse period.

The pulse width can be adjusted by using the multi-function rotary knob in the pulse interface. Alternatively, pressing the Pulse key, and using the numerical keyboard to enter the number and select the unit to complete this setting.

Delay 2

When the pulse type is set to adjustable pulse pair, the delay 2 parameter becomes available. It defines the pulse delay of the second pulse in pulse modulation.

The delay 2 can be adjusted by using the multi-function rotary knob in the pulse interface. Alternatively, pressing the Delay 2 key, and using the numerical keyboard to enter the number and select the unit to complete this setting.

Pulse Width 2

When the pulse type is set to adjustable pulse pair, the pulse width 2 parameter becomes available. It defines the pulse width of the second pulse in pulse modulation.

The pulse width 2 can be adjusted by using the multi-function rotary knob in the pulse interface. Alternatively, pressing the Pulse 2 key, and using the numerical keyboard to enter the number and select the unit to complete this setting.

Trigger Mode

When the pulse type is set to pulse train, the trigger mode parameter becomes available. The trigger mode can be adjusted by pressing the Trigger Mode in pulse modulation interface. Three options are available: free running, external trigger, and gating.

Free running: Continuously emits a pulse sequence, ignoring all triggers.

External trigger: The external trigger (level trigger) is provided to the PULSE IN connector on the rear panel. Each time a TTL pulse signal of the specified polarity is received, the signal generator initiates a pulse modulation.

Gating: The pulse sequence runs in a gated manner. The external trigger (level trigger) is provided to the PULSE IN connector on the rear panel. Each time a TTL pulse signal of the specified polarity is received, the signal generator initiates a pulse modulation within its active level. Once initiated, the emission will always be completed, even if the gated trigger becomes inactive.

Edit Pulse Train

When the pulse type is set to pulse train, press the Edit Pulse Train key in pulse modulation to open the pulse train editing window, as shown in the following figure.

As shown in the figure above, the list displays various pulse information for the pulse train. Additionally, operations such as adding, deleting, and exporting pulses can be performed.

Serial number: Represents the row of each pulse sequence cycle. When the cycle (element) is repeated, the number of rows is skipped in the repeated pulse cycle numbers. For example, in the pulse sequence shown above, the pulse period with 3 μs high-level time and 2 μs low-level time is repeated twice. However, this pulse period is only displayed in the second row (i.e., not in the third row).

High-level time: Represents the on-time of each pulse period in the pulse sequence.

Low-level time: Represents the off time of each pulse period in the pulse sequence.

Number of repetitions: Represents the number of repetitions of each pulse period in the pulse sequence.

After clicking (Add a row of data), you can click on High-level time, Low-level time, and Number of repetitions to edit the data.

Click to delete the row of data with the currently selected serial number.

Click to delete all pulse train data.

Click to export the pulse train data.

Click return to the previous level.

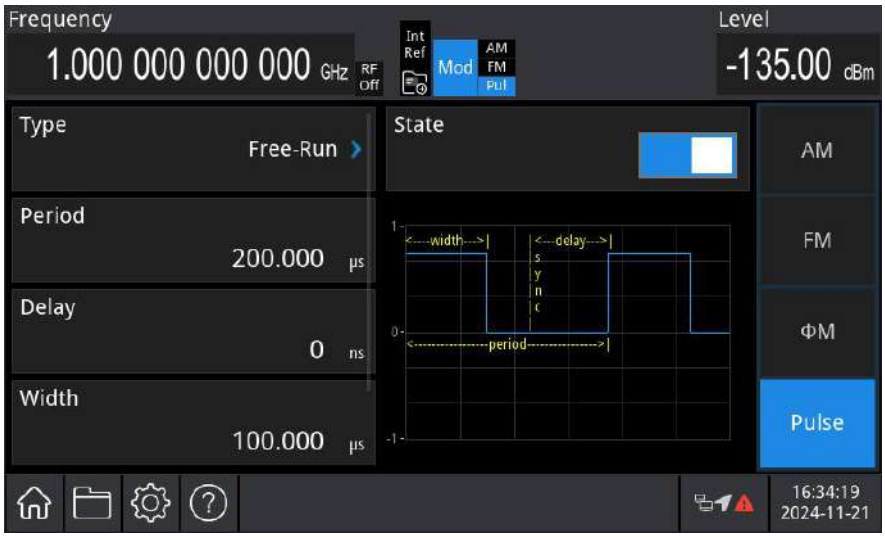
Comprehensive Example

First, set the instrument to pulse modulation (Pulse) mode. Then, configure the frequency to 100 kHz and the amplitude to 0 dBm as the carrier wave. It is modulated by a 24 μs pulse with a period of 100 μs. The procedure is as follows.

1) Enable Pulse Mode

Press the Default→Home key in the analog stream mapper on the screen, check the analog

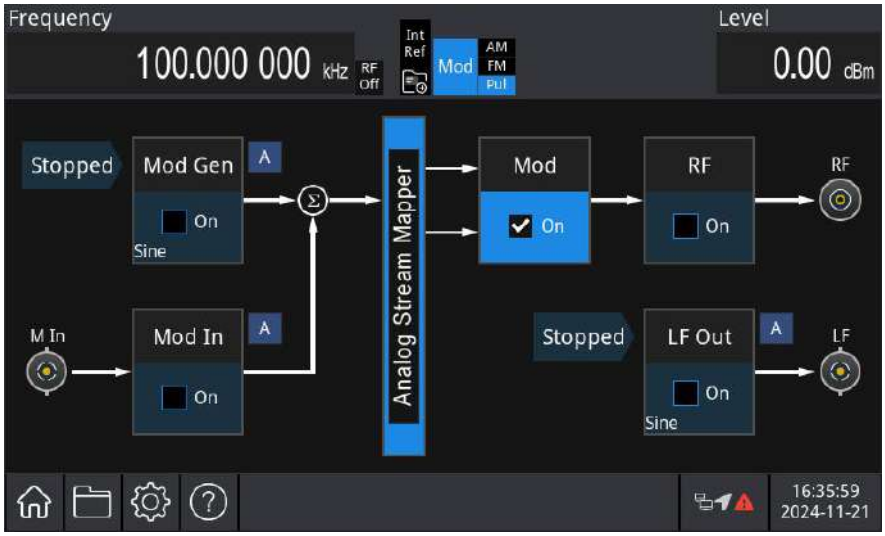
modulation ON, and press the Mod →Pulse →State key to enable Pulse mode.



2) Set Carrier Wave and Amplitude

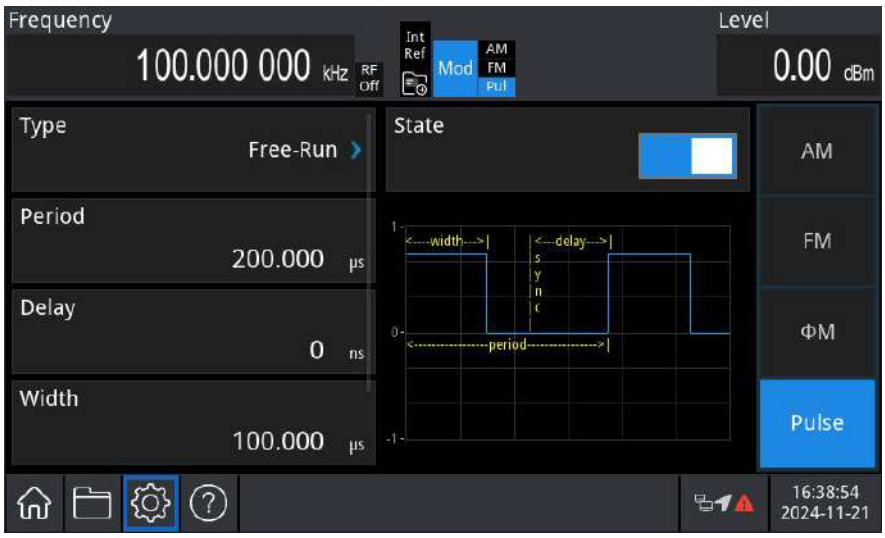
Press the Freq key to set the frequency, then use the numerical keyboard to enter 100 and select the unit kHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter 0 and select the unit dBm for this parameter, as shown in the following figure.

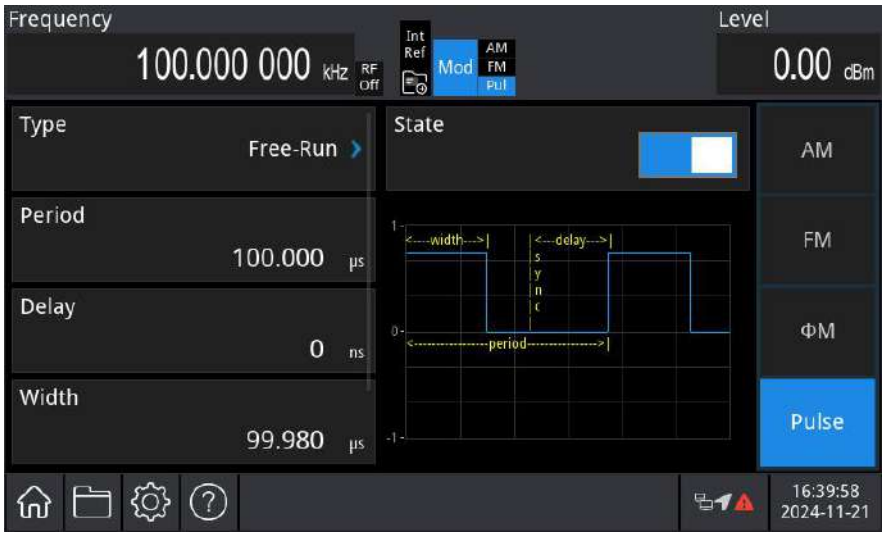


3) Set Pulse Period

Press the Home→ Mod →Pulse key to return to the following interface.

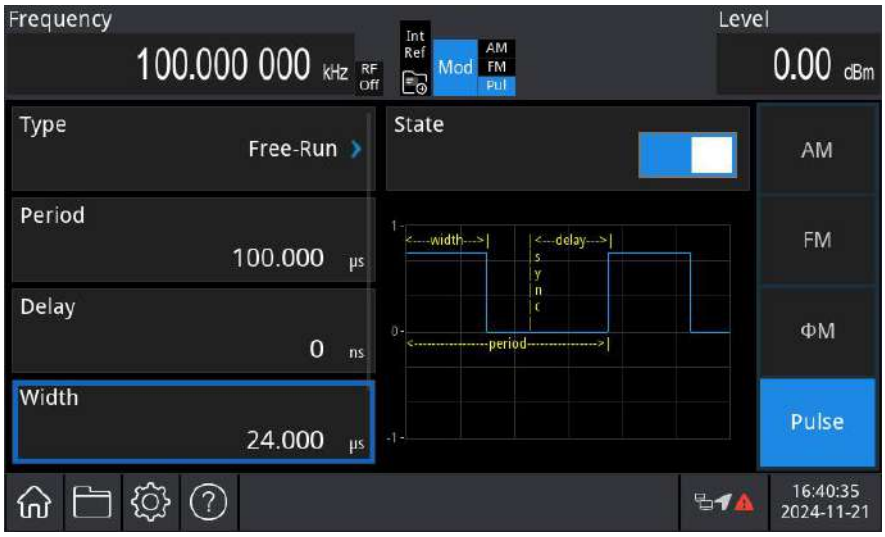


Press the Period key, use the numerical keyboard to enter 100 and select the unit µs for this parameter.



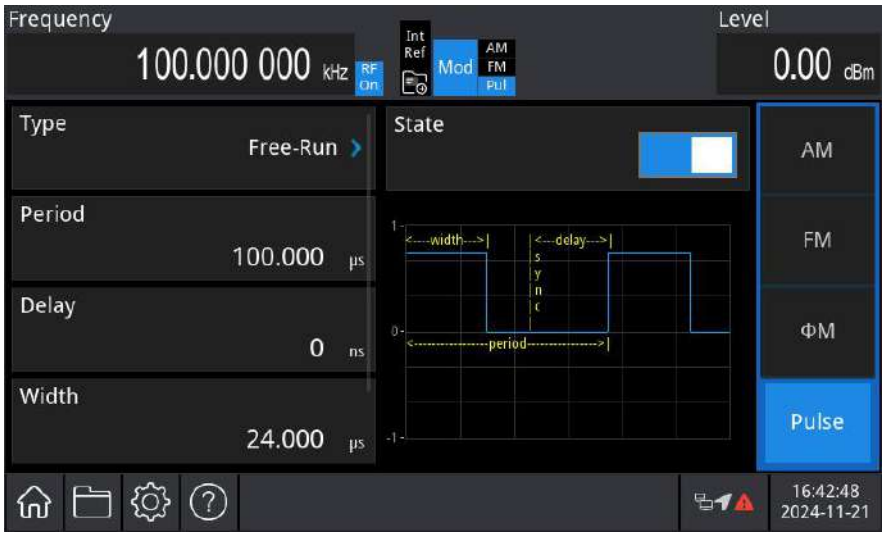
4) Set Pulse Width

In pulse modulation interface, press the Pulse key, use the numerical keyboard to enter 24 and select the unit µs for this parameter, as shown in the following figure.

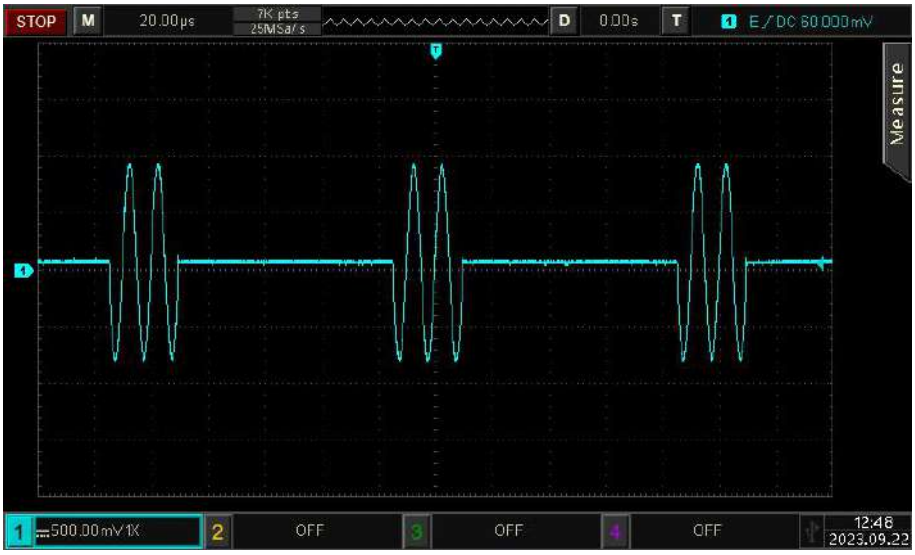


5) Enable Channel Output

Press the RF On/Off key on the front panel. If the key is illuminated, the channel output is enabled.



View the AM modulation waveform on an oscilloscope, as shown in the following figure.

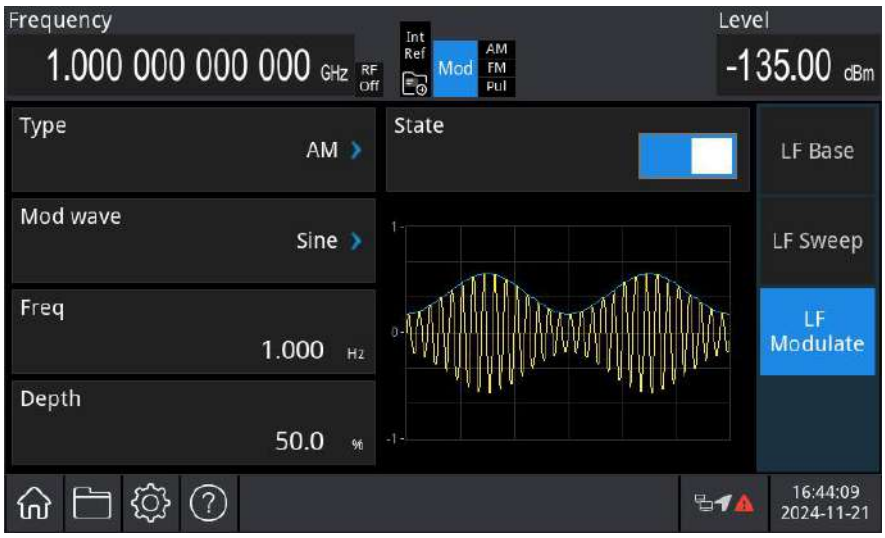


4.1.5 LF Amplitude Modulation (AM)

In AM mode, the modulated wave consists of the carrier wave and the modulation wave. The amplitude of the carrier wave changes with the amplitude of the modulation wave.

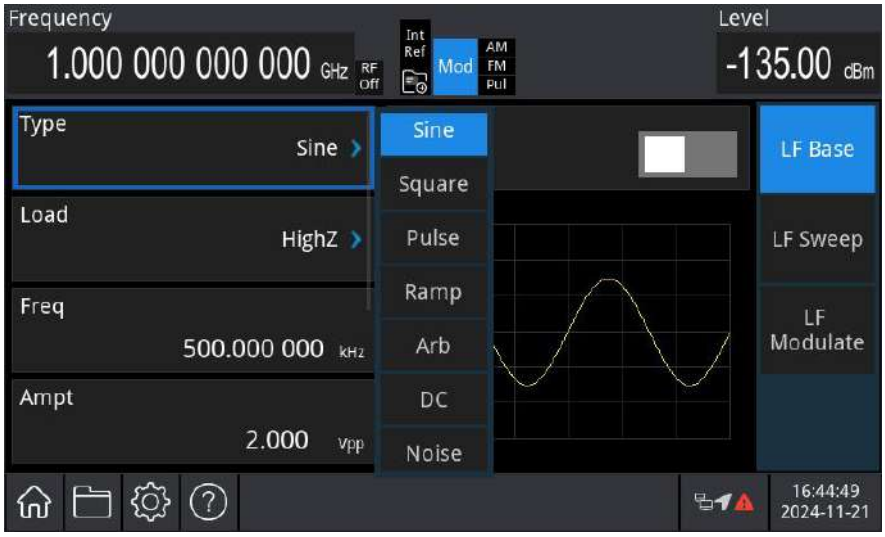
Select Amplitude Modulation (AM)

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the AM mode from the drop-down menu. The instrument will output the modulated waveform according to the current modulation wave and the carrier wave.



Select Carrier Wave

The carrier wave can be set to sine wave, square wave, pulse wave, ramp wave, or arbitrary wave. The default carrier wave is sine wave. After the AM is enabled, press the LF Base →Type key in the modulation interface to open the carrier wave list.



Set Carrier Wave

Each carrier wave has a different frequency, with a default frequency of 500 kHz. The frequencies of each carrier wave are shown in the following table.

Carrier Wave	Frequency							
	USG3045M/M-P		USG3065M/M-P		USG5014M/M-P		USG5022M-P	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Sine Wave	1 mHz	50 MHz	1 mHz	50 MHz	1 mHz	50 MHz	1 mHz	50 MHz
Square Wave	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz
Pulse	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz

Wave								
ramp wave	1 mHz	3 MHz	1 mHz	3 MHz	1 mHz	3 MHz	1 mHz	3 MHz
Arbitrary Wave	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz

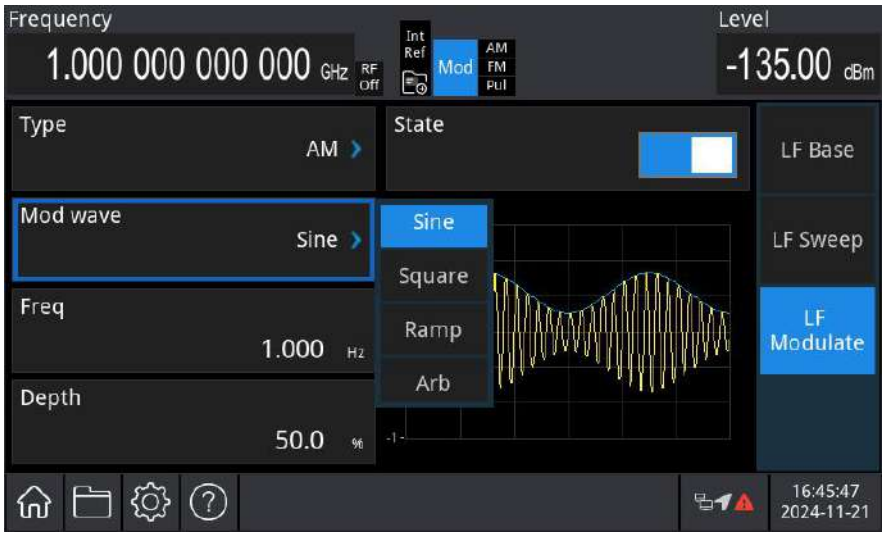
Rotate the multi-function rotary knob or press the Freq key to set the carrier wave frequency and use the numerical keyboard to enter the number and select the unit to complete this setting.

Select Modulation Wave

USG5000 series modulation source is internal modulation source. The internal modulation source includes sine wave, square wave, ramp wave, and arbitrary wave, with the default internal modulation set to a sine wave.

After AM mode is enabled, the default modulation wave (sine wave) will be displayed. The modulation wave can be adjusted by rotating the multi-function rotary knob or pressing the Mod Wave to adjust it.

- Square wave: Duty ration is 50%.
- ramp wave: Symmetry is 50%.
- Arbitrary wave: When an arbitrary waveform is selected as the modulation waveform, the radio-frequency signal generator limits the length of the arbitrary waveform to 4 kpts through automatic sampling.



Set Modulation Frequency

Set the frequency for the modulation wave within a range of 0.002 Hz to 5 MHz (default: 1 Hz). After AM mode is enabled, the default modulation wave frequency of 1 Hz will be displayed. The modulation frequency can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Freq key and using the numerical keyboard to enter the number and select

the unit to complete this setting.

Set Modulation Depth

The modulation depth indicates the change in amplitude, expressed as a percentage. The AM modulation depth can be set between 0% and 120%, with a default of 50%.

- When the modulation depth is 0%, the output is a constant amplitude at half the carrier wave's amplitude.
- When the modulation depth is 100%, the output amplitude varies with the modulation waveform.
- When the modulation depth is 100%, the output amplitude will not exceed 10 Vpp (with a 50 Ω load).

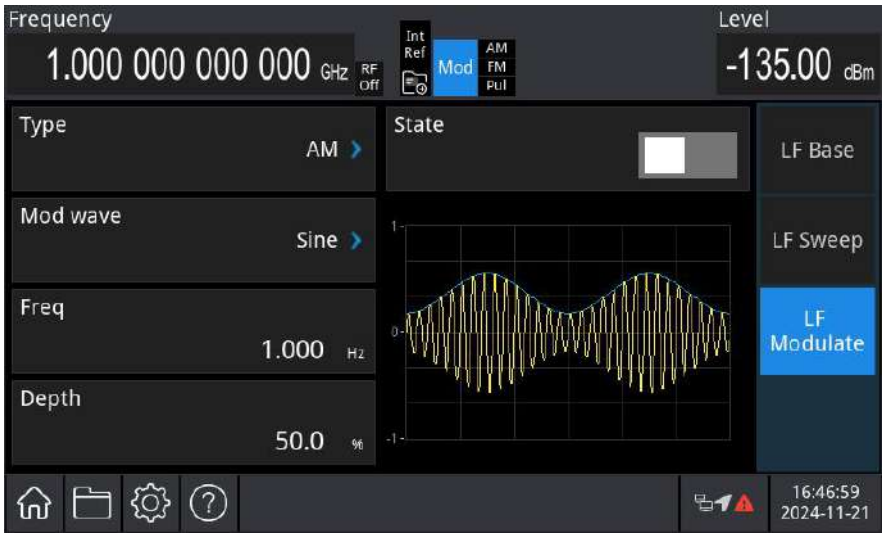
The modulation depth can be adjusted by using the multi-function rotary knob in analog modulation source interface or pressing the Depth key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Comprehensive Example

First, set the instrument to amplitude modulation (AM) mode. Then, configure a 200 Hz sine wave as the internal modulating signal, and set a 10 kHz square wave with an amplitude of 200 mVpp and a duty ratio of 45% as the carrier signal. Finally, set the modulation depth to 80%. The procedure is as follows.

