SSG6082A-V
Vector Signal Generator

User Manual

EN01A

SIGLENT TECHNOLOGIES CO.,LTD

Contents

1 Introduction

The SSG6082A-V vector signal generator has an output frequency range of 9 kHz ~ 8 GHz, supports AM&FM&PM analog modulation, and has functions such as pulse modulation, pulse sequence generator and power meter control. It has a built-in 500 MHz bandwidth IQ baseband source and can generate common digital modulation signals and common communication protocol signals such as 5G NR, WLAN, LTE, BLUETOOTH and IOT when used with a SigIQPro host computer. After factory adjustment, the RF output has excellent 1 GHz broadband characteristics and excellent ACPR characteristics, which can meet multiple application scenarios such as R&D and production.

Product Model:

Model	Frequency Range	
	CW MODE	IQ MODE
SSG6082A-V	9 kHz - 8 GHz	10 MHz - 8 GHz

Features and Benefits:

- Frequency ranges from 9 kHz to 8 GHz
- Frequency resolution 0.001 Hz
- Level output from -140 dBm to +30 dBm
- Phase noise < -132 dBc/Hz @1 GHz, offset 10 kHz(typ.)
- Level accuracy ≤ 0.7 dB(typ.)
- Standard AM, FM and PM analog modulation with internal, external and Int+Ext source
- Pulse modulation, on/off ratio ≥ 0.7 dB (typ.) (option)
- Pulse train generator(option)
- USB power meter measurement
- Support IQ Custom modulation, can output QAM, FSK, ASK, PSK, multitone and other modulation signals, support playback of data sources generated by Matlab
- Support waveform file playback, waveform sequence generation and playback
- Support the playback of protocol files and can generate 5G_NR, WLAN, LTE, BLUETOOTH, IOT and other communication protocol signals
- Support various application scenarios such as MIMO
- Supports real-time IQ baseband AWGN, accurately controls signal and noise power, and simplifies additional measurements and calculations required for receiver measurements

- Support S parameter compensation in vector mode to optimize the broadband characteristics of the test system
- Power sensor control kit, which can conveniently use the power sensor to measure power, control power output, and correct line loss
- Web remote control is supported, which is convenient for users to control devices remotely
- Equipped with a 5-inch (800x480) display and capacitive touch screen for easy and convenient operation
- Rich communication interfaces. Standard USB-Host, USB Device (USB-TMC), LAN (VXI-11, Socket, Telnet), optional GPIB

2 Important Safety Information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

2.1 General Safety Summary

Carefully read the following safety precautions to avoid personal injury and prevent damage to the instrument and any products connected to it. To avoid potential hazards, please use the instrument as specified.

To Avoid Fire or Personal Injury.

Use Proper Power Line.

Only use a local/state approved power cord for connecting the instrument to mains power sources.

Ground the Instrument.

The instrument grounds through the protective terra conductor of the power line. To avoid electric shock, the ground conductor must be connected to the earth. Make sure the instrument is grounded correctly before connect its input or output terminals.

Connect the Signal Wire Correctly.

The potential of the signal wire is equal to the earth, so do not connect the signal wire to a high voltage. Do not touch the exposed contacts or components.

Look over All Terminals' Ratings.

To avoid fire or electric shock, please look over all ratings and signed instructions of the instrument. Before connecting the instrument, please read the manual carefully to gain more information about the ratings.

Equipment Maintenance and Service.

When the equipment fails, please do not dismantle the machine for maintenance. The equipment contains capacitors, power supply, transformers, and other energy storage devices, which may cause high voltage damage. The internal devices of the equipment are sensitive to static electricity, and

direct contact is easy to cause irreparable damage to the equipment. It is necessary to return to the factory or the company's designated maintenance organization for maintenance. Be sure to pull out the power supply when repairing the equipment. Live line operation is strictly prohibited. The equipment can only be powered on when the maintenance is completed and the maintenance is confirmed to be successful.

Not Operate with Suspected Failures.

If you suspect that there is damage to the instrument, please let qualified service personnel check it.

Avoid Circuit or Wire Exposed Components Exposed.

Do not touch exposed contacts or components when the power is on.

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep the surface of the instrument clean and dry.

The responsible body or operator should refer to the instruction manual to preserve the protection afforded by the equipment. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Any parts of the device and its accessories are not allowed to be changed or replaced, other than authorized by the manufacturer or agent.

2.2 Safety Terms and Symbols

When the following symbols or terms appear on the front or rear panel of the instrument or in this manual, they indicate special care in terms of safety.

	This symbol is used where caution is required. Refer to the accompanying information or documents to protect against personal injury or damage to the instrument.
	This symbol warns of a potential risk of shock hazard.
	This symbol is used to denote the measurement ground connection.
	This symbol is used to denote a safety ground connection.
	This symbol shows that the switch is an On/Standby switch. When it is pressed, the instrument's state switches between Operation and Standby. This switch does not disconnect the instrument's power supply. To completely power off the instrument, the power cord must be unplugged from the AC socket after the instrument is in the standby state.
CAUTION	The "CAUTION" symbol indicates a potential hazard. It calls attention to a procedure, practice, or condition which may be dangerous if not followed. Do not proceed until its conditions are fully understood and met.
WARNING	The "WARNING" symbol indicates a potential hazard. It calls attention to a procedure, practice, or condition which, if not followed, could cause bodily injury or death. If a WARNING is indicated, do not proceed until the safety conditions are fully understood and met.

2.3 Working Environment

Environment

The instrument is used indoors and should be operated in a clean and dry environment with an ambient temperature range.

NOTE: Direct sunlight, electric heaters, and other heat sources should be considered when evaluating the ambient temperature.

	**WARNING:** Do not operate the instrument in explosive, dusty, or humid environments.

Ambient Temperature

Operating: 0 ℃ to +50 ℃

Non-operation: -20 ℃ to +70 ℃

NOTE: Direct sunlight, radiators, and other heat sources should be taken into account when assessing the ambient temperature.

Humidity

0 ℃ to 30 ℃, ≤ 95 %RH

30 ℃ to 50 ℃, ≤ 75 %RH

Mains supply voltage fluctuations

Please refer to “2.5 Power and Grounding Requirements”.

Altitude

Operating: ≤ 3,000 m

Installation (overvoltage) Category

This product is powered by mains conforming to installation (overvoltage) Category II.

NOTE:

Installation (overvoltage) category I refers to situations where equipment measurement terminals are connected to the source circuit. In these terminals, precautions are done to limit the transient voltage to a correspondingly low level.

Installation (overvoltage) category II refers to the local power distribution level which applies to equipment connected to the AC line (AC power).

Degree of Pollution

The product may be operated in environments of Pollution Degree II.

NOTE: Degree of Pollution II refers to a working environment that is dry and non-conductive pollution occurs. Occasional temporary conductivity caused by condensation is expected.

IP Rating

IP20 (as defined in IEC 60529).

2.4 Cooling Requirements

This instrument relies on the forced air cooling with internal fans and ventilation openings. Care must be taken to avoid restricting the airflow around the apertures (fan holes) at each side of the instrument. To ensure adequate ventilation it is required to leave a 15 cm (6 inch) minimum gap around the sides of the instrument.

	**CAUTION:** Do not block the ventilation holes located on both sides of the instrument.

	**CAUTION:** Do not allow any foreign matter to enter the instrument through the ventilation holes, etc.

2.5 Power and Grounding Requirements

The instrument operates on single-phase 100 to 240 Vrms (+/-10%) AC power at 50/60 Hz (+/-5%).

No manual voltage selection is required because the instrument automatically adapts to line voltage.

Depending on the type and number of options and accessories, the instrument can consume up to 135 W of power.

NOTE: The instrument automatically adapts to the AC line input within the following ranges:

Voltage Range:	90 - 264 Vrms
Frequency Range:	47 - 63 Hz

The instrument includes a grounded cord set containing a molded three-terminal polarized plug and

a standard IEC320 (Type C13) connector for making line voltage and safety ground connection. The AC inlet ground terminal is connected directly to the frame of the instrument. For adequate protection against electrical shock hazards, the power cord plug must be inserted into a mating AC outlet containing a safety ground contact. Use only the power cord specified for this instrument and certified for the country of use.

	**WARNING:** Electrical Shock Hazard! Any interruption of the protective conductor inside or outside of the instrument, or disconnection of the safety ground terminal creates a hazardous situation. Intentional interruption is prohibited.

The position of the instrument should allow easy access to the socket. To make the instrument completely power off, unplug the instrument power cord from the AC socket.

The power cord should be unplugged from the AC outlet if the instrument is not to be used for an extended period.

	**CAUTION:** The outer shells of the front panel terminals (LF OUTPUT, RF OUTPUT) are connected to the instrument's chassis and therefore to the safety ground.

2.6 Cleaning

Clean only the exterior of the instrument, using a damp, soft cloth. Do not use chemicals or abrasive elements. Under no circumstances allow moisture to penetrate the instrument. To avoid electrical shock, unplug the power cord from the AC outlet before cleaning.

	**WARNING:** Electrical Shock Hazard! No operator serviceable parts inside. Do not remove covers. Refer servicing to qualified personnel

2.7 Abnormal Conditions

Do not operate the instrument if there is any visible sign of damage or has been subjected to severe transport stresses.

If you suspect the instrument's protection has been impaired, disconnect the power cord and secure the instrument against any unintended operation.

Proper use of the instrument depends on careful reading of all instructions and labels.

	**WARNING:** Any use of the instrument in a manner not specified by the manufacturer may impair the instrument's safety protection. This instrument should not be directly connected to human subjects or used for patient monitoring.

Informations essentielles sur la sécurité

Ce manuel contient des informations et des avertissements que les utilisateurs doivent suivre pour assurer la sécurité des opérations et maintenir les produits en sécurité.

Exigence de Sécurité

Lisez attentivement les précautions de sécurité ci - après afin d 'éviter les dommages corporels et de prévenir les dommages aux instruments et aux produits associés. Pour éviter les risques potentiels, utilisez les instruments prescrits.

Éviter l 'incendie ou les lésions corporelles.

Utilisez un cordon d'alimentation approprié.

N'utilisez que des cordons d'alimentation spécifiques aux instruments approuvés par les autorités locales.

Mettez l'instrument au sol.

L'instrument est mis à la Terre par un conducteur de mise à la terre de protection du cordon d'alimentation. Pour éviter un choc électrique, le conducteur de mise à la terre doit être mis à la terre. Assurez - vous que l'instrument est correctement mis à la terre avant de connecter les bornes d'entrée ou de sortie de l'instrument.

Connectez correctement le fil de signalisation.

Le potentiel de la ligne de signal est égal au potentiel au sol, donc ne connectez pas la ligne de signal à haute tension. Ne touchez pas les contacts ou les composants exposés.

Voir les cotes de tous les terminaux.

Pour éviter un incendie ou un choc électrique, vérifiez toutes les cotes et signez les instructions de l'instrument. Avant de brancher l'instrument, lisez attentivement ce manuel pour obtenir de plus amples renseignements sur les cotes.

Entretien du matériel.

En cas de défaillance de l'équipement, ne pas démonter et entretenir l'équipement sans autorisation.

L'équipement contient des condensateurs, de l'alimentation électrique, des transformateurs et d'autres dispositifs de stockage d'énergie, ce qui peut causer des blessures à haute tension. Les dispositifs internes de l'équipement sont sensibles à l'électricité statique. Le contact direct peut facilement causer des blessures irrécupérables à l'équipement. L'équipement doit être retourné à l'usine ou à l'organisme de maintenance désigné par l'entreprise pour l'entretien. L'alimentation électrique doit être retirée pendant l'entretienLa ligne ne doit pas être mise sous tension tant que l'entretien de l'équipement n'est pas terminé et que l'entretien n'est pas confirmé.

Ne pas fonctionner en cas de suspicion de défaillance.

Si vous soupçonnez des dommages à l'instrument, demandez à un technicien qualifié de vérifier.

L 'exposition du circuit ou de l' élément d 'exposition du fil est évitée.

Lorsque l 'alimentation est connectée, aucun contact ou élément nu n' est mis en contact.

Ne pas fonctionner dans des conditions humides / humides.

Pas dans un environnement explosif.

Maintenez la surface de l 'instrument propre et sec.

L'organisme ou l'opérateur responsable doit se référer au cahier des charges pour protéger la protection offerte par le matériel.La protection offerte par le matériel peut être compromise si celui - ci est utilisé de manière non spécifiée par le fabricant.

Aucune pièce du matériel et de ses annexes ne peut être remplacée ou remplacée sans l'autorisation de son fabricant.

Termes et symboles de sécurité

Lorsque les symboles ou termes suivants apparaissent sur le panneau avant ou arrière de l'instrument ou dans ce manuel, ils indiquent un soin particulier en termes de sécurité.

	Ce symbole est utilisé lorsque la prudence est requise. Reportez-vous aux informations ou documents joints afin de vous protéger contre les blessures ou les dommages à l'instrument.
	Ce symbole avertit d'un risque potentiel de choc électrique.
	Ce symbole est utilisé pour désigner la connexion de terre de mesure.
	Ce symbole est utilisé pour indiquer une connexion à la terre de sécurité.
	Ce symbole indique que l'interrupteur est un interrupteur marche / veille. Lorsqu'il est enfoncé, l'état de l'instruments bascule entre Fonctionnement et Veille. Ce commutateur ne déconnecte pas l'alimentation de l'appareil. Pour éteindre complètement l'instruments, le cordon d'alimentation doit être débranché de la prise secteur une fois l'instruments en état de veille.
CAUTION	Le symbole " CAUTION" indique un danger potentiel. Il attire l'attention sur une procédure, une pratique ou une condition qui peut être dangereuse si elle n'est pas suivie. Ne continuez pas tant que ses conditions n'ont pas été entièrement comprises et remplies.
WARNING	Le symbole " WARNING" indique un danger potentiel. Il attire l'attention sur une procédure, une pratique ou une condition qui, si elle n'est pas suivie, pourrait entra ner des blessures corporelles ou la mort. Si un AVERTISSEMENT est indiqué, ne continuez pas tant que les conditions de sécurité ne sont pas entièrement comprises et remplies.

Environnement de travail

Environnement

L'instrument doit être utilisé à l'intérieur dans un environnement propre et sec dans la plage de température ambiante.

NOTE: la lumière directe du soleil, les réchauffeurs électriques et d'autres sources de chaleur doivent être pris en considération lors de l'évaluation de la température ambiante.

	**ATTENTION:** ne pas utiliser l'instrument dans l'air explosif, poussiéreux ou humide.

Température ambiante

En fonctionnement: 0 ℃ à +50 ℃

Hors fonctionnement: -20 ℃ à +70 ℃

NOTE: pour évaluer la température de l'environnement, il convient de tenir compte des rayonnements solaires directs, des radiateurs thermiques et d'autres sources de chaleur.

Humidité

0 ℃ à 30 ℃, ≤ 95 % HR

30 ℃ à 50 ℃, ≤ 75 % HR

Fluctuation de la tension d'alimentation

Vérifiez s'il vous plaît "Connexions d'alimentation et de terre".

Altitude

Fonctionnement: ≤ 3000 m

Catégorie d 'installation (surtension)

Ce produit est alimenté par une alimentation électrique conforme à l 'installation (surtension) Catégorie II.

Installation (overvoltage) Category Definitions Définition de catégorie d 'installation (surtension)

La catégorie II d'installation (surtension) est un niveau de signal applicable aux terminaux de mesure d' équipement reliés au circuit source.Dans ces bornes, des mesures préventives sont prises pour limiter la tension transitoire à un niveau inférieur correspondant.

La catégorie II d'installation (surtension) désigne le niveau local de distribution d 'énergie d' un équipement conçu pour accéder à un circuit alternatif (alimentation alternative).

Degré de pollution

Un instruments peut être utilisé dans un environnement Pollution Degree II.

NOTE: Pollution Degree II signifie que le milieu de travail est sec et qu'il y a une pollution non conductrice.Parfois, la condensation produit une conductivité temporaire.

IP Rating

IP20 (as defined in IEC 60529).

Exigences de refroidissement

Cet instrument repose sur un refroidissement à air forcé avec des ventilateurs internes et des ouvertures de ventilation. Des précautions doivent être prises pour éviter de restreindre le flux d'air autour des ouvertures (trous de ventilateur) des deux côtés de la source de signal. Pour assurer une ventilation adéquate, il est nécessaire de laisser un espace minimum de 15 cm (6 pouces) sur les côt és de l'instrument.

	**ATTENTION:** Ne bloquez pas les trous de ventilation de chaque c té de la source de signal.

	**ATTENTION:** Ne laissez pas d'objets étrangers pénétrer dans la source de signal par les trous de ventilation, etc.

Connexions d'alimentation et de terre

L'instrument fonctionne avec une alimentation CA monophasée de 100 à 240 Vrms (+/- 10%) à 50/60 Hz (+/- 5%).

Aucune sélection manuelle de la tension n'est requise car l'instrument s'adapte automatiquement à la tension de ligne.

Selon le type et le nombre d'options et d'accessoires, l'instrument peut consommer jusqu'à 135 W d'énergie.

Remarque: l'instrument s'adapte automatiquement à l'entrée de ligne CA dans les plages suivantes:

Plage de tension:	90 – 264 Vrms
Gamme de fréquences:	47 – 63 Hz

L'instrument comprend un jeu de cordons mis à la terre contenant une fiche polarisée à trois bornes moulée et un connecteur standard IEC320 (Type C13) pour établir la tension de ligne et la connexion de mise à la terre de sécurité. La borne de mise à la terre de l'entrée CA est directement connectée au châssis de l'instrument. Pour une protection adéquate contre les risques d'électrocution, la fiche du cordon d'alimentation doit être insérée dans une prise secteur correspondante contenant un contact de sécurité avec la terre. Utilisez uniquement le cordon d'alimentation spécifié pour cet instrument et certifié pour le pays d'utilisation.

	**Avertissement:** risque de choc électrique! Toute interruption du conducteur de terre de protection à l'intérieur ou à l'extérieur de la portée ou la déconnexion de la borne de terre de sécurité crée une situation dangereuse. L'interruption intentionnelle est interdite.

La position de l'instruments doit permettre un accès facile à la prise. Pour éteindre complètement l'instruments, débranchez le cordon d'alimentation de l'instrument de la prise secteur.

Si la source n'est pas utilisée pendant une période prolongée, débranchez le cordon d'alimentation de la prise secteur.

	**ATTENTION:** les enveloppes extérieures des bornes du panneau avant (LF OUTPUT, RF OUTPUT) sont connectées au ch ssis de l'instrument et donc à la terre de sécurité.

Nettoyage

Nettoyez uniquement l'extérieur de l'instrument à l'aide d'un chiffon doux et humide. N'utilisez pas de produits chimiques ou d'éléments abrasifs. Ne laissez en aucun cas l'humidité pénétrer dans l'instrument. Pour éviter les chocs électriques, débranchez le cordon d'alimentation de la prise secteur avant de le nettoyer.

	**Avertissement:** risque de choc électrique! Aucune pièce réparable par l'opérateur à l'intérieur. Ne retirez pas les capots. Confiez l'entretien à un personnel qualifié.

Conditions anormales

Utilisez l'instrument uniquement aux fins spécifiées par le fabricant.

N'utilisez pas l'instrument s'il présente des signes évidents de dommages ou s'il a été soumis à de fortes contraintes de transport.

Si vous pensez que la protection de l'instruments a été altérée, débranchez le cordon d'alimentation et sécurisez l'instrument contre toute opération involontaire.

Une bonne utilisation de l'instrument nécessite la lecture et la compréhension de toutes les instructions et étiquettes.

	**Avertissement:** Toute utilisation de l'instruments d'une manière non spécifiée par le fabricant peut compromettre la protection de sécurité de l'instrument. Cet instrument ne doit pas être directement connecté à des sujets humains ni utilisé pour la surveillance des patients.

3 First Steps

3.1 Delivery Checklist

First, verify that all items listed on the packing list have been delivered. If you note any omissions or damage, please contact your nearest **SIGLENT** customer service center or distributor as soon as possible. If you fail to contact us immediately in case of omission or damage, we will not be responsible for replacement.

3.2 Quality Assurance

The signal generator has a 3-year warranty from the date of shipment, during normal use and operation. **SIGLENT** can repair or replace any product that is returned to the authorized service center during the warranty period. We must first examine the product to make sure that the defect is caused by the process or material, not by abuse, negligence, accident, abnormal conditions, or operation.

SIGLENT shall not be responsible for any defect, damage, or failure caused by any of the following:

a) Attempted repairs or installations by personnel other than **SIGLENT.**

b) Connection to incompatible devices/incorrect connection.

c) For any damage or malfunction caused by the use of non-**SIGLENT** supplies. Furthermore, **SIGLENT** shall not be obligated to service a product that has been modified. Spare, replacement parts and repairs have a 90-day warranty.

The instrument's firmware has been thoroughly tested and is presumed to be functional. Nevertheless, it is supplied without a warranty of any kind covering detailed performance. Products not made by **SIGLENT** are covered solely by the warranty of the original equipment manufacturer.

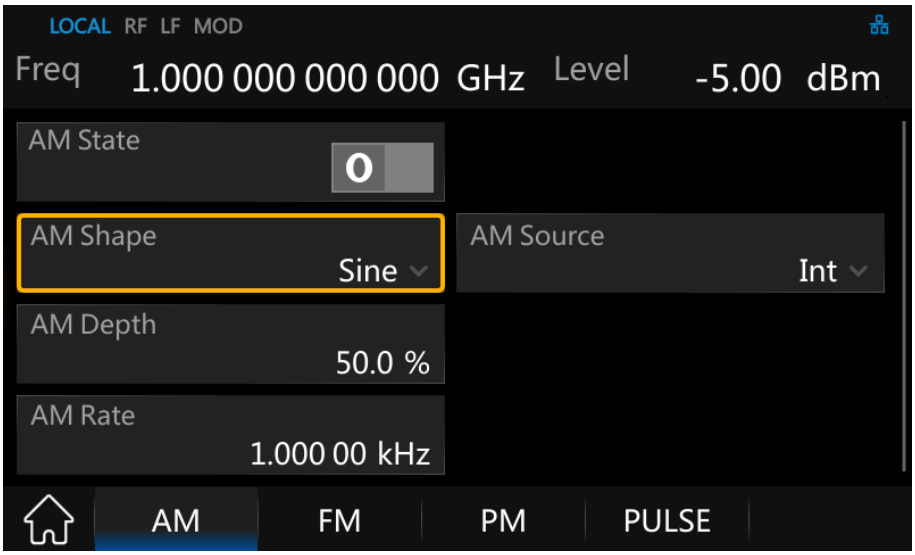
3.3 Maintenance Agreement

We provide various services based on maintenance agreements. We offer extended warranties as well as installation, training, enhancement and on-site maintenance, and other services through specialized supplementary support agreements. For details, please consult your local **SIGLENT** customer service center or distributor.

4 Document Conventions

For convenience of description, this article makes the following conventions:

- Text surrounded by a box border is used to represent the front panel buttons. For example, FREQ represents the "FREQ" button on the front panel.
- Italicized text with shading is used to represent the touchable or clickable menu/button/region on the touch screen. For example, *AM Shape* represents the "AM Shape" setting items on the screen:



- Bold Text with square brackets is used to represent connectors, such as **[RF OUTPUT 50Ω]** indicating the RF output connector on the front panel.
- For the operations that contain multiple steps, the description is in the form of "Step 1 > Step 2 >...". As an example, follow each step in the sequence to enter the upgrade interface:

  UTILITY > *System* > *Update*

  Press the UTILITY button on the front panel as step 1, choose the *System* group on the screen as step 2, and click the *Update* option on the screen as step 3 to enter the upgrade interface.

5 Getting Started

5.1 Power On

The RF signal source provides two power-on methods, namely:

Power On Line

When the "Power On Line" function is enabled, the RF signal source only needs to be connected to the AC power supply through the power cord to power on.

The steps to set the "Power On Line" enable are:

UTILITY > *System* > *Settings* > *Power On Line*

Power On Manually

When the "Power On Line" function is not enabled, after the RF signal source is connected to the AC power supply through the power cord, you need to manually press the power button to turn on the signal source.

5.2 Shut Down

Press the power button for two seconds to turn off the signal source. Or follow the steps below:

UTILITY > *System* > *Shutdown*

NOTE: After pressing the power off button, the RF signal source is still in standby mode. If you no longer want the RF signal source to consume power, completely power down the instrument by unplugging the instrument power cord from the AC outlet.

5.3 System Information

Follow the steps below to examine the software and hardware versions of the signal source.

UTILITY > *System* > *System Info*

See the section "8.14.1.2 System Info" for details.

5.4 Install Options

A license is necessary to unlock a software option. See the section "8.14.1.8 Option" for details.

6 Quick Start

6.1 Front Panel Introduction

Figure 6-1 The Front Panel

1. Function keys
2. USB Host
3. LF output
4. RF output
5. Knob
6. Direction key
7. Digital keyboard
8. Touch screen display area
9. Power button

6.1.1 Function Keys

Table 6-1 Function keys description

Control Keys	Description
FREQ	Set frequency, frequency offset, phase offset and other related parameters
LEVEL	Set level, level offset, ALC state, flatness and other related parameters
SWEEP	Set sweep state, step sweep, list sweep, sweep direction and other related parameters
MODE	Set analog modulation parameters (AM, FM, PM and PULSE)
AM	Set AM parameters
FM/PM	Set FM and PM parameters

PULSE	Set Pulse modulation parameters
I/Q	Set IQ related parameters
LF	Set LF state, LF level, LF frequency and other related parameters
TRIG	When the trigger type is set to Key, press this button to perform one operation
MOD ON/OFF	The main switch of various modulation modes
RF ON/OFF	RF signal output switch
PRESET	Press this button to revert to the default parameters. The default parameters refer to the default parameter table
UTILITY	System and file related operations
HOME	You can get back to the main interface quickly
ESC /Close	During the parameter editing process, pressing this key will clear the input of the active function area and exit the parameter input state Press this key to return to local control if previously controlling the instrument remotely

6.1.2 Direction Knob and Keys

1. Direction knob

Rotate left and right to increase or decrease the value of the active parameter, or adjust the focus position in non-parametric input state. Pressing it down is equal to “Enter”.

2. Direction keys

In the non-parametric input state, press the up, down, left and right direction keys to move the focus frame in sequence.

Press the knob in the parameter input area, the cursor will focus to a certain position, then press the left and right direction keys to change the position of the cursor, and use the up and down keys to fine tune the value of the cursor position.

6.1.3 Digital Keyboard

The front panel of the RF signal source provides a numeric keypad, as shown below. The keyboard

supports English uppercase and lowercase characters, numbers and common symbols (including decimal point, space, negative sign and ! , @, #, $, %, ^, &, *), mainly for editing the name of files or folders and setting parameters (refer to the "6.5 Parameter Settings" section).

Figure 6-2 Digital keyboard

Table 6-2 Digital keys description

Control Keys	Description
0 ␣	Digit 0 and space bar switch
. *…#	In the English state, enter the special symbol !, @, #, $, %, ^, &, *. In the digital state, enter the decimal point
— A<>a	In the digital state, enter the "-" sign. In the English state input for case switching
G/n dBµV	When setting the amplitude, press this key to set the unit as dBuV. When setting the frequency, press this key to set the unit as GHz. If the input is a time-related parameter, press this key to set the unit as ns
M/u µV	When setting the amplitude, press this key to set the unit as uV. When setting the frequency, press this key to set the unit as MHz. If the input is a time-related parameter, press this key to set the unit as us
K/m mV	When setting the amplitude, press this key to set the unit as MV. When setting the frequency, press this key to set the unit as kHz. If the input is a time-related parameter, press this key to set the unit as ms
x1 dBm	When setting the amplitude, press this key to set the unit as dBm. When setting the frequency, the unit selected will be Hz. If the input is time, the unit will be set to s
BACK SPACE	During the parameter editing process, pressing this key will delete the character to the left of the cursor

ENTER	In the parameter input process, pressing this key will end the parameter input and add the currently set unit for the parameter

6.1.4 Key Backlight

1. Power switch

Orange light constantly on indicates the instrument is in stand-by state.

White light constantly on indicates the instrument is in power on state.

2. MOD ON/OFF

When the modulation function is turned on, the button backlight is on; when the modulation function is turned off, the button backlight is off.

3. RF ON/OFF

When the RF signal is on, the button backlight is on; when the RF signal is off, the button backlight is off.

When the RF ON/OFF and MOD ON/OFF backlights are on at the same time, it is used to output modulated RF signals.

6.1.5 Connectors

Figure 6-3 Front Panel Connectors

1. LF OUTPUT

Output the LF (low frequency) signal. The output can also be configured to source the modulation waveform for FM and PM modulation types.

Type: female BNC.

Impedance: 50 Ω.

2. RF OUTPUT

Output the RF signal.

Type: female N.

Impedance: 50 Ω.

	**CAUTION** Damage Levels: 50 Vdc; +30 dBm maximum RF power at frequency greater than 1 MHz.

6.2 Rear Panel Introduction

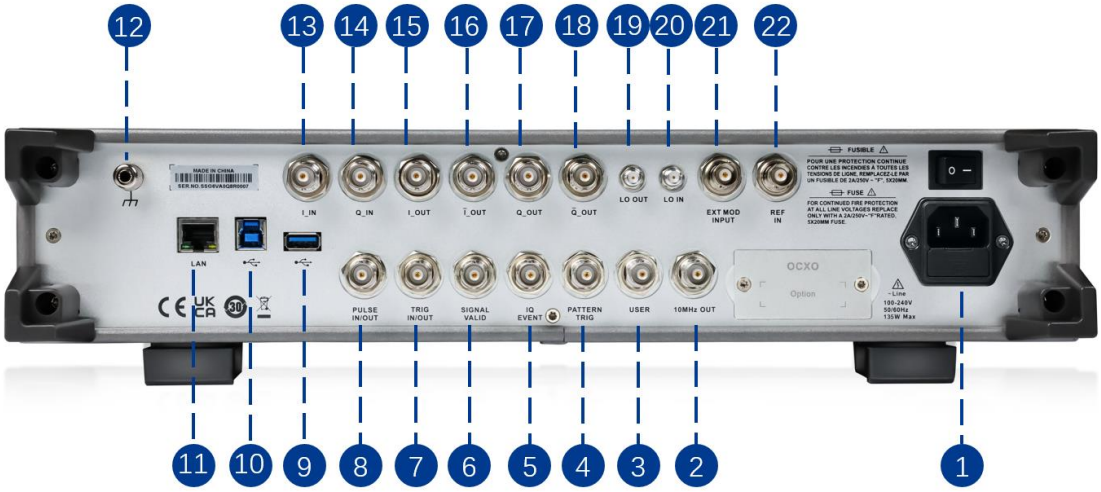


Figure 6-4 The Rear Panel

1. AC power input terminal

The RF signal source can operate with AC power from 100 V - 240 V, 50 / 60 Hz. Please connect the RF signal source to the AC power supply with the supplied power cord.

2. 10MHz OUT

The **[10MHz OUT]** and **[REF IN]** connectors are commonly used to establish synchronization between multiple instruments.

The RF signal generator can use the internal or an external reference source.

If the RF signal generator uses the internal reference source, the **[10MHz OUT]** connector can output a 10 MHz signal generated by the instrument's internal clock source for synchronization with other devices.

If the RF signal generator uses an external reference source, the **[10MHz OUT]** connector can output a 10 MHz signal of the same source as the external reference source for synchronization with other devices.

3. USER

Reserved Port.

4. PATTERN TRIG

Trigger signal input port for built-in IQ baseband generator.

5. IQ_EVENT

Output on this connector occurs whenever Marker is on in an Arb-based waveform.

Marker level ≈ 3.3 V (positive polarity selected),

Marker level = 0 V (negative polarity selected).

6. SIGNAL VALID

When the RF output frequency or amplitude is modified, the RF output connector of the front panel outputs the RF signal at the specified frequency and amplitude after a certain response and processing time in the internal circuit of the instrument. In this process, the **[SIGNAL VALID]** connector outputs an impulse synchronization signal to indicate the validity of the RF output signal:

High level (3.3 V): Indicates that the RF signal is being configured.

Low level (0 V): Indicates that the RF signal is stable (effective).

7. TRIG IN/OUT

When PULSE trigger source is "Int ", the connector can be used to output the trigger signal.

When the RF Sweep, LF Sweep, or PULSE trigger source is "Ext", the connector is used to input the external trigger signal.

8. PULSE IN/OUT

The function of the connector is determined by the current mode of pulse modulation.

- PULSE IN: When the pulse source is "Ext", it is used to input external pulse signals.
- PULSE OUT: When the Pulse modulation source is "Int" and the pulse output switch is turned on, it is used to output the pulse signal generated by the internal generator. The output signal is related to "Pulse Mode", and can be set to "Single", "Double" or "Train".

9. USB host

The RF signal source can be used as the “main device” to connect to an external USB device, like a USB RF power meter. The interface reads the data or state file in the U disk, or stores the current instrument state or data in the U disk.

10. USB device

The interface can be connected to a compatible computer and controlled by software on the host computer.

11. LAN interface

The RF signal source can be connected to a network through the interface and remotely controlled.

12. Ground

The system ground terminal.

13. I_IN

Used to input an external modulated I baseband signal when the external IQ modulation mode is on.

14. Q_IN

Used to input an external modulated Q baseband signal when the external IQ modulation mode is on.

15. I_OUT

Output the analog, quadrature-phase component of I/Q modulation from the internal baseband generator when the internal IQ modulation mode is on.

16. $\overline{\text{I}}$_OUT

Used in conjunction with the I_OUT connector to provide a balanced baseband stimulus.

17. Q_OUT

Output the analog, in-phase component of I/Q modulation from the internal baseband generator when the internal IQ modulation mode is on.

18. $\overline{\text{Q}}$_OUT

Used in conjunction with the Q_OUT connector to provide a balanced baseband stimulus.

19. LO OUT

Modulator internal local oscillator signal output port.

20. LO IN

Modulator external local oscillator signal input port.

21. EXT MOD INPUT

Input BNC connection for external modulation.

22. REF IN

The **[REF IN]** and **[10MHZ OUT]** connectors are commonly used to establish synchronization between multiple instruments.

The RF signal generator can use the internal or an external reference source.

If the RF signal generator detects that the **[REF IN]** connector receives an external clock signal, the signal will be used as an external reference source and the user interface status bar will display "Ext Ref". When the external reference is lost, exceeds the limit, or disconnected, the instrument will automatically switch to the internal reference, and the user interface status bar will no longer display "EXT REF".

6.3 User Interface

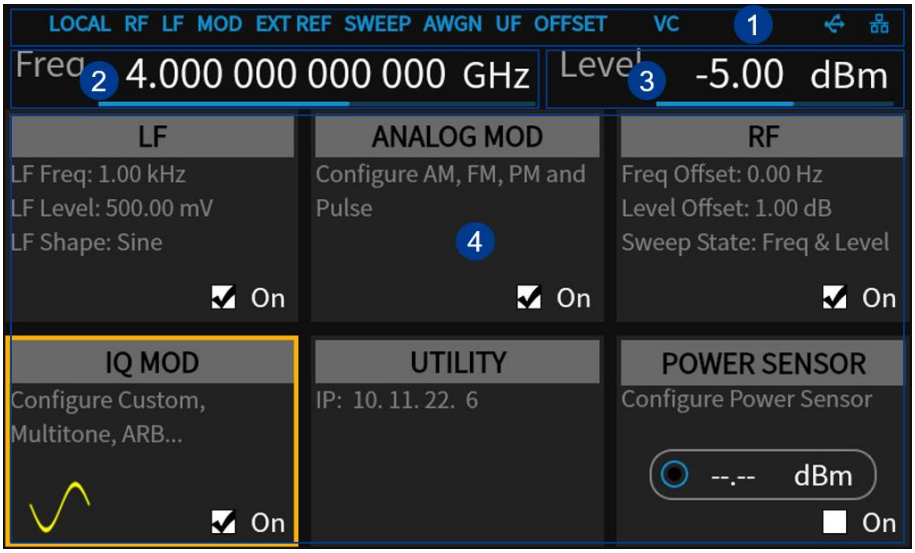


Figure 6-5 The User Interface

1. Prompt status bar
2. RF frequency
3. RF level
4. Touch screen display area: Display the settings under each menu

6.3.1 Prompt Status Bar

- Display LOCAL (local), or REMOTE (remote). When REMOTE is displayed, the instrument is being controlled by a remote computer and the front panel input will be locked. To unlock the front panel (enter LOCAL mode), press ESC or send “SYSTem:REMote 0” to quit.
- RF: The RF output state.
- LF: Low frequency signal generator state.
- MOD: The modulation state.
- EXT REF: EXT REF shows that the SSG6082A-V is using an external reference.
- REF UNLOCK: Indicates that the SSG6082A-V reference clock source is out of lock.
- SWEEP: The status of the sweep state.
- AWGN: The status of the Additive White Gaussian Noise (AWGN) to a carrier when IQ Modulation.
- UF: Level flatness function enabled.
- OFFSET: Level offset enabled.
- VC: The Vector Correction function is turned on. By importing s2p files, this function transfers

the frequency response flatness to the DUT plane by shifting the test signal reference plane from the SSG6082A-V output port to the input port of the DUT, thus completing the de-embedding of the device under test (DUT).

-  The identification is displayed when a USB disk is inserted.
- LAN: LAN state.  Indicates that LAN is successfully connected.  Indicates that there is no network connection or network connection failed.

6.3.2 RF Frequency

RF output frequency setting. When the sweep type is "Freq" or "Freq & Level", the frequency sweeping progress bar is displayed.

6.3.3 RF Level

RF output level setting. When the sweep type is "Level" or "Freq & Level", level sweeping progress bar is displayed.

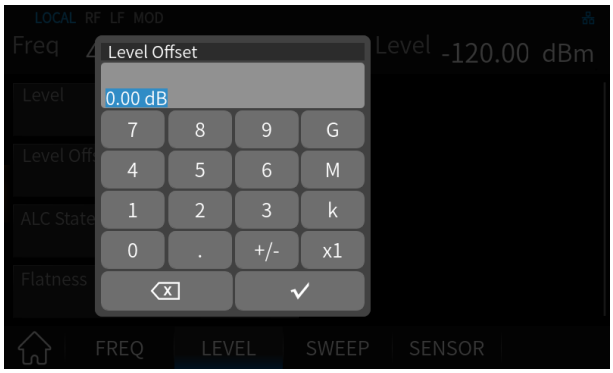
6.3.4 Touch Screen Display Area

Touch screen display area displays the settings under each menu.

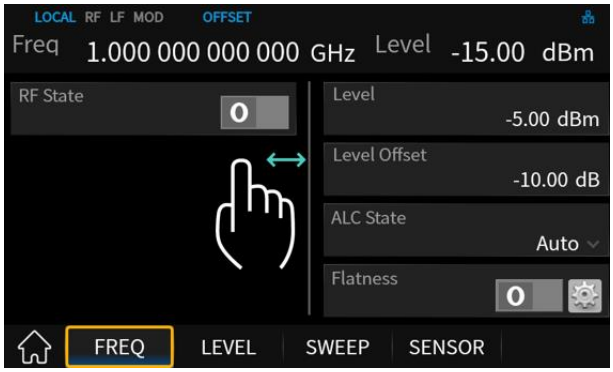
- LF: LF output state, LF waveform and LF sweep related parameters can be set. Sine, Square, Sawtooth, Triangle and DC can be set up.
- ANALOG MOD: Analog Modulation state. Amplitude modulation, frequency modulation, phase modulation, or pulse can be set.
- RF: RF output state. Frequency, level or RF sweep can be set.
- IQ MOD: I/Q modulation state. IQ modulation can be set.
- UTILITY: System and file related parameters can be set.
- POWER SENSOR: Power sensor state and power sensor related parameters can be set.

6.4 Touch Operation

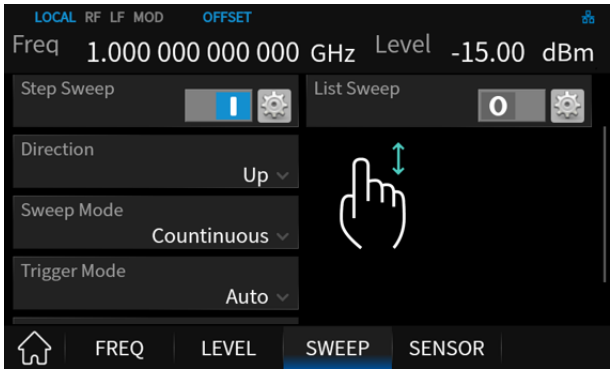
The RF signal source provides a 5-inch capacitive touch screen to support various gesture operations, including:



Click on the screen parameters or menu to pop up a virtual keyboard where you can edit the parameters.



Left or right slide switches menus.



Up or down slides the display menu.

6.5 Parameter Settings

The parameter settings of the RF signal source include numerical input, drop-down box input and switch settings.

6.5.1 Numerical Input

Numerical input can be done through keys and numeric keyboard, keys and knob/direction keys, or touch screen. The following takes setting the frequency offset to 100 MHz as an example to introduce three numerical input methods.

1. Use keys and numeric keypad
   1) Press the FREQ button on the front panel to enter the frequency parameter setting area.
   2) Rotate the knob or press the direction keys to focus on the *Frequency Offset* parameter in the parameter setting area.
   3) Use the front panel numeric keypad to enter the value "100".
   4) Press the M/u uV button to set the unit to MHz.

2. Using the buttons and knob/directional keys
   1) Press the FREQ button on the front panel to enter the frequency parameter setting area.
   2) Rotate the knob or press the direction keys to focus on the *Frequency Offset* parameter in the parameter setting area.
   3) Press the ENTER button or knob to enter the editing state of the parameters.
   4) Adjust the left and right direction keys to select the number of parameter digits to be adjusted.
   5) Rotate the knob or press the up and down direction keys to change the parameter value until the desired parameter value is obtained.
   6) Press the ENTER button or knob to confirm the parameter value.

3. Use the touch screen
   1) Starting from the main interface, click *RF* Module > *Frequency* > *Frequency Offset*. A virtual keyboard for setting parameters will pop up.
   2) Enter 100 on the virtual keyboard, and then select the unit MHz.

6.5.2 Drop-Down Box Input

The input in the drop-down box can be entered through buttons, knobs/direction keys, or touch screen. The following takes setting the ALC status value as an example to introduce two drop-down box input methods.

1. Using the buttons and knob/directional keys
   1) Press the LEVEL button on the front panel to enter the amplitude parameter setting area.
   2) Rotate the knob or press the direction keys to focus on the *ALC State* parameter in the parameter setting area.
   3) Press the ENTER button or knob to open the drop-down box.
   4) Rotate the knob or press the direction keys to select the drop-down box option.
   5) Press the ENTER button or knob to confirm the option.

2. Use the touch screen
   1) Starting from the main interface, click *RF* Module > *LEVEL* > *ALC State*, and the drop-down box will open.
   2) Click the option in the drop-down box.

6.5.3 Switch Settings

The switch status can be set through buttons and knobs/direction keys, or the touch screen. When the switch button is on the right and is blue, it is on. When the switch button is on the left and gray, it means off.

The following takes setting the flatness switch as an example to introduce two switch setting methods.

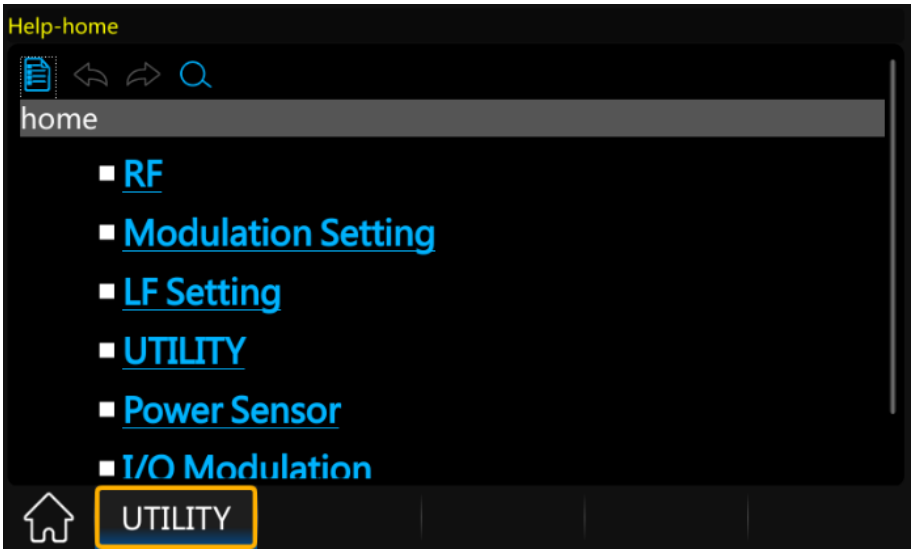
1. Using the buttons and knob/directional keys
   1) Press the LEVEL button on the front panel to enter the level parameter setting area.
   2) Rotate the knob or press the direction keys to focus on the Flatness switch  in the parameter setting area.
   3) Press the ENTER button or knob to switch the switch state.

2. Use the touch screen
   1) Starting from the main interface, click *RF* Module > *LEVEL* > *Flatness*  ,
   2) Click the switch to toggle the switch state.

6.6 Help Information

The RF signal source has a built-in help system that provides help information for each function and menu.

1. Press UTILITY > *Help* to enter help information page.
2. Click to enter the corresponding directory to view.

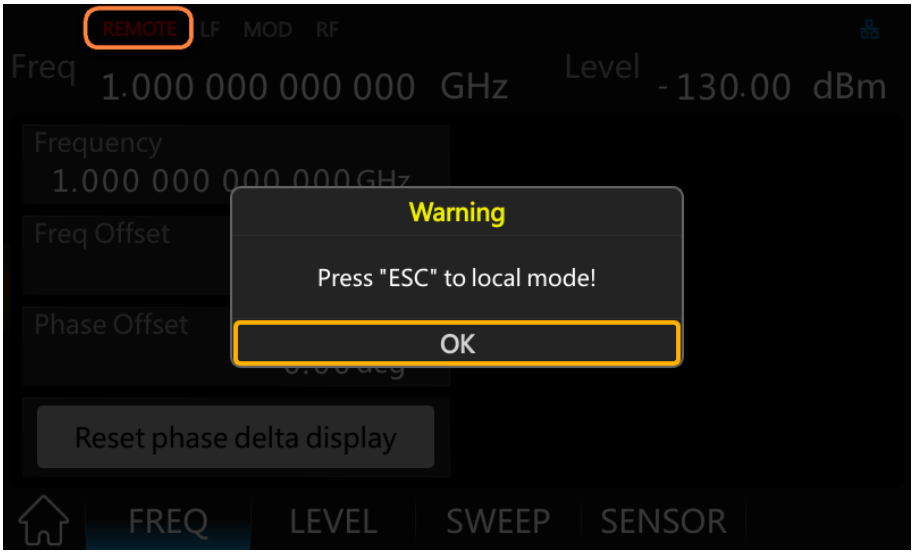


7 Application Examples

7.1 REMOTE and LOCAL Mode

When the signal generator is controlled by a remote computer, the instrument will be in REMOTE mode and the front panel input will be locked.

As shown below, the “REMOTE” icon appears in the status bar, and if you touch the screen or press any key in the font panel, a warning box will appear.



To unlock the front panel, namely, to enter LOCAL mode, there are two ways:

- Press ESC in the front panel to quit.
- Send SCPI command “SYSTem:REMote 0”.

After exiting the REMOTE mode, the “LOCAL” icon will appear in the status bar.

7.2 Synchronizing Instruments

The SSG6082A-V is equipped with an internal reference oscillator that generates a 10 MHz reference frequency, which can be used as an internal reference source.

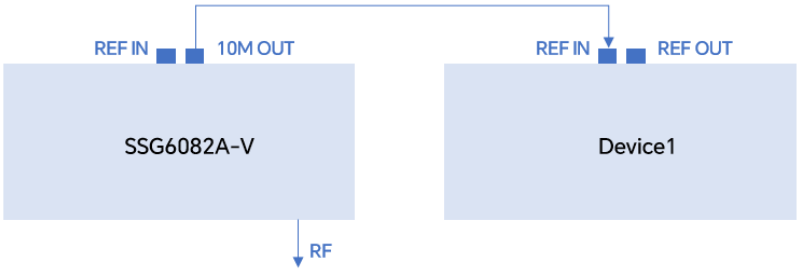
Alternatively, you can use an external signal as the reference source for the SSG6082A-V, which can process external reference frequency in the range of 1 MHz to 100 MHz.

Regardless of the used reference source, multiple interconnected instruments can be synchronized.

7.2.1 Using the internal 10 MHz reference signal of the SSG6082A-V

Connect the **[10MHz OUT]** connector on the rear panel of the SSG6082A-V to the **[REF IN]** connector of the other device. The internal reference oscillator of the SSG6082A-V now provides the reference frequency for the other device.

As shown in the figure below, the internal clock source of SSG6082A-V is the clock reference source of device 1.



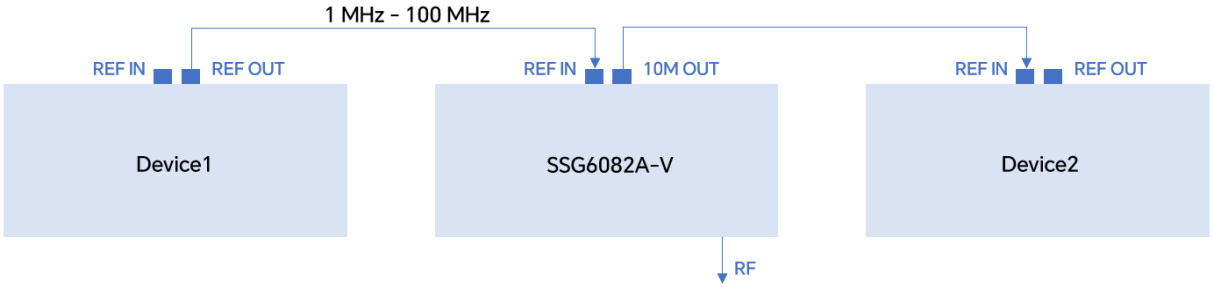
7.2.2 Using external reference source

Connect the **[REF OUT]** connector of the device that serves as the frequency reference to the **[REF IN]** connector on the rear panel of the SSG6082A-V. You can input a reference frequency between 1 MHz and 100 MHz and set the external reference frequency on the SSG6082A-V:

1. Click *UTILITY* > *Settings* > *Ref Source Setting* on the touch screen, and set *Ref Frequency Type* as “Variable”.
2. Set the external reference frequency value in *Ext Frequency*.

After connecting to an external reference source, a blue "EXT REF" icon will be displayed in the user interface status bar of the SSG6082A-V, and the **[10M OUT]** connector will output a 10 MHz signal with the same source as the external reference signal.

As shown in the figure below, the reference clocks of the SSG6082A-V and device 2 both use the clock source of device 1.



7.3 Correcting 10 MHz Internal Reference Source

Using a high-accuracy frequency meter, the RF signal generator can correct the accuracy of the 10 MHz internal reference signal through the "10M Adjustment" function. The 10 MHz internal reference signal is generated by the internal clock source OCXO of SSG6082A-V and output from the **[10MHz OUT]** connector. During calibration, connect the **[10MHz OUT]** connector to a frequency meter and then adjust the reference oscillator codeword until the accuracy of the 10 MHz reference signal reaches the target value.

1. Set the reference frequency type

   Click *UTILITY* > *Settings* > *Ref Source Setting* , and set *Ref Frequency Type* as "Fixed 10M".

2. Set the reference oscillator code

   1) Click *10M Adjustment* >  to enter the " Ref Osc Setting " page.

   2) Turn on the *10M Adjustment* switch. At this time, the clock reference will use the code set in *Ref Osc Code* . If the reference calibration is off, the clock reference will use the default code.

   3) Click *Ref Osc Code* to pop up the virtual keyboard and set the code.

3. Correcting 10 MHz reference

   The frequency of the reference signal can be modified through the codeword. According to the frequency measured by the frequency meter, increase or decrease the reference oscillator codeword, and repeat the operation until the 10MHz reference signal output by the internal clock source meets the accuracy requirements.

7.4 Output RF Signal

The following takes the output of a radio frequency signal with a frequency of 3 GHz and an amplitude of 0 dBm from the **[RF OUTPUT 50Ω]** connector as an example.

1. Restore factory settings

   1) Press UTILITY > *Settings* > *Preset Type* to set the reset type to default;

   2) Press PRESET to perform the reset operation.

2. Set the frequency

   Press the FREQ button and use the numeric keyboard to enter 3 GHz, or click the frequency

input box on the touch screen to pop up the virtual keyboard and enter 3 GHz on the virtual keyboard.

3. Set the amplitude

   Press the LEVEL button and use the numeric keyboard to enter 0 dBm, or click the level input box on the touch screen to pop up the virtual keyboard and enter 0 dBm on the virtual keyboard.

4. Turn on RF output

   Press RF ON/OFF button to turn on the RF output, or press HOME > *RF* module > *On* to turn on the RF output. After turning on the RF output, the RF ON/OFF button light turns on, and the “RF” icon in the status bar turns blue.

At this time, the **[RF OUTPUT 50Ω]** connector outputs a radio frequency signal with a frequency of 3 GHz and an amplitude of 0 dBm.

7.5 Use the Flatness Function to Correct Line Loss

In conjunction with a power meter, RF signal sources can use the flatness function to correct for line loss.

Connect the **[RF OUTPUT 50Ω]** connector of the RF signal source to the cable under test, and connect the end of the cable to the power meter. Plug the power meter into the USB port of the RF signal source and wait for the power meter connection to complete.

1. Restore factory settings

   1) Press UTILITY > *Settings* > *Preset Type* to set the reset type to default.

   2) Press PRESET to perform the reset operation.

2. Set the frequency and amplitude

   1) Press FREQ > *RF Frequency* , and set it to 1 GHz.

   2) Press LEVEL > *Level* , and set it to 0 dBm.

3. Set the frequency of flatness calibration

   1) Press LEVEL > *Flatness* >  > *Setting* , and select the *Fill Type* as "Manual Step".

2) Set *Start Freq* to 4 GHz, *Stop Freq* to 5 GHz, and *Points* to 11.

4. Perform amplitude calibration

Click *Fill Flatness with Sensor* button and a "Collecting" dialog will pop up.

After the data collection is completed, the user interface will automatically return to the flatness list page and give the amplitude correction value of each frequency.

7.6 Output a Modulated Signal

The following takes amplitude modulation as an example to introduce the output of an analog modulation signal: the carrier frequency is 1 GHz, the carrier amplitude is -10 dBm, the AM modulation depth is 80%, the modulation frequency is 10 kHz, and the modulation waveform is a sine wave.

1. Restore factory settings

1) Press UTILITY > *Settings* > *Preset Type* to set the reset type to default;

2) Press PRESET to perform the reset operation.

2. Set carrier frequency and amplitude

1) Press FREQ > *RF Frequency* , and set it to 1 GHz.

2) Press LEVEL > *Level* , and set it to -10 dBm.

3. Set the AM modulation parameters

Press MODE or click *ANALOG MOD* > *AM* on the touch screen to enter the amplitude modulation parameter setting interface.

1) Set *AM Shape* to Sine;

2) Set *AM Depth* to 80%;

3) Set *AM Rate* to 10 kHz;

4) Turn on *AM State* ;

4. Turn on analog modulation and RF output

1) Press the MOD ON/OFF button, the button light turns on, and the MOD icon in the status bar of the user interface changes from gray to blue;

2) Press the RF ON/OFF button, the button light turns on, and the RF icon in the status bar of the user interface changes from gray to blue.

At this time, the **[RF OUTPUT 50Ω]** connector outputs the modulated RF signal in the current configuration.

7.7 Output a Pulse Train

The following steps describe how to output a user-defined pulse sequence from the **[PULSE IN/OUT]** connector on the rear panel of the RF signal source. The specific setting parameters of the pulse sequence are shown in the table below.

Serial number	Positive pulse width	Negative pulse width	Repetitions
1	10 ms	30 ms	1
2	20 ms	20 ms	2

1. Restore factory settings

   1) Press UTILITY > *Settings* > *Preset Type* to set the reset type to default;

   2) Press PRESET to perform the reset operation.

2. Install the pulse sequence generator option

   Press UTILITY > *Option* to enter the option installation interface, select and install the "SSG6080AV-PU" and “SSG6080AV-PT” options. After restarting the machine, the RF signal generator will enable the pulse modulation and pulse sequence functions.

3. Edit pulse list

   Press MODE or click *ANALOG MOD* > *PULSE* on the touch screen to enter the pulse modulation parameter setting interface.

   1) Set *Pulse Mode* to Train,

   2) Click *Pulse Train* >  to enter the pulse sequence editing interface, set the *On Time* of the first pulse to 10 ms, the *Off Time* to 30 ms, and the *Count* to 1;

   3) Click *Add* to add a row, set the *On Time* to 20 ms, the *Off Time* to 20 ms, and the *Count* to 2.

4. Turn on pulse modulation and pulse output

   Return to pulse modulation setting interface,

1) Turn on the *Pulse Out* switch,

2) Turn on the *Pulse State* switch.

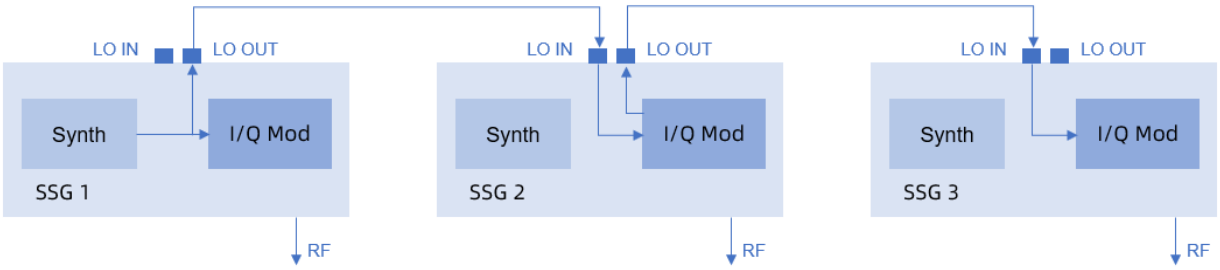
5. Turn on analog modulation

   Press the MOD ON/OFF button, the button light turns on, and the MOD icon in the status bar of the user interface changes from gray to blue.

At this time, the **[PULSE IN/OUT]** connector outputs the pulse train signal configured as above.

7.8 LO Coupling of Cascaded Instruments

By configuring LO coupling, phase coherence of cascaded instruments can be achieved. This example shows how to configure three SSG6082A-V generators for LO coupling, and assume the RF frequency of 1 GHz.



The above figure shows the LO coupling setup using three SSG6082A-V generators:

- SSG6082A-V 1 uses its internal oscillator signal.
- SSG6082A-V 2 receives the LO signal from the first instrument.
- SSG6082A-V 3 receives the LO signal from the second instrument.

The configuration steps are as follows:

1. Connect the **[LO OUT]** of SSG6082A-V 1 to the **[LO IN]** of SSG6082A-V 2, and connect the **[LO OUT]** of SSG6082A-V 2 to the **[LO IN]** of SSG6082A-V 3.

2. Configure SSG6082A-V 1

   1) Set the carrier frequency to 1 GHz.

   2) Set I/Q > *I/Q Control* > *I/Q LO Source* to Int.

3) Turn On *I/Q LO Output* .

3. Configure SSG6082A-V 2

1) Set the carrier frequency to 1 GHz.

2) Set I/Q > *I/Q Control* > *I/Q LO Source* to Ext.

3) Turn On *I/Q LO Output* .

4. Configure SSG6082A-V 3

1) Set the carrier frequency to 1 GHz.

2) Set I/Q > *I/Q Control* > *I/Q LO Source* to Ext.

3) Turn Off *I/Q LO Output* .

At this point, the three SSG6082A-Vs will generate RF signals with stable incremental phases because they use the same oscillator signal.

7.9 Output IQ Modulated Signal in Custom Mode

The following steps describe how to generate an IQ modulated signal with a modulation mode of 32QAM. Users can modify and configure IQ modulation related parameters according to actual application requirements.