1) Enable AM Mode

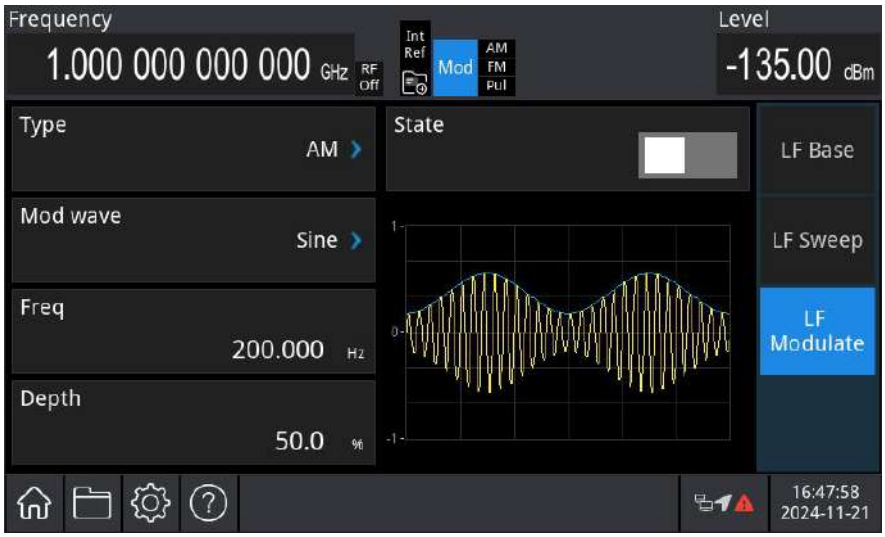
Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the AM from the drop-down menu to enable AM mode.



2) Set Modulation Signal

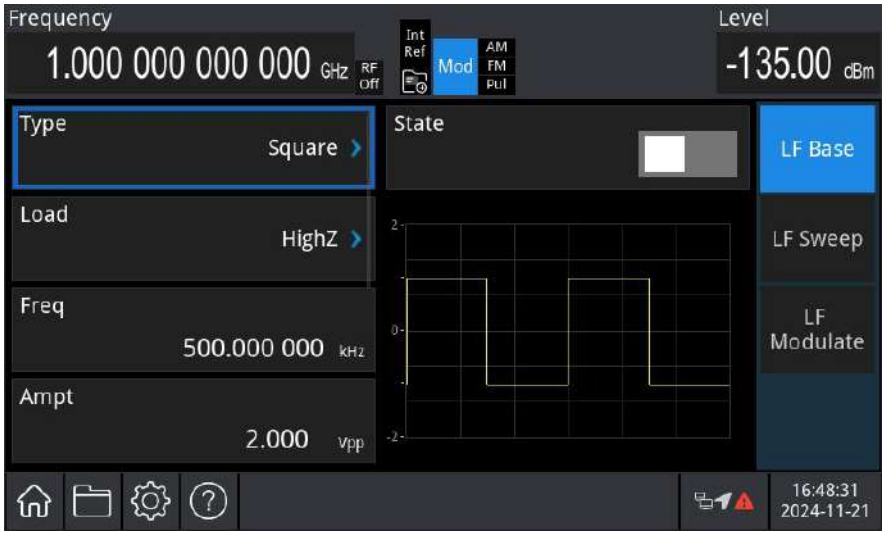
After setting step 1, press the Freq key, use the numerical keyboard to enter 200, and select the

unit Hz for this parameter.



3) Set Carrier Signal

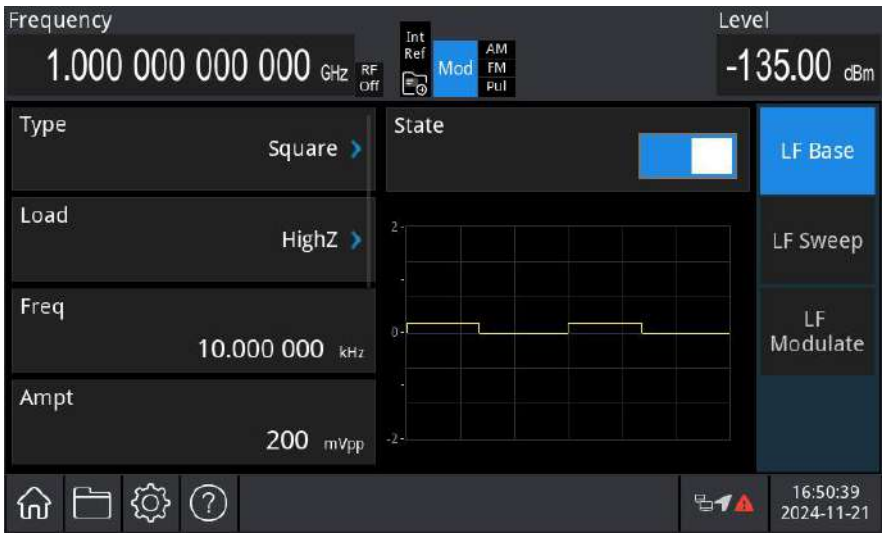
Press the LF Base →Type key to open the LF carrier list, select the square wave as the carrier wave (default: sine wave.)



Press the Freq key to set the frequency, then use the numerical keyboard to enter 10 and select the unit kHz for this parameter.

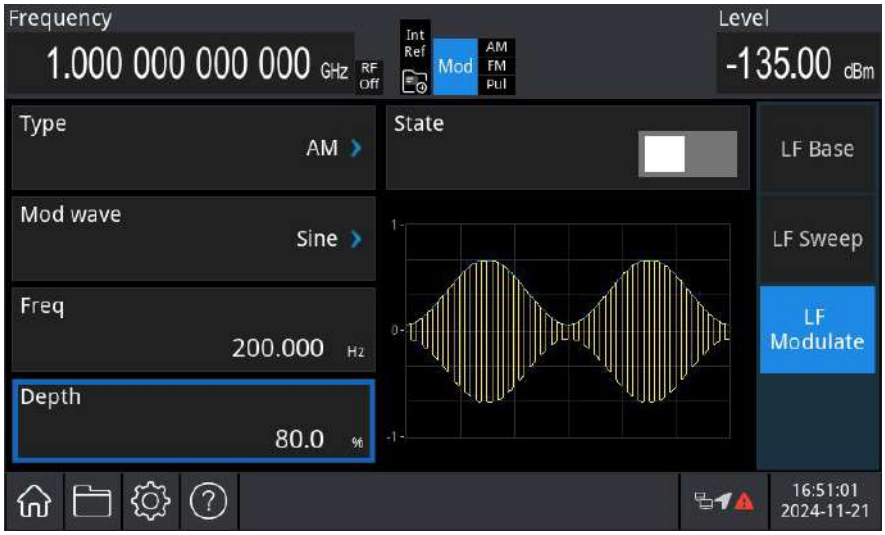
Press the Ampt to set the amplitude, then use the numerical keyboard to enter 200 and select the unit mVpp for this parameter.

Press the Duty key to set the frequency, then use the numerical keyboard to enter 45 and select the unit % for this parameter, as shown in the following figure.



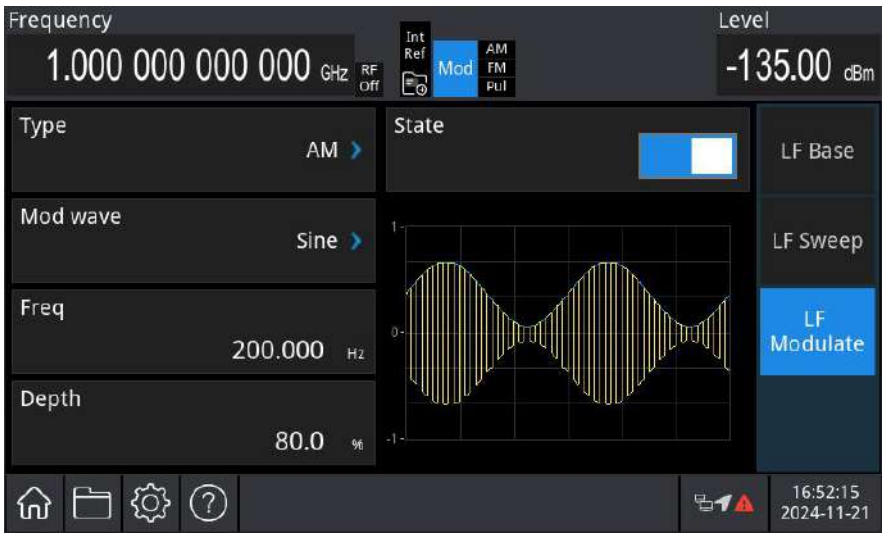
4) Set Modulation Depth

After setting the carrier parameters, press the LF Modulate key to enter the amplitude setting, press the Depth key, then use the numerical keyboard to enter 80 and select the unit % for this parameter.

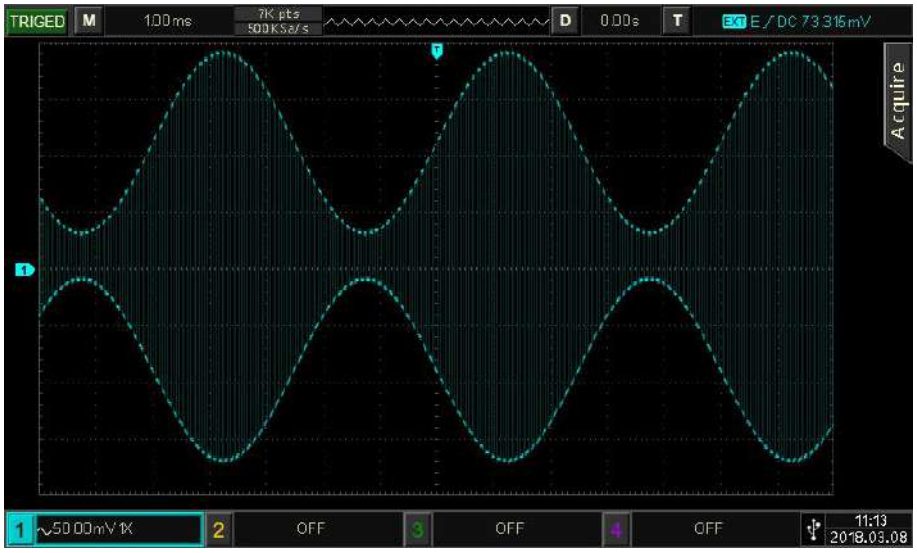


5) Enable Channel Output

Press the LF key. If the key is illuminated, the channel output is enabled.



View the AM modulation waveform on an oscilloscope, as shown in the following figure.

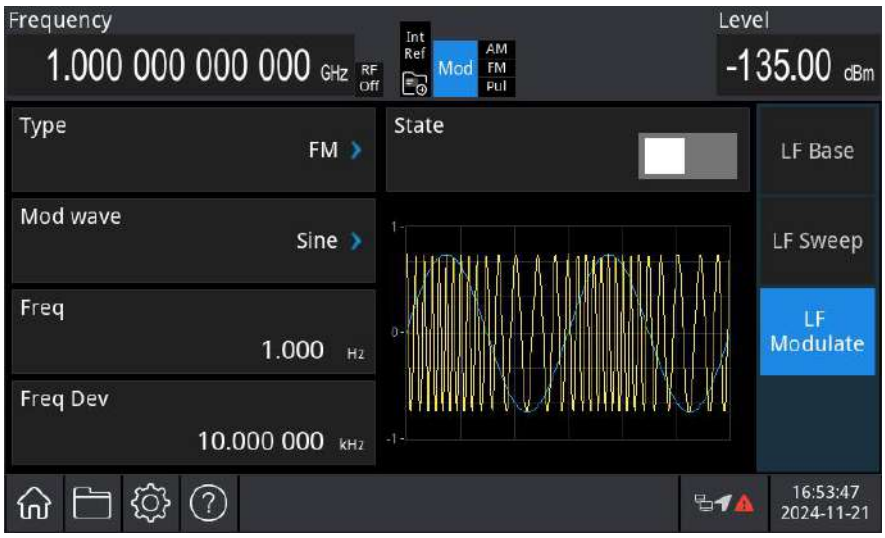


4.1.6 LF Frequence Modulation (FM)

In FM mode, the modulated wave consists of the carrier wave and the modulation wave. The frequency of the carrier wave changes with the amplitude of the modulation wave.

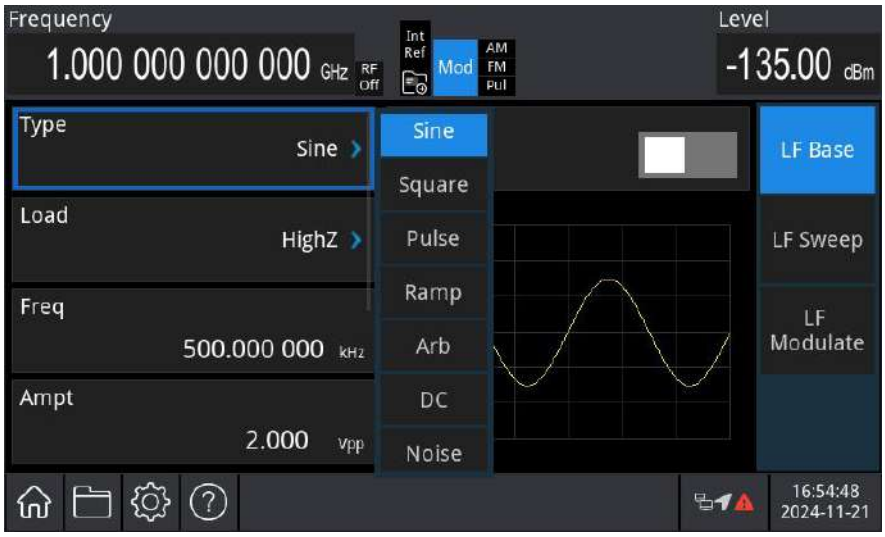
Select Frequence Modulation (FM)

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the FM mode from the drop-down menu. The instrument will output the modulated waveform according to the current modulation wave and the carrier wave.



Select Carrier Wave

The carrier wave can be set to sine wave, square wave, pulse wave, ramp wave, or arbitrary wave. The default carrier wave is sine wave. After the FM is enabled, press the LF Base →Type key in the modulation interface to open the carrier wave list.



Set Carrier Wave

Refer to Carrier Wave Frequency in AM mode.

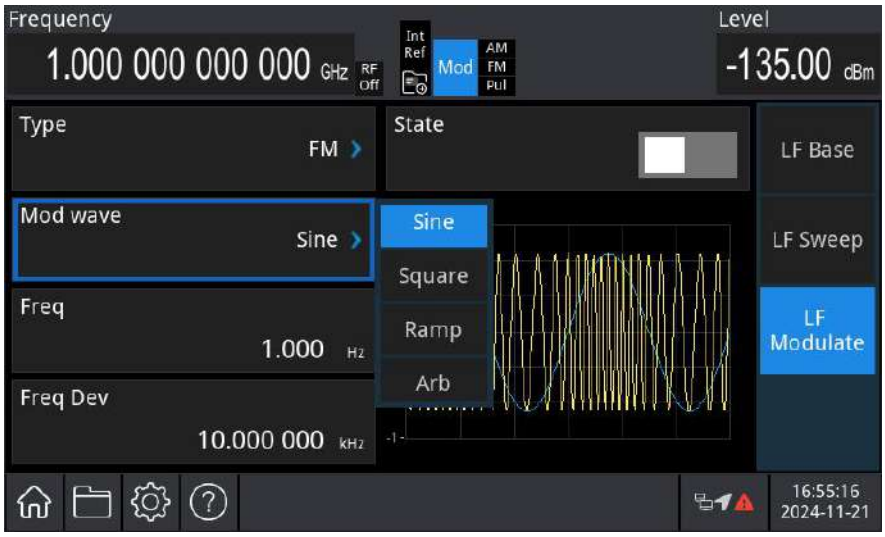
Select Modulation Wave

USG5000 series modulation source is internal modulation source. The internal modulation source includes sine wave, square wave, ramp wave, and arbitrary wave, with the default internal modulation set to a sine wave.

After FM mode is enabled, the default modulation wave (sine wave) will be displayed. The modulation wave can be adjusted by rotating the multi-function rotary knob or pressing the Mod Wave to adjust it.

- Square wave: Duty ration is 50%.

- ramp wave: Symmetry is 50%.
- Arbitrary wave: When an arbitrary waveform is selected as the modulation waveform, the radio-frequency signal generator limits the length of the arbitrary waveform to 4 kpts through automatic sampling.



Set Modulation Frequency

Set the frequency for the modulation wave within a range of 0.002 Hz to 5 MHz (default: 1 Hz). After FM mode is enabled, the default modulation wave frequency of 1 Hz will be displayed. The modulation frequency can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Freq key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Set Frequency Offset

Frequency offset indicates the deviation of the frequency-modulated wave relative to the carrier wave frequency. The FM frequency offset range can be set from a minimum of DC up to half of the current maximum carrier frequency. The default frequency offset is 10 kHz.

The frequency offset can be adjusted by using the multi-function rotary knob in modulation source interface, or pressing the Freq Offset key and using the numerical keyboard to enter the number and select the unit to complete this setting.

- Frequency offset ≤ Carrier wave frequency: If the frequency offset exceeds the carrier frequency, the instrument will automatically limit the offset to the maximum allowed by the current carrier frequency.
- The sum of the frequency offset and the carrier wave frequency ≤ Maximum allowed by the current carrier frequency: If the frequency offset value is invalid, the instrument will automatically limit the offset to the maximum allowed by the current carrier frequency.
- The difference of the carrier frequency and frequency offset > Modulation frequency: If the

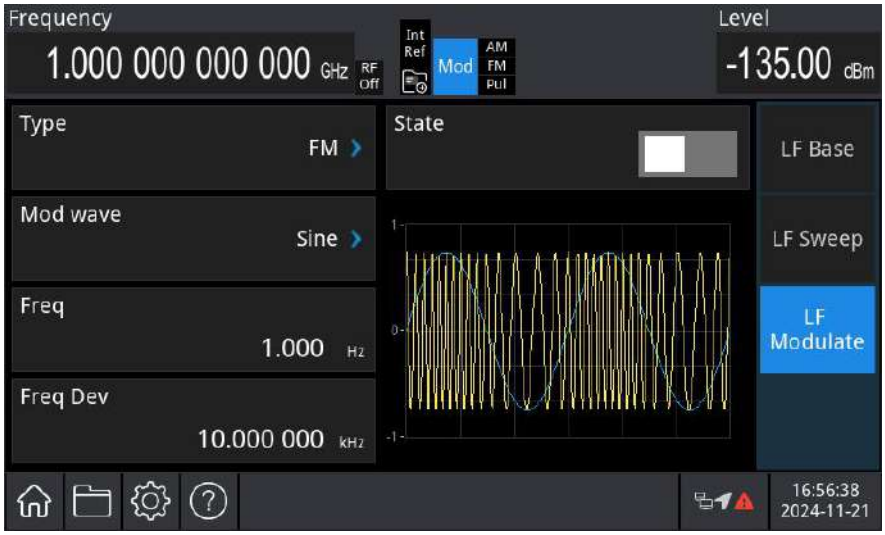
frequency offset value is invalid, the instrument will automatically limit the offset to the maximum allowed by the current carrier frequency.

Comprehensive Example

First, set the instrument to frequency modulation (FM) mode. Then, configure a 2 kHz square wave as the internal modulating signal, and set a 10 kHz sine wave with an amplitude of 100 mVpp as the carrier signal. Finally, set the frequency offset to 5 kHz. The procedure is as follows.

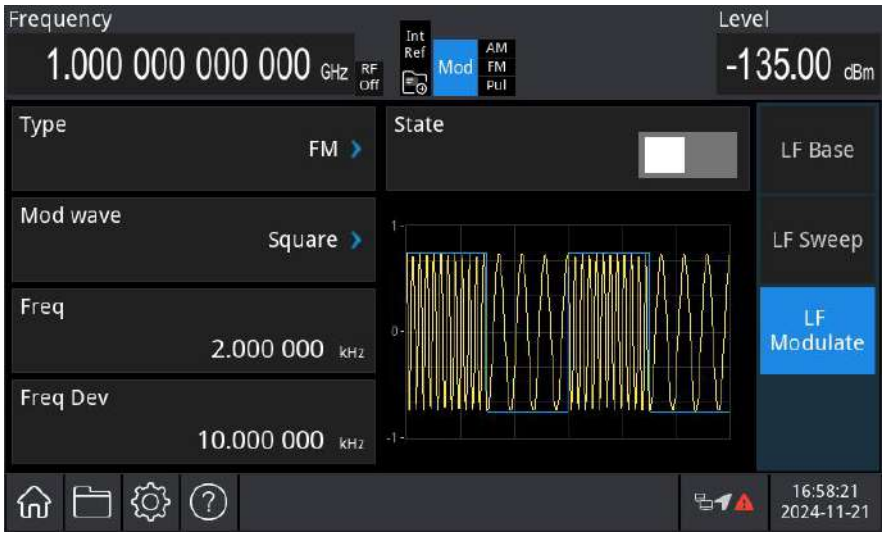
1) Enable FM Mode

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the FM from the drop-down menu to enable FM mode.



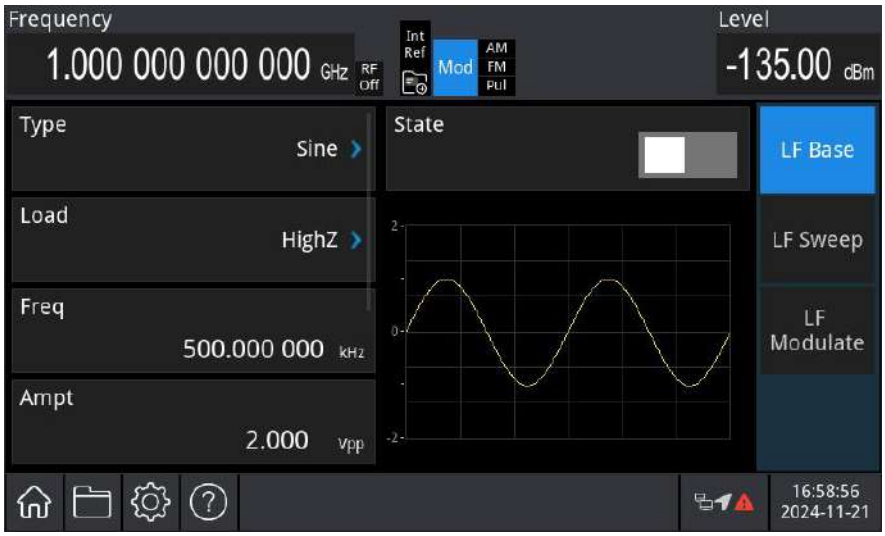
2) Set Modulation Signal and Wave

After setting step 1, press the Mod Wave key to select the square wave as the modulation wave. Then, press the Freq key, and use the numerical keyboard to enter 2, and select the unit kHz for this parameter.



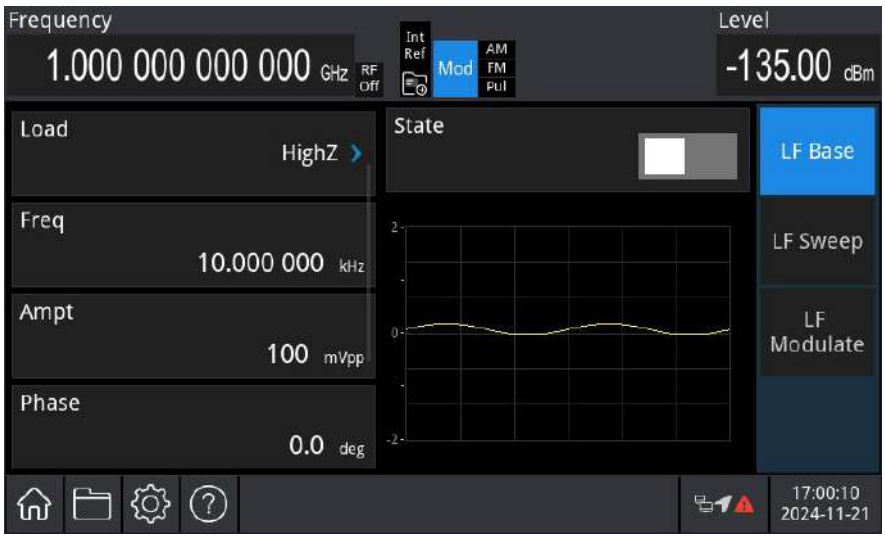
3) Set Carrier Signal

Press the LF Base →Type key to open the LF carrier list, select the sine wave as the carrier wave (default: sine wave.)