1. Restore factory settings

1) Press UTILITY > *Settings* > *Preset Type* to set the reset type to default;

2) Press PRESET to perform the reset operation.

2. Set the baseband signal

1) Press I/Q > *Custom* .

2) Open the *Data Source* setting interface:

Set *Data Setup* to PN9, *Symbol Rate* to 1MHz, and *Symbol Length* to 512.

3) Open the *Modulation* setting interface:

Set *Mod Type* to QAM, *QAM Type* to 32QAM.

4) Open the *Filter* setting interface:

Set *Filter Type* to RootCosine, *Filter Alpha* to 0.35, *Filter Length* to 128,

OverSampling to 4.

5) Turn on *Custom State* .

3. Set carrier frequency and amplitude

1) Press FREQ > *RF Frequency* , and set it to 1 GHz.

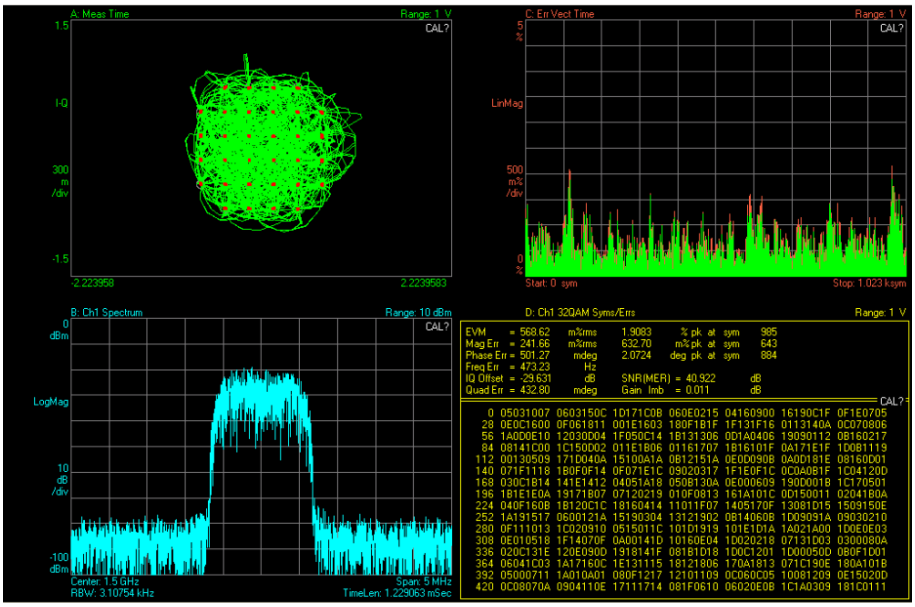
2) Press LEVEL > *Level* , and set it to 0 dBm.

4. Turn on IQ modulation and RF output

1) Press MOD ON/OFF button to turn on IQ modulation.

2) Press RF ON/OFF button to turn on RF output.

At this time, the **[RF OUTPUT 50Ω]** connector outputs an IQ modulation signal with a modulation mode of 32QAM, and the IQ modulation signal is connected to an IQ demodulation device to observe the demodulation characteristics of the IQ modulation signal:



7.10 Test OIP3 of Active Devices in Multitone Mode

OIP3 is a key indicator for evaluating the linearity of active devices. This can be tested using the SSG6082A-V. The following steps describe how to generate a two-tone continuous wave signal with a carrier frequency of 3.2 GHz and an interval frequency of 1 MHz to test OIP3 of the active device.

1. Restore factory settings

1) Press UTILITY > *Settings* > *Preset Type* to set the reset type to default;

2) Press PRESET to perform the reset operation.

2. Set the baseband signal

1) Press I/Q > *Multitone* .
2) Set *Tone Number* to 1;
3) Set *Sample Rate* to 10 MHz;
4) Set *Freq Spacing* to 1 MHz;
5) Turn off *Single Side* state;
6) Turn on *Multitone State* ;

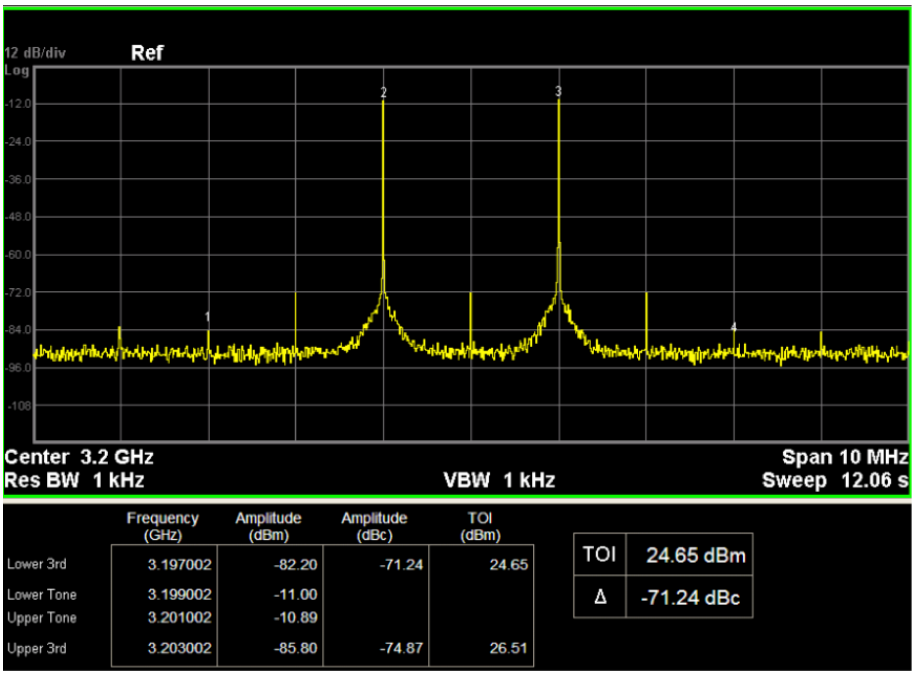
3. Set carrier frequency and amplitude

1) Press FREQ > *RF Frequency* , and set it to 3.2 GHz.
2) Press LEVEL > *Level* , and set it to -10 dBm.

4. Turn on IQ modulation and RF output

1) Press MOD ON/OFF button to turn on IQ modulation.
2) Press RF ON/OFF button to turn on RF output.

At this time, the **[RF OUTPUT 50Ω]** connector of the SSG6082A-V outputs a two-tone continuous wave signal with a carrier frequency of 3.2 GHz and an interval frequency of 1 MHz. The signal is used as the input of the active device, and the output signal is tested to obtain the OIP3 characteristic as shown in the following figure.



NOTE: IQ compensation can be performed through *I/Q Control* > *I/Q Adjustment* menu of the SSG6082A-V. For example, when the IQ modulation signal shows a significant local oscillator leakage, it can be solved by alternately adjusting the Offset of I and Q.

7.11 Play Waveform Sequence in ARB Mode

Using the ARB (arbitrary waveform) mode of SSG6082A-V, you can play waveform sequences.

1. Restore factory settings

   1) Press UTILITY > *Settings* > *Preset Type* to set the reset type to default;

   2) Press PRESET to perform the reset operation.

2. Create Waveform Sequence

   Press I/Q > *ARB* to enter the ARB modulation setting interface.

   1) Click *Waveform Sequence* to enter the waveform sequence setting interface;

   2) Click *Build* button to enter the waveform sequence creating interface;

   3) Click *Insert* button in the bottom menu to add built-in waveform files "Local/iq_wave/RAMP_WAVE.ARB " and "Local/iq_wave/SINE_WAVE.ARB ";

   4) Modify the number of repetitions of SINE_WAVE to 2 and RAMP_WAVE to 3;

   5) Click *Save* button in the bottom menu and save the sequence as "seq1".

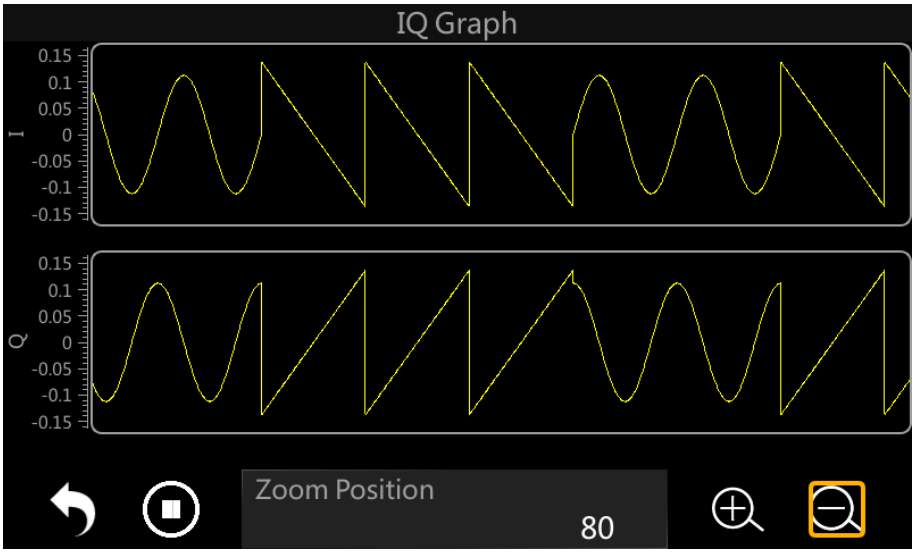
3. Play Waveform Sequence

   1) Press I/Q > *ARB* > *Select Waveform* , and select to play the sequence "Local/seq1.SEQ ";

   2) Turn on *ARB State* ;

   3) Turn on MOD ON/OFF ;

At this time, the waveform sequence "seq1" is played. You can return to the main page and click button in the *IQ MOD* block to view the played waveform. The waveform currently playing is shown as below:



7.12 Add AWGN to Modulated Signal in ARB Mode

Using the ARB (arbitrary waveform) mode of SSG6082A-V, you can add Additive White Gaussian Noise (AWGN) to the carrier while modulating the carrier.

1. Restore factory settings

   1) Press UTILITY > *Settings* > *Preset Type* to set the reset type to default;

   2) Press PRESET to perform the reset operation.

2. Set the carrier frequency

   Press FREQ > *RF Frequency* , and set it to 2 GHz.

3. Set the real-time AWGN function

   1) Press I/Q > *ARB* > *ARB Setup* > *Real Time AWGN* to enter the real-time

AWGN setting interface;

2) Set *Output Mux* to "Carrier + Noise",

Carrier Bandwidth to 3.84 MHz,

Flat Noise Bandwidth to 8 MHz,

Carrier to Noise Ratio Format to "C/N",

Carrier to Noise Ratio to 34 dB,

Power Control to "Total ",

Total Power to -10dBm;

3) Turn on the *Real Time AWGN* state.

4. Play Waveform

1) Press I/Q > *ARB* > *Select Waveform*, and select to play the built-in waveform "Local/iq_wave/WCDMA/WCDMA_3 DPCH.ARB";

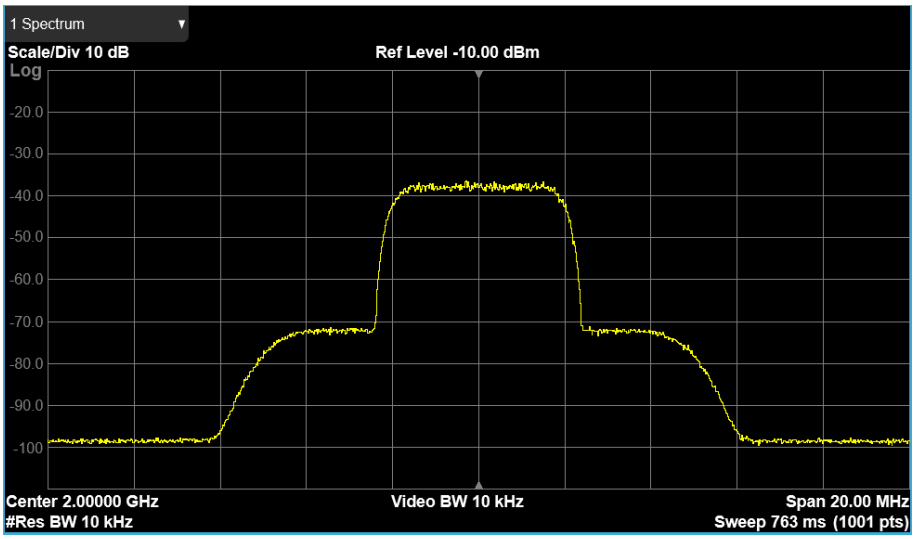
2) Turn on *ARB State*.

5. Turn on IQ modulation and RF output

1) Press MOD ON/OFF button to turn on IQ modulation.

2) Press RF ON/OFF button to turn on RF output.

At this time, connect the **[RF OUTPUT 50Ω]** connector of the SSG6082A-V to the spectrum analyzer. set the center frequency of the spectrum analyzer to 2 GHz, turn on the trace averaging function, and the spectrum of the modulated wave with Additive White Gaussian Noise is shown below.



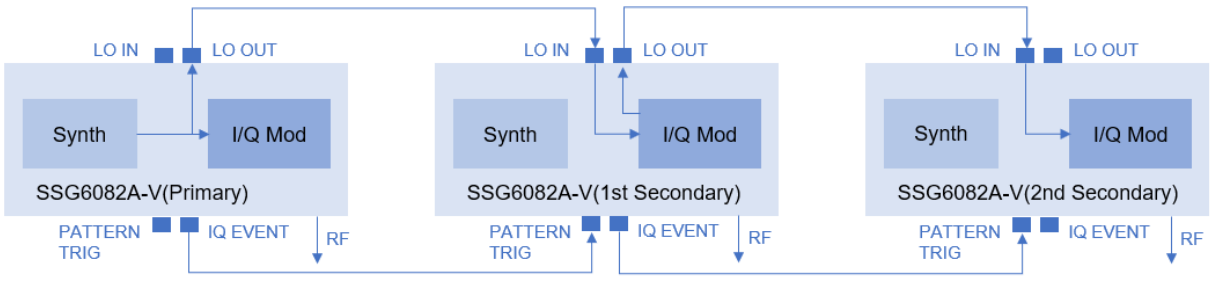
7.13 ARB Multi-BBG Settings

By configuring the Multi-BBG Settings function to achieve synchronized output from multiple SSG6082A-V signal generators, it is typically used to set up test environments for multi-channel RF systems (common technologies include MIMO, antenna diversity, and beamforming).

The synchronization of multi-channel RF systems involves two aspects: baseband signal timing synchronization and RF signal phase coherence. “Baseband timing synchronization” refers to the temporal alignment of baseband signals generated among multiple signal generators. In a multi-device system composed of multiple signal generators, it ensures that each signal source can respond to the same trigger signal while generating baseband signals through ARB function. “RF signal phase coherence” refers to maintaining a constant relative phase clock among the RF signals from multiple signal generators. Since different signal generators use distinct local oscillator (LO) sources, their temperature drift characteristics inevitably differ. During long time operation, the varying temperature drifts of independent LO sources cause the phase relationships between RF signals from multiple generators to deviate from deterministic values, thereby breaking phase coherence. Only when all signal sources share the same LO can long-term phase coherence be preserved.

The Multi-BBG Settings function in the SSG6082A-V signal generator achieves baseband timing synchronization across devices through a daisy-chain architecture. This configuration simplifies multi-unit cascading by automatically propagating trigger signals, eliminating manual synchronization interventions. Before use the function, you need to know “Primary” and “Secondary”. In a preconfigured multi-device synchronization network utilizing the Multi-BBG Settings function, one Primary unit and multiple Secondary units are cascaded (Primary-to- Secondary and Secondary -to- Secondary connections). The trigger signal is output from the Primary unit, transmitted to the first-tier Secondary unit connected to the Primary. The first-tier Secondary unit then outputs the trigger signal to the second-tier Secondary unit, and this process continues sequentially until the trigger signal reaches the final-tier Secondary unit in the network. Finally, all signal generators in the network synchronously output baseband signals through their ARB functions.

The Multi-BBG Settings function in the SSG6082A-V signal generator achieves RF signal phase coherence across LO coupling.



The diagram illustrates three SSG6082A-V signal generators cascaded in a daisy-chain configuration, with their LOs synchronized through LO IN/OUT interfaces. After proper cable connections, the physical architecture of the Multi-BBG synchronization network is established.

NOTE: To achieve optimal synchronization performance, ensure equal-length cabling for all cascade connections.

Signal generator cascading steps are as follows:

1. Connect the **[LO OUT]** of SSG6082A-V(Primary) to the **[LO IN]** of SSG6082A-V(1st Secondary), and connect the **[LO OUT]** of SSG6082A-V(1st Secondary) to the **[LO IN]** of SSG6082A-V(2nd Secondary).
2. Connect the **[IQ EVENT]** of SSG6082A-V(Primary) to the **[PATTERN TRIG]** of SSG6082A-V(1st Secondary), and connect the **[IQ EVENT]** of SSG6082A-V(1st Secondary) to the **[PATTERN TRIG]** of SSG6082A-V(2nd Secondary).

After building the above synchronization network, the configuration steps are as follows:

1. Configure SSG6082A-V (Primary)
   1) Set the carrier frequency to 1 GHz.
   2) Set I/Q > *I/Q Control* > *I/Q LO Source* to Int.
   3) Turn on *I/Q LO Output* .
   4) Set I/Q > *ARB* > *Multi-BBG Settings* > *Multi-BBG Sync Type* to Primary.
   5) Set *Number Of Secondaries* to 2.
2. Configure SSG6082A-V (1st Secondary)
   1) Set the carrier frequency to 1 GHz.
   2) Set I/Q > *I/Q Control* > *I/Q LO Source* to Ext.
   3) Turn on *I/Q LO Output* .
   4) Set I/Q > *ARB* > *Multi-BBG Settings* > *Multi-BBG Sync Type* to Secondary.
   5) Set *Number Of Secondaries* to 2.
   6) Set *Secondary Position* to 1.
   7) Click *Listen Failed* , and it will change to *Listening...* , indicating that the secondary has now entered the listening state.
3. Configure SSG6082A-V (2nd Secondary)
   1) Set the carrier frequency to 1 GHz.
   2) Set I/Q > *I/Q Control* > *I/Q LO Source* to Ext.
   3) Turn On *I/Q LO Output* .
   4) Set I/Q > *ARB* > *Multi-BBG Settings* > *Multi-BBG Sync Type* to Secondary.

5) Set *Number Of Secondaries* to 2.

6) Set *Secondary Position* to 2.

7) Click *Listen Failed* , and it will change to *Listening...* , indicating that the secondary has now entered the listening state.

4. Configure SSG6082A-V (Primary)

1) Click *Start Sync* , the Primary initates the synchronization pulse.

2) the Secondarys within the network will change to *Sync Success* .

3) Check whether all Secondarys within the network have their status changed to *Sync Success* . If not, verify the physical connections for errors.

The three signal generators in the synchronization network have now completed synchronization. Configure the required waveform segments for playback on each unit respectively, then trigger the primary to generate test signals. No operation is required on the slave units – all three signal generators will output signals synchronously. Note: Under the “Continuous” trigger type, the “Free Run” trigger mode is no longer selectable. Signal output must be triggered and cannot start autonomously.

7.14 DUT De-embedding Using Vector Correction Function

When the DUT is not directly connected to the RF output port of the SSG6082A-V, but is connected to this port through a two-port interconnect network consisting of cables, attenuators, amplifiers, switches, test fixtures, and even antennas, the vector compensation function of the SSG6082A-V can perform DUT de-embedding to accurately characterize the characteristics of the DUT.

Steps:

1. Use a vector network analyzer (VNA) to acquire the phase/amplitude of the two-port interconnect network connecting the SSG6082A-V RF output port and the DUT.
2. Import the generated scattering parameters Sxy as s2p files into the SSG6082A-V.

1) Press I/Q > *I/Q Control* > *Vector Correction* > *User S-Parameter* button to enter the edit page of the s2p file list.

2) Click the *Insert* button in the bottom menu bar to add the s2p files.

3) Click the s2p file list to modify the input port, output port, and activation/deactivation status of the s2p files.

4) Click the *Apply* button in the bottom menu bar to apply the current s2p file list.

5) Users can click the *Overview* button in the bottom menu bar to view the frequency range, gain, and phase of the activated s2p files. Click the *Table* button in the bottom menu bar to return to the s2p file list page during Overview.

3. Turn on the vector compensation function.

   Press I/Q > *I/Q Control* > *Vector Correction* to turn on the vector compensation function.

4. If necessary, you can turn on absolute level compensation.

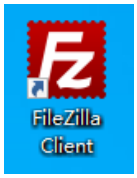
   Turn on the *Power Compensation* switch to perform absolute RF level correction based on the activated s2p files. The absolute level correction value is displayed in *Absolute Level Correction* button.

7.15 Download/Upload Files Using FTP (LAN)

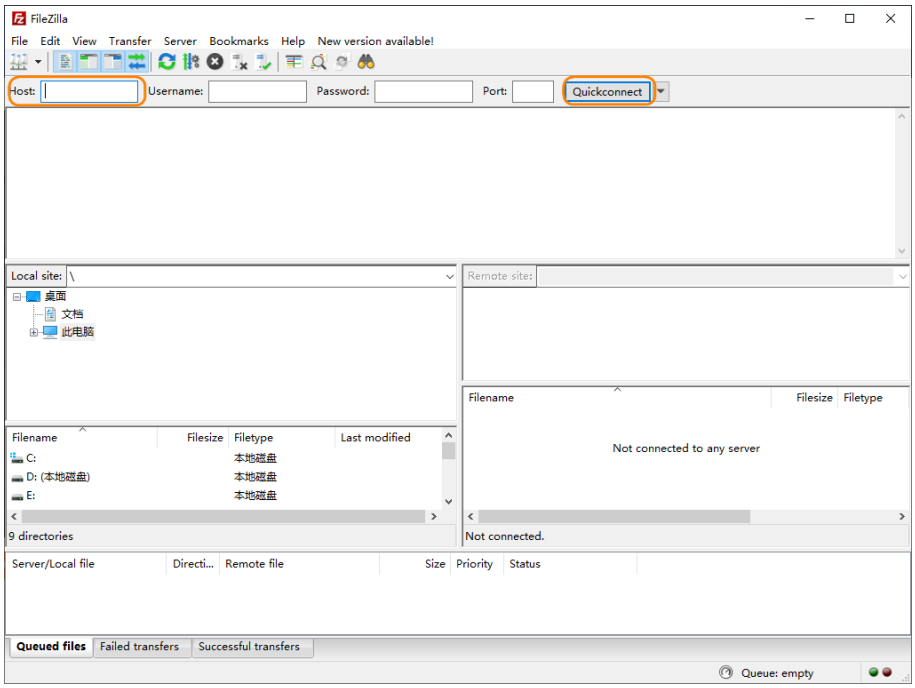
The RF signal generator supports LAN and FTP protocols. Users can download files in the "Local" folder of the signal generator to a computer through the free software FileZilla, or upload files from a computer to the "Local" folder of the signal generator. The file transfer supports TLS encryption.

Here's how to use FileZilla software to download or upload files via LAN.

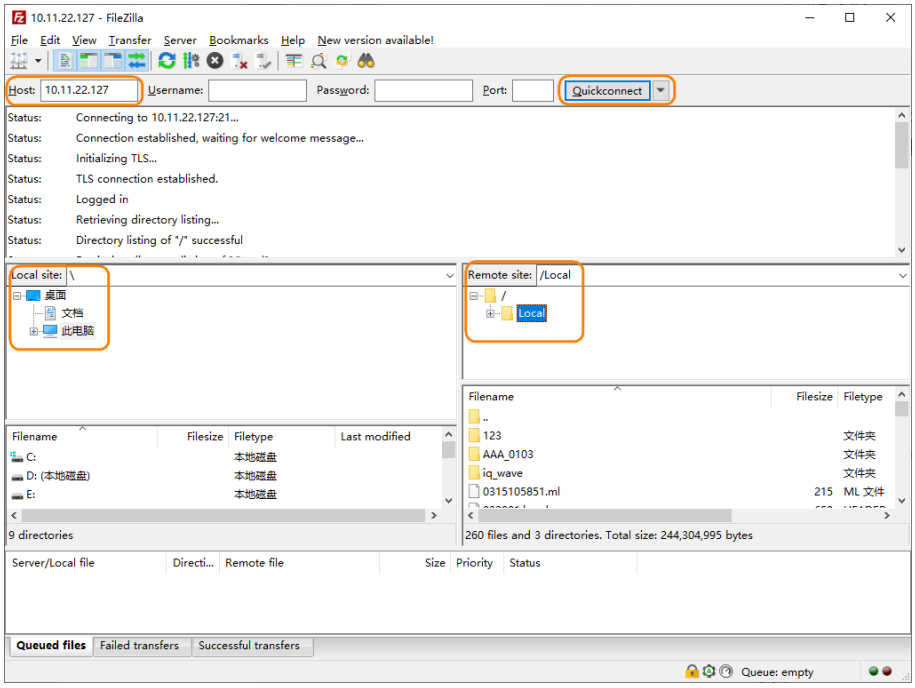
1. Install FileZilla software on your computer.



2. Set the LAN parameters of the signal generator, and ensure that the IP address can be pinged.
3. Open the FileZilla software, the user interface is as shown below:

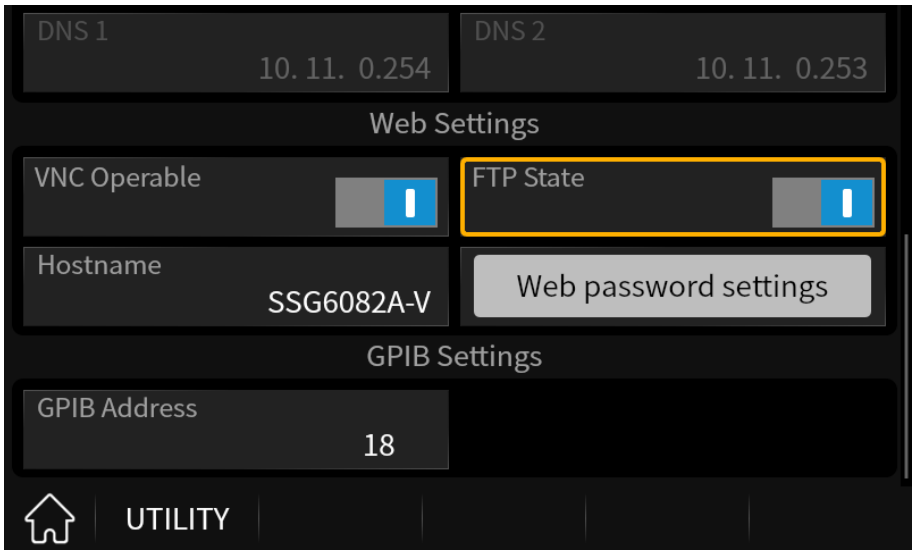


4. Fill in the IP address of the signal generator in the "Host" input box of the FileZilla software, and then click the "Quickconnect" button to connect to the signal source.



5. Once the signal source is connected, you can transfer files between the local site (computer) and the remote site (the “Local” folder of the signal source).

6. If you want to turn off the FTP function, you can press UTILITY > *Interface* > *Web Settings* > *FTP State* to turn off FTP, as shown in the figure below. It will now be impossible to transfer files via FTP (LAN) between the computer and the source.


DNS 1
10. 11. 0.254
DNS 2
10. 11. 0.253
Web Settings
VNC Operable
FTP State
Hostname
SSG6082A-V
Web password settings
GPIB Settings
GPIB Address
18
UTILITY

8 Front Panel Operation

This chapter introduces in detail the function keys on the front panel of SSG6082A-V and the associated menu functions.

8.1 Frequency

You can set the frequency value in the display frequency input box on the status bar, or you can set the frequency value in the frequency parameter setting area. Note that there is a difference between the frequency displayed on the status bar and the frequency in the parameter setting area. The difference between them will be described in the following chapters.

Figure 8-1 Frequency setting

8.1.1 RF Display Frequency and Output Frequency

If the RF output is connected to a downstream instrument, such as a mixer, the frequency offset can be set in the frequency parameter setting area. The relationship between the display frequency of the status bar and the frequency of the parameter setting area is as follows:

1. The relationship between display frequency, output frequency and frequency offset is:

   Display frequency (display frequency in status bar) = output frequency (frequency in parameter setting area) + frequency offset

2. The difference between the displayed frequency and the frequency offset is the RF output frequency.

8.1.2 Frequency Offset

Click *Freq Offset* to set the frequency offset of the RF output signal.

When the RF signal source is connected to an external mixer and other equipment, by setting a reasonable frequency offset, the frequency after passing through the mixer can be directly read and set.

8.1.3 Phase Offset

Click *Phase Offset* to set the phase offset of the RF signal.

When multiple RF sources output signals simultaneously, multiple signals can be output to the same phase or fixed phase offset by adjusting this parameter. At this point you should set multiple RF sources to the same frequency and synchronize their clocks.

Click *Reset Phase delta display* button to reset the currently displayed phase offset value to 0 degrees, but the actual phase offset of the signal does not change.

8.1.4 RF State

Functionally equivalent to the RF ON/OFF button on the front panel.

8.2 Level

You can set the level value in the display level input box on the status bar, or you can set the level value in the level parameter setting area. Note that there is a difference between the display level on the status bar and the level in the parameter setting area. The difference between them will be described in the following chapters.

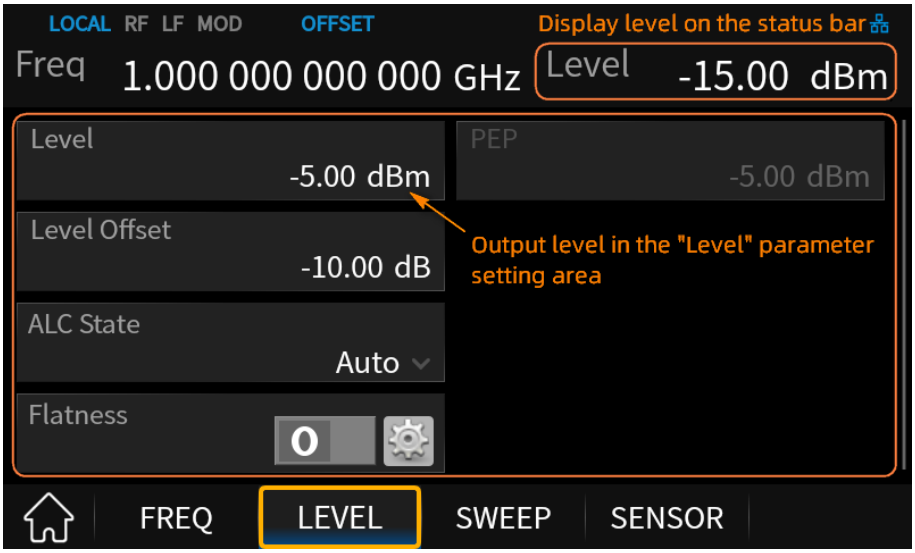


Figure 8-2 Level setting

8.2.1 RF Display Level and Output Level

If the RF signal source works in a system with an attenuator or amplifier, you can set the corresponding level offset parameters in the level parameter setting area. When the signal source and attenuator or amplifier are viewed as a whole, the level value can be viewed directly in the display level area of the status bar.