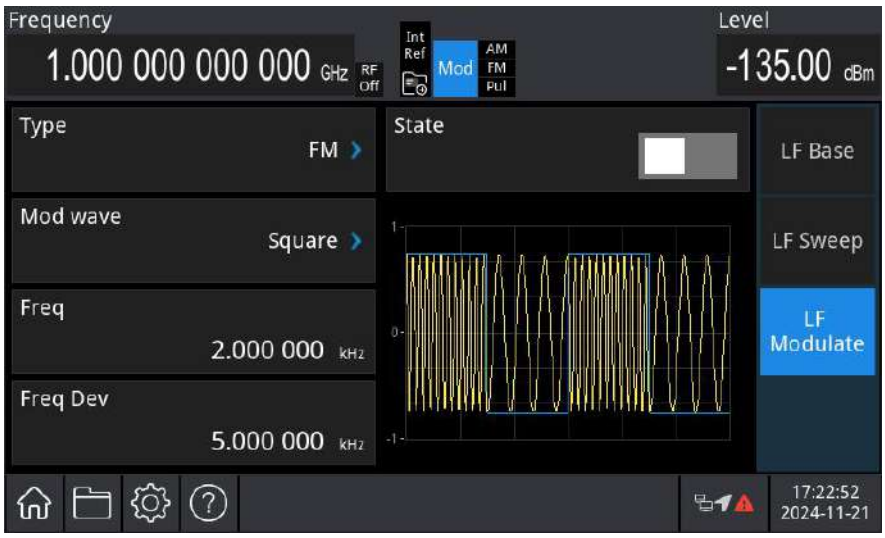
Press the Freq key to set the frequency, then use the numerical keyboard to enter 10 and select the unit kHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter 100 and select the unit mV for this parameter.



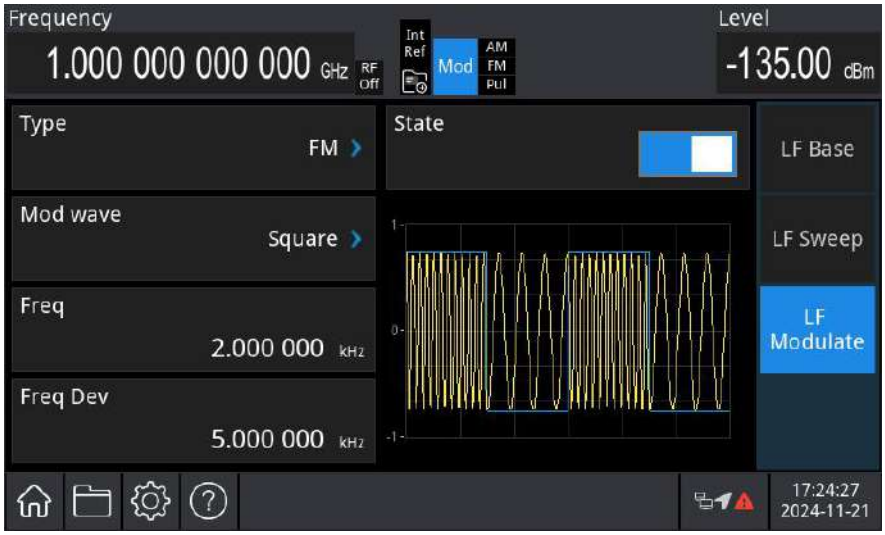
4) Set Frequency Offset

After setting the carrier parameters, press the LF Modulate to enter the FM setting menu, press the Freq Offset key, then use the numerical keyboard to enter 5 and select the unit kHz for this parameter.

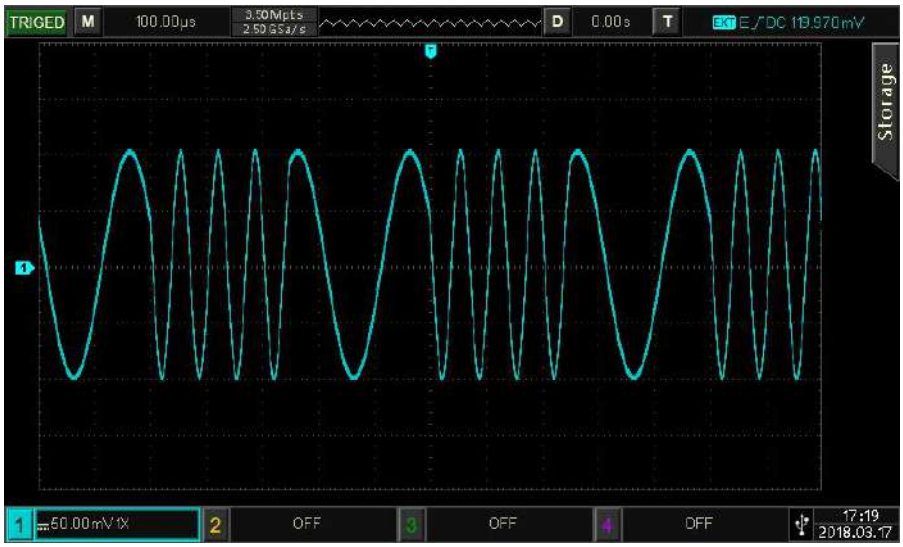


5) Enable Channel Output

Press the Home key in the analog stream mapper on the screen, check the function generator ON. If the LF key is illuminated, the channel output is enabled.



View the FM modulation waveform on a spectrum analyzer, as shown in the following figure.



4.1.7LF Phase Modulation (ΦM)

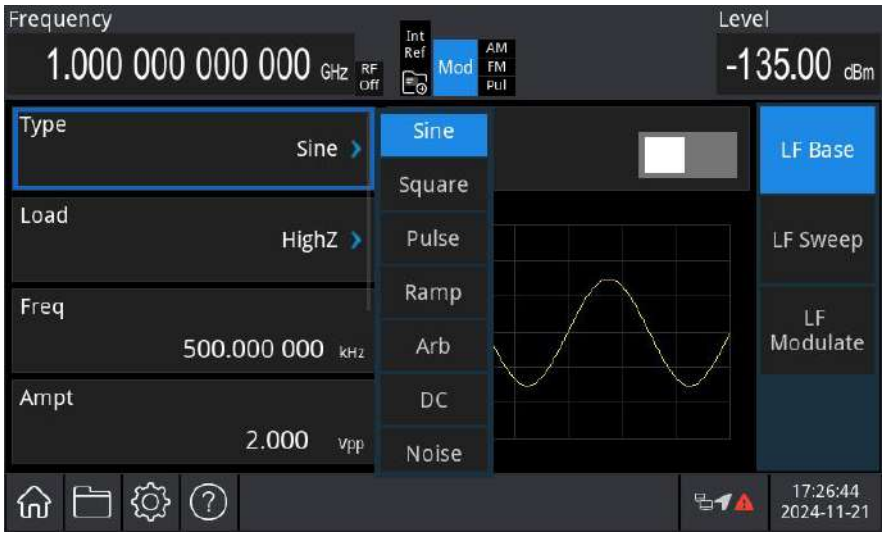
In ΦM mode, the modulated wave consists of the carrier wave and the modulation wave. The phase of the carrier wave changes with the amplitude of the modulation wave.

Select Phase Modulation (ΦM)

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the ΦM mode from the drop-down menu. The instrument will output the modulated waveform according to the current modulation wave and the carrier wave.

Select Carrier Wave

The carrier wave can be set to sine wave, square wave, ramp wave, or arbitrary wave. The default carrier wave is sine wave. After the ΦM is enabled, press the LF Base →Type key in the modulation interface to open the carrier wave list.



Set Carrier Wave

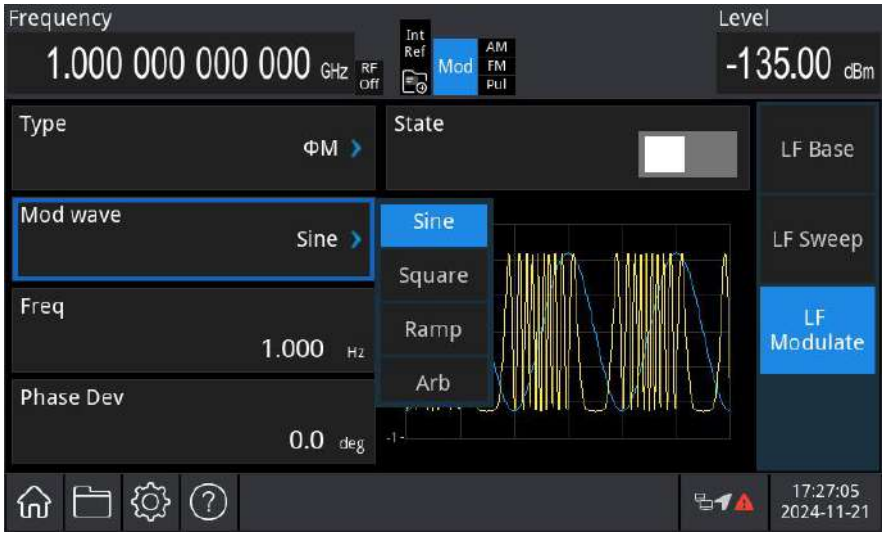
Refer to Carrier Wave Frequency in AM mode.

Select Modulation Wave

USG5000 series modulation source is internal modulation source. The internal modulation source includes sine wave, square wave, ramp wave, and arbitrary wave, with the default internal modulation set to a sine wave.

After ΦM mode is enabled, the default modulation wave (sine wave) will be displayed. The modulation wave can be adjusted by rotating the multi-function rotary knob or pressing the Mod Wave to adjust it.

- Square wave: Duty ration is 50%.
- ramp wave: Symmetry is 50%.
- Arbitrary wave: When an arbitrary waveform is selected as the modulation waveform, the radio-frequency signal generator limits the length of the arbitrary waveform to 4 kpts through automatic sampling.



Set Modulation Frequency

Set the frequency for the modulation wave within a range of 0.002 Hz to 5 MHz (default: 1 Hz). After ΦM mode is enabled, the default modulation wave frequency of 1 Hz will be displayed. The modulation frequency can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Freq key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Set Phase Offset

Phase offset indicates the deviation of the phase-modulated wave relative to the carrier wave phase. The ΦM phase offset range can be set from 0° to 360°. The default frequency offset is 0°.

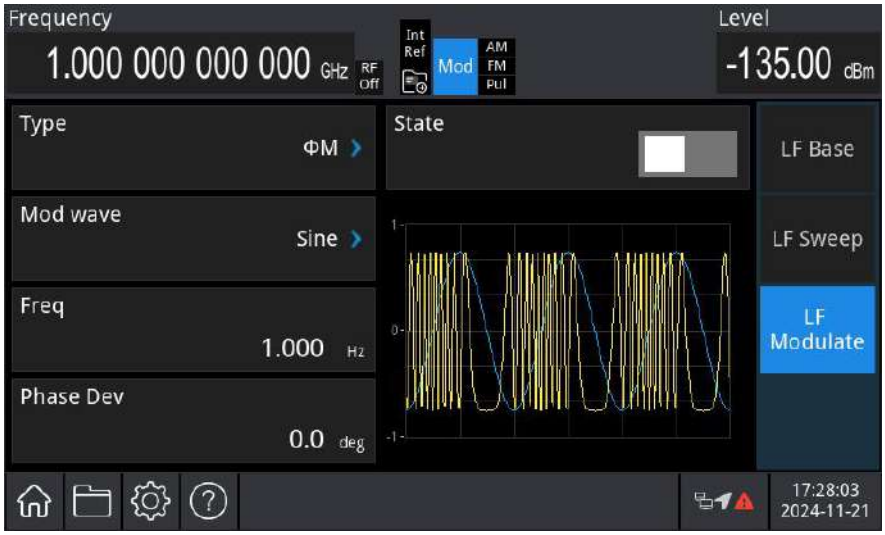
The phase offset can be adjusted by using the multi-function rotary knob in an analog modulation source interface, or pressing the Phase Dev key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Comprehensive Example

First, set the instrument to phase modulation (ΦM) mode. Then, configure a 200 Hz sine wave as the internal modulating signal, with a carrier signal frequency of 900 Hz and an amplitude of 100 mVpp. Finally, set the phase offset to 200°. The procedure is as follows.

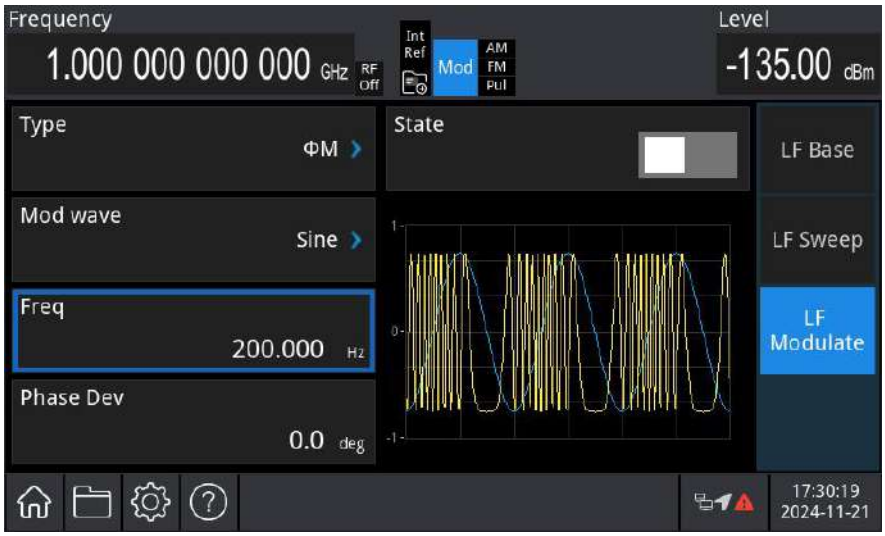
1) Enable ΦM Mode

Press the Home key in the analog stream mapper on the screen, the press the LF Out →LF Modulate →Type key, select the ΦM from the drop-down menu to enable ΦM mode.



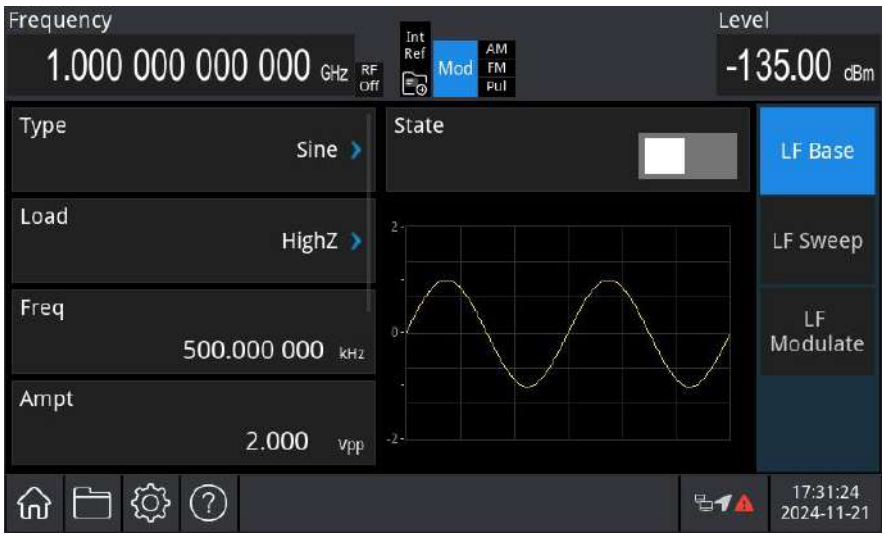
2) Set Modulation Signal

After setting step 1, press the Freq key, use the numerical keyboard to enter 200, and select the unit Hz for this parameter.



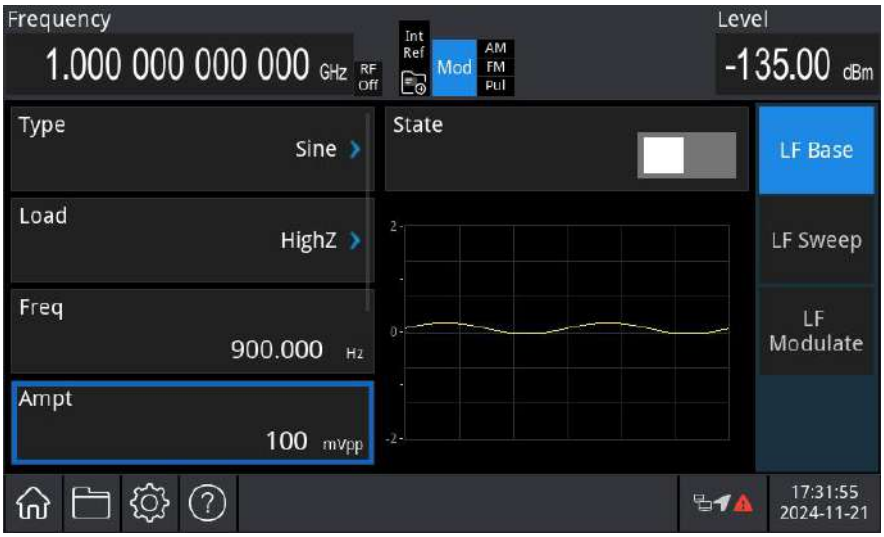
3) Set Carrier Signal

Press the LF Base →Type key to open the LF carrier list, select the sine wave as the carrier wave (default: sine wave.)



Press the Freq key to set the frequency, then use the numerical keyboard to enter 900 and select the unit Hz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter 100 and select the unit mVpp for this parameter, as shown in the following figure.



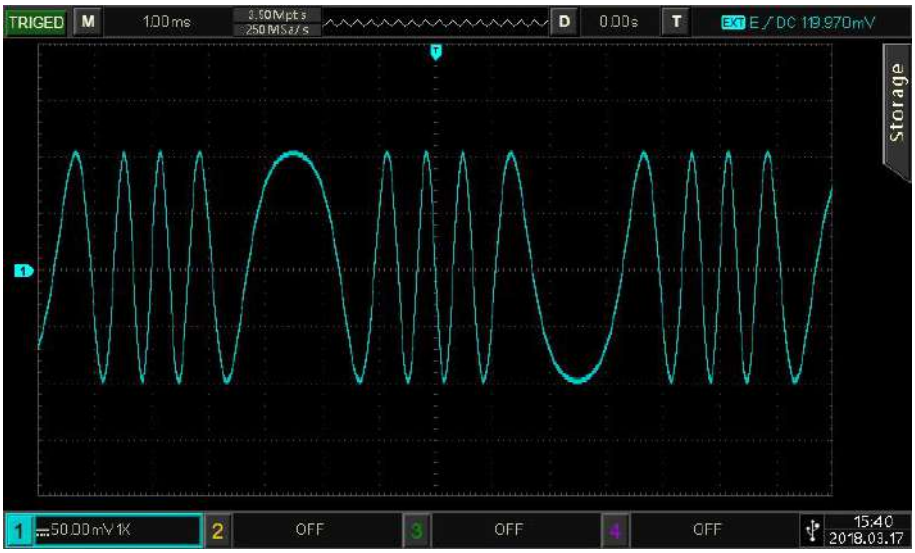
4) Set Phase Offset

After setting the carrier parameters, press the LF Modulate to enter the ΦM setting menu, press the Phase Dev key, then use the numerical keyboard to enter 200 and select the unit deg for this parameter.

5) Enable Channel Output

Press the LF key. If the key is illuminated, the channel output is enabled.

View the ΦM modulation waveform on an oscilloscope, as shown in the following figure.

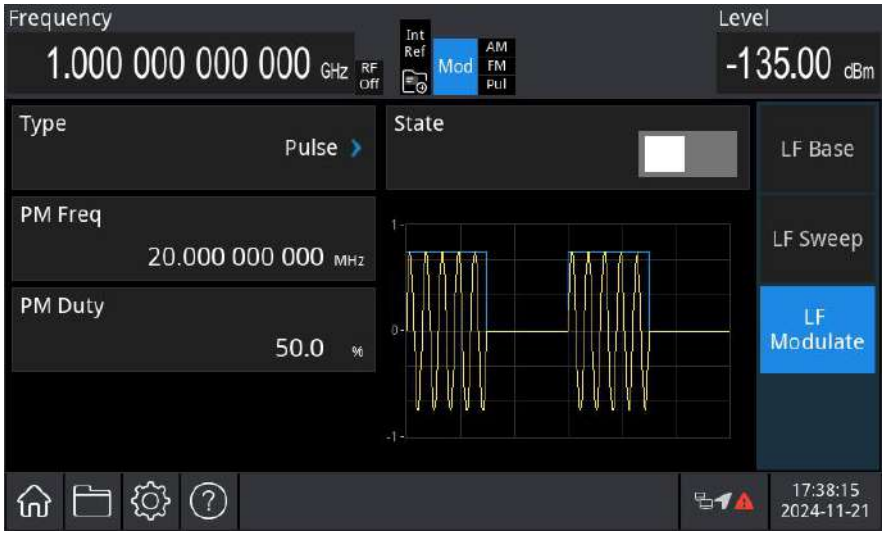


4.1.8 LF Pulse Modulation (Pulse)

In pulse modulation, the modulated wave consists of a carrier wave and a modulation wave. The default modulation wave is a pulse wave. The output period of the carrier wave varies according to the amplitude of the modulation wave.

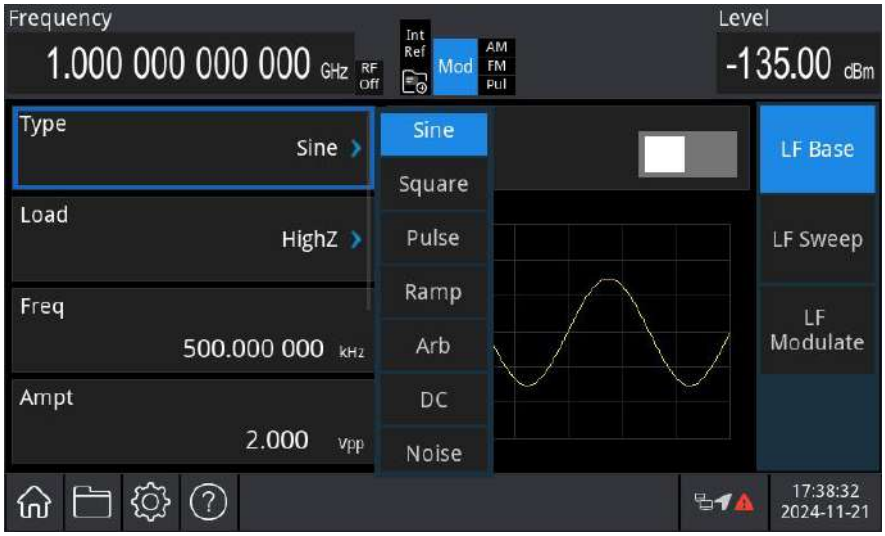
Select Pulse Modulation (Pulse)

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the Pulse mode from the drop-down menu. The instrument will output the modulated waveform according to the current modulation wave and the carrier wave.



Select Carrier Wave

The carrier wave can be set to sine wave, square wave, pulse wave, ramp wave, or arbitrary wave. The default carrier wave is sine wave. After the Pulse is enabled, press the LF Base →Type key in the modulation interface to open the carrier wave list.



Set Carrier Wave

Refer to Carrier Wave Frequency in AM mode.

Set Pulse Frequency

Set the frequency for the modulation wave within a range of 1 mHz to 25 MHz (default: 20 MHz). After Pulse mode is enabled, the default modulation wave frequency of 20 MHz will be displayed. The pulse frequency can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Pulse Freq key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Set Duty Ratio

After Pulse is enabled, the duty ratio represents the proportion of the modulated waveform's output within one cycle of the modulation wave. The adjustable range of the phase offset for Pulse modulation is from 0% to 100%, with a default value of 50%.

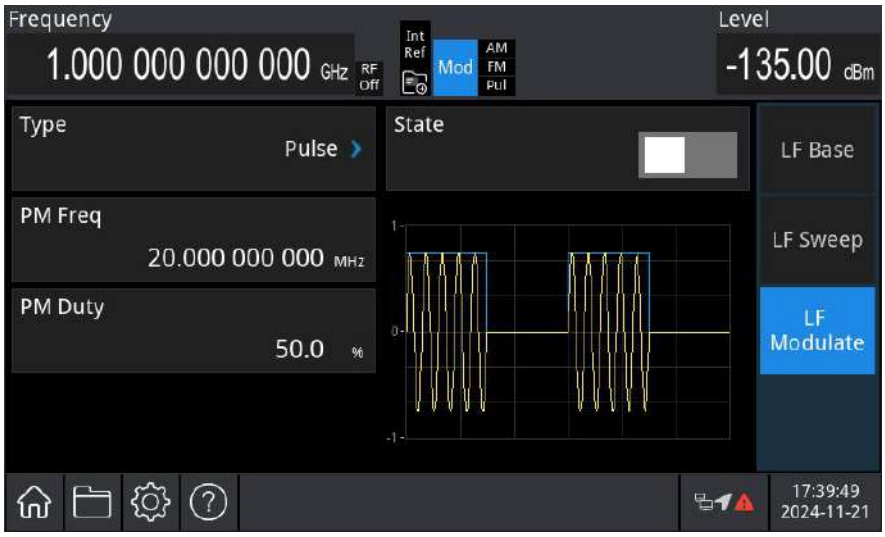
The duty ratio can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Duty key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Comprehensive Example

First, set the instrument to pulse modulation (Pulse) mode. Then, configure a 10 kHz sine wave as the modulating signal, and set a 900 kHz sine wave with an amplitude of 100 mVpp as the carrier signal. Finally, set the duty ratio to 70%. The procedure is as follows.

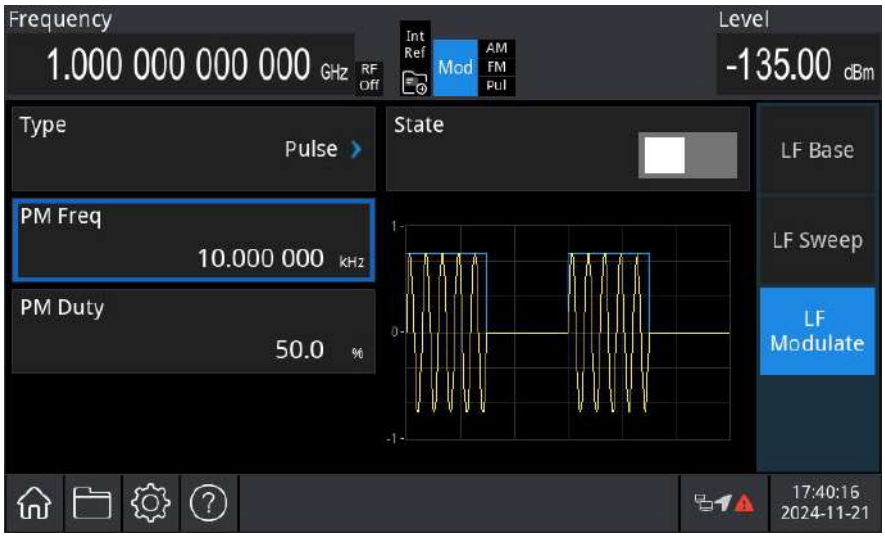
1) Enable Pulse Mode

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the Pulse from the drop-down menu to enable Pulse mode.



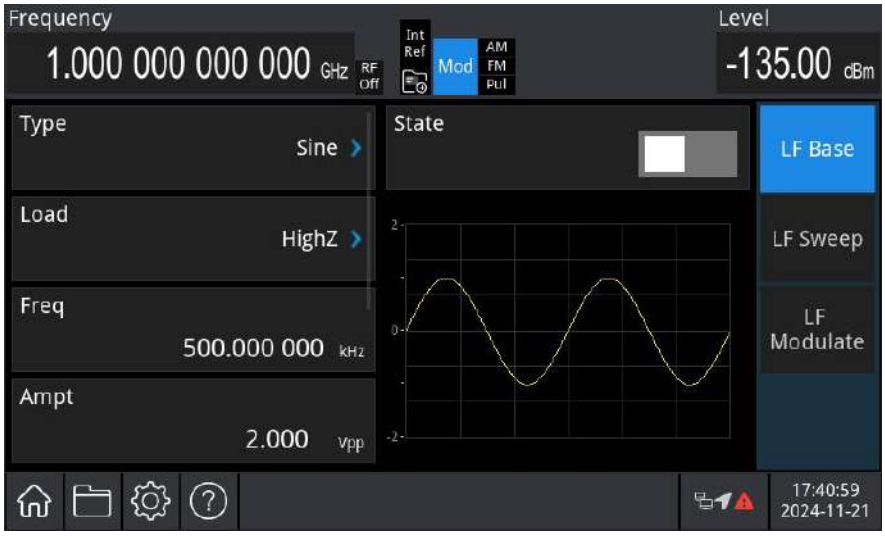
2) Set Modulation Signal

After setting step 1, press the Pulse Freq key, use the numerical keyboard to enter 10, and select the unit kHz for this parameter.



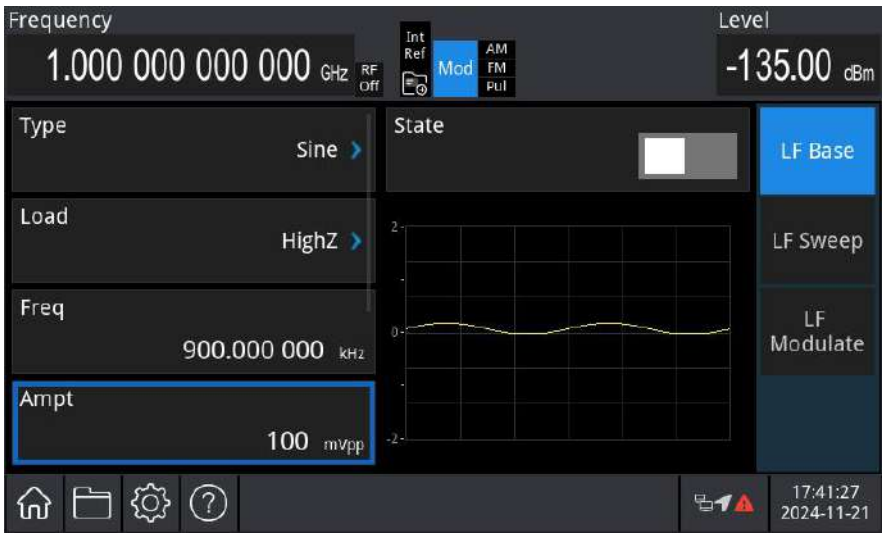
3) Set Carrier Signal

Press the LF Base →Type key to open the LF carrier list, select the sine wave as the carrier wave (default: sine wave.)



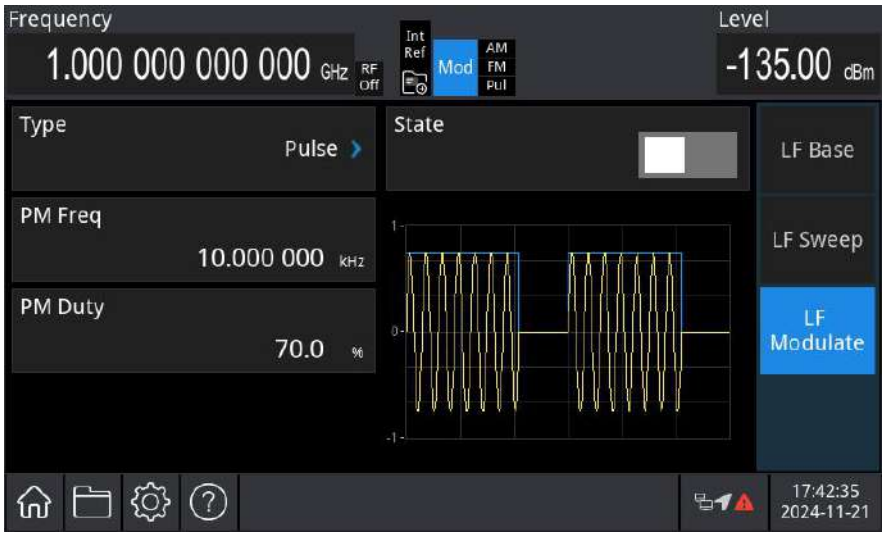
Press the Freq key to set the frequency, then use the numerical keyboard to enter 900 and select the unit kHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter 100 and select the unit mVpp for this parameter, as shown in the following figure.



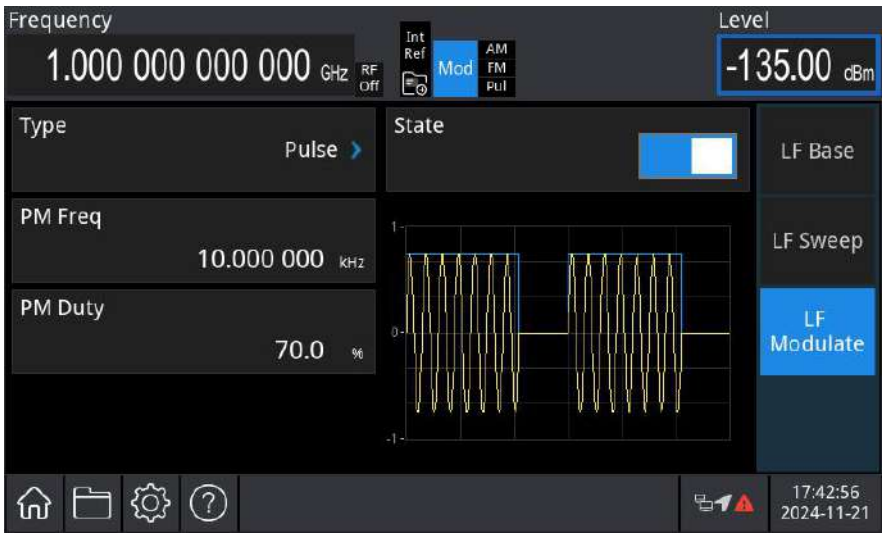
4) Set Duty Ratio

After setting the carrier parameters, press the LF Modulate key to enter the Pulse setting, press the DUTY key, then use the numerical keyboard to enter 70 and select the unit % for this parameter.

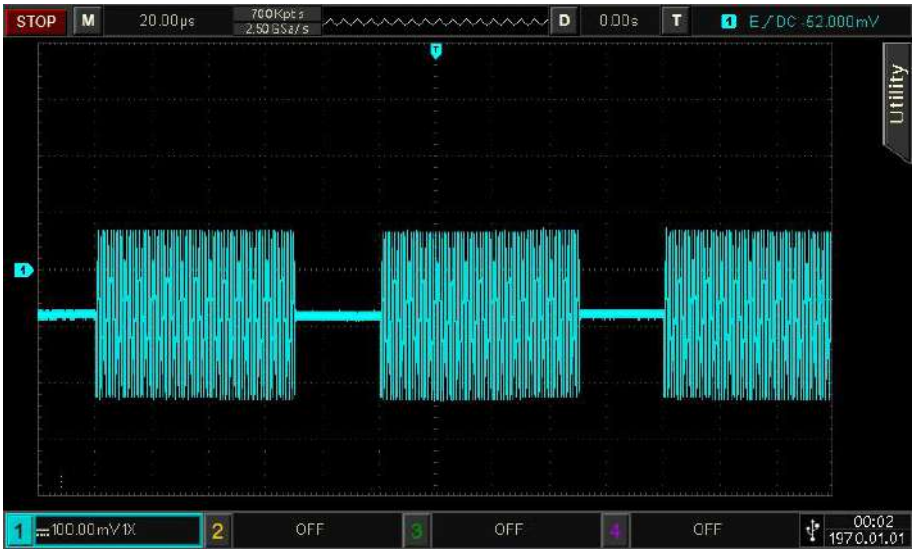


5) Enable Channel Output

Press the LF key. If the key is illuminated, the channel output is enabled.



View the Pulse modulation waveform on an oscilloscope, as shown in the following figure.

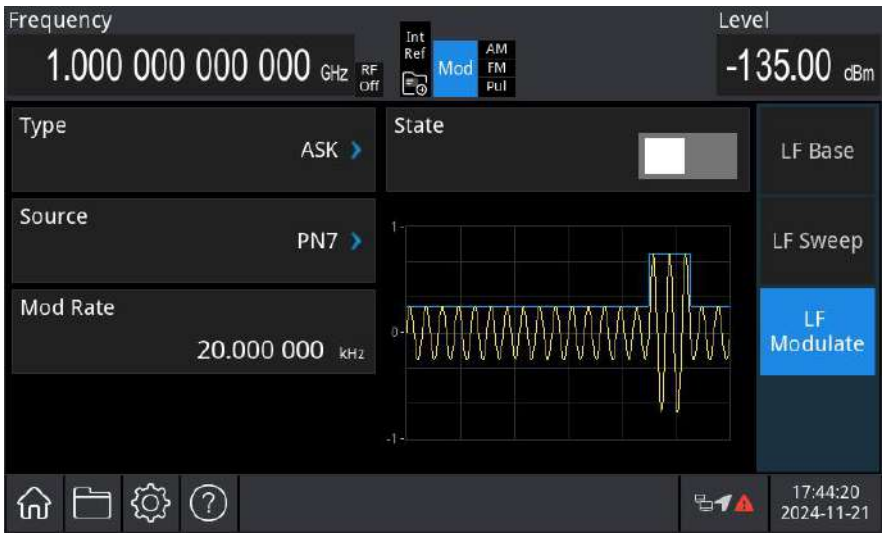


4.1.9 LF Amplitude Shift Keying (ASK)

In ASK mode, the amplitude of the carrier signal changes to represent the digital signal as “0” or “1.” The output carrier signal varies in amplitude based on the logic level of the modulation signal.

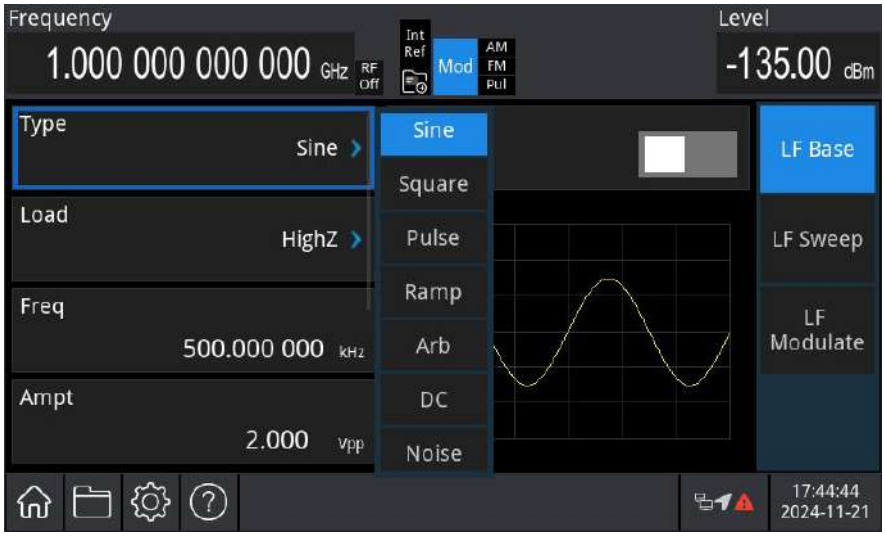
Select ASK Mode

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the ASK mode from the drop-down menu. The instrument will output the modulated waveform according to the current ASK rate and the carrier wave.



Select Carrier Wave

The ASK carrier wave can be set to sine wave, square wave, pulse wave, ramp wave, or arbitrary wave. The default carrier wave is sine wave. After the ASK is enabled, press the LF Base →Type key in the modulation interface to open the carrier wave list.



Set Carrier Wave

Refer to Carrier Wave Frequency in AM mode.

Set ASK Rate

Set the ASK rate within a range of 2 mHz to 5MHz (default: 20 kHz). The ASK rate can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Rate key and using the numerical keyboard to enter the number and select the unit to complete this setting.

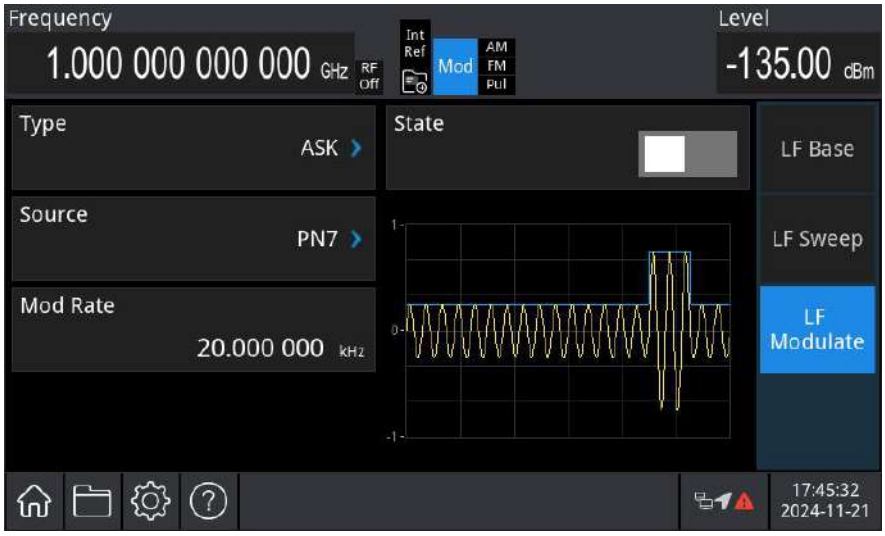
Comprehensive Example

First, set the instrument ASK mode. Then, configure a 15 kHz sine wave and an amplitude of 2 Vpp as the carrier signal, and let the amplitude of the carrier frequency switch at a frequency of 300 Hz.

The procedure is as follows.

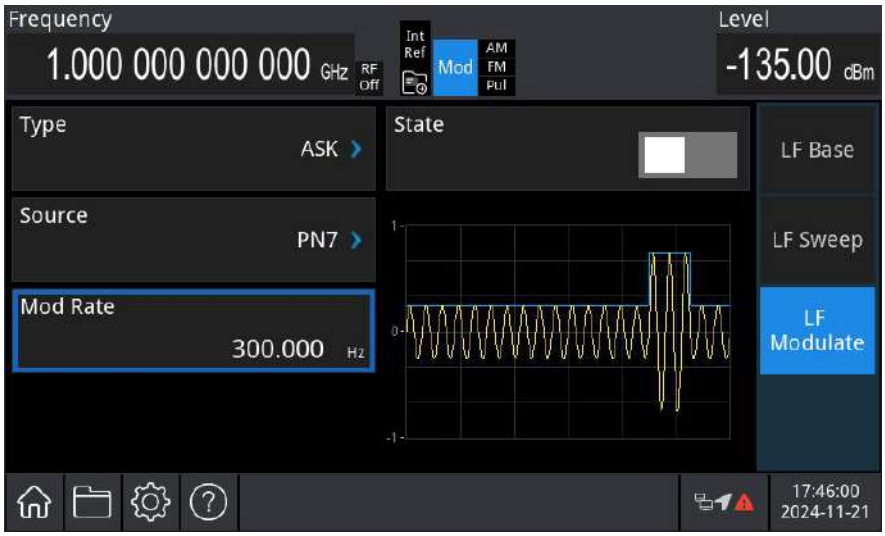
1) Enable ASK Mode

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the ASK from the drop-down menu to enable ASK mode.



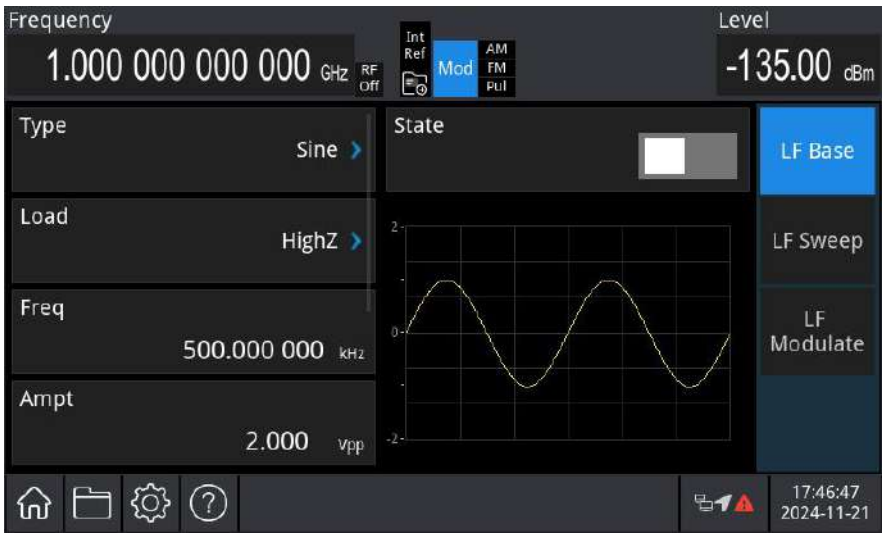
2) Set Modulation Rate

Press the Mod Rate key, use the numerical keyboard to enter 300, and select the unit Hz for this parameter.



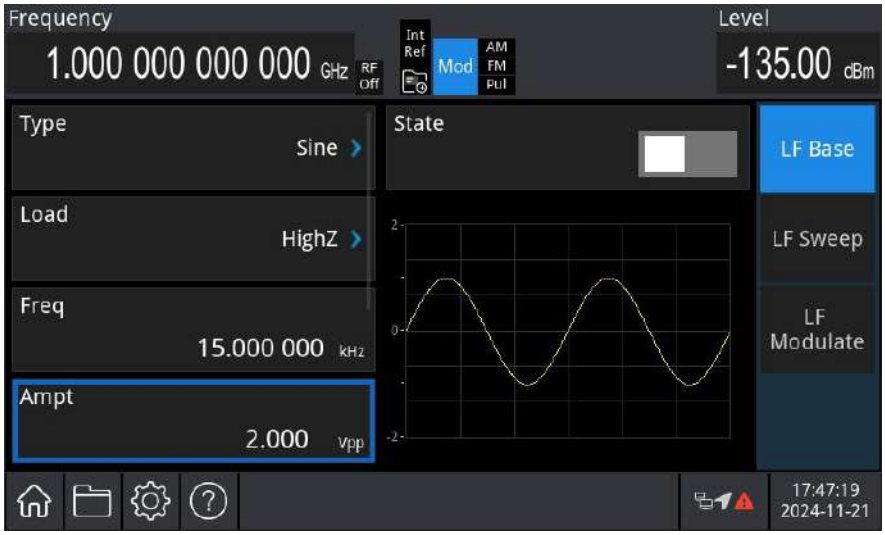
3) Set Carrier Signal

Press the LF Base →Type key to open the LF carrier list, select the sine wave as the carrier wave (default: sine wave.)



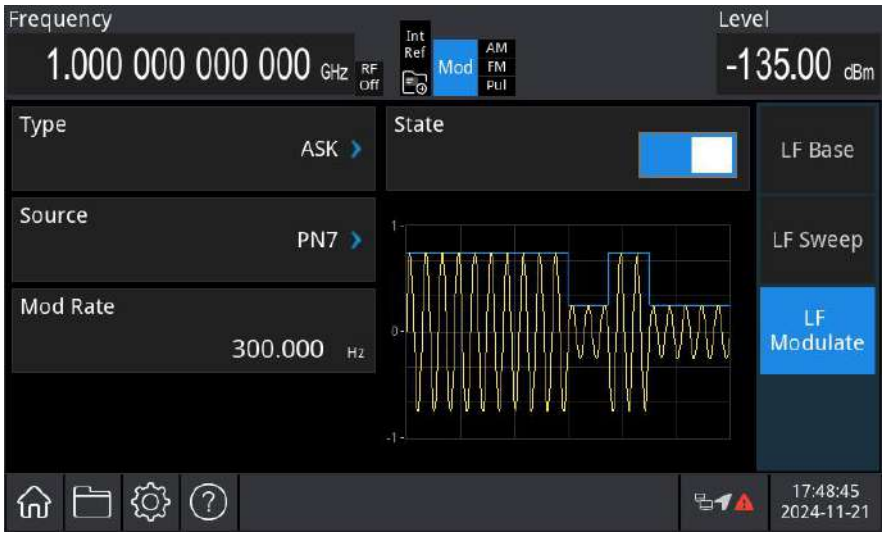
Press the Freq key to set the frequency, then use the numerical keyboard to enter 15 and select the unit kHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter 2 and select the unit Vpp for this parameter.

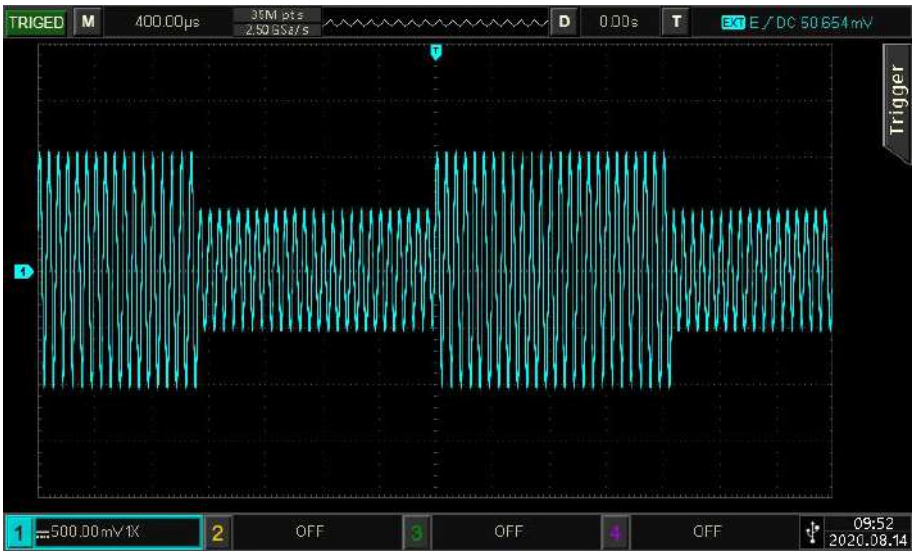


4) Enable Channel Output

Press the LF key. If the key is illuminated, the channel output is enabled.