The relationship between the display level of the status bar and the level of the parameter setting area is as follows:

1. The relationship between the display level, output level and level offset is:

   Display level (display level in status bar) = output level (level in parameter setting area) + level offset

2. The difference between the display level and level offset is the RF output level.

8.2.2 PEP

Displays the peak envelope power of the waveform.

8.2.3 Level Offset

Click *Level Offset* to set the level offset of the RF output signal.

When the RF output is connected to a fixed attenuation or gain, by setting a reasonable level offset, the attenuated or amplified amplitude value can be directly read and set on the RF source.

After setting the level offset to be non-zero, a blue "OFFSET" icon will be displayed on the status bar of the user interface.

8.2.4 ALC State

Click *ALC State* to select the working status of the ALC function.

ALC stands for Automatic Level Control. It is an adaptive control system to stabilize the RF output level.It continuously monitors the current level and adjusts it to keep a steady state over temperature and time.

ALC has three working states: "Off", "On" and "Auto":

AUTO

Automatically turn on or off the ALC function according to the equipment state.

On

Enable ALC permanently, regardless of the currently selected mode.

Off (S&H)

Deactivate ALC. The instrument switches to Sample & Hold (S&H) state, which still allows maintaining a constant output level. In “S&H” mode, the signal generator switches for a short period of time into CW mode and activates ALC. The ALC adjusts the level to the set value and the generator holds the value. Then the generator switches ALC off again and back to the previous operating mode.

8.2.5 Flatness

The flatness correction function can adjust the RF output amplitude corresponding to the frequency point within the frequency range of the instrument to compensate for external losses introduced by cables or other equipment.

The flatness function mathematically adjusts the output by applying a user-defined list of level corrections, thereby adjusting the amplitude at specific frequencies. Correction is performed by

adding the correction value from the flatness correction list to the output level of the corresponding RF frequency. For frequencies not included in the list, the level correction is determined by linear interpolation of the nearest correction value.

After the flatness correction function is turned on, a blue "UF" icon will be displayed on the status bar of the user interface.

8.2.5.1 Create Flatness List

Press LEVEL > *Flatness* , or click *RF* module on the home page > *LEVEL* > *Flatness* , and then click to enter the flatness list editing page.

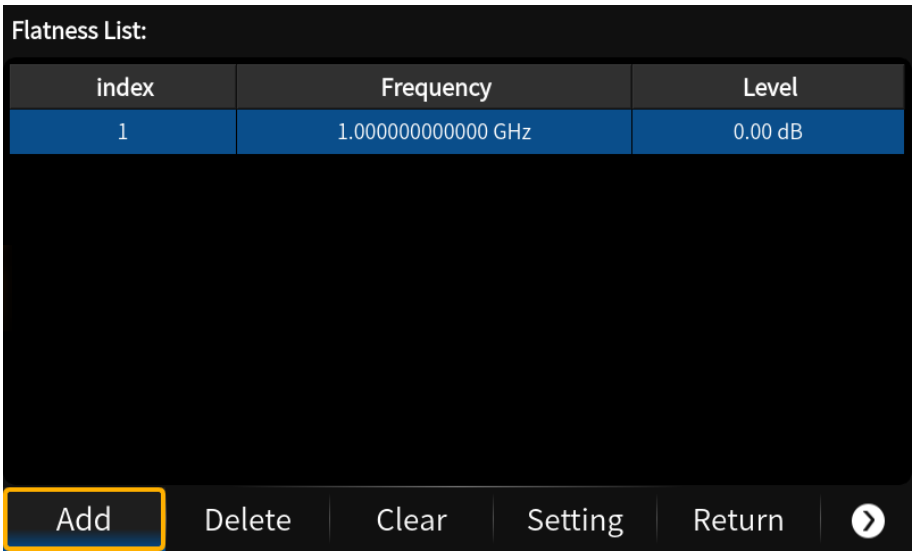


Figure 8-3 Flatness list editing page

The flatness list consists of index, correction frequency and level correction value, and is an empty list by default.

- Click *Add* to insert a row after the last row. The user needs to edit the frequency and level correction values.
- Click *Delete* to delete the currently selected row.
- Click *Clear* to restore the flatness list to empty.
- Click *Setting* to enter the flatness list automatic filling page. For details, please see "Auto Fill Flatness List".
- Click *Return* to return to the previous menu.
- Click > *Open* to select and load the flatness correction file (*.UFLT).

- Click ❯ > *Save* to save the current flatness list to a UFLT file.
- Each page of the user interface can display up to 25 lines of data. When the flatness list exceeds 25 rows of data, you can click ❯ > *First* / *Previous* / *Next* / *Last* to browse the list content.
- Click each frequency and correction value in the table area to set them through the touch screen keyboard or the front panel keypad.

Users need to pay attention to the following when editing the flatness list:

1. When there is a frequency offset, the frequency offset value needs to be added to the correction frequency.
2. The flatness list is automatically sorted from small to large according to the correction frequency.

8.2.5.2 Auto Fill Flatness List

After entering the flatness list setting page, you can choose one of the following three methods to automatically fill the flatness list with the power sensor.

1. Flatness List
   1) Firstly, set the correction frequency points in the flatness list editing page.
   2) Secondly, click the *Setting* button to enter the automatic filling flatness list page.
   3) Thirdly, select *Fill Type* as "Flatness List".
   4) Finally, click the *Fill Flatness With Sensor* button.

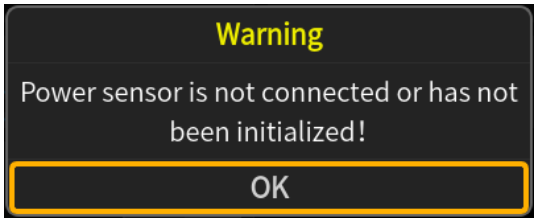
2. Manual Step
   1) Firstly, click the *Setting* button to enter the automatic filling flatness list page.
   2) Secondly, select *Fill Type* as "Manual Step".
   3) Thirdly, in the pop-up edit box, set the start frequency, stop frequency, frequency space mode and frequency step or number of points that need to be corrected.
   4) Finally, click the *Fill Flatness With Sensor* button.

3. Sweep List
   1) Firstly, set the sweep frequency in SWEEP > *List Sweep* .
   2) Secondly, select the flatness list *Fill Type* as "Sweep List".
   3) Finally, click the *Fill Flatness With Sensor* button.

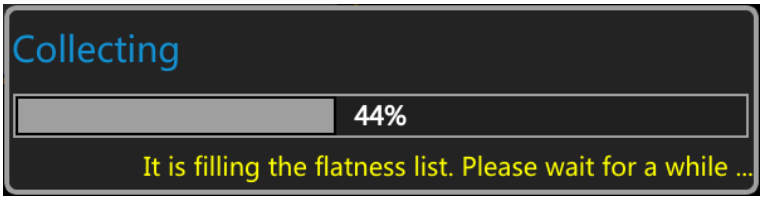
After clicking the *Fill Flatness With Sensor* button, the RF signal source will automatically generate the amplitude correction values of the flatness list.

NOTE:

- When use sweep list to populate the flatness list, the correction frequencies of the flatness list is consistent with the sweeping frequencies of the sweep list, and the correction frequencies of the flatness list will be automatically sorted from small to large.
- When using the auto-fill flatness list function, please connect the power meter correctly to the RF signal source. If a power meter is not connected or is not recognized, the flatness list will not automatically populate. Please pay attention to the pop-up message.



- When automatically filling the flatness list, there's no need for you to turn on the RF state or sensor state. Before or after "Fill Flatness With Sensor" executed, the RF state and sensor state will be turned on or turned off automatically.
- During the process of automatically filling the flatness list, the user interface will pop up the following prompt message. Do not move the power meter during this process.



8.3 Sweep

When the RF sweep function is enabled, the sweep signal will be output from the **[RF OUTPUT 50Ω]** connector on the front panel.

Please note that the RF sweep signal will be output only when the RF switch RF ON/OFF is on.

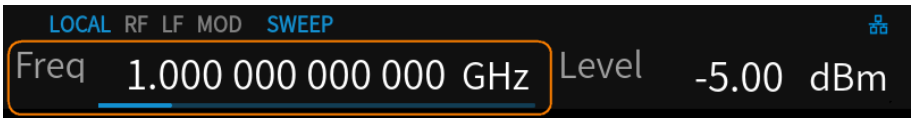
You can press the SWEEP button on the front panel to enter the RF sweep setting interface.

8.3.1 Sweep State

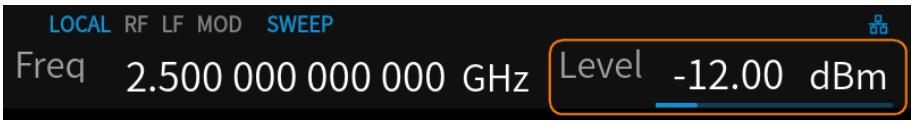
The sweep state is off by default. The RF signal generator offers three sweep types: Freq, Level, and Freq & Level. Select any one of the sweep types to enable RF sweeping. After the sweep function is enabled, a blue "SWEEP" icon will be displayed on the status bar of the user interface.

Clicking the drop-down box of the *Sweep State* to choose a sweep type:

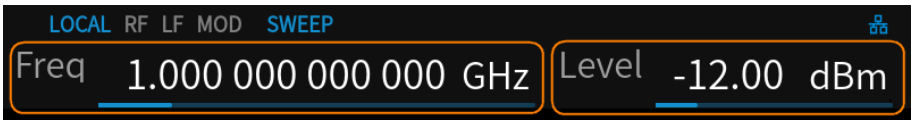
- Off: Default state. Turn off the sweep function.
- Freq: Enable frequency sweep. At this time, the display frequency refreshes the current sweeping frequency value in real time, and the current sweep progress can be observed on the frequency sweep progress bar.



- Level: Enable level sweep. At this time, the display level refreshes the current sweeping level value in real time, and the current sweep progress can be observed on the level sweep progress bar.



- Freq& Level: Enable both frequency and level sweep. At this time, the display frequency and display level refresh the current sweeping frequency and level values in real time, and the current sweep progress can be observed on the frequency and level sweep progress bar.



NOTE: Turning on RF sweep turns off the power control function of the power meter. If an RF sweeping is in progress, the power meter's power control function cannot be turned on.

8.3.2 Step Sweep

The step sweep is on by default. Click the slide  to switch the on-off state. Click  to enter the parameter setting menu of step sweep.

NOTE: The step sweep and list sweep are mutually exclusive. One will shut off automatically when the other is on.

Step sweep settings include the following parameters:

1) Start Freq: Initial frequency of the sweep.
2) Stop Freq: Final frequency of the sweep.
3) Start Level: Initial amplitude level of the sweep.
4) Stop Level: Final amplitude level of the sweep.
5) Dwell Time: The interval time between two adjacent sweep points.
6) Sweep Points: The number of points in a sweep. The frequency and level values of each sweep point are interpolated from the start and stop parameters.
7) Sweep Shape: The cycle mode of sweep, there are two types: "Sawtooth" and "Triangle", which can be selected by clicking the drop-down box.
   - Sawtooth: Sweep period is always from the start frequency or start level to the stop frequency or stop level. The sweep sequence is similar to a "sawtooth wave".
   - Triangle: Sweep period is always from the start frequency or start level to the stop frequency or stop level, and then return back to the start frequency or start level. The sweep sequence is similar to a "triangle wave".
8) Sweep Space: the change from one frequency to another within a frequency sweep step. Frequency sweep has two step types: linear and logarithmic, which can be selected by clicking the drop-down box.

   NOTE: Level sweep only supports linear steps and does not need setting.

8.3.3 List Sweep

The list sweep is off by default. Click the slide  to switch the on-off state. Click  to enter the editing page of list sweep.

NOTE: The list sweep and step sweep are mutually exclusive. One will shut off automatically when the other is on.

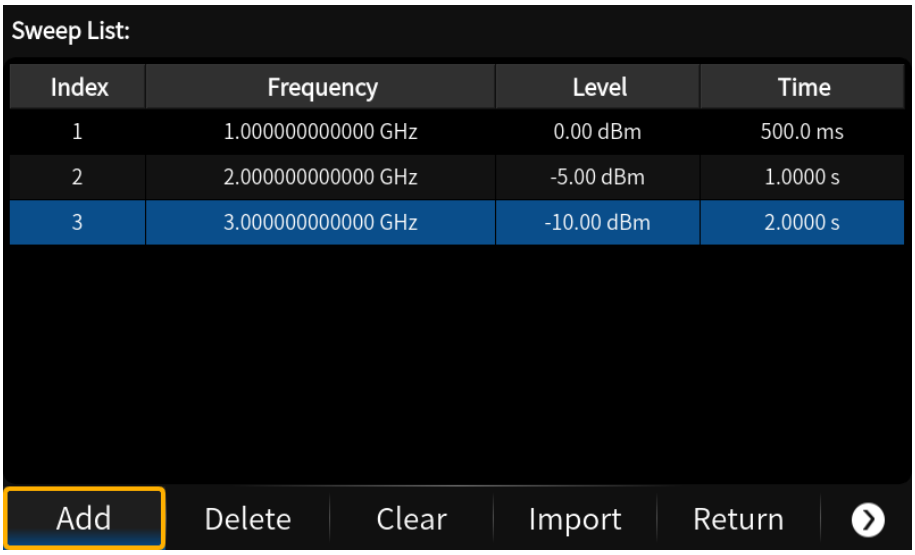


Figure 8-4 List sweep editing page

The sweep list includes index number, sweep frequency, sweep level and dwell time. The default value is "1,1.5 GHz,-110 dBm,50 ms".

- Click *Add* to insert a row before the currently selected row. The newly inserted row will copy the currently selected row.
- Click *Delete* to delete the currently selected row.
- Click *Clear* to restore the sweep list to the default value.
- Click *Import* to generate a sweep list based on the step sweep settings..
- Click *Return* to return to the previous menu.
- Click ❯ > *Open* to select and load the sweep list file (*.LSW).
- Click ❯ > *Save* to save the current sweep list to a LSW file.
- Each page of the user interface can display up to 25 lines of data. When the sweep list exceeds 25 rows of data, you can click ❯ > *First* / *Previous* / *Next* / *Last* to browse the list content.
- Click each frequency, level and dwell time parameter in the table area to set them through the touch screen keyboard or the front panel keypad.

Users need to pay attention when editing the sweep list: when there is a frequency offset/level offset, the offset value needs to be added to the sweep frequency/sweep level.

8.3.4 Sweep Direction

The sweep direction defaults to “Up”. The signal source provides two types: “Up” Or “Down”. Click the drop-down box of *Direction* to enable the corresponding sweep direction.

- Up: The signal source sweeps from the start frequency or start level to the stop frequency or stop level. The progress bar displayed in the parameter bar sweeps from left to right.
- Down: The signal source sweeps from the stop frequency or stop level to the start frequency or start level. The progress bar displayed in the parameter bar sweeps from right to left.

8.3.5 Sweep Mode

The sweep mode defaults to “Continuous”. The signal source provides two sweep modes: “Continuous” or “Single”. Click the drop-down box of *Sweep Mode* to enable the desired mode.

- Continuous: When the trigger conditions are met, the signal source sweeps continuously according to the current settings.
- Single: When the trigger conditions are met, each time you click the *Execute single sweep* button, the signal source will sweep for a cycle with the current settings, and then stop.

Please note that the *Execute single sweep* button will only be displayed when the sweep mode is "Single" and hidden otherwise.

8.3.6 Trigger Mode

The trigger mode defaults to “Auto”. The signal source provides four types of trigger mode: “Auto”, “Key”, “Bus” and “Ext”.

Click the drop-down box of *Trigger Mode* to select the desired type:

Auto

- If the sweep mode is "Continuous", after selecting any sweep state, the signal source starts sweeping continuously.
- If the sweep mode is "Single", after selecting any sweep state, you need to click the *Execute single sweep* button to start sweeping. The sweep stops after completing one cycle.

Key

- If the sweep mode is “Continuous”, the device will start a one-time sweep after you pressed the Trigger button on the front panel or click the *Click to trigger* button on the touch screen.
- If the sweep mode is “Single”, first click the *Execute single sweep* button, and then a one-

time sweep will be started after you pressed the Trigger button on the front panel or click the *Click to trigger* button on the touch screen.

Bus

- If the sweep mode is “Continuous”, the device will start a one-time sweep after receiving a “*TRG” command from the control computer via the communication bus (USB, LAN or GPIB).
- If the sweep mode is “Single”, first click the *Execute single sweep* button, and then a one-time sweep will be started after the device received a “*TRG” command.

Ext

The device receives the external trigger signal input from the **[TRIG IN/OUT]** connector on the rear panel.

- If the sweep mode is “Continuous”, the device will start a one-time sweep every time it receives a TTL pulse of specified polarity.
- If the sweep mode is “Single”, first click the *Execute single sweep* button, and then the device will start a one-time sweep every time it receives a TTL pulse of specified polarity.

Please note that the above description of the sweep trigger mode is based on the point trigger mode being "Auto" mode.

8.3.7 Point Trigger

The point trigger mode defaults to “Auto”. The signal source provides four types of point trigger mode: “Auto”, “Key”, “Bus” and “Ext”.

Click the drop-down box of *Point Trigger* to select the desired type:

Auto

- If the sweep mode is “Continuous”, just select one sweep state to start sweeping each point continuously within one sweep cycle.
- If the sweep mode is “Single”, click *Execute single sweep* button to start sweeping each point within one sweep cycle.

Key

- If the sweep mode is “Continuous”, the device will sweep one point each time the Trigger button on the front panel is pressed or the *Click to trigger* button on the touch screen is

clicked.

- If the sweep mode is “Single”, first click the *Execute single sweep* button, then each time you press the Trigger button or click the *Click to trigger* button the device will sweep one point. The sweep stops after completing one cycle.

Bus

- If the sweep mode is “Continuous”, the device will sweep one point each time it receives a “*TRG” command.
- If the sweep mode is “Single”, first click the *Execute single sweep* button, then the device will sweep one point each time it receives a “*TRG” command. The sweep stops after completing one cycle.

Ext

The device receives the external trigger signal input from the **[TRIG IN/OUT]** connector on the rear panel.

- If the sweep mode is “Continuous”, the device will sweep one point each time it receives a TTL pulse of specified polarity.
- If the sweep mode is “Single”, first click the *Execute single sweep* button, then the device will sweep one point each time it receives a TTL pulse of specified polarity. The sweep stops after completing one cycle.

Please note that the above description of the point trigger mode is based on the sweep trigger mode being "Auto" mode.

8.3.8 Trigger Slope

When the trigger mode or point trigger mode is “Ext”, you can select “Positive” or “Negative” as the external trigger slope. The default trigger slope is “Positive”.

Click the drop-down box to select the desired trigger slope:

- Positive: The sweep is triggered when the rising edge of the external trigger signal arrives.
- Negative: The sweep is triggered when the falling edge of the external trigger signal arrives.

Please note that the *Trigger Slope* button will be displayed only when the trigger mode or point trigger mode is “Ext”, and will be hidden in other cases.

8.3.9 About Sweep Conditions

When performing a sweep operation, the priorities that need to satisfy the sweep conditions from high to low are:

Sweep mode > Trigger mode > Point trigger mode.

For example, when "Key" is selected for both trigger mode and point trigger mode:

- In "Continuous" sweep mode, press the Trigger button first to meet the trigger condition, and then press the Trigger button again to meet the point trigger condition. At this time the signal source will start sweeping.
- In "Single" sweep mode, press the *Execute single sweep* button first to meet the single sweep condition. Then press the Trigger button two times to meet the trigger condition and point trigger condition. At this time the signal source will start sweeping. The sweep stops after completing one cycle.

8.4 Analog Modulation

Analog modulation includes amplitude modulation, frequency modulation, phase modulation and pulse modulation.

You need to turn on the analog modulation master switch to enable the analog modulation function. You can turn it on by pressing the MOD ON/OFF button on the front panel, or through the *ANALOG MOD* module switch on the home page, as shown in the figure below. After turning on the analog modulation master switch, a blue "MOD" icon will be displayed on the status bar of the user interface.

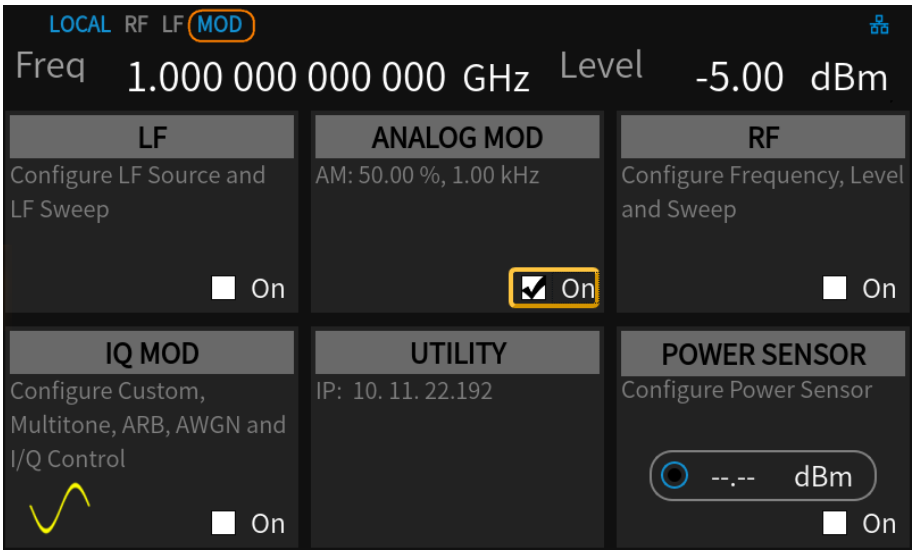


Figure 8-5 Analog modulation master switch

8.4.1 Amplitude Modulation (AM)

Amplitude Modulation (AM) is a technique that modulates the original signal by changing the amplitude of the carrier signal. When the amplitude of the original signal changes, the amplitude of the carrier signal also changes linearly, thus superimposing the characteristics of the original signal on the carrier signal.

You can click *ANALOG MOD* module > *AM* on the homepage to enter the AM page, or you can press the MODE button several times until you switch to the AM page.

8.4.1.1 AM State

Press *AM State* to turn on or off the amplitude modulation.

8.4.1.2 AM Source

Internal and/or external source can be selected for amplitude modulation. Press *AM Source* to set the amplitude modulation source to “Int”, “Ext” or “Int + Ext”. The default is “Int”.

1. Int

The internal modulation source is generated inside the instrument and is shared with the low frequency generator (LF). When internal source modulation is on, the LF output will be off. When the LF output is on, internal source modulation will be off.

2. Ext

External modulation source is the external modulation signal input by the **[EXT MOD INPUT]** connector on the rear panel of the RF signal source. The modulated signal can be an arbitrary waveform. At this time, the modulation depth is controlled by the level of the external modulation signal.

3. Int + Ext

After selecting "Int + Ext", the modulation signal is synthesized from internal and external modulation sources, which can realize two-tone amplitude modulation.

8.4.1.3 AM Shape

The internal source of amplitude modulation supports two modulation waveforms: sine and square. After setting the AM source to "Int" or "Int + Ext", you can press *AM Shape* to choose the AM waveform of internal source to be "Sine" or "Square".

8.4.1.4 AM Rate

After setting the AM modulation source to "Int" or "Int + Ext", you can press *AM Rate* to set the modulation frequency of the internal source.

- The modulation frequency range of sine wave is 0.01 Hz~100 kHz.
- The modulation frequency range of square wave is 0.01 Hz~20 kHz.

8.4.1.5 AM Depth

Modulation depth represents the degree to which the carrier amplitude changes, expressed as a percentage.

- When selecting internal modulation source, the setting range of AM modulation depth is 0.0%~100%. The relationship between the modulation depth *m* and the carrier sideband amplitude difference *ΔP* satisfies the relationship:

$$\Delta P = 6.02 - 20 * \lg m$$

- When selecting external modulation source, the actual modulation depth is related to the amplitude of the external input modulation signal, that is:

  Modulation depth = amplitude of the external input signal × external modulation sensitivity

  For example, if the modulation depth is set to 100%, then the actual modulation depth is 100% when the external modulation signal is 2 Vpp (0 V offset), and when the external modulation signal is 1 Vpp (0 V offset), the actual modulation depth is 50%.

- When selecting internal + external modulation source, the setting value is the total modulation depth, with the internal source accounting for 50% and the external source accounting for 50%. The modulation depth of the external source is related to the amplitude of the external input modulation signal, that is:

  Modulation depth = setting value × 0.5 + amplitude of external input signal × external modulation sensitivity

  For example, if the modulation depth is set to 100%, the modulation depth allocated to the internal source and the external source will be 50% each. Since the external modulation sensitivity is 25%/V, the actual modulation depth is 100% when the external modulation signal is 2 Vpp (0 V offset), and the actual modulation depth is 75% when the external modulation signal is 1 Vpp (0 V offset).

8.4.1.6 AM Sensitivity

It displays the unit depth quantified by the amplitude of the external modulation signal.

8.4.2 Frequency Modulation (FM)

Frequency Modulation (FM) is a technology that modulates the original signal by changing the frequency of the carrier signal. The frequency changes of the original signal are converted into frequency changes of the carrier signal, thereby carrying the characteristics of the original signal on the carrier signal.

You can click *ANALOG MOD* module > *FM* on the homepage to enter the FM page, or you can

press the MODE button several times until you switch to the FM page.

8.4.2.1 FM State

Press *FM State* to turn on or off the frequency modulation.

8.4.2.2 FM Source

Internal1, internal2 and/or external source can be selected for frequency modulation. Press *FM Source* to set the frequency modulation source to “Int1”, “Int2”, “Int1 + Int2”, “Ext”, “Int1 + Ext” or “Dual”. The default is “Int1”.

1. Int

When "Int1", "Int2", "Int1 + Int2" or "Dual" is selected, the modulation source is completely generated within the instrument and is collectively referred to as "Internal Source". There are two internal sources to choose from, Internal Source 1 and Internal Source 2. Parameters such as waveform, frequency deviation and modulation rate of the two internal sources can be set independently.

When "Int1 + Int2" is selected, two internal modulation sources are used for dual-tone modulation.

When "Dual" is selected, the waveforms of the two internal sources are superimposed and then modulated as a new modulation signal.

2. Ext

External modulation source is the external modulation signal input by the **[EXT MOD INPUT]** connector on the rear panel of the RF signal source. The modulated signal can be an arbitrary waveform.

3. Int + Ext

After selecting "Int1 + Ext", the modulation signal is superposed by internal source 1 and external source. In this way, two-tone modulation or more complex modulation can be achieved.

8.4.2.3 FM Shape

The internal source of frequency modulation supports four modulation waveforms: “Sine”, “Square”, “Sawtooth” or “Triangle”.

8.4.2.4 FM Rate

After setting the FM source to internal or internal + external, you can set the modulation frequency of internal source 1 through *FM Rate 1*, and set the modulation frequency of internal source 2 through *FM Rate 2*.

- The modulation frequency range of sine wave is 0.01 Hz ~ 100 kHz.
- The modulation frequency range of square wave, sawtooth wave or triangle wave is 0.01 Hz ~ 20 kHz.

8.4.2.5 FM Deviation

Corresponding to different carrier frequencies, the frequency deviation range may be different. The setting range is 0.01 Hz ~ N×1 MHz. The value of N is related to the carrier frequency. Please refer to the data sheet for details.

- When the modulation source is set to “Int1” or “Int2” or “Dual”, the setting value is the frequency deviation of the RF output.

- When the modulation source is set to “Int1 + Int2”, the frequency deviation is related to the frequency deviation set by the two modulation sources respectively. The frequency deviation of the RF output = frequency deviation 1 + frequency deviation 2. "frequency deviation 1" and "frequency deviation 2" correspond to the frequency deviation setting values of "internal source 1" and "internal source 2" respectively.

- When the modulation source is set to “Ext”, the actual frequency deviation is related to the amplitude of the external input modulation signal, that is:

  Frequency deviation of RF output = amplitude of external input signal × external modulation sensitivity

  For example, if the maximum frequency deviation is set to 100 kHz, then the actual frequency deviation is 100 kHz when the external modulation signal is 2 Vpp (0 V offset), and when the external modulation signal is 1 Vpp (0 V offset), the actual frequency offset is 50 kHz.

- When the modulation source is set to "Int1+Ext", the setting value is the maximum value of the total frequency deviation, with the internal source accounting for 50% and the external source accounting for 50%. The external source modulation frequency deviation is related to the amplitude of the external input modulation signal, that is:

  Frequency deviation of RF output = setting value × 0.5 + external input signal amplitude × external modulation sensitivity

  For example, if the maximum frequency deviation is set to 100 kHz, the frequency deviation

allocated to the internal source and the external source is 50% each. Since the external modulation sensitivity is 25 kHz/V, when the external modulation signal is a full-scale 2 Vpp (0 V offset), the actual modulation frequency offset is 100 kHz, and when the external modulation signal is 1 Vpp (0 V offset), the actual modulation frequency offset is 75 kHz.

8.4.2.6 FM Sensitivity

External modulation sensitivity displays the unit frequency deviation quantized by the amplitude of the external modulation signal.

8.4.2.7 FM Phase

When the modulation source selects “Int1 + Int2” or "Dual", set the initial phase of the waveform signal generated by Internal source1 or Internal source2. Different phase settings will affect the final Modulation results.