View the ASK modulation waveform on an oscilloscope, as shown in the following figure.

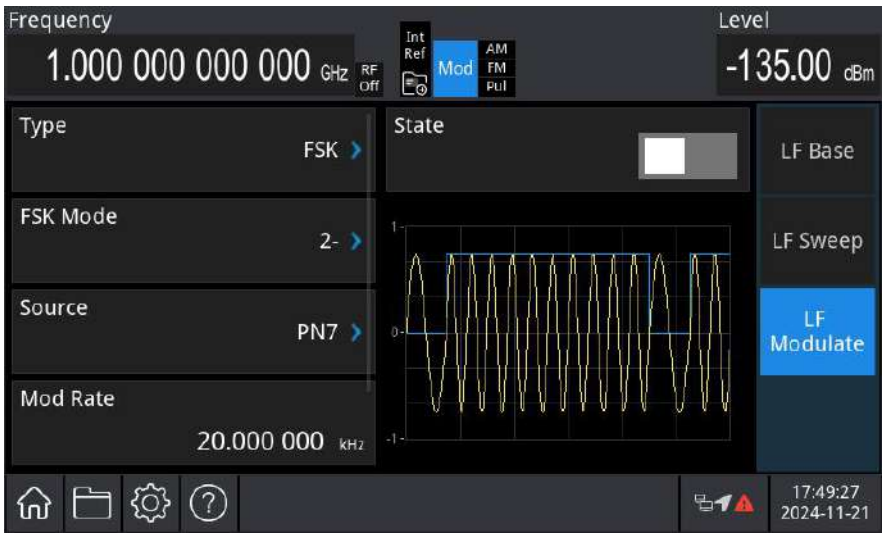


4.1.10 LF Frequency Shift Keying (FSK)

In FSK mode, the instrument's switching rate between the carrier frequency and the hopping frequency can be configured.

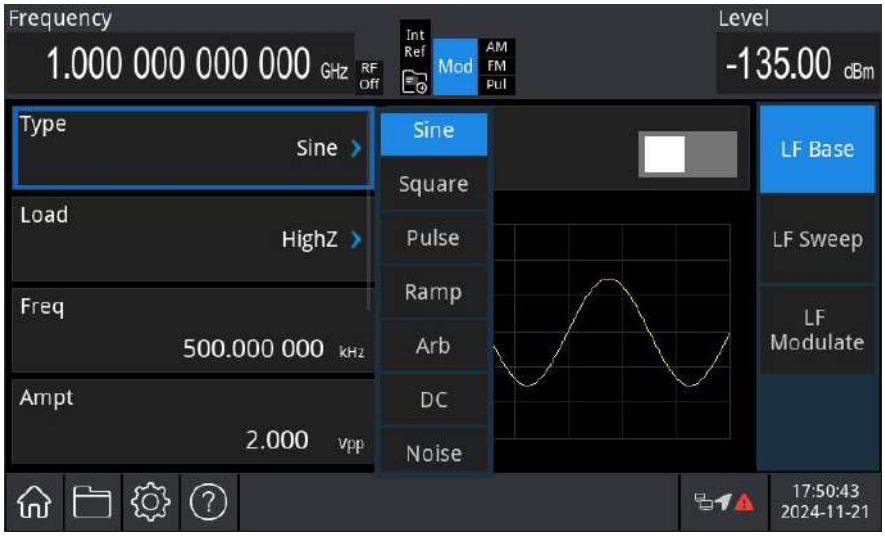
Select FSK Mode

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the FSK mode from the drop-down menu. The instrument will output the modulated waveform according to the current ASK rate and the carrier wave.



Select Carrier Wave

The carrier wave can be set to sine wave, square wave, pulse wave, ramp wave, or arbitrary wave. The default carrier wave is sine wave. After the FSK is enabled, press the LF Base →Type key in the modulation interface to open the carrier wave list.



Set Carrier Wave

Refer to Carrier Wave Frequency in AM mode.

Set Hopping Frequency

After FSK mode is enabled, the default hopping frequency 10 kHz will be displayed.

The hopping frequency can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Hopping Freq 1 key and using the numerical keyboard to enter the number and select the unit to complete this setting. Hopping frequency range is depends on the carrier wave, the frequency setting of the carrier wave can refer to Carrier Frequency in AM mode.

Set FSK Rate

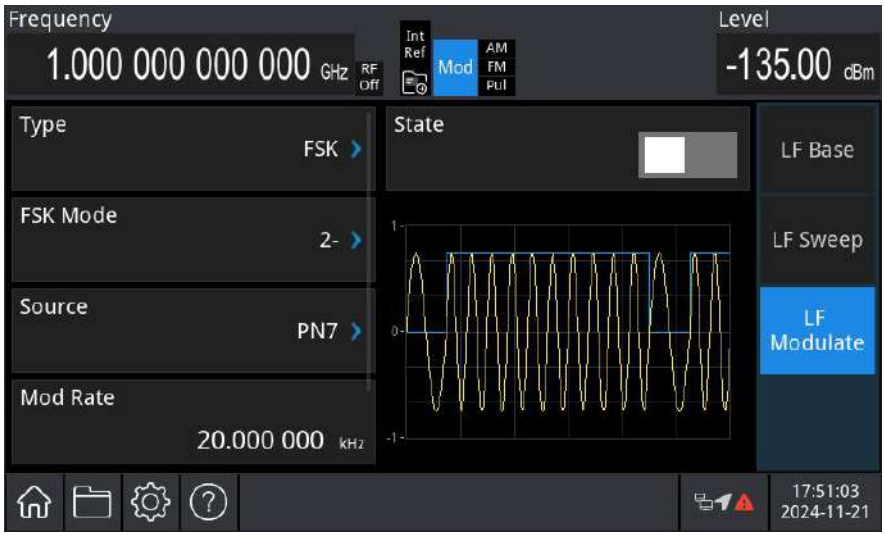
Switch between the carrier frequency and hopping frequency. After FSK mode is enabled, set the FSK within a range of 2 mHz to 5MHz (default: 20 kHz). The FSK rate can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Mod Rate key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Comprehensive Example

First, set the instrument to FSK mode. Then, configure a 2 kHz, 1 Vpp sine wave as the carrier signal, and set a hopping frequency to 800 Hz, let the carrier frequency and hopping frequency switch at a frequency of 200 Hz. The procedure is as follows.

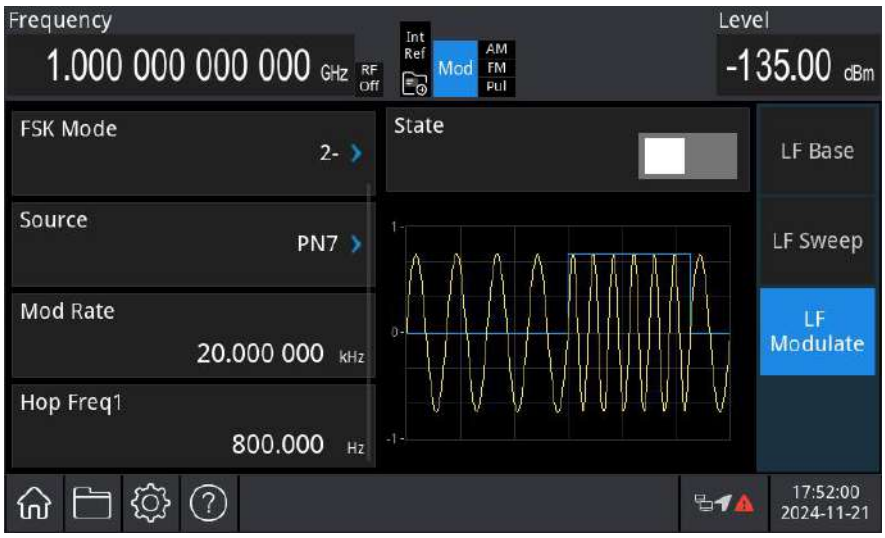
1) Enable FSK Mode

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the FSK from the drop-down menu to enable FSK mode.



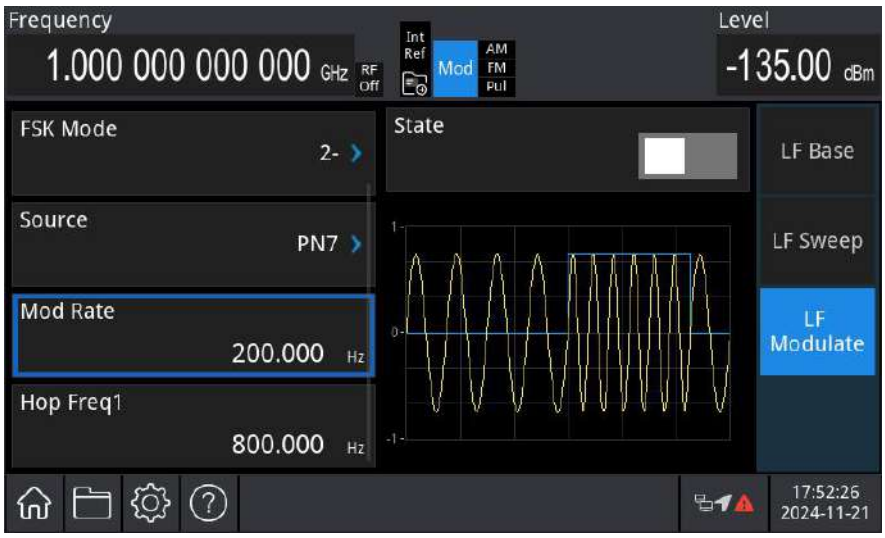
2) Set Hopping Frequency and Modulation Rate

After setting step 1, press the Hopping Freq 1 key, use the numerical keyboard to enter 800, and select the unit Hz for this parameter.



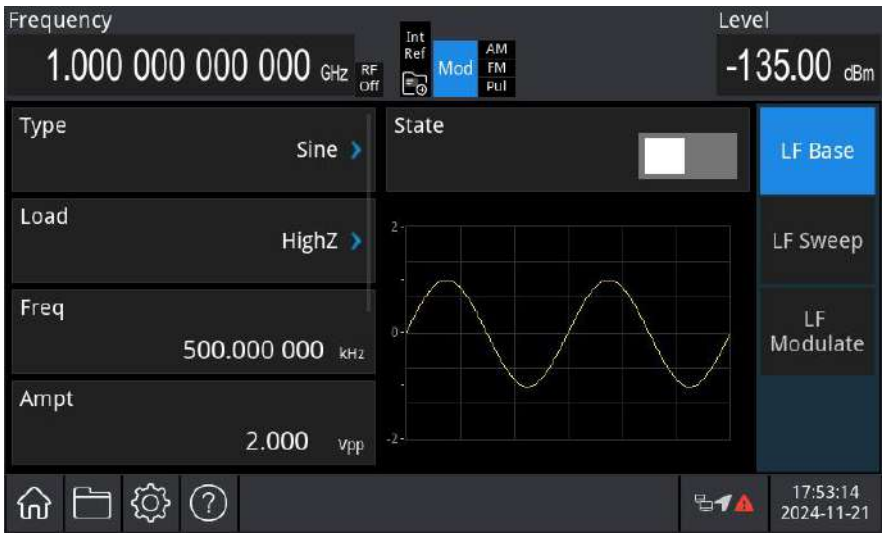
3) Modulation Rate

Press the Mod Rate key, use the numerical keyboard to enter 200, and select the unit Hz for this parameter.



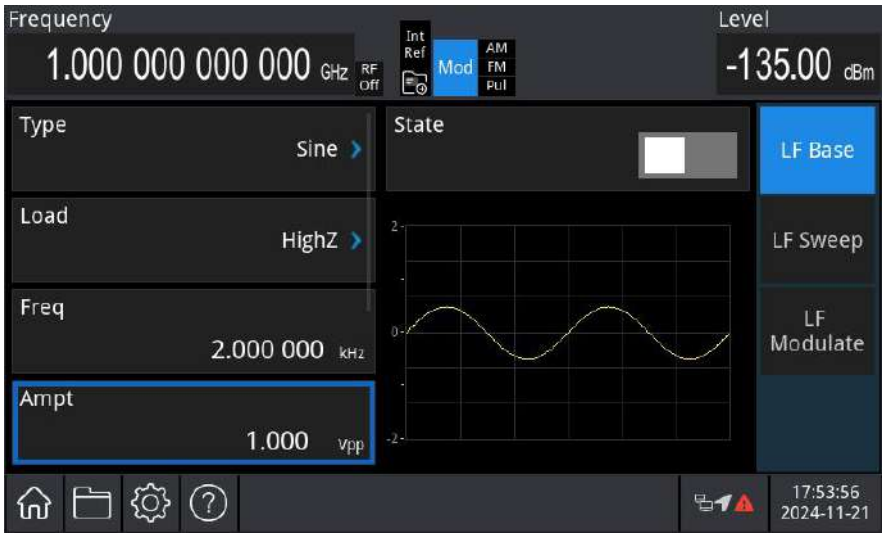
4) Set Carrier Signal

Press the LF Base →Type key to open the LF carrier list, select the sine wave as the carrier wave (default: sine wave.)



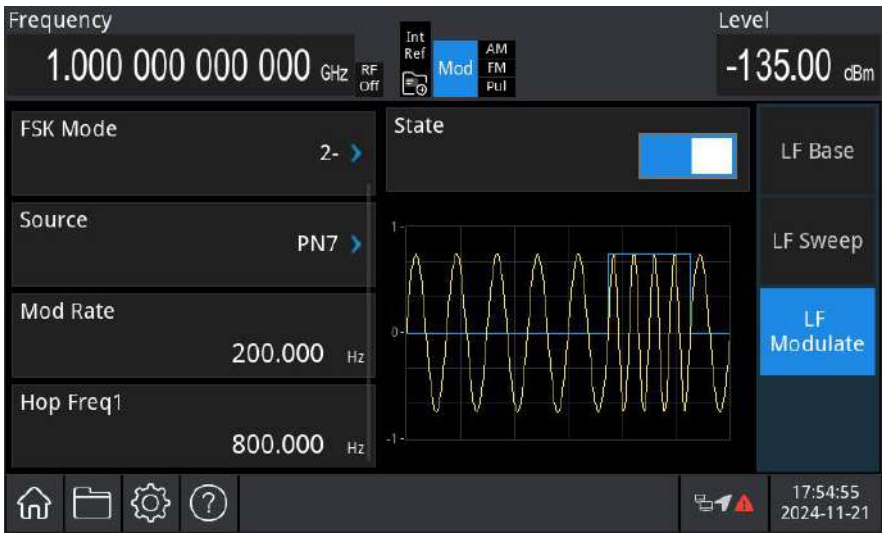
Press the Freq key to set the frequency, then use the numerical keyboard to enter 2 and select the unit kHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter 1 and select the unit Vpp for this parameter.

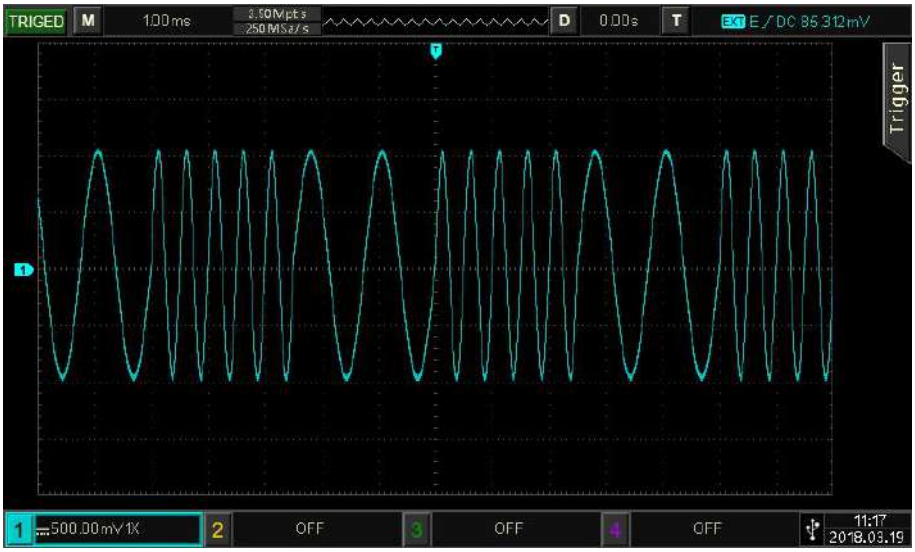


5) Enable Channel Output

Press the LF key. If the key is illuminated, the channel output is enabled.



View the FSK modulation waveform on an oscilloscope, as shown in the following figure.

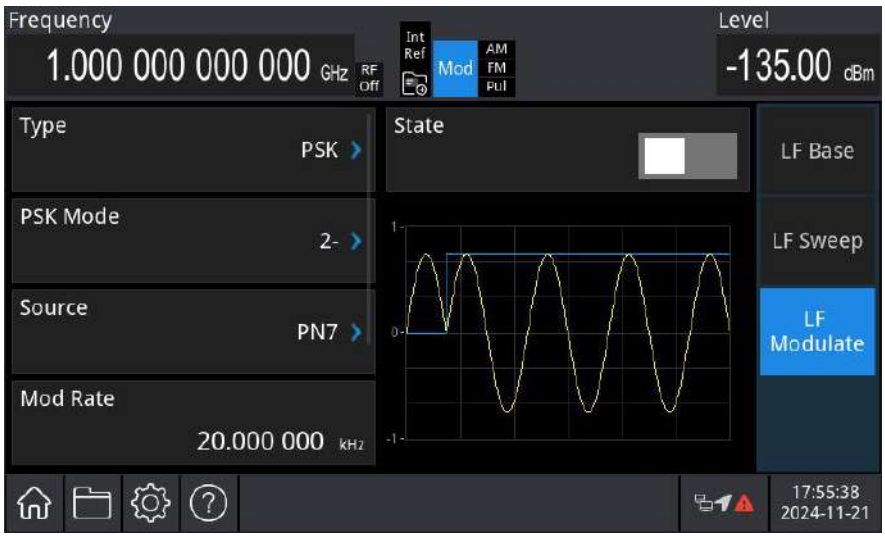


4.1.11 LF Phase Shift Keying (PSK)

In PSK mode, the radio-frequency signal generator can be configured to shift between two preset phases (carrier phase and modulation phase). The carrier signal phase or the modulation signal phase is output according to the logic level of the modulation signal.

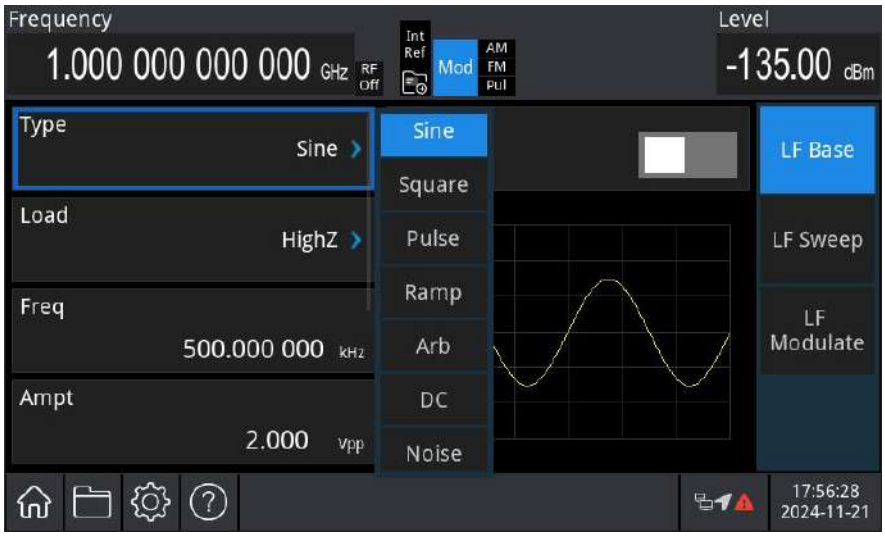
Select Phase Shift Keying (PSK)

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the PSK mode from the drop-down menu. The instrument will output the modulated waveform according to the current modulation wave and the carrier wave.



Select Carrier Wave

The carrier wave can be set to sine wave, square wave, ramp wave, or arbitrary wave. The default carrier wave is sine wave. After the PSK is enabled, press the LF Base →Type key in the modulation interface to open the carrier wave list



Set Carrier Wave

Refer to Carrier Wave Frequency in AM mode.

Set PSK Rate

Set the moving frequency between the carrier phase and modulation phase. After PSK mode is enabled, set the PSK within a range of 2 mHz to 5MHz (default: 20 kHz). The PSK rate can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Mod Rate key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Set Modulation Phase

The modulation phase indicates the deviation of the phase-modulated wave relative to the carrier wave phase. The PSK modulation phase range can be set from 0° to 360°. The default frequency offset is 0° and 90°.

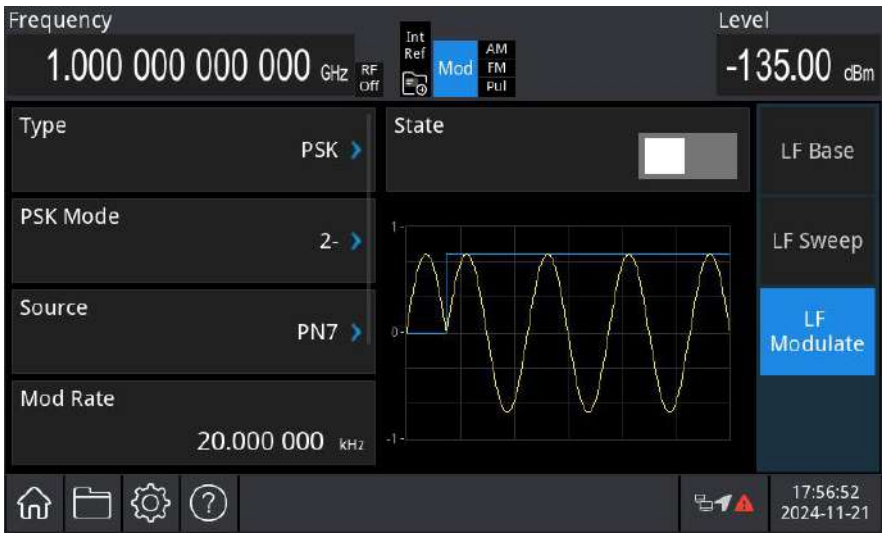
The phase offset can be adjusted by using the multi-function rotary knob in analog modulation source interface, or pressing the Phase Dev and Phase 2 key and using the numerical keyboard to enter the number and select the unit to complete this setting

Comprehensive Example

First, set the instrument to phase shift keying (PSK)) mode. Then, configure a 2 kHz, 2 Vpp sine wave as the carrier signal. Finally, let the carrier phase and modulation phase 180° switch at a frequency of 2 kHz. The procedure is as follows.

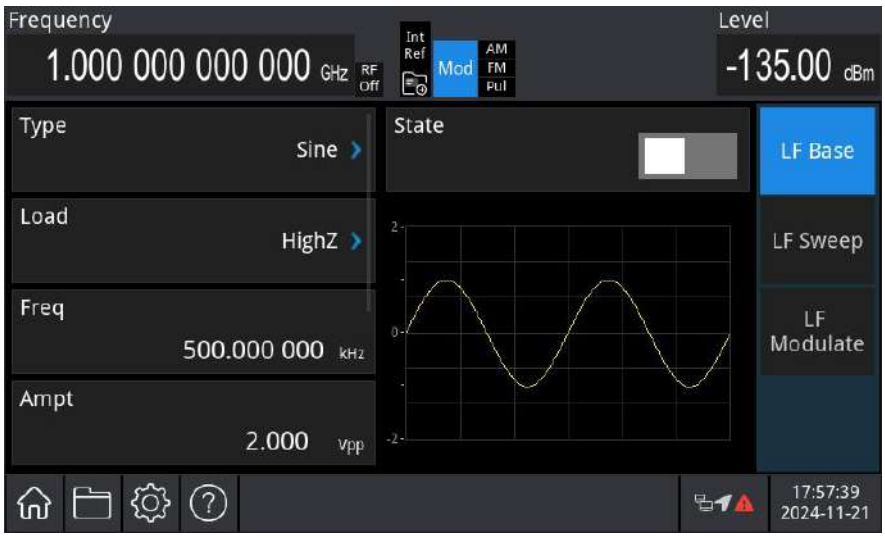
1) Enable PSK Mode

Press the Home key in the analog stream mapper on the screen, the press the LF Out →LF Modulate →Type key, select the PSK from the drop-down menu to enable PSK mode.