The setting range of FM phase is -360° ~ +360°.

8.4.2.8 FM Proportion

When "Dual" is selected as the modulation source, set the respective amplitude ratios of the waveform signals of internal source 1 and internal source 2 during the superposition process, that is:

The amplitude of the superimposed waveform = setting value × waveform amplitude of internal source 1 + (100% - setting value) × waveform amplitude of internal source 2.

For example, when the setting value is 30%, 30% of the amplitude value of internal source 1 and 70% of the amplitude value of internal source 2 are used for superposition.

The setting range of FM Proportion is 0% ~ 100%.

8.4.3 Phase Modulation (PM)

Phase Modulation (PM) is a technology that modulates the original signal by changing the phase of the carrier signal. The phase change of the original signal is converted into the phase change of the carrier signal, thereby transmitting the information of the original signal on the carrier signal.

You can click *ANALOG MOD* module > *PM* on the homepage to enter the PM page, or you can press the MODE button several times until you switch to the PM page.

8.4.3.1 PM State

Press *PM State* to turn on or off the phase modulation.

8.4.3.2 PM Source

Internal and/or external source can be selected for phase modulation. Press *PM Source* to set the phase modulation source to “Int”, “Ext” or “Int + Ext”. The default is “Int”.

1. **Int**

The internal modulation source is generated inside the instrument, and the modulation frequency can be set and the modulation waveform can be selected.

2. **Ext**

External modulation source is the external modulation signal input by the **[EXT MOD INPUT]** connector on the rear panel of the RF signal source. The modulated signal can be an arbitrary waveform.

3. **Int + Ext**

After selecting "Int + Ext", the modulation signal is synthesized from internal and external modulation sources, which can realize two-tone phase modulation.

8.4.3.3 PM Shape

The internal source of PM supports two modulation waveforms: sine and square. After setting the PM source to "Int" or "Int + Ext", you can press *PM Shape* to choose the PM waveform of internal source to be "Sine" or "Square".

8.4.3.4 PM Rate

After setting the PM modulation source to "Int" or "Int + Ext", you can press *PM Rate* to set the modulation frequency of the internal source.

- The modulation frequency range of sine wave is 0.01 Hz~100 kHz.
- The modulation frequency range of square wave is 0.01 Hz~20 kHz.

8.4.3.5 PM Deviation

Different carrier frequencies have different phase deviation ranges. The setting range is 0.01 rad~N×5 rad. The value of N is related to the carrier frequency. Please refer to the data sheet for details.

- When the modulation source is internal, the setting value is the maximum phase deviation of the RF output.

- When the modulation source is external, the actual maximum phase deviation is related to the amplitude of the external input modulation signal, that is:

  Phase deviation of RF output = amplitude of external input signal × external modulation sensitivity

  For example, if the maximum phase deviation is set to 1 rad, then the actual maximum phase deviation is 1 rad when the external modulation signal is 2 Vpp (0 V offset), and when the external modulation signal is 1 Vpp (0 V offset), the actual maximum phase deviation is 0.5 rad.

- When the modulation source is external + internal, the setting value is the maximum value of the total phase deviation, with the internal source accounting for 50% and the external source accounting for 50%. The external source modulation phase deviation is related to the amplitude of the external input modulation signal, that is:

  Phase deviation of RF output = setting value × 0.5 + amplitude of external input signal × external modulation sensitivity

  For example, if the maximum phase deviation is set to 1 rad, the phase deviation allocated to the internal source and the external source is 50% each. Since the external modulation sensitivity is 0.25 rad/V, the actual maximum phase offset is 1 rad when the external modulation signal is 2 Vpp (0 V offset), and the actual maximum phase offset is 0.75 rad when the external modulation signal is 1 Vpp (0 V offset).

8.4.3.6 PM Sensitivity

It shows the unit phase deviation quantified by the amplitude of the external modulation signal.

8.4.4 Pulse Modulation (PULSE)

Pulse Modulation refers to the process of using pulse signals as modulation signals to modulate radio frequency carrier signals.

You can click *ANALOG MOD* module > *PULSE* on the homepage to enter the pulse modulation page, or you can press the MODE button several times until you switch to the pulse modulation page.

8.4.4.1 Pulse State

Press *Pulse State* to turn pulse modulation on or off.

8.4.4.2 Pulse Source

Press *Pulse Source* to select “Int” or “Ext” modulation source. The default is “Int”.

1. **Int**

The internal pulse generator of the RF signal source provides the modulation source. You can set the pulse mode, pulse period, pulse width and other parameters of the modulation source.

2. **Ext**

The RF signal source receives the external pulse signal input from the **[PULSE IN/OUT]** connector on the rear panel as the modulation source. At this time, the setting items such as pulse mode, pulse period, pulse width, trigger mode and pulse output are hidden.

8.4.4.3 Ext Polarity

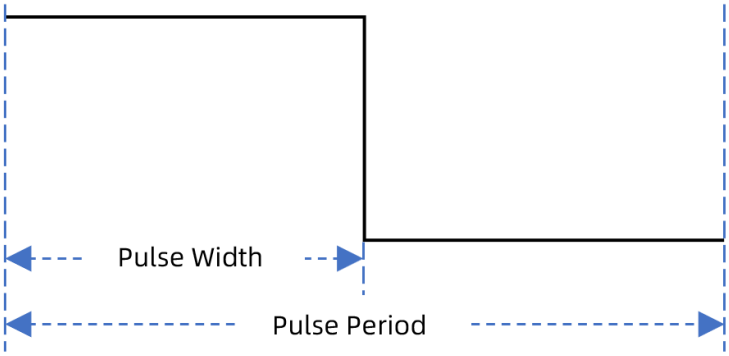
When the pulse source is external, click *Ext Polarity* to switch the trigger polarity of the external modulation source. The default is "Normal".

- Normal: Pulse modulation is performed when the external modulation signal is high level.
- Inverse: Pulse modulation is performed when the external modulation signal is low level.

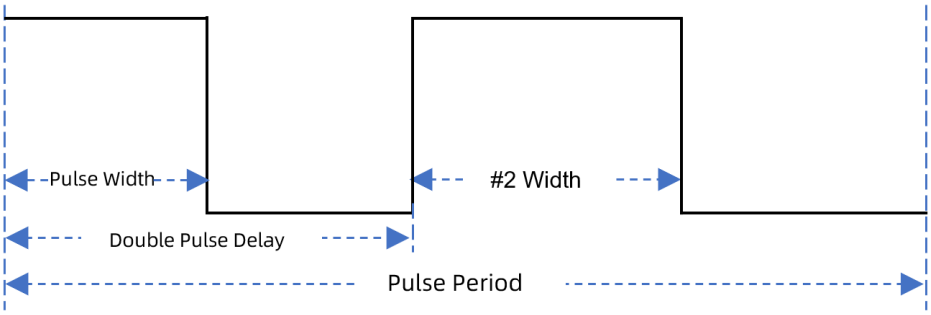
8.4.4.4 Pulse Mode

When the modulation source is “Int”, the RF signal source provides three pulse modes: “Single”, “Double” and “Train”. The default is “Single”. Click the drop-down box to select the pulse mode.

- Single: Generate one pulse signal in one pulse period. At this time, the two settings “Double Pulse Delay” and “#2 Width” are hidden.



- Double: Generate two pulse signals in one pulse period. At this time, the two settings “Double Pulse Delay” and “#2 Width” are shown.



- Train: Generate multiple pulse signals in one pulse period. At this time, the *Pulse Train* setting item appears, and the settings “Pulse Period”, “Pulse Width”, “Double Pulse Delay” and “#2 Width” are hidden. For a detailed introduction to pulse train, please see the "Pulse Train" chapter.

8.4.4.5 Pulse Period

Pulse period represents the time interval between two adjacent periodic pulses. When the pulse mode is single pulse or double pulse, the pulse period needs to be set.

8.4.4.6 Pulse Width

Pulse width represents the high-level duration of a single-pulse modulation signal, or the high-level duration of the first pulse of a double-pulse modulation signal.

8.4.4.7 Double Pulse Delay

Double-pulse delay represents the delay from the start of the first pulse to the start of the second

pulse in a single cycle of a double-pulse modulation signal.

8.4.4.8 #2 Width

#2 Pulse Width represents the high duration of the second pulse within a single cycle in a double pulse modulation signal.

8.4.4.9 Pulse Train

When the *Pulse Mode* is set to Train, the *Pulse Train* setting item appears, and the settings "Pulse Period", "Pulse Width", "Double Pulse Delay" and "#2 Width" are hidden.

8.4.4.9.1 The Settings of Pulse Train

Click the setting button of *Pulse Train* to enter the pulse train editing interface.

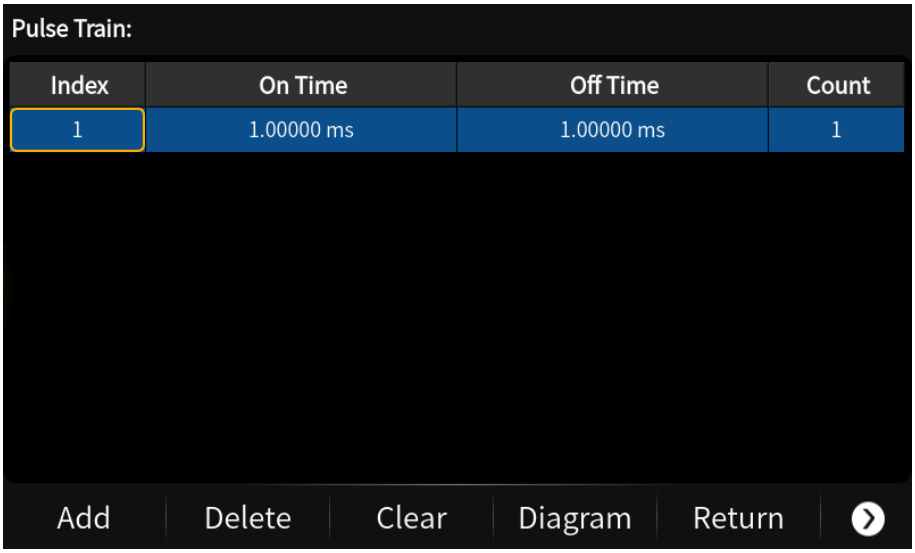


Figure 8-6 Pulse train editing page

Each row of parameters of the pulse train represents the settings of each pulse signal within a single pulse period:

- Index indicates the sequence number of the pulse signal corresponding to the row.
- On time indicates the duration of the high level of the pulse signal.
- Off time indicates the duration of the low level of the pulse signal.
- Count indicates the number of repetitions of the pulse signal.

The default value is "1,1 ms,1 ms,1".

- Click *Add* to insert a row before the currently selected row. The newly inserted row will copy the currently selected row.
- Click *Delete* to delete the currently selected row.
- Click *Clear* to restore the pulse train to the default value.
- Click *Diagram* to view the diagram of the current pulse train.
- Click *Return* to return to the previous menu.
- Click > *Open* to select and load the pulse train file (*.PULSTRN).
- Click > *Save* to save the current pulse train to a PULSTRN file.
- Each page of the user interface can display up to 25 lines of data. When the pulse train exceeds 25 rows of data, you can click > *First* / *Previous* / *Next* / *Last* to browse the list content.
- Click each parameter in the table area to set them through the touch screen keyboard or the front panel keypad.

8.4.4.9.2 Pulse Train Diagram

Click the *Diagram* button in the pulse train editing interface to to view the diagram of the current pulse train.

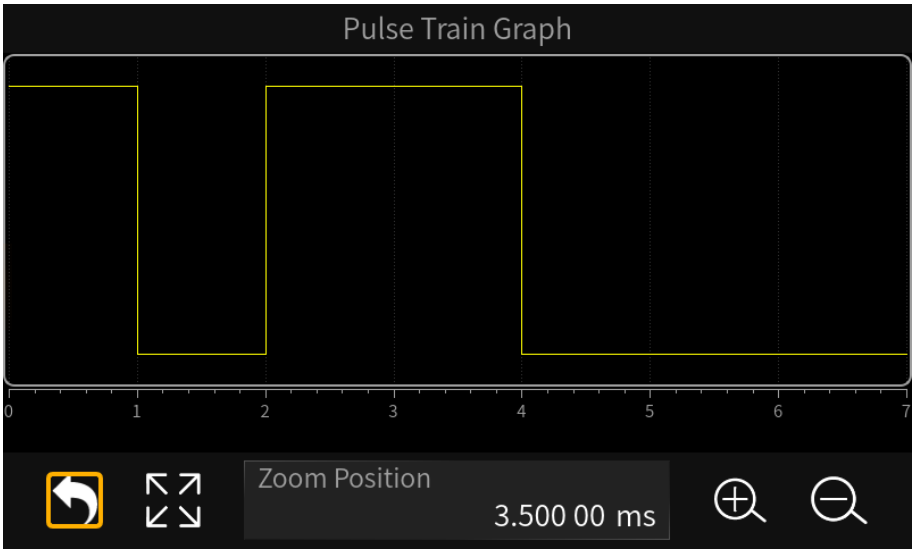


Figure 8-7 Pulse train graph page

As shown in the figure above, the page consists of the upper drawing area and the lower control area:

Drawing area

A schematic diagram of the waveform generated based on the current pulse train. The vertical direction represents the high and low level changes of each pulse signal in the pulse train, and the

position of the high and low levels in this direction remains unchanged; the horizontal direction represents the high and low level duration of each pulse signal in the pulse train, which can be enlarged or reduced for easy observation and comparison.

Control area

- Click  to return to the pulse train editting page.
- Click  to restore the waveform to the initial state.
- The “Zoom Position” parameter control displays the center position of the current waveform, and the operations of zoom in, zoom out and restore buttons are based on this position. It can be set through the touch screen keyboard or the front panel keypad to make the current waveform translate to the corresponding position.
- Click  to zoom in the center position of the current waveform.
- Click  to zoom out the center position of the current waveform.

The zoom operation of the drawing area can be achieved in the following ways:

1) Zoom, pan and restore through the Control Area’s  ,  ,  button, and “Zoom Position” parameter.
2) You can also use your finger or stylus to zoom in or zoom out directly on the touch screen.
3) On the touch screen, use the mouse wheel. Pull the wheel down to zoom in and up to zoom out. The zoom position of the wheel is consistent with the "zoom position" of the control area.

8.4.4.10 Pulse Out

The default state is off. Click the sliding switch to switch the pulse output state.

When the pulse output is turned on, the RF signal source will output the pulse signal generated by the internal pulse generator from the **[PULSE IN/OUT]** connector on the rear panel.

NOTE: When the pulse source is External, the pulse output state will be automatically turned off.

8.4.4.11 Pulse Out Polarity

Click *Pulse Out Polarity* to switch the polarity of the pulse signal output from the **[PULSE IN/OUT]** connector on the rear panel. The default is "Normal".

- Normal: Output positive polarity pulse signal.
- Inverse: Output negative polarity pulse signal.

8.4.4.12 Trigger Out

The default state is off. Click the sliding switch to switch the trigger output status.

When the trigger output is turned on, the RF signal source will output the trigger signal generated by the internal pulse generator from the **[TRIG IN/OUT]** connector on the rear panel.

NOTE: When the trigger mode is "Ext Trig" or "Ext Gate", the trigger output function will be automatically turned off. When the trigger mode of RF SWEEP or LF SWEEP is set to external, the trigger output function will also be automatically turned off.

8.4.4.13 Pulse Trigger

The trigger mode defaults to "Auto". The RF signal source offers five pulse trigger types: "Auto", "Key", "Bus", "Ext Trig" and "Ext Gate".

Click the drop-down box corresponding to the trigger mode to select the desired type.

- Auto: The signal source satisfies the trigger condition at any time.
- Key: When the trigger mode is selected as "key", the user interface will display the *Click to trigger* button. Each time you press the Trigger key or the *Click to trigger* button on the user interface, the RF signal source will start a pulse modulation.
- Bus: Each time the SCPI command "*TRG" is received, the RF signal source will start a pulse modulation.
- Ext Trig: When the trigger mode is selected as "Ext Trig", the user interface will display the "Trig Slope" button. At this time, the RF signal source receives the trigger signal input from the **[PULSE IN/OUT]** connector on the rear panel. Each time a TTL pulse signal of specified polarity is received, the RF signal source starts a pulse modulation.
- Ext Gate: When the trigger mode is selected as "Ext Gate", the user interface will display the "Trig Polarity" button. At this time, the RF signal source receives the trigger signal input from the **[PULSE IN/OUT]** connector on the rear panel. Each time a TTL pulse signal of specified polarity is received, the RF signal source starts pulse modulation within its effective level.

8.4.4.14 Trigger Delay

The trigger delay represents the delay of the pulse modulated signal from the reception of the external trigger signal to the start of the first pulse modulation. When the trigger mode is "Ext Trig", the user interface will display the *Trigger Delay* setting item.

8.4.4.15 Trigger Slope

The default is “Positive”. Click the drop-down box to switch the trigger slope.

- Positive: Trigger a pulse when the positive slope of the external trigger signal arrives.
- Negative: Trigger a pulse when the negative slope of the external trigger signal arrives.

When the trigger mode is "Ext Trig", the user interface will display the *Trigger Slope* setting item.

8.4.4.16 Trigger Polarity

The default is “Normal”. Click the drop-down box to switch the trigger polarity.

- Normal: Trigger pulse modulation during the high-level effective time of the external gate signal.
- Inverse: Trigger pulse modulation during the low-level effective time of the external gate signal.

When the trigger mode is "Ext Gate", the user interface will display the *Trigger Polarity* setting item.

8.5 LF

8.5.1 LF Source

The RF signal source has a built-in low-frequency signal generator, which can be used as a low-frequency signal output or an internal source for analog modulation. When used as a low-frequency signal output, LF supports several commonly used waveforms, and the frequency and amplitude of the low-frequency signal can be set.

Press the LF key on the front panel, select *LF Source* in the menu, or click *LF* Module > *LF Source* on the home page to enter the LF parameter setting interface.

8.5.1.1 LF State

Press *LF State* to turn LF output on or off.

8.5.1.2 LF Shape

Press *LF Shape* to select the waveform of the LF output signal. The supported waveforms are "Sine", "Square", "Sawtooth", "Triangle" and "DC". The default is "Sine".

8.5.1.3 LF Frequency

Press *LF Frequency* to set the frequency of the LF output signal.

- When the waveform is "Sine", the LF frequency setting range is 0.01 Hz ~ 1 MHz.
- When the waveform is "Square", "Sawtooth" or "Triangle", the LF frequency setting range is 0.01 Hz ~ 20 kHz.

8.5.1.4 LF Level

Press *LF Level* to set the LF output amplitude. The setting range is 1 mVpp ~ 3 Vpp. Multiple unit format settings are supported.

8.5.1.5 LF Level Offset

Press *LF Level Offset* to set the amplitude offset of the LF output. The setting range is

$$|LF\ \ Level\ \ Offset| \leq \min(2.5 - \frac{1}{2}LEVEL, 2\ \ V)$$

8.5.1.6 LF Phase

Press *LF Phase* to set the LF phase. The setting range is -360° ~ 360°, and it supports setting in degrees or radians.

8.5.2 LF Sweep

The RF signal source supports outputting LF waveforms that gradually change from the start frequency to the end frequency within a specified time, that is, LF output supports frequency sweeping.

Press the LF key on the front panel, select *LF Sweep* in the menu, or click *LF* Module > *LF Sweep* on the home page to enter the LF Sweep parameter setting interface.

8.5.2.1 Sweep State

Press *Sweep State* to activate the LF frequency sweep signal generation.

8.5.2.2 Start Freq

Press *Start Freq* to set the start frequency of LF frequency sweep.

8.5.2.3 Stop Freq

Press *Stop Freq* to set the stop frequency of LF frequency sweep.

8.5.2.4 Center Freq

Press *Center Freq* to set the center frequency of LF frequency sweep.

8.5.2.5 Freq Span

Press *Freq Span* to set the frequency Span of LF frequency sweep.

8.5.2.6 Sweep Time

Press *Sweep Time* to set the duration of one LF sweep.

8.5.2.7 Direction

Press *Direction* to set the frequency direction of LF sweep to up or down.

- Up: Scan from the start frequency to the end frequency.
- Down: Scan from the end frequency to the start frequency.

8.5.2.8 Trigger Mode

The default LF trigger mode is "Auto". The RF signal generator provides four trigger types: "Auto", "Key", "Bus" and "Ext".

Click the drop-down box of *Trigger Mode* to select the desired type.

1. **Auto**

Generate a continuously repeating sweep signal immediately after activating the sweep mode.

2. **Key**

Each time the Trigger key on the front panel is pressed or the *Click to Trigger* button on the touch screen is clicked, the signal generator starts a sweep.

3. **Bus**

Each time the "*TRG" command is sent, the signal generator starts a sweep.

4. **Ext**

The signal generator receives the external trigger signal input from the **[TRIG IN/OUT]** connector on the rear panel of the instrument. Each time a TTL pulse signal of a specified polarity is received, the signal generator starts a sweep.

NOTE: If the trigger mode is changed during the LF sweep, the signal generator will stop sweeping and return to the initial state until the next trigger event starts.

8.5.2.9 Trigger Slope

When the trigger mode is external, you can select the type of *Trigger Slope* to determine whether the sweep is triggered by the "Positive" or "Negative" of the external trigger signal. The default trigger edge is "Positive".

Click the drop-down box to start the corresponding trigger edge setting:

- Positive: When the rising edge of the external trigger signal arrives, the sweep is triggered.
- Negative: When the falling edge of the external trigger signal arrives, the sweep is triggered.

Please note that the *Trigger Slope* button will only be displayed when the trigger mode is "Ext", and it is hidden in other cases.

8.5.2.10 Sweep Shape

Press *Sweep Shape* to select the cyclic mode of LF sweep. There are two types: "Sawtooth" and "Triangle", and the default value is "Sawtooth".

- Sawtooth: Sweep period is always from the start frequency or start level to the stop frequency or stop level. The sweep sequence is similar to a "sawtooth wave".
- Triangle: Sweep period is always from the start frequency or start level to the stop frequency or stop level, and then return back to the start frequency or start level. The sweep sequence is similar to a "triangle wave".

8.5.2.11 Sweep Space

Press *Sweep Space* to select the mode for the calculation of the frequency sweep intervals.

- Linear: Take the frequency value entered as an absolute value in Hz.
- Log: Takes the value entered as a logarithmic value that means as a constant fraction of current frequency in %.

8.6 Power Sensor

The RF signal source can be connected to a USB power sensor through the USB Host interface. The power meter models currently supported by the RF signal source are shown in the following table:

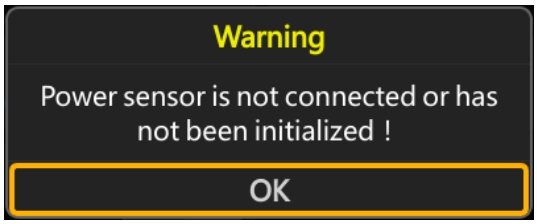
Table 8-1 Power sensor model supported

Manufacturer	Model
R&S	NRP6A, NRP18A
	NRP8S, NRP18S, NRP33S, NRP40S, NRP50S, NRP67S
	NRP40T
Keysight	U2000A, U2001A, U2002A, U2004A
	U2000B, U2001B
	U2000H, U2001H, U2002H

8.6.1 Parameter Settings

Click the *POWER SENSOR* module on the home page to enter the power meter parameter setting interface.

Please note that when the power sensor is not connected or initialized, you cannot set any parameters for the power sensor measurement. At this time, the user interface will pop up the following prompt:



8.6.1.1 Sensor Info

Displays the model information of the connected power sensor. If the power sensor is not connected or initialized, the power sensor information is blank.

8.6.1.2 Sensor State

Turn on or off the level measurement by the power sensor. The default is "off".

After turning on the power sensor measurement function, the measurement control refreshes the power sensor measurement value in real time.

8.6.1.3 Measurement

Display the current reading of the sensor.

You can select the unit used for result display: dBm, dBμV, uV, mV, V, nW, uW, mW, W.

8.6.1.4 Level Control

With the Level Control function, you can achieve very stable and accurate RF power your DUT. With the aid of a downstream control circuit, a CLPC (Closed Loop Power Control), you can detect frequency response characteristics of the components: such as losses due to cables, modules or components and compensate these effects accordingly.

For details, please refer to the introduction of the "8.6.2 Level Control" section.

8.6.1.5 Statistics

The Statistics function is disabled by default. When enabled, the statistics of the power sensor measurements will be displayed.

- On: Turn on the statistics function. The statistical parameters will be displayed next to the statistics switch. The statistical parameters include the average value, minimum value, maximum value and statistical times. Click the  button to clear all current statistical values and start a new round of statistics.
- Off: Turn off the statistics function. The statistical parameters will be automatically hidden.

8.6.1.6 Auto Zero

The power sensor zero adjustment function can reduce the impact of noise and zero deviation on the measurement results and improve the accuracy of RF power measurement.

Zero adjustment is disabled by default. Click the drop-down box to switch the zero adjustment type.

- Disabled: The zero buttons will be hidden.
- INT: Zero button is displayed.
- EXT: Zero button is displayed.

Click the “Click to perform zeroing” button and the power sensor will start the zero adjustment operation. At this time, the button name will change to "Zero Adjustment...". After the zero adjustment is completed, the button name will return to " Click to perform zeroing".

Please note when performing zeroing of the power sensor:

1) Generally, all measurement signals should be turned off before the power sensor performs zeroing. For specific operations, please refer to the user manual of the power sensor.
2) If the power sensor does not have the option of internal or external zeroing, the "INT" and "EXT" options in the drop-down box will be replaced by the "Enabled" option.

To reduce the impact of noise and zero deviation on the measurement results, it is recommended to zero the power sensor in the following situations:

- Warm-up phase just after connecting to the signal source.
- Temperature change exceeds 5 ℃.
- Connect the power sensor to the RF output port at high temperature.
- The power sensor has not been zeroed in the past 24 hours.
- Before measuring low-power signals, such as signals with expected measured power more than 10 dB below the lower limit of the measurement range.

8.6.1.7 Frequency

The measured frequency mode is “Auto” by default. Click the drop-down box to switch the mode.

- Auto: Automatically configure the power sensor 's measurement frequency value based on the output frequency of the RF.
- Manual: The power sensor's measurement frequency value can be customized.

8.6.1.8 Level Offset

The level offset is set to "off" by default. Click the slide switch to turn the level offset on or off.

- On: The level offset value can be set at this time. The displayed reading value of the power sensor will be the actual measured value plus the level offset value. This function makes measurement easier when there are amplifiers and attenuators in the middle of the signal chain.
- Off: The level offset value setting will be automatically hidden. At this time the displayed reading value of the power sensor is consistent with the actual measured value.

8.6.1.9 Averaging

The averaging mode is “Auto” by default. Click the drop-down box to switch the averaging mode.

- Auto: Automatically configure the average times according to the current measurement. The average times are only displayed and cannot be modified.
- Manual: Manually set the average times of the power sensor measurement.

8.6.1.10 Logging

The log function is disabled by default. Click the slide switch to turn on or off the function. When the log function is turned on, the signal generator will record the measurement values and save them in a log file in TXT format.

The log file is saved in the path: Local:/power_sensor/.

8.6.2 Level Control

Figure 8-8 Power control

As shown above, the sensor measures a proportional power in defined time intervals, derived from a coupler. It considers optionally the given S-parameters and returns the results to the generator. The signal generator compares the measured level with the set value and adjusts its output level accordingly. This allows you to control the external signal level continuously and reliably reach a constant input level at the DUT in real time.

In practice, an RF splitter is needed to split the RF signal. One of them is connected to the DUT and the other is connected to the power meter. The signal source is for acquisition and compensation. Power compensation can be used to minimize cable losses, the attenuation of passive networks, and the amplification of the signal by a power amplifier and the frequency response of each device in the link as the frequency changes.

NOTE: When the RF sweep function is turned on, the level control function cannot be turned on. The RF sweep function must be turned off before turning on the level control function, and vice versa.

8.6.2.1 Level Control State

The default setting is "off". Click the slide switch to switch the on/off state.

This setting item is the same as the "Level Control" function in the upper menu.

8.6.2.2 Measurement

Display the current power sensor reading. You can click the drop-down box to change the current power display unit.

This setting item is consistent with the "Measurement" function in the upper menu.

8.6.2.3 Target Level

Specify the nominal level expected at the input of the sensor. The signal generator adjusts the output power accordingly, in order to meet the target value at the sensor input, thus meeting the power required by the DUT.

8.6.2.4 Level Limit

Set an upper limit for RF output power to protect your DUT from damage due to high input power. If the input RF signal power exceeds the limit, the set value will not take effect and the source will pop up a warning message.

8.6.2.5 Catch Range

The capture range means that if the power sensor reading is within the effective capture range, it is a valid reading and the RF signal is adjusted and compensated. Set the capture range of the control system. If the power sensor reading exceeds this range, the reading will be ignored.

Effective Capture Range = Target Level +/- Catch Range

8.7 IQ Modulation

IQ modulation, that is, two orthogonal signals (carriers with the same frequency and phase difference of 90°, generally expressed by Sin and Cos) and I (In-Phase, in-phase component) and Q (Quadrature Phase, quadrature component) signals are carrier modulated separately and then transmitted together, thereby improving spectrum utilization.

The IQ modulation functions of SSG6082A-V include: Custom, ARB, Multitone, AWGN and LFM, in addition to I/Q control settings. Please see the following chapters for details:

- Custom
- ARB
- Multitone
- AWGN
- LFM
- I/Q Control

8.8 Custom

Custom IQ modulation types include QAM, ASK, PSK, FSK, and MSK modulation. You can also customize IQ data for modulation.

8.8.1 Custom State

Press I/Q > *Custom* > *Custom State* to turn on or off the Custom modulation.

8.8.2 Data Source

Press I/Q > *Custom* > *Data Source* to set the symbol data that to be modulated.

8.8.2.1 Data Setup

Selects a data source type for modulation.

Choices: PN7 | PN9 | PN15 | PN23 | User. Default: PN7 (Seed: 0x7F).

- For PN7, PN9, PN15 and PN23 selections, the software automatically generates the data source bits. At this time the Seed field is available, and you can input the PN seed in *Seed (Hex)* .
- For User selection, the *User Data* button appears instead the *Seed (Hex)* button. You can click the setting button to enter the user data editing interface.