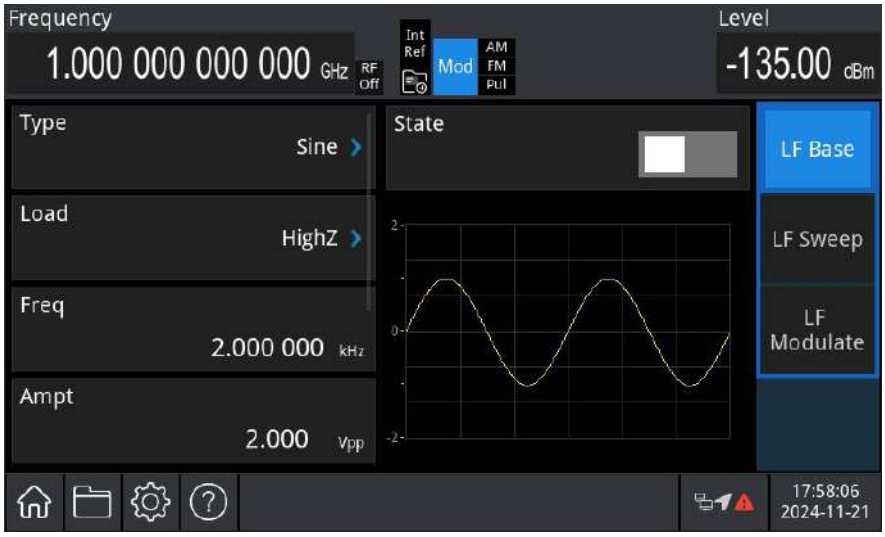
2) Set Carrier Signal

Press the LF Base →Type key to open the LF carrier list, select the sine wave as the carrier wave (default: sine wave.)



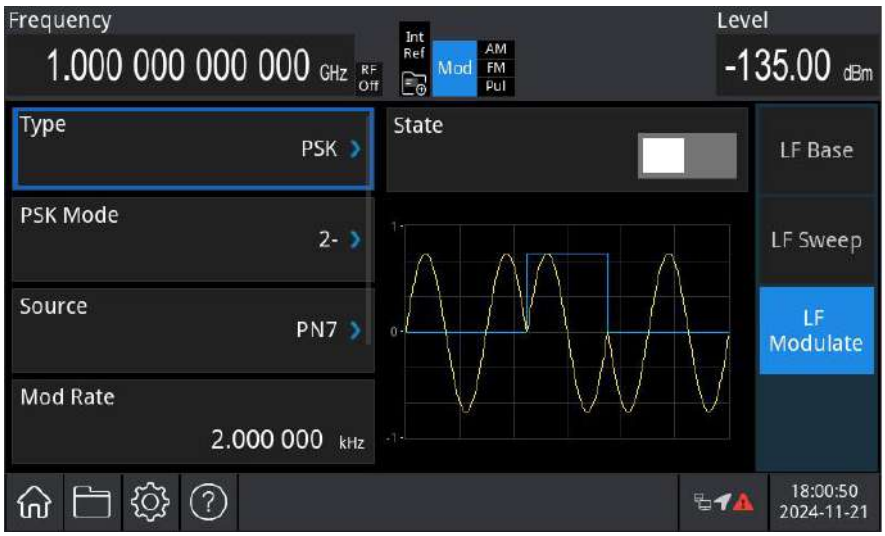
Press the Freq key to set the frequency, then use the numerical keyboard to enter 2 and select the unit kHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter 2 and select the unit Vpp for this parameter。



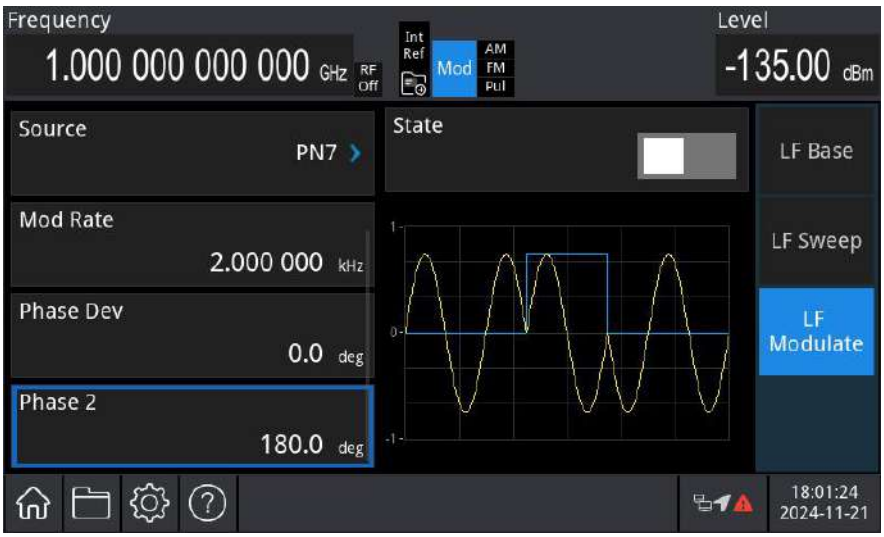
3) Set Modulation Rate

After setting the carrier parameters, press the LF Modulate to enter the PSK setting menu, press the Rate key, then use the numerical keyboard to enter 2 and select the unit kHz for this parameter.



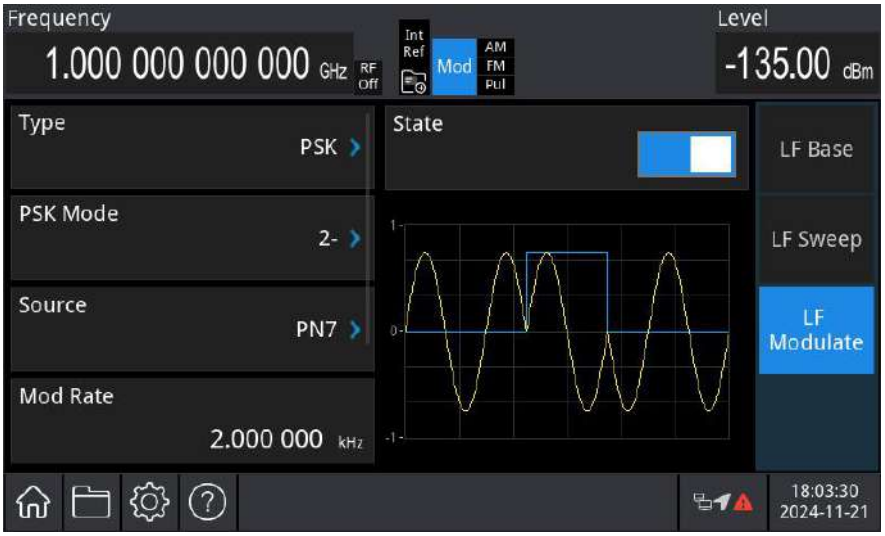
4) Set Phase

Press the Phase Dev key and Phase Dev key to adjust the phase Dev to 0° and the phase 2 to 180°.

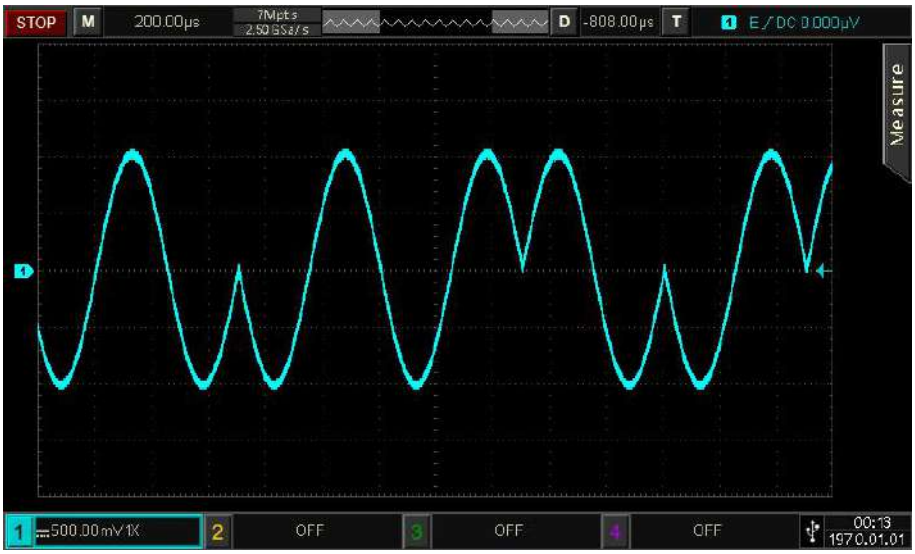


5) Enable Channel Output

Press the LF key. If the key is illuminated, the channel output is enabled.



View the PSK modulation waveform on an oscilloscope, as shown in the following figure.



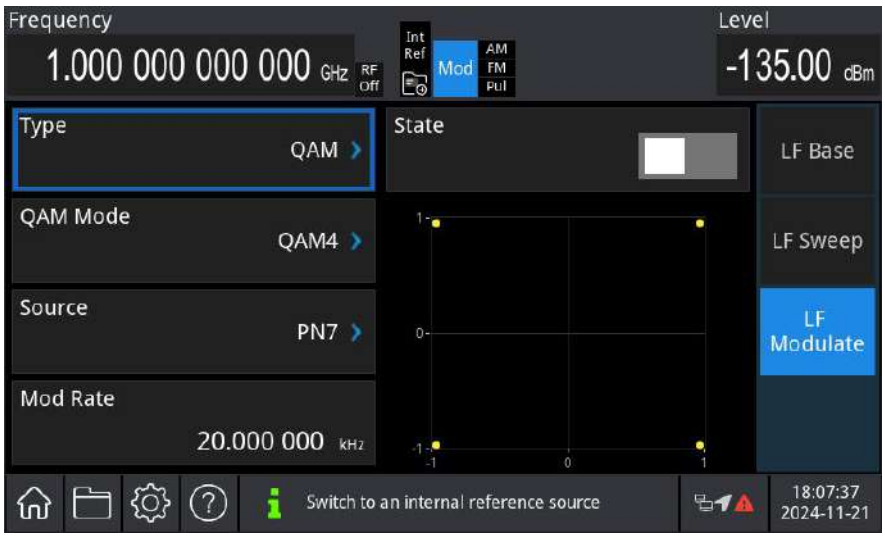
4.1.12 LF Quadrature Modulation (QAM)

In QAM mode, set two signals with the same frequency but a 90° phase difference (typically represented as Sin and Cos) as the carrier wave, and use a baseband signal to modulate this carrier. USG5000M RF analog signal generator supports seven modulation types: QAM4, QAM8, QAM16, QAM32, QAM64, QAM128, and QAM256.

Note: For accurate demodulation, it is recommended to use the 10 MHz reference output signal of this instrument as the reference clock input for the demodulation device or input the demodulation device's reference clock as the signal clock. This clock synchronization enables precise demodulation by eliminating phase differences.

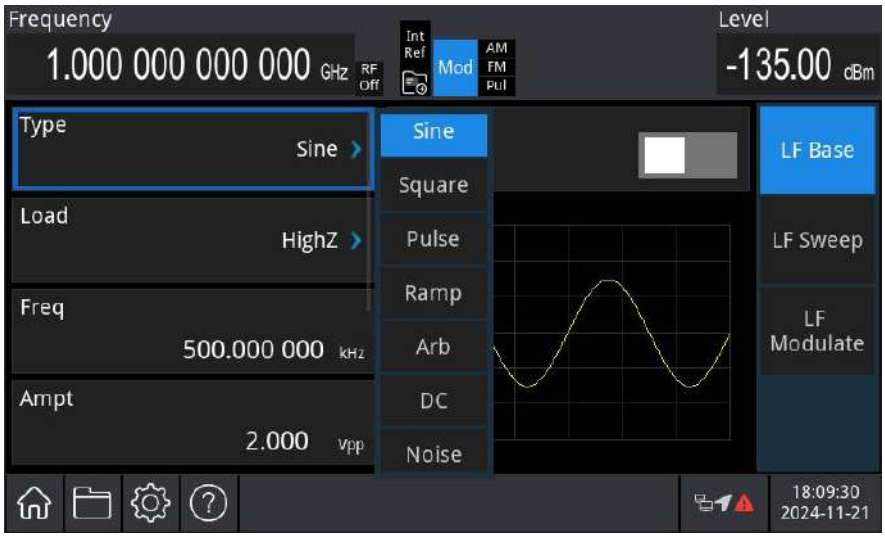
Select Quadrature Modulation (QAM)

Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the QAM mode from the drop-down menu. The instrument will output the modulated waveform according to the current modulation wave and the carrier wave.



Select Carrier Wave

The carrier wave can be set to sine wave, square wave, pulse wave, ramp wave, or arbitrary wave. The default carrier wave is sine wave. After the QAM is enabled, press the LF Base →Type key in the modulation interface to open the carrier wave list.



Set Carrier Wave

Refer to Carrier Wave Frequency in AM mode.

Select QAM Mode

The modulation mode, i,e the distribution of the constellation diagram, varies based on the selected modulation mode. Press the LF Modulate →QAM Mode key, and select the modulation mode to QAM4, QAM8, QAM16, QAM32, QAM64, QAM128, or QAM256M from the drop-down menu.

Select Symbol

When QAM mode is enabled, the default symbol is PN7. The symbol can be adjusted by using multi-function rotary knob or pressing the softkey Source → PN3 key to select PN7, PN9, PN11,

PN13, PN15, PN17, PN19, PN21, PN23, or PN25.

Set Modulation Rate

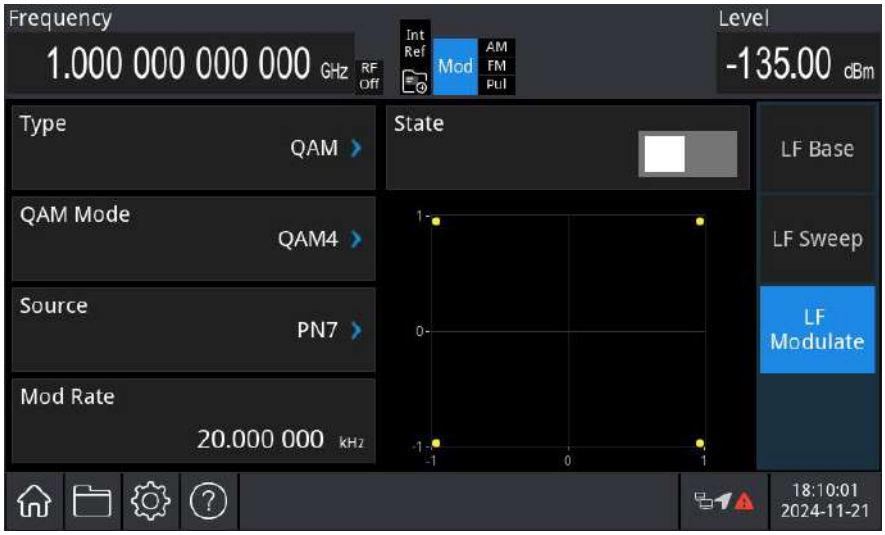
Set the moving frequency between the carrier phase and modulation phase. After QAM mode is enabled, set the modulation rate within a range of 2 mHz to 5MHz (default: 20 kHz). The modulation rate can be adjusted by using the multi-function rotary knob in modulation source interface or pressing the Mod Rate key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Comprehensive Example

First, set the instrument to quadrature modulation (QAM) mode. Then, configure a 2 kHz, 2 Vpp sine wave as the carrier signal, and set the rate to 100 Hz, the modulation mode to QAM64, the data source to PN7. The procedure is as follows.

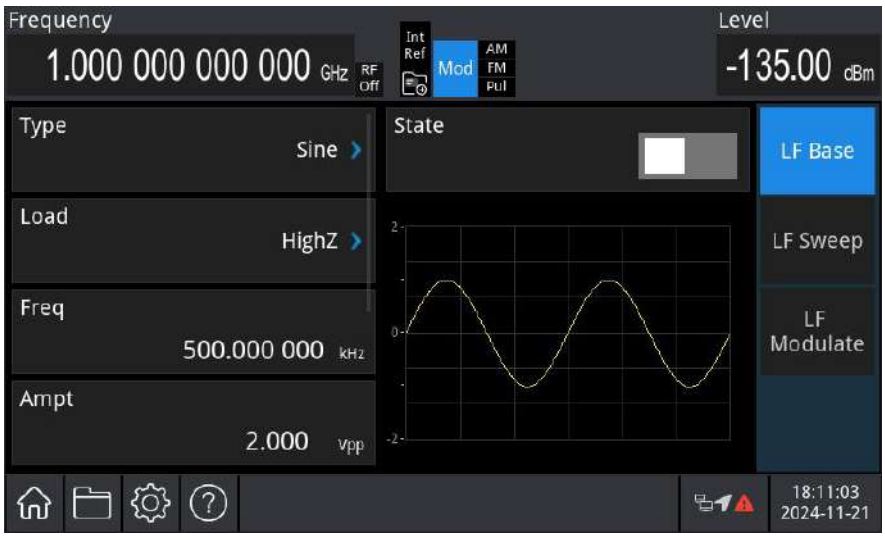
1) Enable QAM) Mode

   Press the Home key in the analog stream mapper on the screen, then press the LF Out →LF Modulate →Type key, select the QAM from the drop-down menu to enable QAM mode.



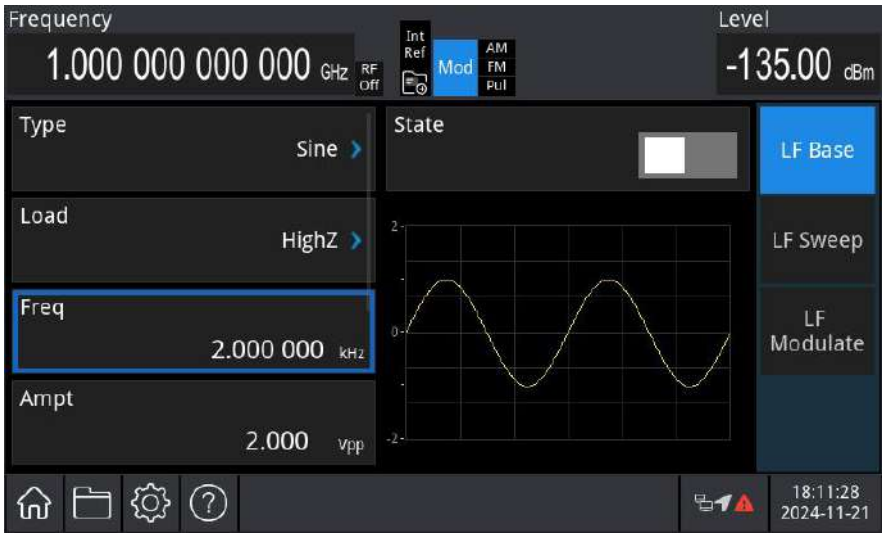
2) Set Carrier Signal

   Press the LF Base →Type key to open the LF carrier list, select the sine wave as the carrier wave (default: sine wave.)



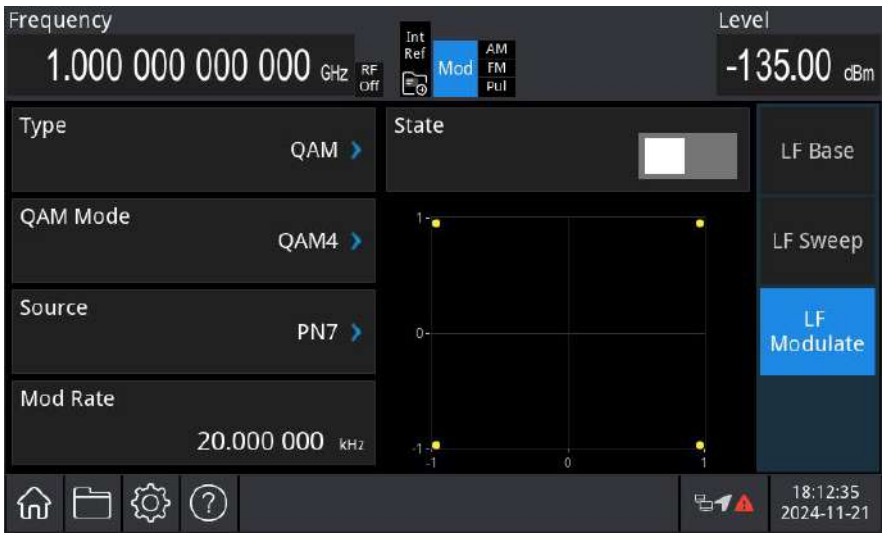
Press the Freq key to set the frequency, then use the numerical keyboard to enter 2 and select the unit kHz for this parameter.

Press the Ampt to set the amplitude, then use the numerical keyboard to enter 2 and select the unit Vpp for this parameter.



3) Set Modulation Signal

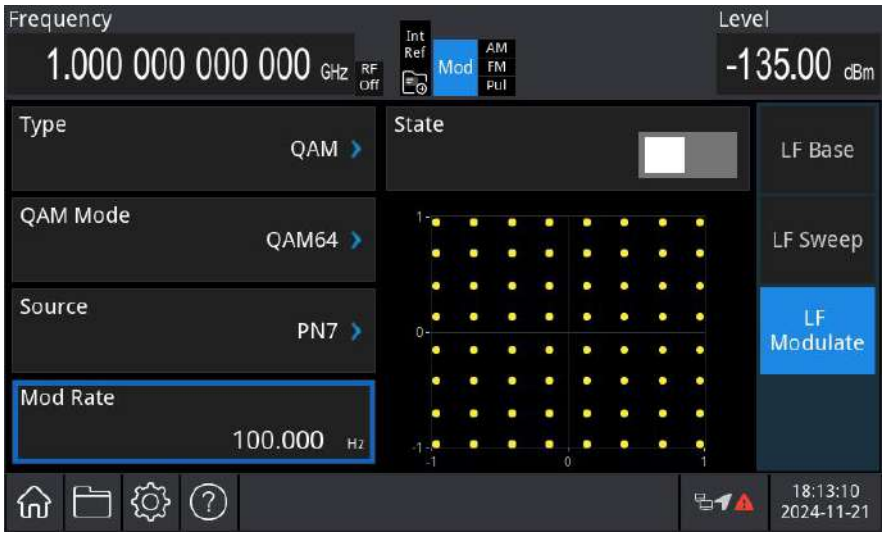
After setting the carrier parameters, press the LF Out→LF Modulate key to return to the following figure to set the modulation signal.



Press the QAM Mode key to select the mode to QAM64.

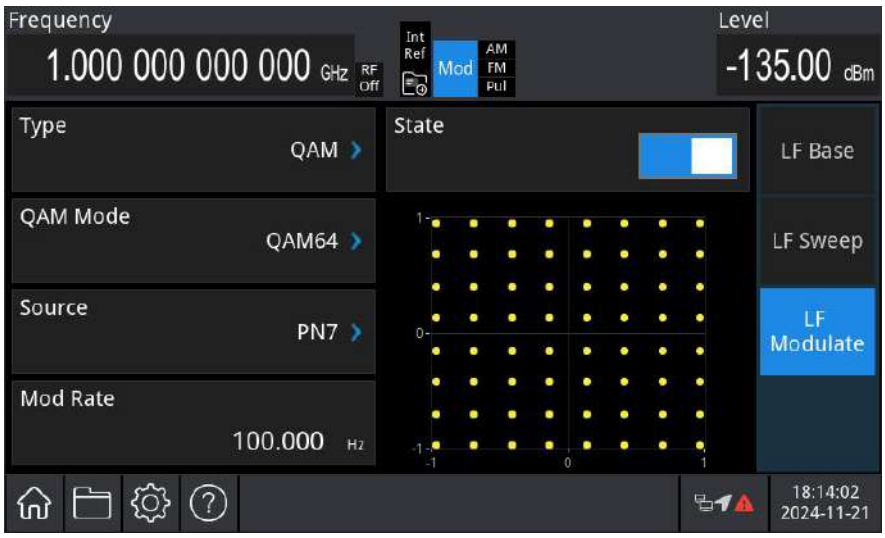
Press the Source key to select PN7.

Press the Mod Rate key, then use the numerical keyboard to enter 100 and select the unit Hz for this parameter. The default rate is 100Hz.



4) Enable Channel Output

Press the Home key, check the function generation ON. If LF the key is illuminated, the channel output is enabled.



View the QAM modulation waveform on an oscilloscope, as shown in the following figure

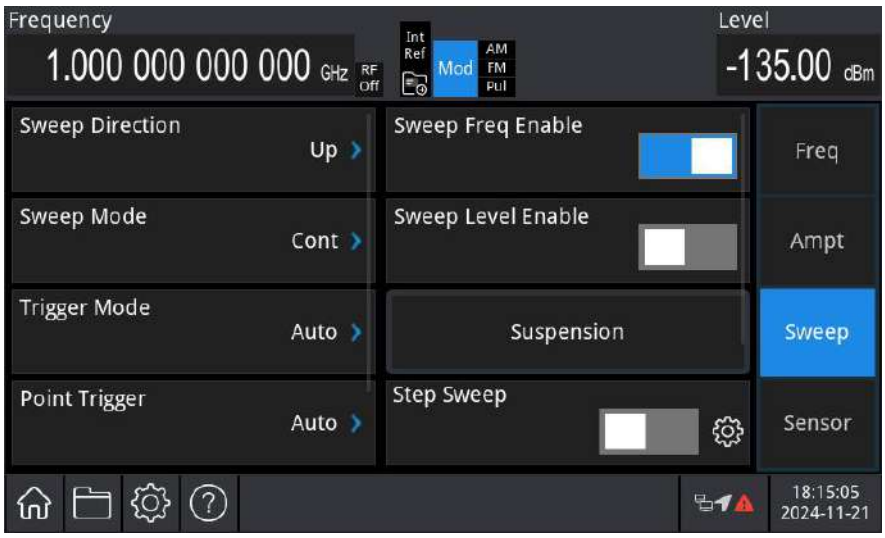
4.2 RF Output Sweep Waveform

In RF sweep mode, the instrument outputs a signal that varies in frequency or amplitude, sweeping from the start frequency to the stop frequency or from the starting amplitude to the stopping amplitude, with a specified dwell time and number of scan points. This sweep can be performed in linear, logarithmic, or list mode.

4.2.1 Select Sweep Mode

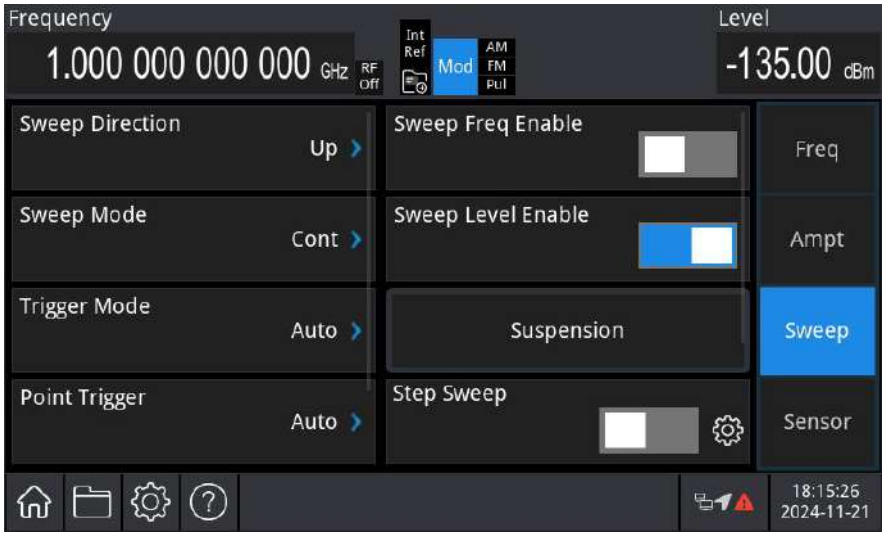
1) Enable Frequency Sweep

Press the Home key in the analog stream mapper on the screen, check RF ON, then press the LF Out →Sweep →SweepFreq Enable key to enable the frequency sweep mode. The instrument will output the frequency-sweep waveform according to the current settings, as shown in the following figure.



2) Enable Amplitude Sweep

Press the Sweep → SweepLevel Enable key, select the amplitude sweep mode. The instrument will output the sweep- amplitude waveform according to the current settings, as shown in the following figure.



3) Disable Sweep Function

Press the Sweep → SweepLevel Enable key to disable the amplitude sweep function; press the SweepFreq Enable key to disable the frequency sweep function.

4.2.2 Step Sweep Setting

Press the Sweep key to the sweep setting interface, press the step sweep ⚙ to open the step sweep parameter interface.

1) Start and Stop Frequency

The start frequency and stop frequency define the lower and upper limits of the frequency range for frequency sweep. The RF analog signal generator always sweeps from the start

frequency to the stop frequency and then returns to the start frequency.

The start and stop frequency can be adjusted by using the multi-function rotary knob in frequency sweep interface, or pressing the Start Freq, Stop Freq key and using the numerical keyboard to enter the number and select the unit to complete this setting.

The default start frequency is 1 GHz, while default stop frequency is 3 GHz. The range of the start and stop frequencies varies with the frequency sweep waveform. Refer to the table below for the frequency range for each sweep waveform.

Frequency							
USG3045M/M-P		USG3065M/M-P		USG5014M/M-P		USG5022M-P	
Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
9 kHz	4.5 GHz	9 kHz	6.5 GHz	9 kHz	14 GHz	9 kHz	22 GHz

2) Start and Stop Amplitude

The start frequency and stop amplitude define the lower and upper limits of the amplitude range for amplitude sweep. The RF analog signal generator always sweeps from the start amplitude to the stop amplitude and then returns to the start amplitude.

The start and stop amplitude can be adjusted by using the multi-function rotary knob in amplitude sweep interface, or pressing the Start Ampt, Stop Ampt key and using the numerical keyboard to enter the number and select the unit to complete this setting.

3) Dwell Time

Set the interval time between two sweep points.

The dwell time can be adjusted by using the multi-function rotary knob in step sweep interface or pressing the Dwell Time key and using the numerical keyboard to enter the number and select the unit to complete this setting.

4) Sweep Point

Set the number of sweep points. The parameters for each sweep point are interpolated from the start and stop values

The sweep point can be adjusted by using the multi-function rotary knob in step sweep interface or pressing the Sweep Point key and using the numerical keyboard to enter the number and select the unit to complete this setting.

5) Sweep Shape

The sweep shape represents the cyclic pattern of multiple sweeps. There are two types: Sawtooth wave and ramp wave.

Sawtooth wave: The sweeping period progresses from the start frequency or level to the stop frequency or level, resembling the pattern of a sawtooth wave.

ramp wave: The sweeping period progresses from the start frequency or level to the stop frequency or level, then returns to the start frequency or level, resembling the pattern of a ramp wave.

The sweep shape can be adjusted by using the multi-function rotary knob in step sweep interface or pressing the Sweep Shape key and using the numerical keyboard to enter the number and select the unit to complete this setting.

6) Sweep Manner

The sweep mode represents the transition from one frequency or amplitude to another within a single step.

Linear: The waveform generator changes the output frequency in a linear manner during the scanning process.

Logarithmic: The waveform generator changes the output frequency in a logarithmic manner.

The sweep mode can be adjusted by using the multi-function rotary knob in step sweep interface or pressing the Sweep Mode key and using the numerical keyboard to enter the number and select the unit to complete this setting.

4.2.3 List Sweep Setting

Press the Sweep key to the sweep setting interface, press the list sweep to open the list sweep parameter interface.

1) Insert a row

Click the (Add a row) key to insert a row at the end of the list by default.

2) Delete row

Select a row in the list, then click the (Delete a row) key to remove the selected row.

3) Edit the parameter in the list

In the list of sweep parameters, use the multi-function knob and arrow keys, or select a specific value to make changes.

4) Delete list

Click the (Clear) key to clear and reset the list.

5) Save list

Click the (Save) key to input a filename and save the list sweep data.

4.2.4 Sweep Direction

Press the Sweep key to the sweep setting interface, the sweep direction can be set to either “Up” or “Down”. The default direction is set to“Up.”

The sweep direction can be adjusted by using the multi-function rotary knob in step sweep interface or pressing the Sweep Direction key and using the numerical keyboard to enter the number and select the unit to complete this setting.

1) Up: When "Up" is selected, the signal generator sweeps from the start frequency or start level to the stop frequency or stop amplitude.
2) Down: When "Down" is selected, the signal generator sweeps from the stop frequency or stop amplitude back to the start frequency or start level.

4.2.5 Sweep Mode

Press the Sweep key to the sweep setting interface, the sweep mode can be set to either “Single” or” Continuous.” The default trigger mode is set to” Continuous.”

The sweep mode can be adjusted by using the multi-function rotary knob in step sweep interface or pressing the Sweep Mode key and using the numerical keyboard to enter the number and select the unit to complete this setting.

1) Continuous: When "Continuous" is selected, the signal generator will perform continuous sweeping once the triggering conditions are met, based on the current settings.
2) Single: When "Single" is selected, the signal generator will perform a single sweep based on the current settings and then stop.

4.2.6 Trigger Mode

Press the Sweep key to the sweep setting interface, the trigger mode can be set to “Auto”, “Key”, “Bus”, or “External.” The default trigger mode is set to “Auto.”

The trigger mode can be adjusted by using the multi-function rotary knob in step sweep interface or pressing the Trigger Mode key and using the numerical keyboard to enter the number and select the unit to complete this setting.

1) Auto: If the current sweep mode is "Continuous", a sweep type (either frequency sweep or amplitude sweep) will be initiated, and sweeping will begin automatically.
   If the current sweep mode is "Single", sweeping will start only after the single-sweeping conditions are met, and it will stop after one sweep.
2) Key: If the current sweep mode is "Continuous", sweeping will be triggered each time the Trigger button on the front panel is pressed or the Trigger key on the scanning settings page is clicked.

If the current sweep mode is "Single", sweeping will start will be triggered each time the Trigger button on the front panel is pressed or the Trigger key on the scanning settings page is clicked. Once the single-sweeping conditions are met, sweeping will start and stop after one sweep.

3) Bus: If the current sweep mode is "Continuous", sweeping will occur each time a triggering SCPI instruction is sent.

   If the current sweep mode is "Single", sweeping will start only after the single-sweeping conditions are met, and it will stop after one sweep.

4) External: The signal generator will receive a triggering signal input from the [TRIG IN/OUT] connector on the rear panel.

   If the current sweep mode is "Continuous", sweeping will start each time a TTL pulse signal of a specified polarity is received.

   If the current sweep mode is "Single", sweeping will start only after the single-sweeping conditions are met, and it will stop after one sweep.

4.2.7 Trigger Edge

When the trigger mode is set to "External", the trigger edge type can be selected to specify whether the rising edge or falling edge of the external signal will be used for triggering.

The trigger edge can be adjusted by using the multi-function rotary knob in step sweep interface or pressing the Trigger Edge key and using the numerical keyboard to enter the number and select the unit to complete this setting.

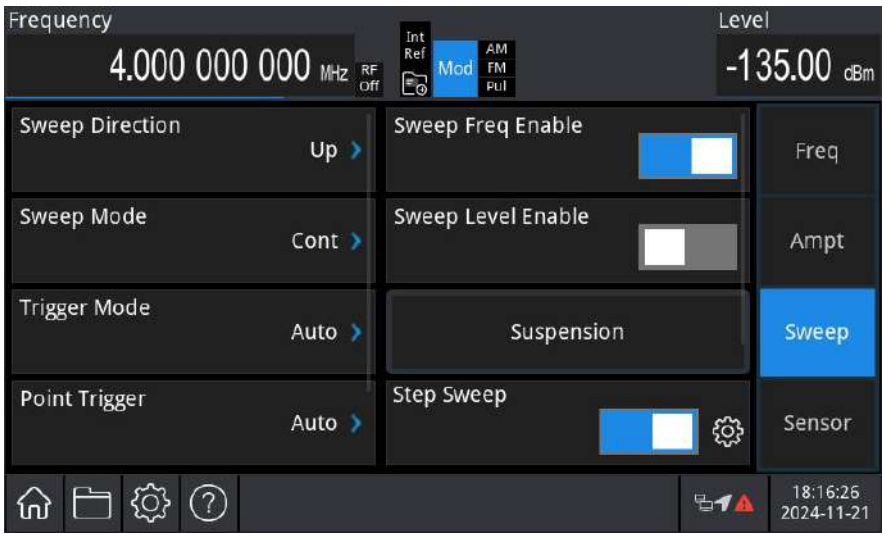
1) Rising edge: When the rising edge is selected, a sweep is triggered upon the arrival of the rising edge of the external trigger signal.
2) Falling edge: When the falling edge is selected, a sweep is triggered upon the arrival of the falling edge of the external trigger signal.

4.2.8 Comprehensive Example

When the instrument operates in sweep mode, configure a frequency-sweep signal with an amplitude of -10 dBm. Set the sweep manner to linear and the sweep shape to triangular. Define the start frequency as 100 kHz and the stop frequency as 10 MHz. Specify the number of sweep points to 100 and the dwell time to 2 ms. Use the internal source to trigger the output of the frequency-sweep waveform. The procedure is as follows.

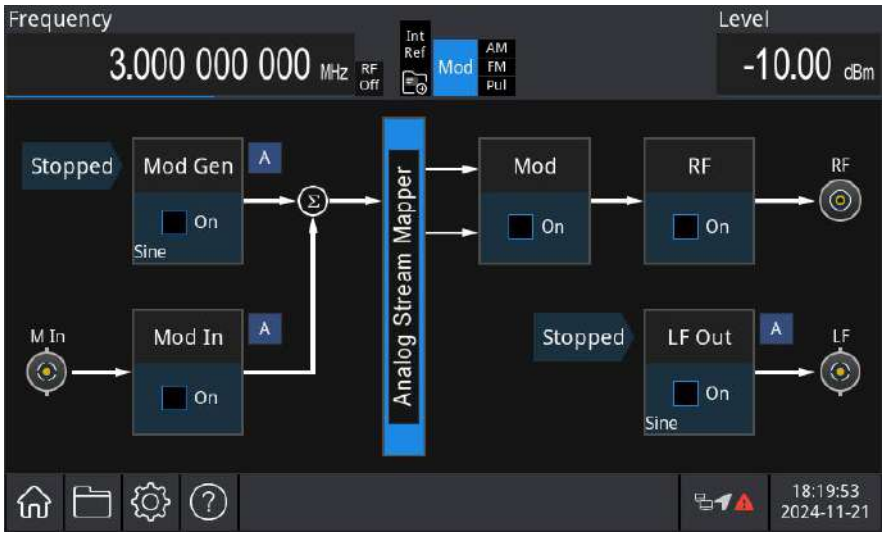
1) Enable Frequency Sweep Function

   Press the Home key in the analog stream mapper on the screen, then press the RF →Sweep →Sweep Freq Enable →Step Sweep key to enable frequency sweep function.



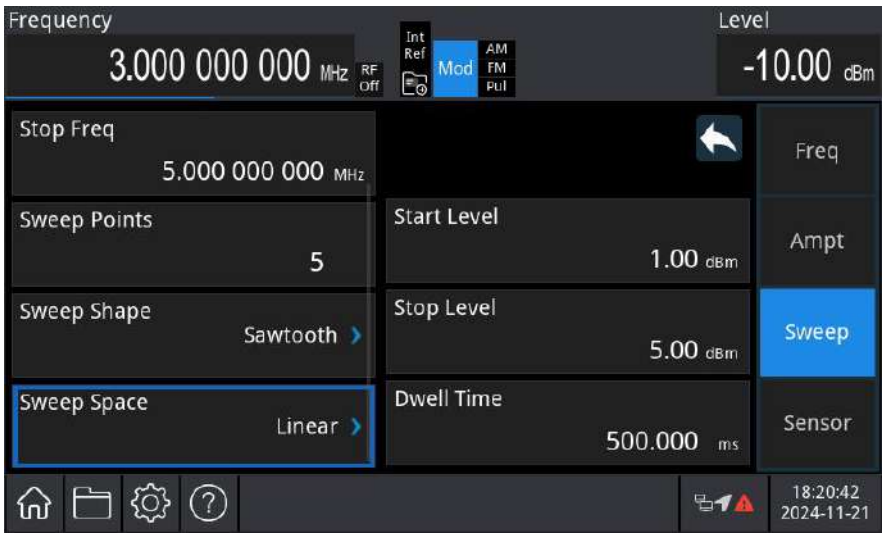
2) Set Amplitude for Frequency Sweep Signal

Press the Ampt key to set the amplitude, use the numerical keyboard to enter -10, and select the unit dBm for this parameter.



3) Set Start/Stop Frequency, Dwell Time, and Sweep Point

Press the Home key in the analog stream mapper on the screen, then press the RF →Sweep key to enter the sweep setting interface, click the step sweep ⚙ to open the sweep parameter interface to enter linear sweep.

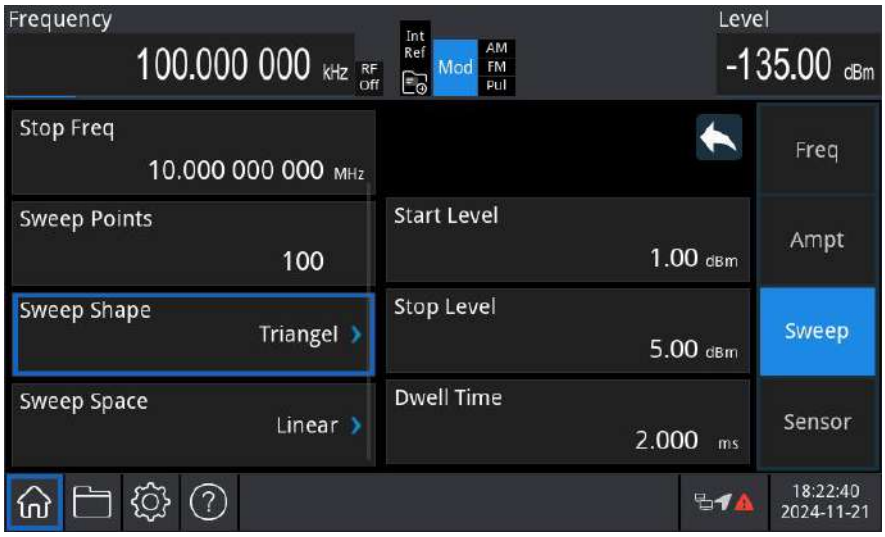


Press the Start Freq key to set the frequency, then use the numerical keyboard to enter 100 and select the unit kHz for this parameter.

Press the Stop Freq key to set the frequency, then use the numerical keyboard to enter 10 and select the unit MHz for this parameter.

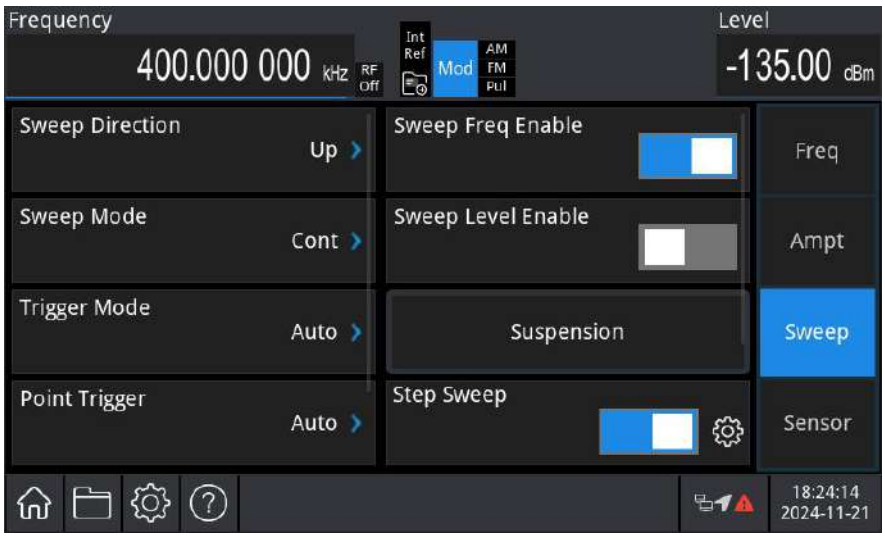
Press the Dwell Time to set the dwell time, then use the numerical keyboard to enter 2 and select the unit ms for this parameter.

Press the Sweep Point to set the sweep point, then use the numerical keyboard to enter 100.



4) Enable Channel Output

Press the Home key in the analog stream mapper on the screen, check RF ON. Press the RF On/Off key. If the key is illuminated, the channel output is enabled.



View the frequency sweep waveform on an oscilloscope, as shown in the following figure.

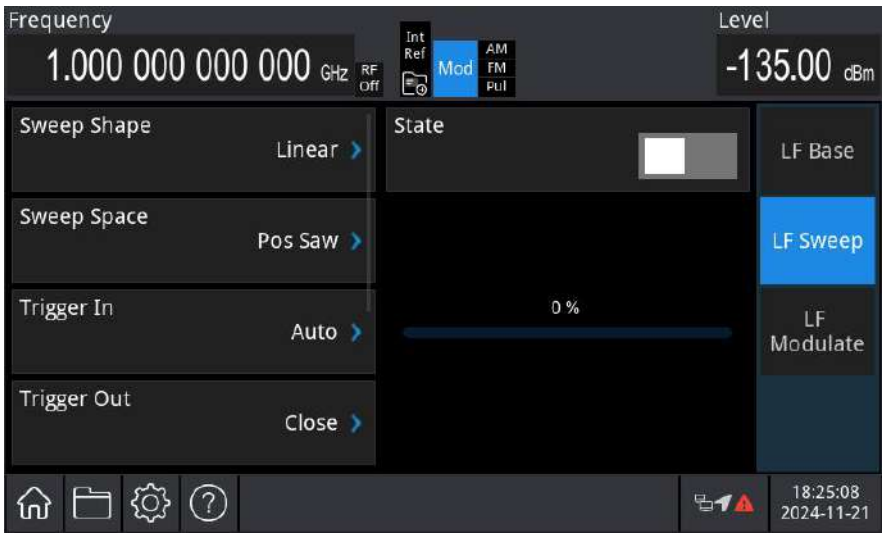
4.3 LF Output Sweep Waveform

In LF sweep mode, within the specified scan duration, the instrument's output frequency changes from the start frequency to the stop frequency in a linear, logarithmic, or step manner. Sine wave, square wave, pulse wave, ramp wave, and arbitrary wave can all be configured to generate frequency sweep outputs.

4.3.1 Select Sweep Mode

1) Enable Frequency Sweep

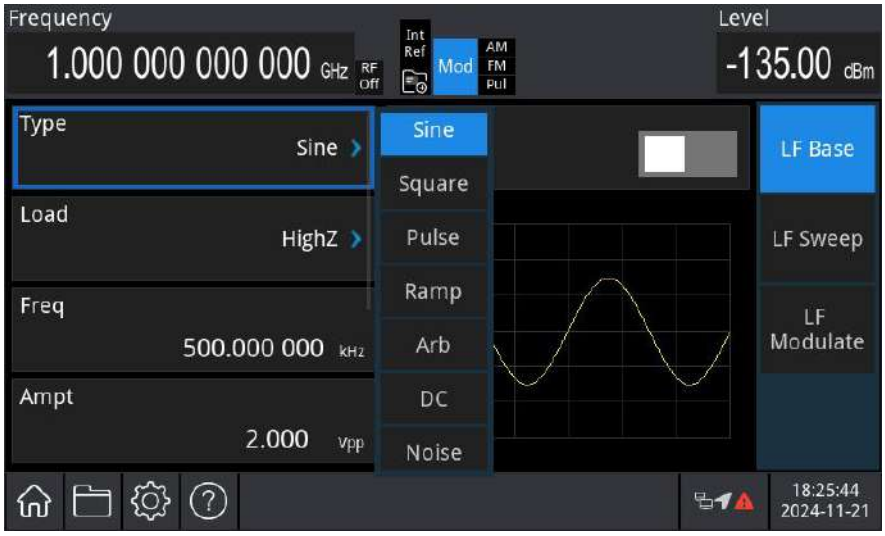
Press the Home key in the analog stream mapper on the screen, check RF ON, then press the LF Out →Sweep →State key to enable the frequency sweep mode. The instrument will output the frequency-sweep waveform according to the current settings, as shown in the following figure.



2) Select Frequency Sweep Wave

The frequency sweep wave can be set to sine wave, square wave, pulse wave, ramp wave, or arbitrary wave. The default wave is sine wave.

After the frequency sweep setting, press the LF Base →Type key to open the carrier wave list.



4.3.2 Start and Stop Frequency

The start frequency and stop frequency define the lower and upper limits of the frequency range for frequency sweep. The RF analog signal generator always sweeps from the start frequency to the stop frequency and then returns to the start frequency.

The start and stop frequency can be adjusted by using the multi-function rotary knob in frequency sweep interface, or pressing the Start Freq, Stop Freq key and using the numerical keyboard to enter the number and select the unit to complete this setting.