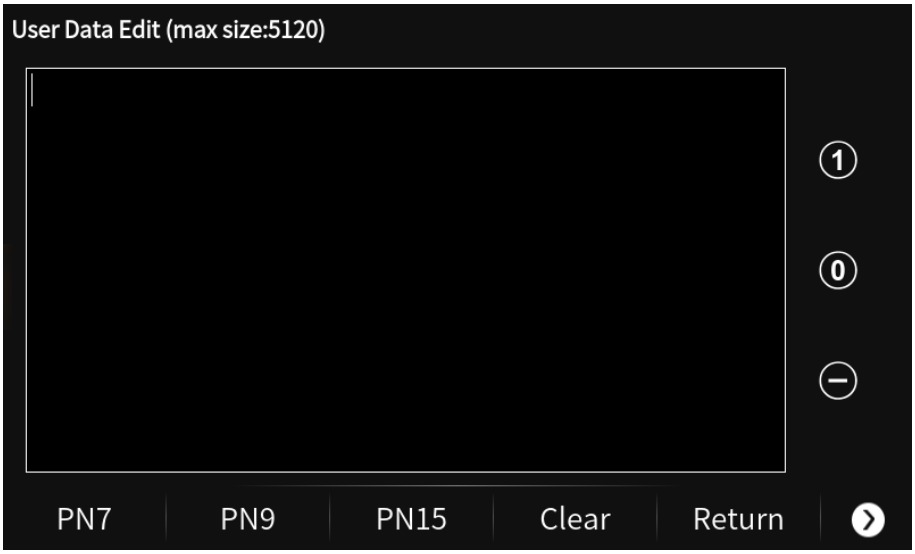


Figure 8-9 Pseudo-random code editing interface

1) Press 1 and 0 to add single bits. Press ⊖ to delete single bits.

2) Data editing: After selecting the editing position, you can enter the numbers 0 and 1 through the touch screen keys or the front panel keyboard, or delete them.
3) Click *PN7* / *PN9* / *PN15* to insert PN7 or PN9 or PN15.
4) Click *Clear* to empty the edited PN code.
5) Click *Return* to return to the previous menu.
6) Click > *Load* to select and load a UDATA file.
7) Click > *Save* to save the current PN code to the UDATA file.

8.8.2.2 Seed (Hex)

When select "PN7 | PN9 | PN15 | PN23" as the data source type, you can set the PN seed. The value is displayed in hexadecimal.

Range: PN7: 0 ~ 7F, PN9: 0 ~ 1FF, PN15: 0 ~ 7FFF, PN23: 0 ~ 7FFFFF.

Default: PN7: 7F, PN9: 1FF, PN15: 7FFF, PN23: 7FFFFF.

8.8.2.3 Symbol Rate

Sets the symbol rate (symbols per second) of the waveform.

Range: (1000/Oversampling) to (1250000000/Oversampling) Sps.

Default: 1 MSps.

NOTE: When the SSG6080AV-B1000 option is disabled, the maximum symbol rate is (625000000/Oversampling) Sps.

8.8.2.4 Symbol Length

Sets the length of modulated symbols.

Range: 100 to 100000.

Default: 2048.

8.8.2.5 Bits/Symbol

Displays the number of bits contained in a modulation symbol. This parameter is read-only and cannot be set.

8.8.3 Modulation

Press I/Q > *Custom* > *Modulation* to select modulation type.

8.8.3.1 Modulation Type

Choices: QAM | ASK | PSK | MFSK | User. Default: QAM.

- QAM

  Select a type in the QAM category for modulation.

  Choices: 16QAM | 32QAM | 64QAM | 128QAM | 256QAM | 512QAM. Default: 16QAM.

- ASK

  Select a type in the ASK category for modulation.

  Choices: 2ASK | 4ASK | 8ASK | 16ASK. Default: 2ASK.

- PSK

  Select a type in the PSK category for modulation.

  Choices: BPSK | QPSK | 8PSK | DBPSK | DQPSK | D8PSK | OQPSK| PI/4-DQPSK | PI/8-D8PSK. Default: BPSK.

- MFSK

  Select a type in the MFSK category for modulation.

  Choices: 2FSK | 4FSK | 8FSK | 16FSK | MSK. Default: 2FSK.

- User

  When "User" is selected as the modulation type, users can customize the IQ data. For details, please see "User IQ Data".

8.8.3.2 User IQ Data

When "User" is selected as the modulation type, the *Custom* setting button will appear. Click the setting button to enter the editing page of the custom IQ data.

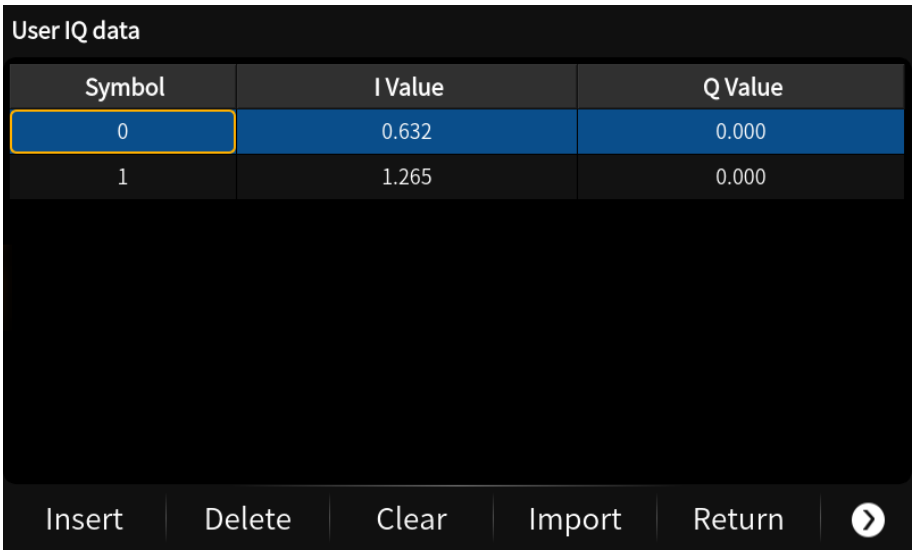
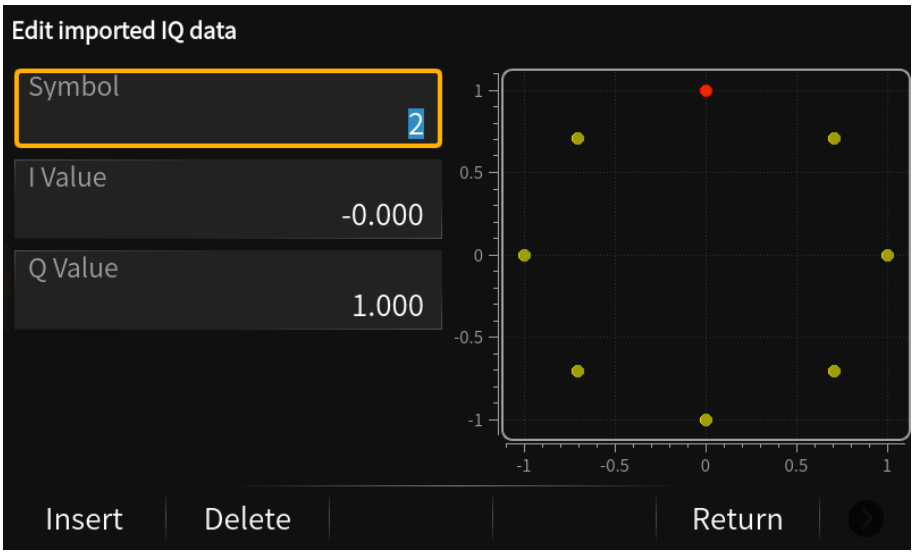


Figure 8-10 User IQ data editing page

As shown in the figure above, the editing page of custom IQ data consists of an IQ data list and a menu at the bottom, where the IQ data list consists of symbols, I values, and Q values.

1) Click *Insert* to insert a row before the currently selected row. The newly inserted row will copy the currently selected row.
2) Click *Delete* to delete the currently selected row.
3) Click *Clear* to restore the IQ data to default value (2ASK).
4) Click *Import* to to import IQ data of 2ASK / 16QAM / 32QAM / 64QAM / 128QAM / 256QAM / 512QAM / BPSK / QPSK / 8PSK.
5) Click *Return* to return to the previous menu.
6) Click > *Load* to select and load an IQ data file (*.MAP).
7) Click > *Save* to save the current IQ data to a MAP file.
8) Click each parameter in the table area to set them through the touch screen keyboard or the front panel keypad.
9) Click > *Graph* to open the constellation and edit IQ symbols. The constellation editing page is as follows:



As shown in the figure above:

- The left side of the page is the editing area, which displays the number and I/Q values of the currently selected symbol.
- The right side of the page is the constellation diagram, and the red point is the currently selected point. You can select and move the symbol through the touch screen.
- The bottom of the page are operation buttons, which can insert or delete symbols.

NOTE: When editing constellation points, the number of points must be a power of 2, otherwise an error message will appear when clicking the "Update" button.

8.8.3.3 Gray

When the modulation type is QAM | ASK | PSK | User, you can turn on or off the Gray code of IQ data. Default is off.

8.8.3.4 FSK Deviation

When the modulation type is selected as 2FSK | 4FSK | 8FSK | 16FSK, the *FSK Deviation* setting is displayed.

FSK Deviation is used to set the frequency deviation of FSK modulation in Hertz (Hz).

Range: 0 ~ 0.8 * Symbol Rate * OverSampling.

Default: 600 kHz.

8.8.4 Filter

Press I/Q > *Custom* > *Filter* to enter the filter settings for Custom modulation.

8.8.4.1 Filter Type

Set the filter type for current modulation.

Choices: RaiseCosine | RootCosine | Gaussian | HalfSine | None.

Default: RootCosine.

NOTE: For HalfSine filter, only OQPSK modulation type is supported.

8.8.4.2 Filter Alpha/BT

Set the Alpha factor of the filter (BT for Gaussian filter).

Filter Alpha range: 0.01~1, default: 0.5.

Filter BT range: 0.1 ~ 5, default: 0.5.

8.8.4.3 Filter Length

Set the symbol length of the filter.

Range: 1~512.

Default: 128.

8.8.4.4 OverSampling

Set the oversampling ratio of the waveform. The waveform sampling rate is determined by the symbol rate and oversampling ratio.

Range: 2 - 32.

Default: 4.

NOTE:

- For OQPSK modulation, the oversampling rate must be even.
- For HalfSine filter, the oversampling rate must be greater than or equal to 8.

8.8.5 Update

Regenerate waveform data according to current settings.

NOTE: If the Update button flashes, it means that the current settings have been changed or the update has failed. If the current settings have been changed, you need to click the Update button to regenerate the waveform data. If the update fails, you need to modify the incorrect modulation parameters and then click the Update button.

8.8.6 Save Waveform

Click the "Save Waveform" button to save the current Custom signal to an arb file (arbitrary waveform file). The saved arb file can be played in ARB mode.

8.9 ARB

8.9.1 ARB State

Press I/Q > *ARB* > *ARB State* to turn ARB on or off.

8.9.2 Select Waveform

Press I/Q > *ARB* > *Select Waveform* to enter the file browser and select the waveform segment or waveform sequence to be played.

NOTE: SSG6082A-V ARB mode supports a maximum of 2G playback points.

8.9.3 Multi-BBG Settings

Press I/Q > *ARB* > *Multi-BBG Settings* to the Multi-BBG Settings page. Through this function, configure the device's role in the synchronization network as either "Primary" or "Secondary", and initiate synchronization or activate listening to establish multi-RF channel test environments, such as MIMO-based systems.

Before using this feature, it is essential to understand how to establish the synchronization network. The following diagram illustrates the connection method of the multi-device synchronization network. In this network, there is 1 primary unit and up to 15 secondary units, meaning the system supports synchronization across a maximum of 16 instrument. The synchronization network connects instruments in a daisy-chain topology. Based on their cascading positions, they are categorized as the primary instrument, 1st secondary instrument, 2nd secondary instrument, and so forth. The primary instrument's **[IQ EVENT]** connects to the 1st secondary instrument's **[PATTERN TRIG]**. The 1st secondary instrument's **[IQ EVENT]** then connects to the 2nd secondary instrument's **[PATTERN TRIG]**, and this pattern continues until the final-level secondary instrument is connected. The synchronization network occupies the **[IQ EVENT]** ports of the primary instrument and all non-final-level secondary instruments (both **[IQ EVENT]** and **[IQ EVENT]** are used). After establishing the synchronization network, only the primary instrument's **[PATTERN TRIG]** and the final-level secondary instrument's **[IQ EVENT]** remain available for triggering and marker functions. To maintain phase coherence among the RF signals output by multiple instruments and prevent phase relationship variations caused by prolonged operation or other factors, users can also achieve phase coherence by configuring multiple signal instruments to share a common LO.

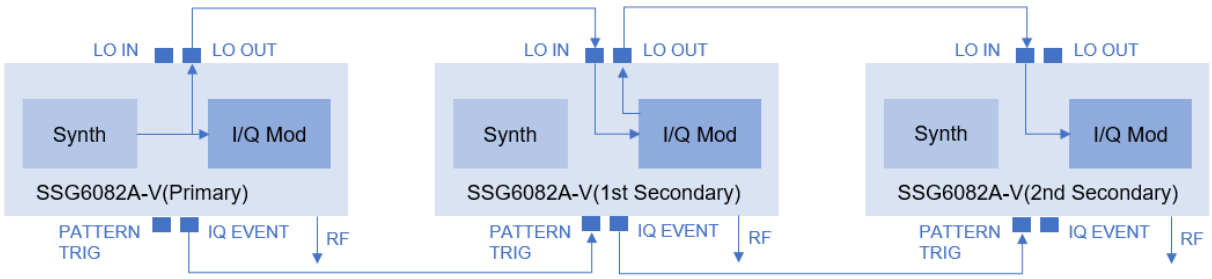


Figure 8-11 Multi-BBG synchronization network

8.9.3.1 Multi-BBG Sync Type

Selects the sync type of instument within synchronization network.

Choices: Off | Primary | Secondary .

- When the sync type is Off, the instrument's **[IQ EVENT]** normally outputs the identification signal and the **[PATTERN TRIG]** normally responds to trigger signals.
- When set to Primary, the instrument's **[IQ EVENT]** must be connected to the Secondary's **[PATTERN TRIG]**. The instrument's **[PATTERN TRIG]** normally responds to trigger signals.
- When set to Secondary, the instrument's **[IQ EVENT]** must be connected to the next-level Secondary instrument's **[PATTERN TRIG]**. If the instrument is the final-level Secondary, its **[IQ EVENT]** normally outputs the identification signal. The instrument's **[PATTERN TRIG]** must be connected to the **[IQ EVENT]** of the previous-level Secondary instrument (or the Primary instrument).

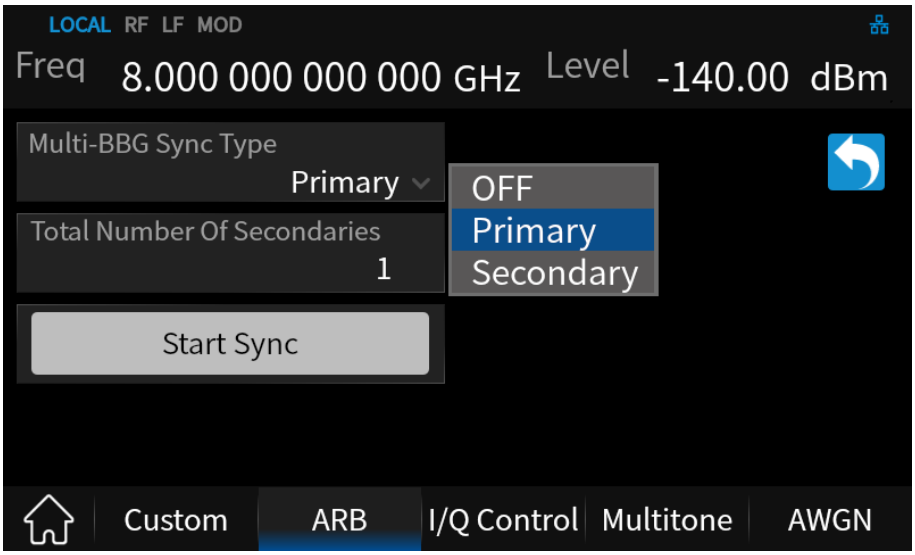


Figure 8-12 Multi-BBG Primary setting page

8.9.3.2 Total Number Of Secondaries

When the Multi-BBG sync type is set to Primary or Secondary, this setting item is displayed. Set the number of Secondary in the synchronization network (excluding the Primary), with a minimum setting of 1 and a maximum of 15.

8.9.3.3 Secondary Position

When the Multi-BBG sync type is set to Secondary, this setting item is displayed. Set the instrument as the nth level Secondary in the synchronization network, with a minimum setting value of 1 and a maximum setting value of 15.

8.9.3.4 Trigger Delay

When the Multi-BBG sync type is set to Secondary, this setting item is displayed. Set trigger delay for the Secondary with a setting range of 0 s~40 s and 1ns resolution.

8.9.3.5 Start Sync

When the multi-instrument sync type is set to Primary, this button is displayed. After all instruments in the synchronization network are properly connected via cables as required, click this button on the Primary instrument to initiate synchronization pulses that synchronize all Secondary instruments in the network.

8.9.3.6 Listen Failed

When the multi-BBG sync type is set to Secondary, this button is displayed. After all instruments in the synchronization network are properly connected via cables as required, clicking this button changes its status to “Listening…”. After the Primary instrument initiates synchronization pulses, if the instruments are properly connected, the synchronization pulses will be cascaded through each level until reaching the final-level Secondary. Each Secondary instrument can receive synchronization pulses from the previous-level instrument, and will automatically display “Sync Success” upon receiving the synchronization pulse.

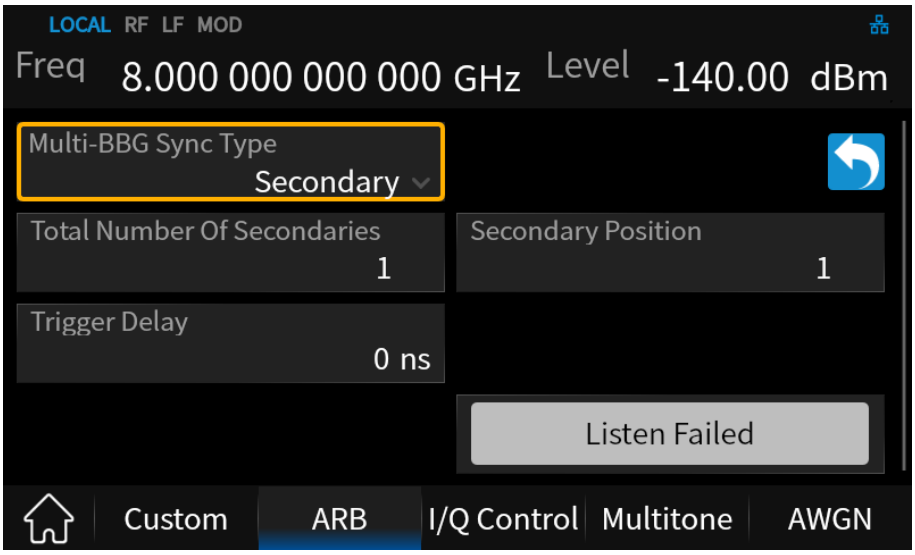


Figure 8-13 Multi-BBG Secondary setting page

8.9.4 Waveform Sequence

8.9.4.1 About Waveform Sequence

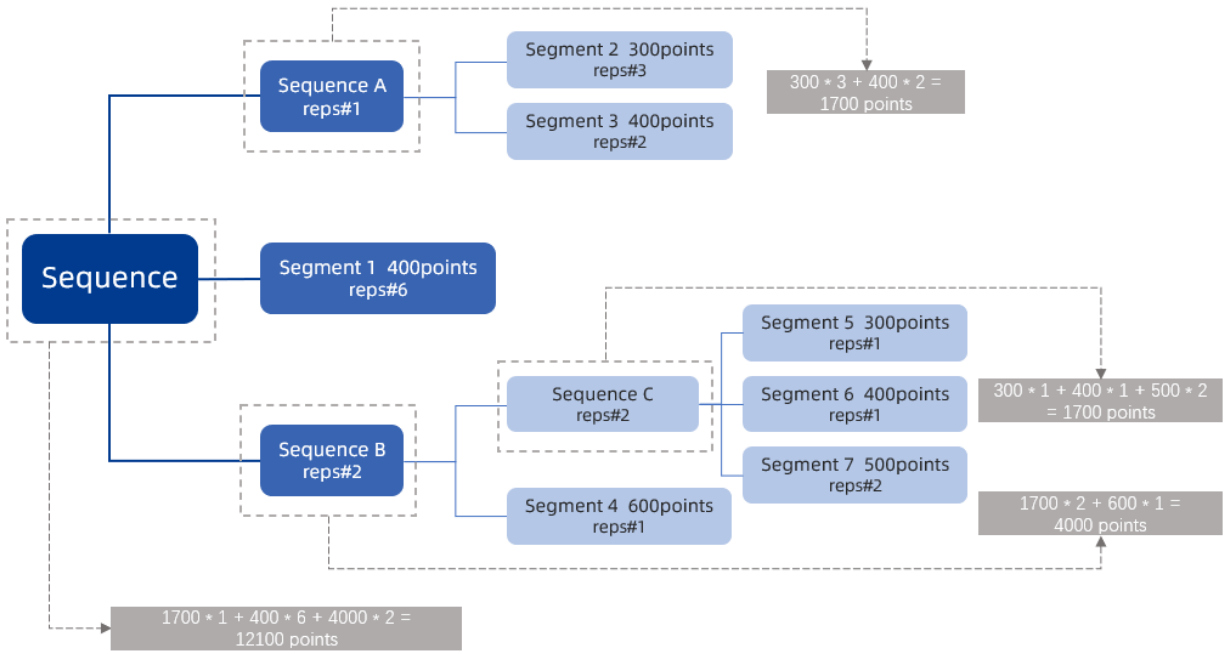
A waveform sequence can contain one or more waveform segments or other waveform sequences, or both. This allows SSG6082A-V to play multiple waveform segments or sequences continuously without stopping.

A waveform sequence can contain up to 1024 waveforms, including segments or other sequences (nested sequences). In addition, each waveform sequence can contain up to 2G points.

The signal generator can let you set the number of times the segments and nested sequences repeat in a waveform sequence:

- Each segment can repeat up to 65535 times, but only counted as one waveform;
- Each nested sequence can repeat up to 65535 times, but only counted as one waveform.

The number of points in a waveform sequence can be calculated based on the example in the figure below:



As shown in the figure above,

1) Sequence A includes waveform segment 2 and waveform segment 3, with a total of 300*3+400*2=1700 points,
2) Sequence C includes waveform segment 5, waveform segment 6 and waveform segment 7, with a total of 300*1+400*1+500*2=1700 points,
3) Sequence B includes sequence C and waveform segment 4, with a total of 1700*2 + 600*1=4000 points,
4) The newly created sequence includes sequence A, waveform segment 1 and sequence B, with a total of 1700 * 1 + 400 * 6 + 4000 * 2 = 12100 points.

8.9.4.2 Operations on Waveform Sequence

Press I/Q > *ARB* > *Waveform Sequence* to create and edit waveform sequences. Users can create new waveform sequences or edit existing waveform sequences.

- Click *Build* button to create a new sequence.
- Click *Current Sequence* to select a sequence and then click *Edit* button to edit the selected sequence.

Figure 8-14 Waveform sequence creation and editing page

As shown in the figure above, the waveform sequence creation or editing page includes a list of waveforms contained in the sequence and operation buttons at the bottom.

All operations for creating or editing a waveform sequence can be performed through the touch screen:

- Click the operation button at the bottom to delete, insert, clear, and save.
- Click *Reps#* of the segment or sequence to change its repetitions.
- Click *Marker* of the segment or sequence to turn on or off its markers.
- After creating or editing the waveform sequence, click *Save* and then name it to complete the creation or editing of the waveform sequence.

8.9.4.3 Example: Play a Sequence

After creating a sequence, you can choose to play it:

1) Press I/Q > *ARB* > *Select Waveform* to select the waveform sequence to be played.
2) Turn on *ARB State* .
3) Turn on the I/Q MOD module switch on the home page, or turn on MOD ON/OFF .
4) Configuring RF Output.

The carrier modulated by a waveform sequence is now available at the signal generator's **[RF OUTPUT 50Ω]** connector.

8.9.5 ARB Setup

Press I/Q > *ARB* > *ARB Setup* to enter the arbitrary waveforms setting interface. The waveform generator supports a variety of settings for arbitrary waveforms to meet a wider range of applications requirements.

8.9.5.1 Sample Clock

Set the sampling rate of arbitrary waveforms.

Range: 400 Hz ~ 625 MHz or 1250 MHz(with option SSG6080AV-B1000), and default is 2 MHz.

8.9.5.2 Modulator Atten

Users can adjust the amplitude of the I and Q signals before entering the IQ modulator. When the modulator attenuation type is set to manual, the waveform generator can set the appropriate modulator attenuation value to obtain the best ACPR characteristics.

- When *Modulator Atten Type* is set to Auto, the *Modulation Atten* value is 0 dB.
- When *Modulator Atten Type* is set to Manual, the *Modulation Atten* value can be set to -10 ~ 10 dB. When a negative value is set, the maximum gain supported by the modulator at different frequencies is different, and the modulator gain effect cannot be guaranteed.

8.9.5.3 Real Time AWGN

Press I/Q > *ARB* > *ARB Setup* > *Real Time AWGN* to enter the AWGN (Additive White Gaussian Noise) setting interface. By turning on this function, SSG6082A-V enables you to apply additive white gaussian noise (AWGN) to a carrier in real time while the modulating waveform plays in ARB.

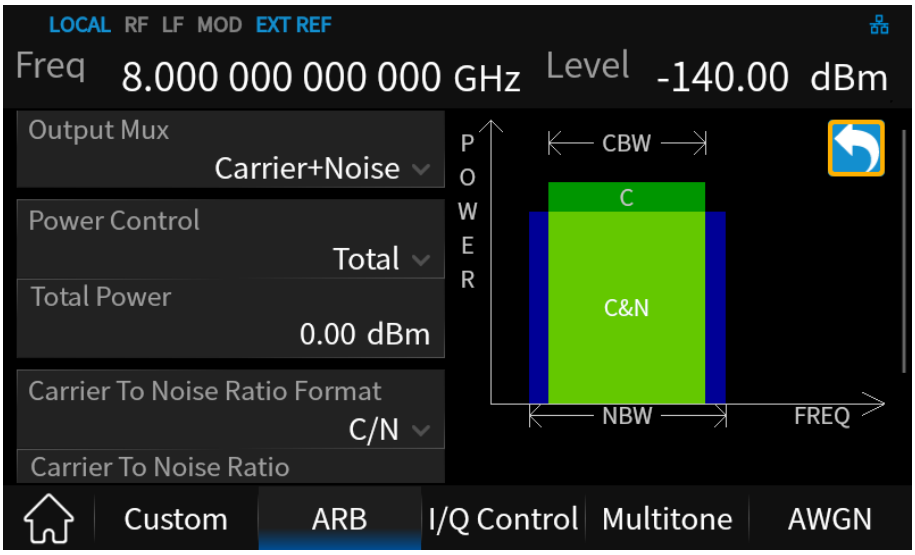


Figure 8-15 Real-time AWGN setting interface

8.9.5.3.1 Output Mux

Set the type of RF output, including "Carrier + Noise", "Carrier" and "Noise".

- Carrier + Noise: Both noise and carrier are output from the internal baseband generator.
- Carrier: Only carrier is output from the internal baseband generator.
- Noise: Only additive noise is output from the internal baseband generator.

With the ALC off, this feature enables direct measurement of the carrier or the noise contributions independently from the total power.

8.9.5.3.2 Power Control

Set the power of carrier and noise.

- Total: Set the total power, namely the sum of the carrier power and total noise power. The carrier power and total noise power change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.
- Carrier: Set the carrier power. The total power and total noise power change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.
- Total Noise: Set the total noise power. The total power and carrier power change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.
- Channel Noise: Set the channel noise power, namely integral power of noise in carrier bandwidth. The total power, carrier power and total noise power change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

8.9.5.3.3 Carrier to Noise Ratio Format

Selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/No) as the variable controlling the ratio of the carrier power to noise power in the carrier bandwidth.

Eb/No Carrier Bit Equation:

$$\mathrm{C/N} = \mathrm{Eb/No} + 10\log_{10}\frac{\mathrm{bitRate}}{\mathrm{CBW}}$$

When Eb/No is selected, the *Carrier Bit Rate* setting appears and can be used to calculate the Eb/No value.

8.9.5.3.4 Carrier Bandwidth

For the selected carrier to noise ratio, the carrier power and channel noise power are integrated over the carrier bandwidth. Typically, Carrier Bandwidth (CBW) is the occupied bandwidth of the carrier.

8.9.5.3.5 Flat Noise Bandwidth

The actual flat noise bandwidth (NBW) should be slightly wider than the carrier bandwidth (typically 1.6 times wider). The occupied bandwidth is = (1.25 * the Flat Noise Bandwidth).

8.9.5.4 Modulation Filter

Set whether the ARB waveform passes through the filter. The optional filter types are RaisedCosine, RootCosine, Gaussian, HalfSine and None, and the default value is None.

After selecting the filter type, you need to set the corresponding filter parameters and finally click the Update button. The filter settings will be applied to the waveform played by ARB.

This filter is applied as the ARB waveform plays, rather than in the waveform data itself.

8.9.5.5 Baseband Offset

A frequency offset can be set for the baseband spectrum in the range of -250 MHz to 250 MHz or -500 MHz to 500 MHz(with option SSG6080AV-B1000).

Common uses for the offset include:

- Offset the carrier from any LO feedthrough (carrier signal spur at the carrier frequency).
- Sum the baseband signal with external I and Q inputs to create a multicarrier signal.

- Use the signal generator's I/Q signal as an IF.

8.9.6 Multi Carrier

This section provides background information about generating multicarrier signals in ARB and the impact of the settings provided.

Press I/Q > *ARB* > *Multi Carrier* to enter the parameter settings for multicarrier.

8.9.6.1 About Multi Carrier

To simulate complex multi carrier scenarios with different baseband signals, the SSG6082A-V provides the possibility to generate multi carrier waveforms. These waveforms can consist of up to 100 carriers, each modulated by the same or by different user-selectable baseband signal. Complex multi carrier scenarios composed of signals from different digital standards can be created by this function.

Because the multi carrier files are processed by the ARB generator, the composed waveform file must be created before it is loaded to and played by the ARB. The SSG6082A-V stores the created multi carrier waveform file under user definable name; as with the single carrier waveforms, the used file extension is *.arb, same as the signal carrier waveform. The instrument appends additional information to the header of the composed waveform file.

While creating a multi carrier waveform, the carrier spacing is adjustable within the total available bandwidth. The total RF bandwidth of the composed multicarrier signal should not exceed the available RF bandwidth (please reference to the data sheet). Each carrier can be separately defined in terms of power, phase and modulated input signal. After all the multi carrier processing steps are completed, the instrument calculates the resulting peak and RMS power over the total signal. This value is then written in the waveform file.

8.9.6.2 Waveform Name

Click this item to input the current multi carrier name. The default value is "MULTICARRIER ".

8.9.6.3 Power Reference

Defines the way the individual carriers in a composed multi carrier signal are leveled.

- Peak: The individual carriers are leveled based on their peak power and the configured Carrier Gain.

  For example, a multi carrier signal is composed of two waveform files,

First carrier "Gain" = 0 dB,

Second carrier "Gain" = -3 dB,

In the resulting multi carrier signal, the peak power of the second carrier signal will be 3 dB lower than the peak power of the first carrier signal.

- RMS: The individual carriers are leveled based on their RMS power and the configured Carrier Gain.

  For example, a multi carrier signal is composed of two waveform files,

  First carrier "Gain" = 0 dB

  Second carrier "Gain" = -3 dB

  In the resulting multi carrier signal, the RMS power of the second carrier signal will be 3 dB lower than the RMS power of the first carrier signal.

8.9.6.4 Carrier Table

Click this item to enter the multi-carrier table setting interface, which contains the settings of each carrier:

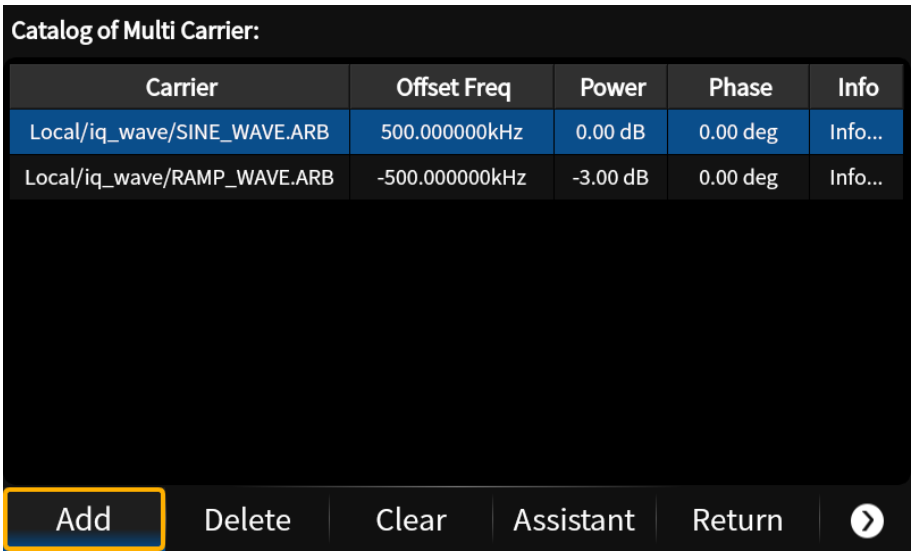


Figure 8-16 Multi-carrier table setting interface

This page comprises the settings of each carrier, and all the carriers are displayed in table form. The number of rows corresponds to the number of carriers.

Each row of parameters in the table represents the settings of a single carrier:

1) Carrier: Set the carrier signal by selecting the waveform segment from the file browser.

2) Offset Freq: Set the offset frequency of the carrier relative to the center frequency.

3) Power: Set the carrier power gain.

4) Phase: Set the carrier phase.

5) Info: Indicates the name, sample rate, number of samples, and signal period of the selected carrier.

Functions of each item in the menu bar at the bottom of the page:

1) Add: Insert a carrier.

2) Delete: Delete the carrier signal in the line where the current cursor is located from the carrier list.

3) Clear: Empty the multi-carrier list.

4) Assistant: Enter the assistant setting menu of carrier list, which is used to generate a list of carriers with fixed carrier signal and equal frequency spacing. The menu contains the following settings:

   - Select Waveform: Set the carrier signal by selecting the waveform segment from the file browser.
   - Freq Space: Set the frequency spacing of adjacent carriers.
   - # of Carrier: Set the number of carriers, up to 100.
   - Done: Generate the carrier list according to the setting above, and return to the carrier list setting interface.

5) Load: Enter the file system directory, select and read the carrier list setting file with the suffix of *.ml.

6) Save: Enter the file system directory, input the file name, and save the current carrier list setting, so as to read it again when necessary.

7) Return: Return to the previous menu.

8.9.6.5 Signal Period Mode

Defines the way the resulting signal period of the multicarrier waveform is calculated. The resulting period is always calculated for all carriers in the carrier table. Use the "Carrier Table > Info" function to obtain information on the sample rate and file length data of each carrier.

- Longest File: The longest I/Q file in the carrier table defines the resulting signal period. Shorter I/Q files are periodically repeated.
- Shortest File: The shortest I/Q file in the carrier table defines the resulting signal period. Only the first part of longer I/Q files is used.

- "LCM": The signal period is defined by the least common multiple of the periods of all waveform files in the carrier table.
- "User": The signal period is set manually (Signal Period). Shorter I/Q files are repeated periodically, and only the first part of longer I/Q files is used.

8.9.6.6 Signal Period

This item displays the signal period of current multi-carrier and can only be set when *Signal Period Mode* is set to "User".

8.9.6.7 Sampling Rate

The item displays the sampling rate of the current multi-carrier signal according to the waveform setting in the carrier table.

8.9.6.8 Create and Load

Click this button to create a multi-carrier file based on the current settings, and then automatically select the multi-carrier in *ARB* > *Select Waveform* .

8.9.6.9 Create a Multi-carrier Signal

To create a multi-carrier waveform file, follow these steps:

1) Enter the "Carrier Table", add each carrier as required, and configure the frequency offset, power gain, phase and other parameters. You can also use the “Assistant” function to add multiple carriers to the carrier list at one time.
2) Set the "Signal Period" and "Power Reference" of the multi-carrier signal to be generated.
3) Name the new multicarrier in "Waveform Name".
4) Finally, click "Create and Load" button to create a multi-carrier.

8.9.7 Marker Utilities

This chapter introduces the concepts and usage of waveform markers.

Press I/Q > *ARB* > *Marker Utilities* to enter marker settings menu.

8.9.7.1 About the Waveform Marker

SSG6082A-V provides four waveform markers to mark specific points on a waveform segment. You can set each marker's polarity and marked points (on a single sample point or over a range of sample points). When the signal generator encounters an enabled marker, an auxiliary signal is routed to the rear panel **[IQ_EVENT]** output.

You can use the auxiliary output signal to synchronize another instrument with the waveform, or as a trigger signal to start a measurement at a given point on a waveform. You can also configure markers to initiate RF Blanking.

8.9.7.2 Marker Number

Select the waveform marker to be set currently. There are four markers 1, 2, 3, and 4 to choose from.

8.9.7.3 Output Mux

Select the marker to output. There are four markers 1, 2, 3, and 4 to choose from. You can also choose to turn off marker output.

The [IQ_EVENT] connector on the rear panel will output the corresponding pulse signal according to the currently selected marker and related settings.

NOTE: The **[IQ_EVENT]** connector can only output one marker signal at a time.

8.9.7.4 Marker Polarity

The default value is "Positive". Click the drop-down box to switch the polarity of the marker.

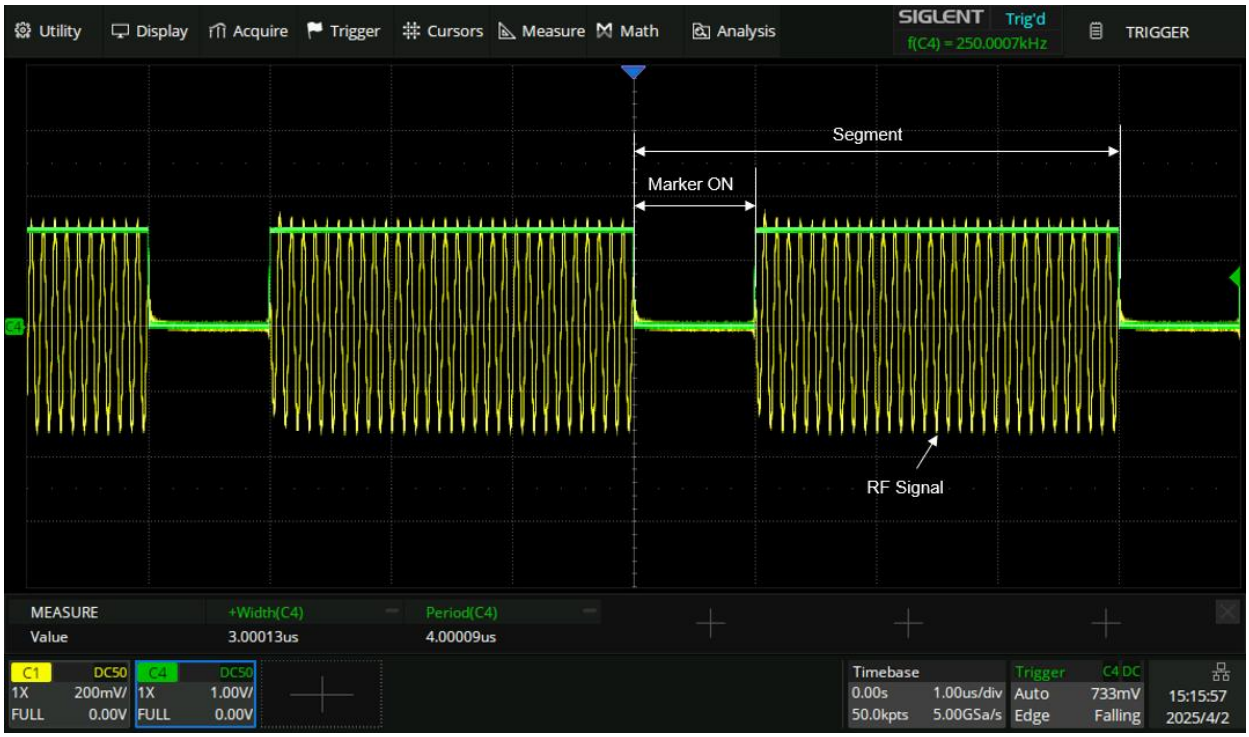
- Positive: the high level (3.3 V) signal is output during the on marker points, and the low level (0 V) signal is output during the off marker points.
- Negative: the low level (0 V) signal is output during the on marker points, and the high level (3.3 V) signal is output during the off marker points.

8.9.7.5 Pulse/RF Blank

When this option is turned on, the signal generator will blank the RF output during the on marker of the waveform segment. The following two figures show the influence of blanking on the RF output signal when the marker polarity is positive and negative respectively.

Marker Polarity = Positive

The RF output is blanked during the on marker points



Marker Polarity = Negative

The RF output is blanked during the on marker points

8.9.7.6 Marker Delay

Set the delay time of pulse signal output by the **[IQ_EVENT]** connector relative to RF signal.

The delay range is 0 to 828 us, and default value is 0 us.

8.9.7.7 Set Markers

Click this item to enter the marker setting interface. Before opening the marker setting, you need to first select the waveform segment or sequence to be played.

- If you choose to play a waveform segment, you can directly edit the marker of the waveform segment in the marker point setting interface, as shown in Figure 8-17.
- If you choose to play a waveform sequence, the marker point setting interface will display the list of waveform segments contained in the sequence, and you can select the waveform segments one by one to edit their markers, as shown in Figure 8-18.

NOTE: Segments in "Local/iq_wave" folder cannot have their markers edited, and the first point is the default marker.

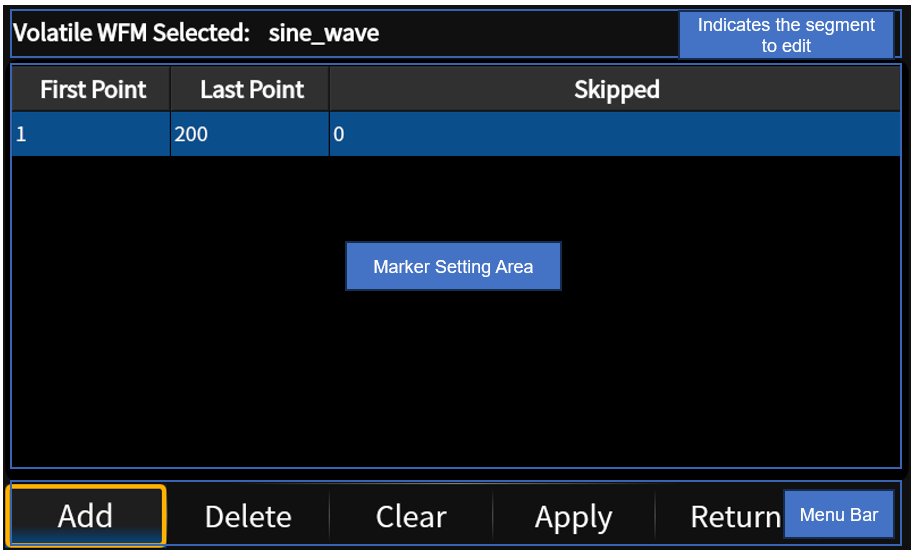


Figure 8-17 Segment marker setting interface

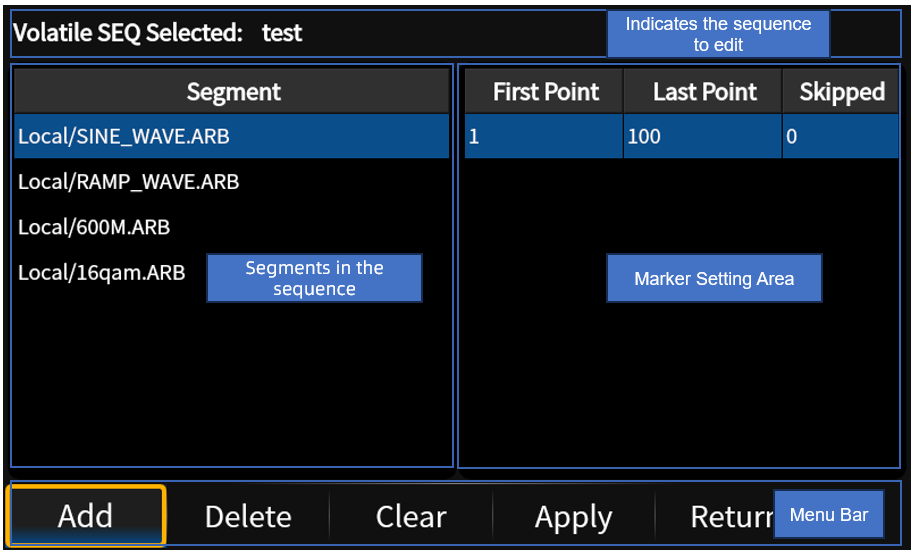


Figure 8-18 Sequence marker setting interface

As shown in the figures above, the marker point setting page consists of four parts.

- The upper part of the page displays the waveform segment or sequence to be edited.
- The middle part of the page includes the segments contained in the sequence (no item if editing a segment) and the marker point setting area.
- The lower part of the page is the menu bar for editing the marker.

Marker Setting Area

In the marker setting area, each row of parameters in the table represents the marker settings of a segment:

- First Mkr Point: Set the sample point corresponding to the first marker point of the segment.
- Last Mkr Point: Set the sample point corresponding to the last marker point of the segment (the last marker point should always be less than or equal to the number of points in the segment, and greater than or equal to the first marker point).
- Skipped: Set the number of sample points you want to skip, so that only one sample point will be output every corresponding number of sample points in the segment.

When marker points are set, they do not replace points that already exist, but are set in addition to existing points. For example, set the marker point range of a segment to 1-30, and then add a marker point range of 20-50. The marker signal consisting of these two marker point ranges starts on sample point 1, and ends at on sample point 50.

Menu Bar

Functions of each item in the menu bar at the bottom of the page:

- Add: Insert a marker point range in the next line where the current cursor is located.
- Delete: Delete the marker point range in the line where the current cursor is located.
- Clear: Clear all the marker points from a waveform segment.
- Apply: Make the current marker points setting of a segment effective.
- Display: Click to view the marker signal diagram.
- Return: Return to the previous menu.

The marker signal diagram showed as below:

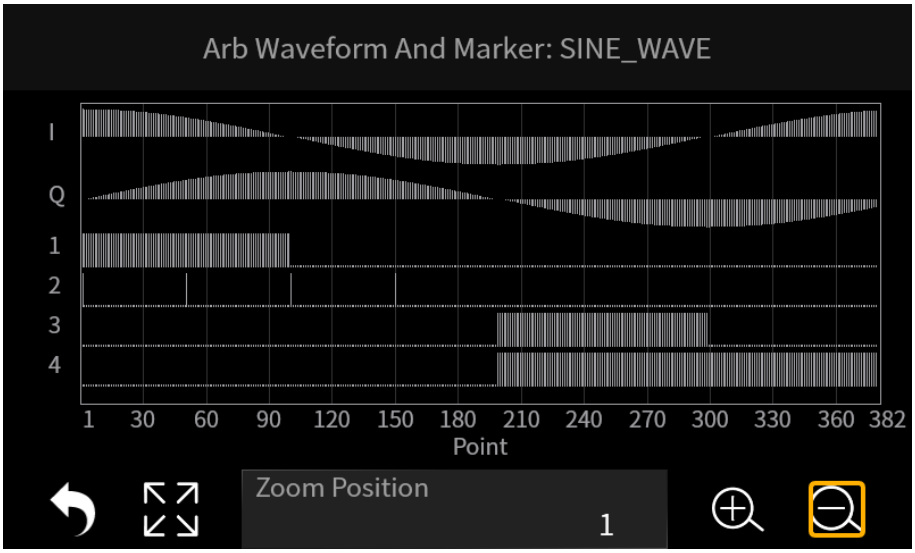


Figure 8-19 Marker signal diagram

As shown, this page consists of the upper plot area and the lower control area:

Plot area:

The marker signal diagram generated according to the current waveform segment and its marker point range.

"I" and "Q" on the right side of Y axis represent the output waveforms of I and Q of the currently selected waveform segment. "1", "2", "3" and "4" represent four marker signals.

The horizontal direction of the schematic diagram represents the sample point and marker point of the waveform segment, and the vertical direction represents the power level of the output signal.

Control area:

- Click  to return to the previous marker point setting page;
- Click  to resume the diagram to the initial state;

- Click  to zoom in the diagram;
- Click  to zoom out the diagram;
- The “Zoom Position” parameter sets the start position of the diagram, and the zoom operation is based on this position.

8.9.8 Waveform Utilities

Press I/Q > *ARB* > *Waveform Utilities* to enter the waveform segment scaling and clipping page.

8.9.8.1 Select Segment

Select the waveform segment for amplitude scaling or peak clipping the I and Q data from the file browser.

8.9.8.2 Scaling

Set the amplitude scaling percentage of a waveform segment.

The signal generator uses an interpolation algorithm (sampling between the I/Q data points) when reconstructing a waveform. For common waveforms, this interpolation can cause overshoots, which may create a DAC over-range error condition. This chapter describes how DAC over-range errors occur and how you can use waveform scaling to eliminate these errors.

Although scaling maintains the basic shape of the waveform, excessive scaling can compromise waveform integrity. For example, if the bit resolution becomes too low the waveform becomes corrupted with quantization noise. To achieve maximum accuracy and optimize dynamic range, scale the waveform no more than is required to remove the DAC over-range error.

8.9.8.3 Clipping

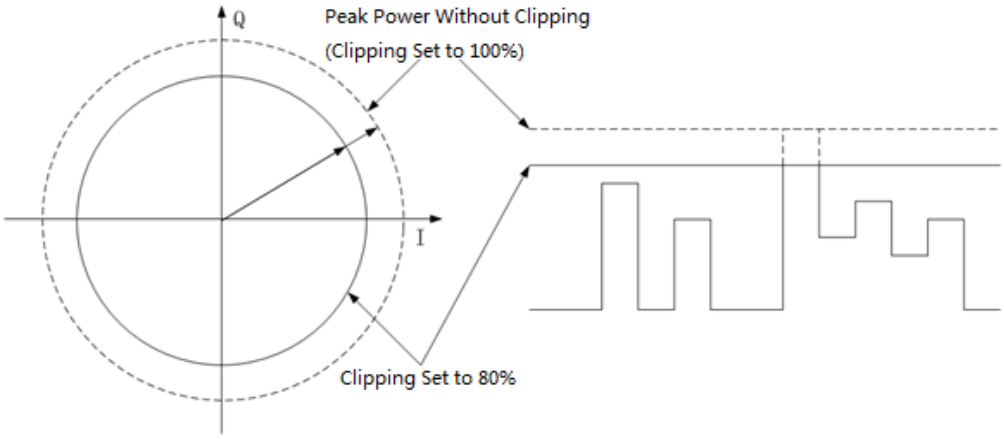
The clipping function enables you to reduce peak-to-average power, and consequently spectral regrowth, by clipping the waveform. Clipping limits waveform power peaks by clipping the I and Q data to a selected percentage of its highest peak.

8.9.8.3.1 Clipping Type

The Signal Generator provides two methods of clipping:

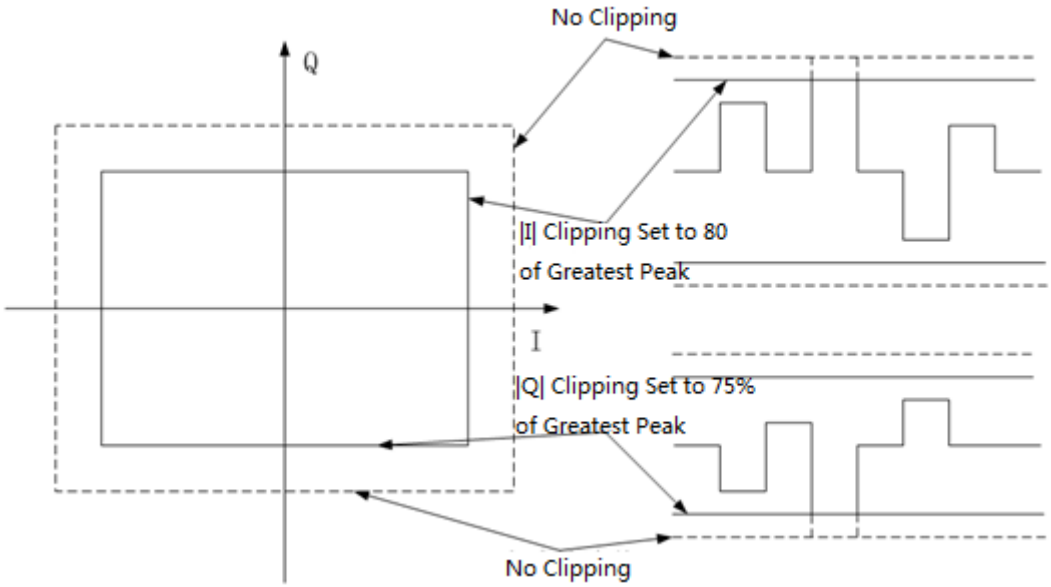
1. Circular clipping

Circular clipping (|I+jQ| clipping) is applied to the composite I/Q data (I and Q data are equally clipped). The clipping level is constant for all phases of the vector and appears as a circle in the vector representation



2. Rectangular clipping

Rectangular clipping (|I|,|Q| clipping) is independently applied the I and Q data. The clipping level is different for I and Q, and appears as a rectangle in the vector representation.



8.9.8.3.2 Clipping Value

- Clip |I+jQ| to

  Set the percentage of I / Q signal value ($\sqrt{I^2+Q^2}$) reduced to the peak value.

- Clip |I| to

  Set I Waveform clipping percentage.

- Clip |Q| to

  Set Q Waveform clipping percentage.

8.9.8.4 Apply to Waveform

Click the "Apply to Waveform" button to make waveform scaling or clipping effective.

After applying scaling or clipping, the waveform data will be saved as a _clip.arb file.

8.9.8.5 Display CCDF

Click to view the CCDF (Complementary Cumulative Distribution Figure) before and after waveform segment clipping.

The CCDF diagram shows as below:

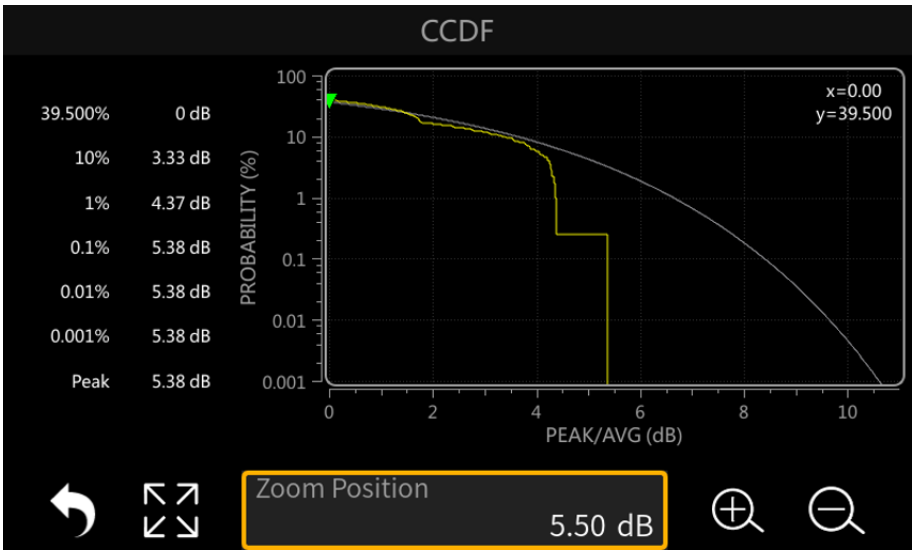


Figure 8-20 CCDF diagram

As shown, the page consists of the upper plot area and the lower control area:

1. Plot area

   Generate a CCDF waveform diagram based on the selected waveform.

   - The vertical direction represents probability; The horizontal direction represents a multiple of the relative average power (in dB).

- The yellow curve is the current CCDF curve of the selected waveform. And the grey curve is the CCDF reference curve.

2. Control area

   The CCDF curve can be zoomed in or out for easy observation and comparison:

   - Click  to return to the previous page;
   - Click  to resume the CCDF to the initial state;
   - Click  to zoom in the diagram.
   - Click  to zoom out the diagram;
   - The “Zoom Position” parameter sets the center position of the diagram, and the zoom operation is based on this position.

8.9.9 Trigger

Press I/Q > *ARB* > *Trigger* to enter the ARB trigger setting menu.

Triggers control data transmission by controlling when the signal generator transmits the modulating signal. You can configure trigger settings so that data transmission occurs once (Single mode), continuously (Continuous mode), or starts and stops repeatedly (Gated and Segment Advance modes).

8.9.9.1 Trigger Type

Trigger type defines the trigger mode: how the waveform plays when triggered.

You can set the trigger type to Continuous, Single, Segment Advance or Ext Gated.

1) Continuous: Continuous mode repeats the waveform until you turn the signal off or select a different waveform, trigger mode, or response (Free Run, Trigger & Run, and Reset & Run).
2) Single: Single mode plays the waveform once.
3) Segment Advance: Segment Advance mode plays a segment in a sequence only if triggered. The trigger source controls segment-to-segment playing. A trigger received during the last segment loops play to the first segment in the sequence.
4) Ext Gated: Ext Gated mode triggers the waveform at the first active triggering state, then repeatedly starts and stops playing the waveform in response to an externally applied gating signal.

8.9.9.2 Continuous Mode

The *Continuous Mode* can be set to Free Run, Trigger & Run or Reset & Run mode.

1) Free Run: Immediately triggers and plays the waveform; triggers received while the waveform is playing are ignored.
2) Trigger & Run: Plays the waveform when a trigger is received; subsequent triggers are ignored.
3) Reset & Run: Plays the waveform when a trigger is received; subsequent triggers restart the waveform.

8.9.9.3 Single Mode

The *Single Mode* can be set to no retrigger, buffered trigger or restart on trigger mode.

1) No Retrigger: Ignores an early trigger received while a waveform is playing.
2) Buffered Trig: An early trigger received while a waveform is playing waits until the current waveform completes, then plays the waveform once more.
3) Restart on Trig: An early trigger received while the waveform is playing immediately restarts the waveform.

8.9.9.4 Segment Advance Mode

The *Segment Advance* mode can be set to single or continuous mode.

1) Single: A segment in a sequence plays once, ignoring the repetition setting, after which the dual ARB player stops and waits for a trigger before advancing to the next segment. The next segment then plays to completion.

   If a trigger is received while a segment is playing, the segment plays to completion. The dual ARB player then advances to the next segment and plays that segment to completion.
2) Continuous: A segment in a sequence plays continuously until the waveform receives another trigger.

   If a trigger is received while a segment is playing, the segment plays to completion. The dual ARB player then advances to the next segment and plays that segment continuously.

8.9.9.5 Ext Gated Mode

The *Ext Gated Mode* can be set to Active High or Active Low. The waveform stops during the inactive state of the trigger source, and plays during the active state.

8.9.9.6 Trigger Source

The trigger source can be set to trigger key, bus, or external.

1) Trigger Key: Each time the Trigger key is pressed, the signal source generates a trigger signal.
2) Bus: Each time the "*TRG" command is sent, the signal source generates a trigger signal.
3) Ext: The signal generator receives the external trigger signal input from the **[PATTERN_TRIG]** connector on the rear panel of the instrument.