Note

- Start frequency < Stop frequency: When the start frequency is less than the stop frequency, the DDS RF analog signal generator sweeps from low to high frequency.
- Start frequency > Stop frequency: When the start frequency is greater than the stop frequency, it sweeps from high to low frequency.
- Start frequency = Stop frequency: When the start frequency equals the stop frequency, the DDS RF analog signal generator outputs a fixed frequency.

The default start frequency is 1 MHz, while default stop frequency is 10 MHz. The range of the start and stop frequencies varies with the frequency sweep waveform. Refer to the table below for the frequency range for each sweep waveform.

Carrier Wave	Frequency							
	USG3045M/M-P		USG3065M/M-P		USG5014M/M-P		USG5022M-P	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Sine Wave	1 mHz	50 MHz	1 mHz	50 MHz	1 mHz	50 MHz	1 mHz	50 MHz
Square Wave	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz
Pulse Wave	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz
ramp wave	1 mHz	3 MHz	1 mHz	3 MHz	1 mHz	3 MHz	1 mHz	3 MHz
Arbitrary Wave	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz	1 mHz	15 MHz

4.3.3 Sweep Manner

In sweep setting interface, press the Sweep Manner key to select either linear or logarithmic.

Linear: During the sweep period, the waveform generator adjusts the output frequency uniformly over time.

Logarithmic: The waveform generator adjusts the output frequency exponentially over time during the sweep period.

4.3.4 Sweep Time

When the frequency sweep function is enabled, the sweep time can be set within a range of 1 ms to 500 s. The default sweep time is 2 s.

The sweep time can be adjusted by using the multi-function rotary knob in sweep interface or pressing the Sweep Time key and using the numerical keyboard to enter the number and select the

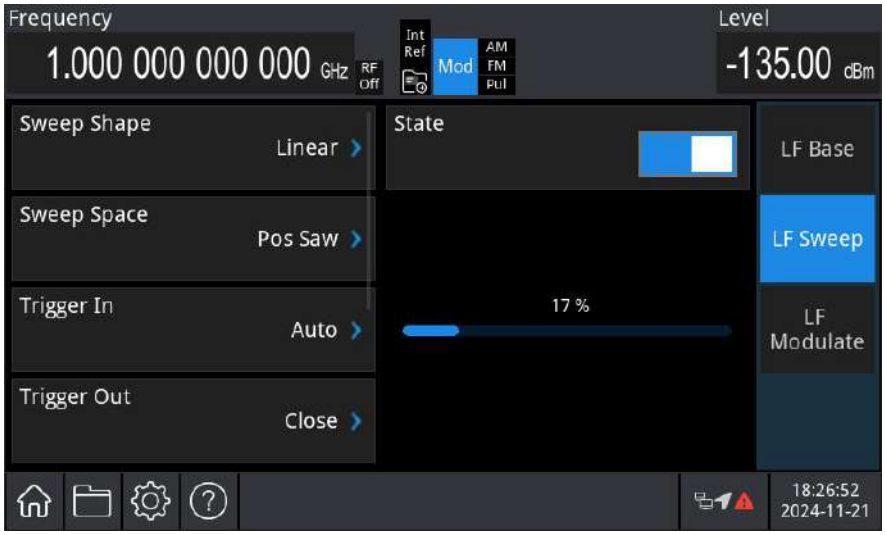
unit to complete this setting.

4.3.5 Comprehensive Example

When the instrument operates in sweep mode, configure a square wave signal with an amplitude of 1 Vpp and a duty cycle of 50% as the frequency sweep waveform. Set the sweep manner to linear. Specify the sweep's start frequency as 1 kHz, the stop frequency as 50 kHz, and the sweep time as 2 ms. Use the internal source to trigger the output of the frequency sweep waveform. The procedure is as follows.

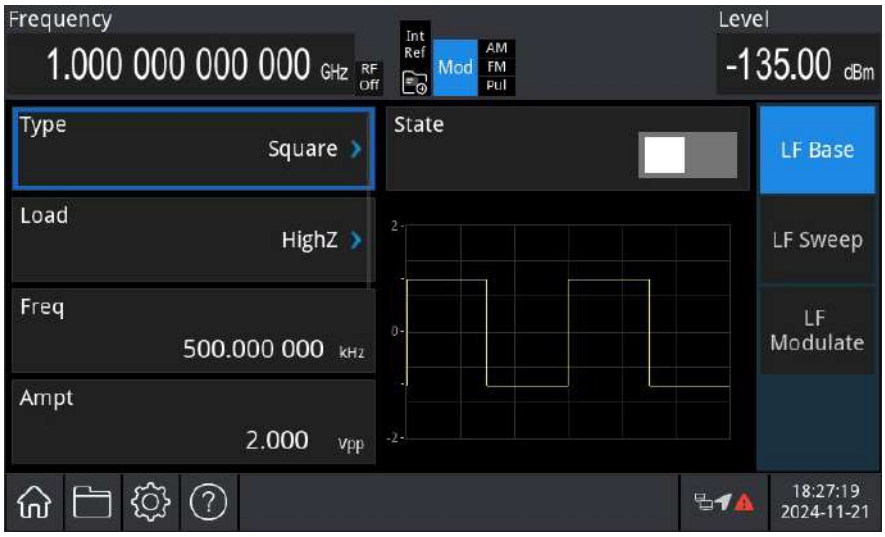
1) Enable Linear Sweep Function

   Press the Home key in the analog stream mapper on the screen, then press the LF Out →Sweep →State key to enable linear sweep function.



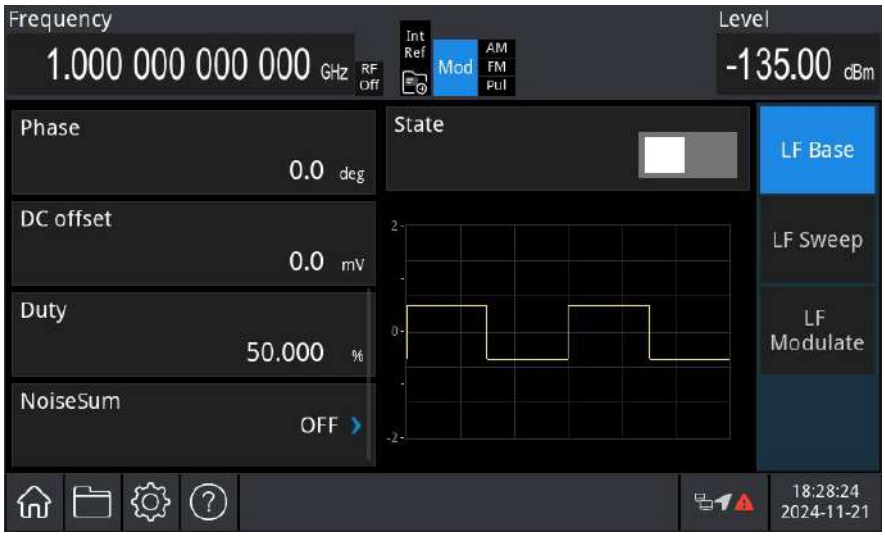
2) Select Frequency Sweep Wave

   Press the LF Base →Type key to open the carrier wave list to select the square wave (default: sine wave.)



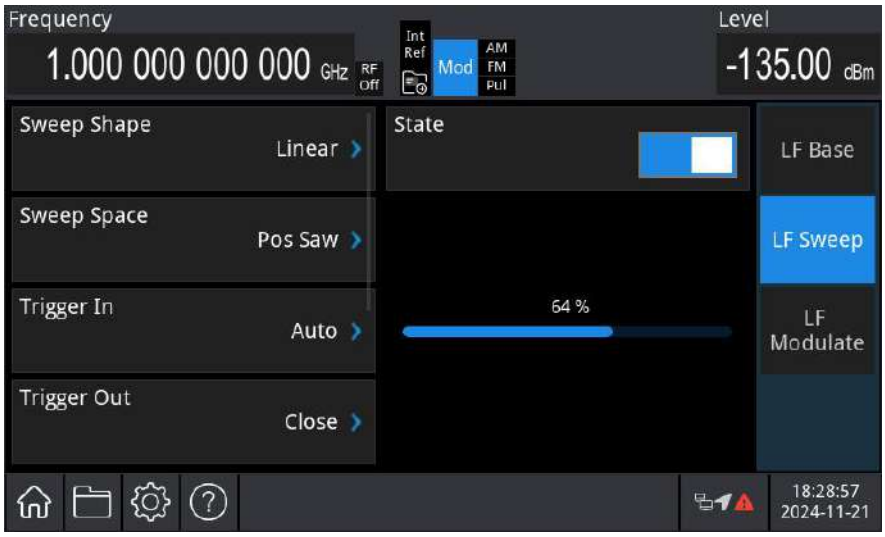
Press the Ampt key to set the amplitude, then use the numerical keyboard to enter 1 and select the unit Vpp for this parameter.

Press the Duty key to set the duty ratio, then use the numerical keyboard to enter 50 and select the unit % for this parameter. The default duty ratio is 50%.



3) Set Start/Stop Frequency and Sweep Time

Press the Sweep →Sweep Manner →Linear key to enter the linear sweep.



Press the Start Freq key to set the frequency, then use the numerical keyboard to enter 1 and select the unit kHz for this parameter. The default start frequency is 1 MHz.

Press the Stop Freq key to set the frequency, then use the numerical keyboard to enter 50 and select the unit kHz for this parameter.

Press the Sweep Time to set the sweep time, then use the numerical keyboard to enter 2 and select the unit ms for this parameter.

4) Enable Channel Output

Press the LF key. If the key is illuminated, the channel output is enabled.

View the linear sweep waveform on an oscilloscope, as shown in the following figure.

4.4 Power Sensor

Connect the USB power sensor through the USB Host interface.

1) Enable Power Meter

Press the Home →RF →Sensor key to enter the power meter setting, as shown in the following figure.

2) Connect Device

Press the Device Connect key to open the connected device menu. Select a device to perform the power measurement.

3) Amplitude Offset

Press the Ampt Offset key to set the amplitude offset, use the numerical keyboard to enter the number and select the unit to complete this setting.

At this point, the displayed value will include the offset value in addition to the actual measurement result. This function is particularly useful in scenarios where amplifiers and attenuators are present in the signal path.

4) Measuring Frequency

The measured frequency is used as the frequency value measured by the power meter;

You can click the Measurement frequency button to enter the number via the touchscreen numeric keypad or the front panel numeric keypad, and press the corresponding unit button to complete the setting.

5) Frequency Coupling

The frequency coupling is disabled by default.

Click the Freq Couple key to enable the frequency coupling.

When the frequency coupling is enabled, the measuring frequency be locked, but the frequency multiplier factor and frequency offset can be set.

Click the Freq Multiplier key, tap the virtual keypad or the numerical keyboard on the front panel to enter the number, then select the unit to complete this setting.

After setting the frequency multiplier factor:

Actual Measurement Frequency = Measurement Frequency × Frequency Multiplication Coefficient.

Click the Freq Offset key, tap the virtual keypad or the numerical keyboard on the front panel to enter the number, then select the unit to complete this setting.

After setting the frequency offset:

Actual Measurement Frequency = Measurement Frequency - Frequency Offset.

6) Average Time

Set the number of averages for the power meter during measurement. Click the Average Time key, tap the virtual keypad or the numerical keyboard on the front panel to enter the number, then select the unit to complete this setting.

7) Measurement Result

Displays the power measurement value of the current frequency, with the unit of dBm.

Chapter 5 Troubleshooting

Possible faults when using the USG5000 and their corresponding troubleshooting methods are listed below. Follow the steps provided for each fault. If the issue persists, please contact your distributor or local office and provide the model information (check the model info, press Utility → System.)

5.1 No Display (Blank Screen)

If the signal generator screen remains blank when the power switch on the front panel is pressed:

1) Check that the power source is properly connected.
2) Ensure the power button is fully pressed.
3) Restart the instrument.
4) If the instrument still does not respond, please contact your distributor or local office for maintenance service.

5.2 No Waveform Output

If the settings are correct but the instrument has no waveform output:

1) Check that the BNC cable and output terminal are properly connected.
2) Ensure the LF or RF key is enabled.
3) If the instrument still does not work, please contact your distributor or local office for maintenance service.

Chapter 6 Service and Support

6.1 Maintenance and Cleaning

(1) General Maintenance

Keep the instrument away from the direct sunlight.

Caution

Keep sprays, liquids and solvents away from the instrument or probe to avoid damaging the instrument or probe.

(2) Cleaning

Check the instrument frequently according to the operating condition. Follow these steps to clean the external surface of the instrument:

Please use a soft cloth to wipe the dust outside the instrument.

When cleaning the LCD screen, please pay attention and protect the transparent LCD screen.

When cleaning the dust screen, use a screwdriver to remove the screws of the dust cover and then remove the dust screen. After cleaning, install the dust screen in sequence.

Please disconnect the power supply, then wipe the instrument with a damp but not dripping soft cloth. Do not use any abrasive chemical cleaning agent on the instrument or probes.

Warning

Please confirm that the instrument is completely dry before use, to avoid electrical shorts or even personal injury caused by moisture.

Appendix

Factory Setting

Parameter	Default Setting
RF Channel	
Channel Output	OFF
Analog Modulation	OFF
Modulation Source	OFF
Modulation Input	OFF
Carrier Wave	
Frequency	1 GHz
Amplitude	-135 dBm
Frequency Offset	0 Hz
Phase Offset	0 deg
Internal TB Calibration	0 ppb
Ref Oscillator Source	Auto
Amplitude Offset	0 dB
User-defined Maximum Power	25 dBm
ALC Status	Auto
Internal Modulation Source	
Modulation Wave	Sine wave
Modulation Frequency	10 kHz
Amplitude	2 Vpp
Phase	0 deg
DC Offset	0 mV
External Modulation Source	
Load	50 Ω
AM (Amplitude Modulation)	
Modulation Depth	50%
FM (Frequency Modulation)	
Frequency Offset	1 kHz

ΦM (Phase Modulation)	
Phase Offset	0 deg
Pulse (Pulse Modulation)	
Pulse Type	Free running
Period	200us
Delay	0ns
Pulse Width	100us
Sync Pulse	1us
External Polarity	Normal
Sweep	
Sweep Direction	Up
Sweep Manner	Continuous
Sweep Mode	Auto
Trigger Mode	Auto
Step Sweep	
Start Frequency	1 GHz
Stop Frequency	3 GHz
Sweep Point	5
Sweep Shape	Sawtooth
Sweep Manner	Linear
Start Amplitude	1 dBm
Stop Amplitude	5 dBm
Dwell Time	500 ms
List Sweep	
Data	1 point: frequency 10 MHz , amplitude -120 dBm , dwell time 500 ms
LF Channel	
Carrier Type	Sine wave
Load	High resistance
Channel Output	OFF
Carrier Wave	
Frequency	500 kHz
Amplitude	2 Vpp
DC Offset	0 mV
Square Wave Duty Ratio	50%

Triangle Wave Symmetry	50%
Pulse Wave Duty Ratio	50%
Pulse Wave Rising Edge	20 ns
Pulse Wave Falling Edge	20 ns
Noise Superposition	OFF
Arbitrary Wave	
Built-in Arbitrary Wave	ACosH.bsv
AM (Amplitude Modulation)	
Modulation Wave	Sine wave
Modulation Frequency	1 Hz
Modulation Depth	50%
FM (Frequency Modulation)	
Modulation Wave	Sine wave
Modulation Frequency	1 Hz
Frequency Offset	10 kHz
ΦM (Phase Modulation)	
Modulation Wave	Sine wave
Modulation Frequency	1 Hz
Phase Dev	0 deg
Pulse (Pulse Modulation)	
Pulse Frequency	20 kHz
Duty Ratio	50%
QAM (Quadrature Modulation)	
QAM Mode	QAM4
Symbol	PN7
Modulation Rate	20 kHz
ASK (Amplitude Shift Keying)	
Symbol	PN7
Rate	20 kHz
FSK (Frequency Shift Keying)	
Mode	2-

Symbol	PN7
Modulation Rate	20 kHz
Hopping Frequency 1	10 kHz
PSK (Phase Shift Keying)	
Mode	2-
Symbol	PN7
Modulation Rate	20 kHz
Phase Dev	0 deg
Phase 2	90 deg
Sweep	
Sweep Manner	Linear
Sweep Shape	Positive sawtooth
Trigger Input	Auto
Trigger Output	OFF
Sweep Time	2s
Start Frequency	1 MHz
Stop Frequency	10 MHz
Step	10
System Parameter	
Language	Factory setting
Backlight	70%
Time Format	24-hour
Date/Time	2018-03-22 16：19
Picture Format	bmp
Screenshot Inverse	OFF

Built-in Arbitrary Wave Table

Type	Name	Description
Common function (15)	AbsSine	Absolute sine wave
	AbsSineHalf	Absolute half-sine wave
	AmpALT	Amplify sine wave
	AttALT	Attenuates sine wave
	Gaussian_monopulse	Gaussian monocycle
	GaussPulse	Gaussian pulse

	NegRamp	Falling ramp
	NPulse	N-Pulse signal
	PPulse	P-Pulse signal
	SineTra	TraSine wave signal
	SineVer	VerSine wave signal
	StairUD	Stair up and down
	StairDn	Stair down
	StairUp	Stair up
	Trapezia	Trapezoid
Engine (25)	BandLimited	Band limited signal
	BlaseiWave	Vibration of blasting "time-vibration velocity" curve
	Butterworth	Butterworth filter
	Chebyshev1	Chebyshev filter I
	Chebyshev2	Chebyshev filter II
	Combin	Combined function
	CPulse	C-Pulse signal
	CWPulse	CW pulse signal
	DampedOsc	Damped oscillation "time-offset" curve
	DualTone	Double audio signal
	Gamma	Gamma signal
	GateVibar	Gate self-oscillation signal
	LFMPulse	Linear FM pulse signal
	MCNoise	Mechanical noise
	Discharge	Ni-MH battery discharge curve
	Pahcur	Brushless DC motor current wave
	Quake	Quake wave
	Radar	Radar signal
	Ripple	Power ripple
	RoundHalf	Half round wave
	RoundsPM	RoundsPM wave
	StepResp	Step response signal
	SwingOsc	Swing oscillation - time curve
	TV	Television signal
	Voice	Voice signal

Maths (27)	Airy	Airy function
	Besselj	Besselj function I
	Besselk	Besselk function
	Bessely	Besselj function II
	Cauchy	Cauchy distribution
	Cubic	Cubic function
	Dirichlet	Dirichlet function
	Erf	Error function
	Erfc	Complementary error function
	ErfcInv	Inverse complementary error function
	ErfInv	Inverse error function
	ExpFall	Exponential falling function
	ExpRise	Exponential rising function
	Gammaln	Natural logarithm of Gamma function
	Gauss	Gaussian distribution (Normal distribution)
	HaverSine	Haversed sine
	Laguerre	Quartic Laguerre polynomial
	Laplace	Laplace distribution
	Legend	Quintic Legendre Polynomials
	Log10	Logarithm function based on 10
	LogNormal	Logarithmic normal distribution
	Lorentz	Lorentzian function
	Maxwell	Maxwell distribution
	Rayleigh	Rayleigh distribution
	Versiera	Versiera
	Weibull	Weibull distribution
	ARB_X2	Square function
SectMod (5)	AM	Sine wave amplitude modulation
	FM	Sine wave frequency modulation
	PFM	Pulse wave modulation
	PM	Sine wave phase modulation
	PWM	Pulse width modulation
Bioelect (6)	Cardiac	Electrocardio signal
	EOG	Electro-oculogram

	EEG	Electroencephalogram
	EMG	Electromyography
	Pulseilogram	Sphygmus curve of common people
	ResSpeed	Expiration rate curve of common people
Medical (4)	LFPulse	Low frequency pulse electrotherapy waveform
	Tens1	Transcutaneous electric nerve stimulation waveform 1
	Tens2	Transcutaneous electric nerve stimulation waveform 2
	Tens3	Transcutaneous electric nerve stimulation waveform 3
Automotive (17)	Ignition	Ignition waveform of automobile internal-combustion engine
	ISO16750-2 SP	Profile map of automobile starting oscillation
	ISO16750-2 Starting1	Automobile starting voltage waveform 1
	ISO16750-2 Starting2	Automobile starting voltage waveform 2
	ISO16750-2 Starting3	Automobile starting voltage waveform 3
	ISO16750-2 Starting4	Automobile starting voltage waveform 4
	ISO16750-2 VR	Operating voltage profile map of automobile under resetting
	ISO7637-2 TP1	Transient phenomena of automobile caused by power cut
	ISO7637-2 TP2A	Transient phenomena of automobile caused by inductance in wiring
	ISO7637-2 TP2B	Transient phenomena of automobile caused by turning off start-up changer
	ISO7637-2 TP3A	Transient phenomena of automobile caused by conversion
	ISO7637-2 TP3B	Transient phenomena of automobile caused by conversion
	ISO7637-2 TP4	Working profile map of automobile

		under start-up
	ISO7637-2 TP5A	Transient phenomena of automobile caused by power cut of battery
	ISO7637-2 TP5B	Transient phenomena of automobile caused by power cut of battery
	SCR	SCR (sintering temperature distribution)
	Surge	Surge signal
Trigonome (21)	CosH	Hyperbolic cosine
	CosInt	Cosine integral
	Cot	Cotangent function
	CotHCon	Concave hyperbolic cotangent
	CotHPro	Convex hyperbolic cotangent
	CscCon	Concave cosine
	CscPro	Convex cosine
	CotH	Hyperbolic cotangent
	CscHCon	Concave hyperbolic cosecant
	CscHPro	Convex hyperbolic cosecant
	RecipCon	Reciprocal of the depression
	RecipPro	Reciprocal of the projection
	SecCon	The secant of the depression
	SecPro	The secant of the projection
	SecH	Hyperbolic secant
	Sinc	Sinc function
	SinH	Cotangent function
	SinInt	Sine integral
	Sqrt	Square root function
	Tan	Tangent function
	TanH	Hyperbolic tangent
AntiTrigonome (16)	ACosH	Arc-cosine function
	ACotCon	Arc- hyperbolic cosine function
	ACotPro	Arc- hyperbolic cosine function
	ACotHCon	Convex arc cotangent function
	ACotHPro	Concave arc- hyperbolic cosine function
	ACscCon	Convex arc- hyperbolic cosine

		function
	ACscPro	Concave arc cosecant function
	ACscHCon	Convex arc cosecant function
	ACscHPro	Concave arc hyperbolic cosecant function
	ASecCon	Convex arc hyperbolic cosecant function
	ASecPro	Concave arc secant function
	ASecH	Convex arc secant function
	ASin	Arc hyperbolic secant function
	ASinH	Arcsin function
	ATan	Arc hyperbolic sine function
	ATanH	Arctan function
Noise (6)	NoiseBlue	Blue noise
	NoiseBrown	Brown noise (red noise)
	NoiseGray	Gray noise
	NoisePink	Pink noise
	NoisePurple	Purple noise
	Noisewhite	White noise
Window Function (17)	Bartlett	Bartlett window
	BarthannWin	Amended Bartlett window
	Blackman	Blackman window
	BlackmanH	BlackmanH window
	BohmanWin	Bohman window
	Boxcar	Rectangle window
	ChebWin	Chebyshev window
	GaussWin	Gaussian window
	FlattopWin	Flat-top window
	Hamming	Hamming window
	Hanning	Hanning window
	Kaiser	Kaiser window
	NuttallWin	The minimum of four Blackman Harris window
	ParzenWin	Parzen window
	TaylorWin	Taylaor window
	Triang	Quarter window (Fejer window)

	TukeyWin	Tukey window
Complex Wavelets (7)	Complex Frequency B-spline	Complex Frequency B-spline function
	Complex Gaussian	Complex Gaussian function
	Complex Morlet	Complex Morlet wavelet
	Complex Shannon	Complex Shannon function
	Mexican hat	Mexican hat wavelet
	Meyer	Meyer wavelet
	Morlet	Morlet wavelet
Other (34)	ABA_1_1	
	ABA_1_2	
	ALT_03	
	ALT_04	
	ALT_05	
	AUDIO	
	COIL_2_1	
	COIL_2_2	
	DC_04	
	ECT_1_2	
	EGR_2	
	EGR_3_2	
	EST_03_2	
	IAC_1_1	
	INJ_1_1	
	INJ_2	
	INJ_3	
	INJ_4	
	INJ_5_6	
	INJ_7	
	KS_1_1	
	MAF_1_1	
	MAF_1_2	
	MAF_5_3	
	MAP_1_1	
	MAP_1_2	

	MC_3	
	Mexican hat	Mexican hat wavelet
	O2PROPA1	
	O2PROPA2	
	O2SNAP	
	STAR02_1	
	TPS_1_1	
	TPS_1_2	

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