NOTE: In “Free Run” or “Ext Gated” trigger mode, the “Trigger Source” item is hidden.

8.9.9.7 Ext Polarity

When the trigger source is set to external, the external trigger polarity can be set to positive or negative.

- Positive: The signal generator responds during the trigger signal low state.
- Negative: The signal generator responds during the trigger signal high state.

NOTE: In Continuous, Single, and Segment Advance modes, use the *Ext Polarity* item to set the external trigger polarity. In Gated mode, the Active Low and Active High items determine the external trigger polarity.

8.9.9.8 Trigger Delay

When setting external trigger source, users can set the external trigger delay. The delay type can be set to off, time, or sample.

- Off: Turn off trigger delay.
- Time: Set the time from when the external trigger signal is received until the trigger takes effect, which can be set through the *Delay Time* button.
- Sample: Set the number of sampling points from the time when the external trigger signal is received until the trigger takes effect, which can be set through the *Delay Samples* button. Where:

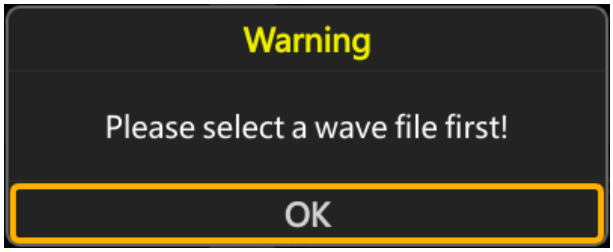
$$Delay\ time = Delay\ Samples / Sampling\ rate$$

NOTE: When the trigger mode is initially selected or when changing from one trigger mode to another, the carrier signal on the RF output may be lost until the modulating signal is triggered. This is because the signal generator sets the I and Q signals to zero volts before the first trigger event.

8.9.10 Waveform Header

After selecting a waveform segment or sequence in I/Q > *ARB* > *Select Waveform* , click the *Waveform Header* button to enter the waveform header setting interface.

NOTE: When no waveform segment or sequence is selected in *Select Waveform* , that is, *NONE is selected, the waveform header setting interface cannot be entered. At this time, the user interface will pop up a prompt:



8.9.10.1 About Waveform Header

For a certain waveform, you can save the settings and parameters of the signal generator in the header file, including the marker settings, etc. When playing the waveform file, the header file settings are automatically applied to the signal generator, so the waveform header file function can set up the signal generator in the same way every time the waveform is played.

The waveform sequence header file takes precedence over the header file of each waveform segment. When the waveform sequence is played, the waveform segment header files are ignored and the waveform sequence header file is automatically loaded into the signal generator.

8.9.10.2 Editing a Waveform Header

The editing interface of a waveform header is shown as below.

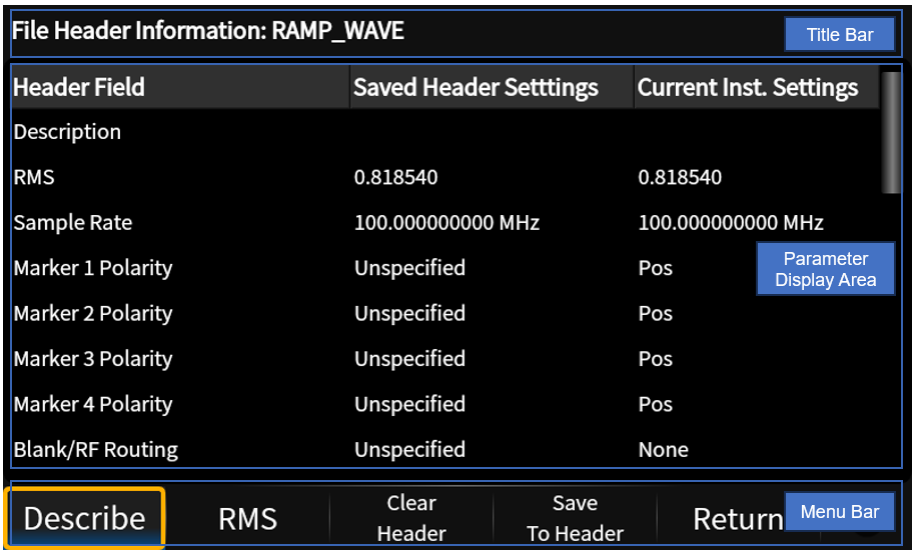


Figure 8-21 Waveform header editing interface

The waveform header editing interface is composed of title bar, parameter display area and menu bar.

1. **Title Bar**

Display the currently selected waveform segment or waveform sequence. Press I/Q > *ARB* > *Select Waveform* to select a segment or sequence to edit its waveform header.

2. **Parameter Display Area**

There are three columns' parameters in parameter display area.

- Header Field: list all the file header parameters.
- Saved Header Settings: show the header settings saved in the currently selected waveform segment or sequence header file. "Unspecified" means that there is no setting saved for that particular parameter.
- Current Inst. Settings: show the current signal generator settings. The header parameters are in I/Q > *ARB* > *ARB Setup* and I/Q > *ARB* > *Marker Utilities* menu.

NOTE: If a setting is unspecified in the header file, the signal generator uses its current value for that setting when you select and play the waveform.

3. **Menu Bar**

- Describe: set a description for the waveform header file.
- RMS: set the RMS value of the waveform data.
- Clear Header: reset the saved header settings to default settings, that is "Unspecified".

- Save to Header: save the information in the Current Inst. Settings column to the header file. At this time, the Saved Header Settings column and the Current Inst. Settings column display the same values.

8.9.11 Waveform Segment File Type

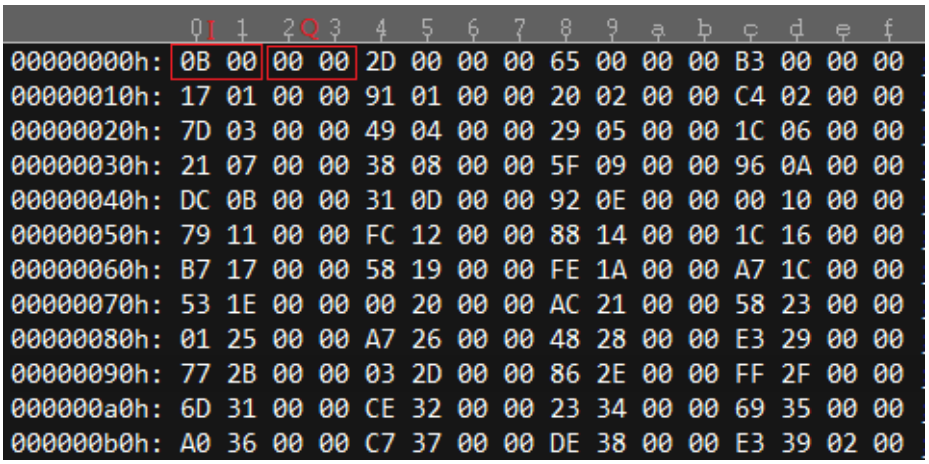
ARB waveform segments can be loaded into three file types: *.arb, *.WDbin and *.txt.

8.9.11.1 arb file

The arb file (*.arb) is generated by the signal generator, or generated by SIGLENT SigIQPro software.

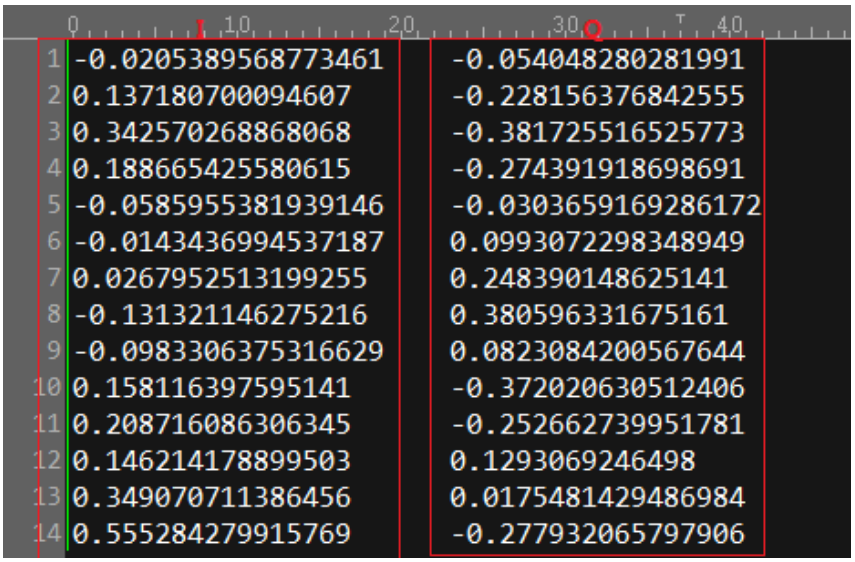
8.9.11.2 WDbin file

A WDbin file (*.WDbin) is a binary file of pure waveform data. The I and Q waveform data are 16-bit complement data and are alternately stored in the file.



8.9.11.3 txt file

The txt file (*.txt) is a txt file of pure waveform data. The I and Q waveform data are stored in the file in the form of floating-point numbers. I and Q are stored in two columns, I in the first column and Q in the second column.


0
10
20
30
40
I
Q
1 -0.0205389568773461 -0.054048280281991
2 0.137180700094607 -0.228156376842555
3 0.342570268868068 -0.381725516525773
4 0.188665425580615 -0.274391918698691
5 -0.0585955381939146 -0.0303659169286172
6 -0.0143436994537187 0.0993072298348949
7 0.0267952513199255 0.248390148625141
8 -0.131321146275216 0.380596331675161
9 -0.0983306375316629 0.0823084200567644
10 0.158116397595141 -0.372020630512406
11 0.208716086306345 -0.252662739951781
12 0.146214178899503 0.1293069246498
13 0.349070711386456 0.0175481429486984
14 0.555284279915769 -0.277932065797906

8.10 Multitone

Press I/Q > *Multitone* to enter multitone mode. Multitone mode supports up to 10 000 tones. The highest sampling rate is 1250 MHz, and the maximum spectral spacing can be up to 500 MHz. Both unilateral spectrum and bilateral spectrum modes are supported.

8.10.1 Multitone State

Press I/Q > *Multitone* > *Multitone State* to turn Multitone on or off.

8.10.2 Tone Number

Press I/Q > *Multitone* > *Tone Number* to set tone number. The maximum support is 10 000. The multitone spectrum defaults to exist in pairs. The number set here refers to the meaning of how many pairs, and is a bilateral spectrum symmetrically distributed on both sides of the center frequency.

8.10.3 Sample Rate

Displays the sampling rate of the generated multi-tone waveform, with the maximum sampling rate being 1250 MHz.

NOTE: When the SSG6080AV-B1000 option is disabled, the maximum multi-tone sampling rate is 625 MHz.

8.10.4 Tone Spacing

Press I/Q > *Multitone* > *Tone Spacing* to set the frequency spacing. The frequency spacing here refers to the frequency spacing between adjacent spectrums.

8.10.5 Single Side

Press I/Q > *Multitone* > *Single Side* to turn the unilateral spectrum mode on or off. If the unilateral spectrum mode is turned on, the spectrum on the left side of the multi-tone (left side of the center frequency) will be removed.

8.10.6 Save State

Press I/Q > *Multitone* > *Save State* to save the current parameter settings of the Multitone mode to a MULSTATE file.

8.10.7 Load State

Press I/Q > *Multitone* > *Load State* to load a MULSTATE file from the file browser as the setting parameters for Multitone mode.

8.11 AWGN

Press I/Q > *AWGN* to enter the AWGN setting menu. You can use AWGN (Additive White Gaussian Noise) to modulate the Carrier waveform.

8.11.1 AWGN State

Press I/Q > *AWGN* > *AWGN State* to turn AWGN modulation on or off. When AWGN modulation is on, the user interface status bar will display a blue "AWGN" icon.

8.11.2 Bandwidth

The setting range of AWGN bandwidth is 320 Hz ~ 500 MHz or 1 GHz(with option SSG6080AV-B1000), and the default is 10 MHz.

8.11.3 Example

Use the following steps to apply 10 MHz bandwidth noise to a 1 GHz, 0 dBm carrier.

1) Press I/Q > *AWGN* > *Bandwidth* to set the noise bandwidth as 10 MHz.
2) Turn on I/Q > *AWGN* > *AWGN State* .
3) Turn on MOD ON/OFF . At this time, an "AWGN" icon will display on the status bar.
4) Configure RF output, set frequency to 1 GHz, amplitude to 0 dBm, and turn on RF ON/OFF .

The carrier with AWGN is now available at the signal generator's **[RF OUTPUT 50Ω]** connector.

8.12 LFM

Linear Frequency Modulation (LFM) is a modulation technique used in wireless communications and radar systems. In linear frequency modulation, the frequency of a signal changes linearly over time, thereby achieving signal modulation.

The principle of linear frequency modulation is to transmit information by changing the frequency of a signal. Its basic idea is that over a period of time, the frequency of a signal changes linearly from an initial frequency to another target frequency. This change can be achieved by changing the phase or frequency of the signal.

In linear frequency modulation, the modulating signal is a continuous bandwidth-limited signal, usually called a modulating wave. The frequency of the modulating wave increases or decreases linearly over time, forming a ramp with an increasing or decreasing frequency. The slope of this ramp determines the bandwidth of the signal.

Press I/Q > *LFM* to enter LFM mode.

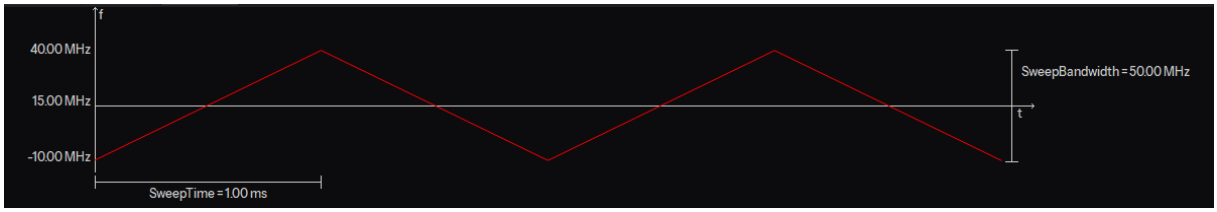
8.12.1 LFM State

Turn Linear Frequency Modulation on or off.

Users can turn on common LFM by setting parameters such as bandwidth, frequency offset, sweep time, sweep type (triangle, up, down), etc., or customize LFM by setting the LFM train.

8.12.2 Common LFM

Set *Mode* to "Common". You can set the common LFM by setting parameters such as bandwidth, frequency offset, sweep time, sweep type (triangle, up, down), etc.



8.12.2.1 Bandwidth

Set the sweep bandwidth for linear frequency modulation signal.

Range: 320 Hz ~ 500 MHz, or 320 Hz ~ 1 GHz (with option SSG6080AV-B1000).

Default: 50 MHz.

8.12.2.2 Freq Offset

Set the frequency offset for linear frequency modulation signal.

Range: -250 MHz ~ 250 MHz, or -500 MHz ~ 500 MHz (with option SSG6080AV-B1000).

Default: 0 Hz.

8.12.2.3 Sweep Time

Set the sweep time for linear frequency modulation signal.

Range: 200 ns ~ 1 s.

Default: 1 ms.

8.12.2.4 Sweep Type

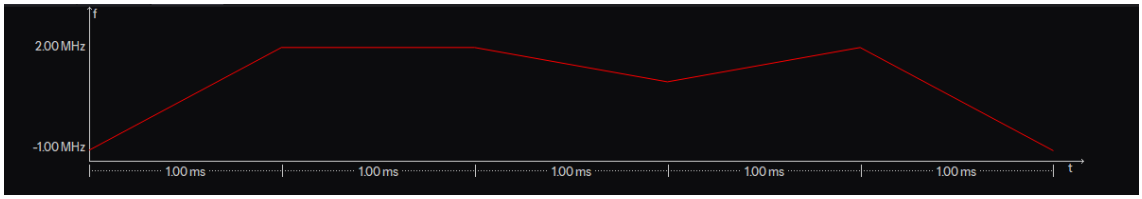
Select the sweep direction type.

Choices: Triangle | Up | Down.

Default: Triangle.

8.12.3 Customized LFM

Set *Mode* to “Customized” to customize the LFM by setting the LFM train.



Click *Train* to customize the LFM sequence.

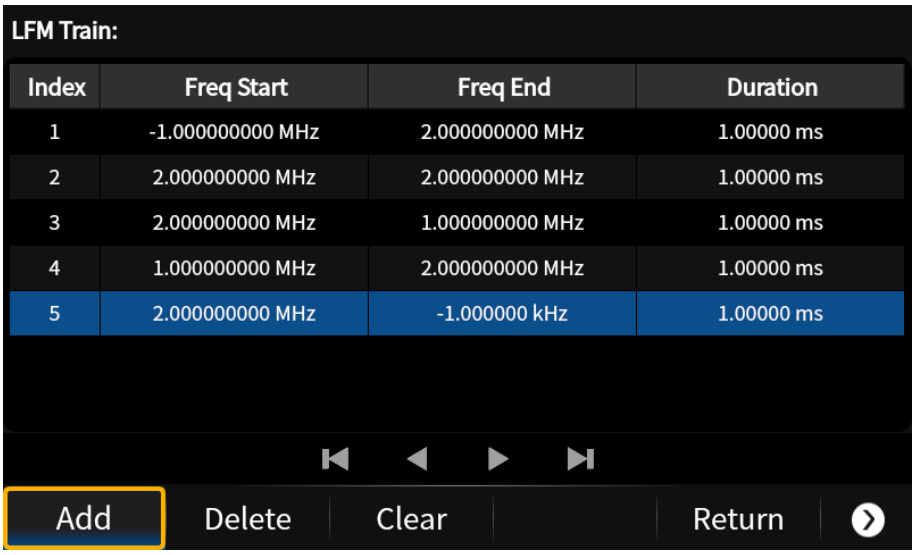


Figure 8-22 LFM train settings page

In the LFM train settings page, you can:

- Add, delete or clear the LFM sequence,
- Set the Start Frequency, End Frequency and Duration of each segment of the LFM sequence,
- Save the current sequence as an lfmt file, or load a sequence from an lfmt file.

8.12.4 Sample Rate

Set the sample rate for linear frequency modulation signal.

Range: 1.25 times the bandwidth to 625 MHz, or 1.25 times the bandwidth to 1.25 GHz (with option SSG6080AV-B1000),

Default: 100 MHz.

8.12.5 Sample Points

Displays the number of sampling points of the linear frequency modulation signal.

Range: 200 ~ 32M.

8.12.6 Update

Regenerate waveform data according to current settings.

NOTE: If the Update button flashes, it means that the current settings have been changed or the

update has failed. If the current settings have been changed, you need to click the Update button to regenerate the waveform data. If the update fails, you need to modify the incorrect modulation parameters and then click the Update button.

8.12.7 Save Waveform

Click the "Save Waveform" button to save the current LFM signal to an arb file (arbitrary waveform file). The saved arb file can be played in ARB mode.

8.13 I/Q Control

Press I/Q > *I/Q Control* to enter the I/Q Control setup menu. The I/Q Control menu not only enables you to select the I/Q signal source and output, but also provides adjustments and calibrations to compensate for differences in I and Q signals.

8.13.1 I/Q Mod State

Turn on or off the I/Q modulation. When turn on the Custom, ARB, Stream, IoT, Multitone, or AWGN modulation, the *I/Q Mod State* will be automatically turned on.

8.13.2 I/Q Source

Set the I/Q modulation source to internal or external.

- Internal: Use the internal signal generated by the signal generator as modulation source.
- External: The signal generator accepts externally supplied analog I and Q signals as modulation sources via the **[I INPUT]** and **[Q INPUT]** connectors on the rear panel.

Example using an external IQ modulation source:

1) Connect the external analog I and Q signals to the **[I INPUT]** and **[Q INPUT]** connectors on the rear panel of the signal generator respectively.
2) Press I/Q > *I/Q Control* > *I/Q Source* to set the I/Q modulation source to External.
3) Turn on *I/Q Mod State* .
4) Turn on MOD ON/OFF .
5) Configure the RF carrier and turn on RF ON/OFF .

At this time, the **[RF OUTPUT 50Ω]** connector of the signal generator will output the carrier signal modulated by the external modulation source.

8.13.3 I/Q RF Compensation

Turn on or off the RF link bandwidth compensation function of I/Q modulation.

8.13.4 Vector Correction

RF signal generators are usually calibrated at their RF output port, which is defined as the reference plane (RP). However, the device under test (DUT) is usually not connected directly to this port, but rather through a two-port interconnect network consisting of cables, attenuators, amplifiers, switches, test fixtures, and even antennas. At the DUT plane (DP) where the DUT is connected to the interconnect network, the frequency response flatness (amplitude/phase) degrades and becomes more pronounced at higher modulation bandwidths and RF frequencies.

In order to accurately characterize the DUT, this undesirable interconnection characteristic must be removed from the DUT plane test signal. This process of moving the reference plane from the RF output port to the DUT input port is called de-embedding.

The SSG6082A-V vector signal generator provides excellent specified RF frequency response flatness (within a modulation bandwidth of 1 GHz) of < 1 dB (measured < 0.4 dB) on the reference plane.

The SSG6082A-V vector compensation feature transfers the natural frequency response flatness to the DUT plane by moving the test signal reference plane to the input port of the DUT. This DUT de-embedding process is performed in real time directly on the SSG6082A-V by importing s2p files that describe the transmission and reflection performance of the two-port interconnect network through its scattering parameters S_{xy}.

The vector compensation feature can import up to 10 s2p files simultaneously, which can describe different parts of the interconnect network, such as cables, switches, attenuators, amplifiers, antennas, etc. The user can activate or deactivate the imported s2p files individually, and for cascaded interconnect networks (multiple s2p file scenarios), the vector compensation feature automatically concatenates all S-parameter matrices.

Frequency response correction applies to:

- The entire frequency range covered by the imported s2p files, not just a dedicated RF frequency,
- Any baseband signal, not just dedicated waveforms.

In addition to the frequency response correction within the modulation bandwidth, an absolute RF level correction is also available based on the activated s2p files.

Press I/Q > *I/Q Control* > *Vector Correction* to enter the vector compensation setup interface of SSG6082A-V.

For the application example, please refer to section "7.14 DUT De-embedding Using Vector Correction Function".

8.13.4.1 Applying s2p Files

Press *Vector Correction* switch to turn the vector compensation function on or off. When the vector compensation function is turned on, a blue "VC" logo will be displayed in the user interface status bar.

Press *User S-Parameter* button to enter the S2P file list import, delete and other editing pages.

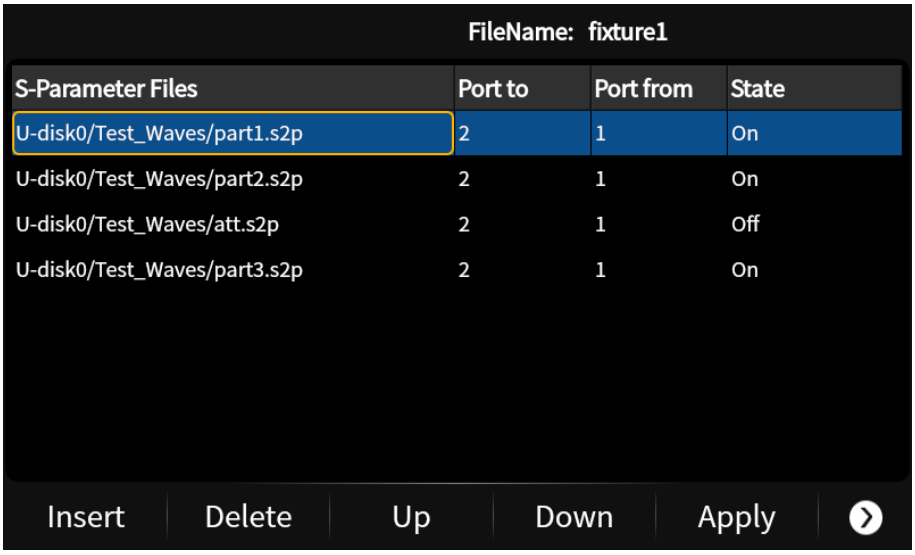


Figure 8-23 S2P file import page for vector compensation function

- Insert: Import an s2p file from the file browser.
- Delete: Delete the selected s2p file.
- Up or Down: You can move the selected s2p file to adjust its order in the s2p file list.
- Click the parameters corresponding to the “Port to”, “Port from” and “State” in the s2p file list to modify the input port, output port, and activation/deactivation status of the s2p file.
- Apply: Apply the current s2p file list in the vector compensation function.
- Save: Save the s2p file list to the FREQRESP file.
- Recall: Load the s2p file list from the FREQRESP file.
- Clear: Clear the s2p file list.
- Overview: View the frequency range, gain and phase of the activated s2p files. Click *Table* during overview to return to the s2p file list page.

NOTE: After updating the s2p file list, the user needs to click the *Apply* button to apply the latest s2p file list in the vector compensation function.

The *Bandwidth* button shows the compensation bandwidth is 1 GHz. The SSG6082A-V performs vector compensation within the full bandwidth.

8.13.4.2 Compensating Absolute Level

Turn on the *Power Compensation* switch to perform absolute RF level correction based on the activated s2p files. The absolute level correction value will be displayed in *Absolute Level Correction* button.

8.13.5 I/Q Adjustment

Use I/Q Adjustment to compensate for or add impairments to the I/Q signals. This adjustment is available only on the RF output.

8.13.5.1 Gain Balance

Adjust the gain for the I signal relative to the Q signal. And use it as an internal channel image optimization.

Range: -4 dB to 4 dB, default is 0 dB.

8.13.5.2 I Offset

Adjust the DC bias level of I+ and I- baseband signals. Unit: %.

Range: -100 to 100%, default is 0%.

8.13.5.3 Q Offset

Adjust the DC bias level of Q+ and Q- baseband signals. Unit: %.

Range: -100 to 100%, default is 0%.

Users can adjust I Offset and Q offset alternately to optimize LO leakage.

8.13.5.4 Quadrature Angle Adjustment

Adjust the phase angle (quadrature skew) between the I and Q vectors by increasing or decreasing the Q phase angle. It only affects the RF output path. Positive skew causes the angle to increase from

90 degrees, while negative skew causes the angle to decrease from 90 degrees. When the quadrature skew is zero, the phase angle between the I and Q vectors is 90 degrees.

This can optimize the image leakage.

Range: -20 to 20°, default is 0.

8.13.5.5 I/Q Balance Adjustment

Execute an IQ balance automatic adjustment function to automatically adjust the gain balance, I offset, Q offset and quadrature angle adjustment.

8.13.5.6 Skew

Adjust the delay between the I and Q vectors. It affects the RF output path only.

Range: -125 to 125 ps, default is 0.

8.13.5.7 Delay

Adjust the delay of the I and Q vectors relative to the marker. It affects only the RF output path.

Range: -180 to 26000 ns, default is 0.

8.13.5.8 Phase Offset

Adjust the I and Q vector phase offsets. It affects the RF output path only.

Range: -360 to 360°, default is 0.

8.13.6 I/Q Output

This adjustment is only applied to the signals routed to the rear panel I and Q output connectors.

8.13.6.1 I/Q Output Level

Set the level of the signals routed to the rear panel I and Q output connectors.

Range: 0 to 3 V, default is 0.

8.13.6.2 I Output Bias

Set the common-mode offset voltage of the in-phase (I) signal routed to the rear-panel I output connector.

Range: -3.6 to 3.6 V, default is 0.

8.13.6.3 Q Output Bias

Set the common-mode offset voltage of the quadrature-phase (Q) signal routed to the rear-panel Q output connector.

Range: -3.6 to 3.6 V, default is 0.

8.13.6.4 I Output Offset

Set the differential offset voltage of the in-phase (I) signal routed to the rear-panel I output connector.

Range: -200 to 200 mV, default is 0.

8.13.6.5 Q Output Offset

Set the differential offset voltage of the quadrature-phase (Q) signal routed to the rear-panel Q output connector.

Range: -200 to 200 mV , default is 0.

8.13.6.6 I/Q Output Gain Balance

Set the I/Q gain ratio for signals routed to the rear panel I and Q output connectors.

Range: -4 to 4 dB, default is 0.

When the setting value is positive, the I signal is attenuated, and when the setting value is negative, the Q signal is attenuated.

8.13.6.7 Quad Angle Adjustment

Adjust the phase angle (quadrature skew) of the I and Q output signals to the rear panel connectors by increasing or decreasing the Q phase angle. Positive skew increases the angle from 90 degrees, while negative skew decreases the angle from 90 degrees. When the quadrature skew is zero, the phase angle of the signals at the I and Q output connectors is 90 degrees.

Range: -10 to 10°, default is 0.

8.13.6.8 I/Q Output Skew

Adjust the delay between the signals routed to the rear panel I and Q output connectors.

Range: -250 to 250 ps, default is 0.

8.13.6.9 I/Q Output Delay

Adjust the delay of the signals routed to the rear panel I and Q output connectors.

Range: -180 to 16000 ns, default is 0.

8.13.6.10 I/Q Output Phase Offset

Adjust the phase offset of the signals routed to the rear panel I and Q output connectors.

Range: -360 to 360°, default is 0.

8.13.6.11 Compensation

Turn on or off the broadband compensation function of the I/Q output link.

8.13.7 I/Q Swap

By swapping the I and Q signals, the modulation sidebands are inverted (the Q portion of the signal is inverted).

- When IQ swapping is off, it is normal output mode, and the output of the RF modulator will be:

  $$i(t)\cos(2\pi * fc * t) + q(t)\sin(2\pi * fc * t)$$

  Where *i(t)* and *q(t)* represent I and Q signals, and *fc* represents the carrier frequency.

- When IQ swapping is on, the Q signal will be inverted, and the output of the RF modulator will be:

  $$i(t)\cos(2\pi * fc * t) - q(t)\sin(2\pi * fc * t)$$

  At this time the spectrum is the mirror image of the normal mode.

8.13.8 I/Q LO Setting

The local oscillator setting allows multiple RF signal sources to use the same local oscillator signal to reduce the phase fluctuations between multiple RF signals, thereby achieving a stable phase relationship between multiple RF signals.

For the application example, refer to the "7.8 LO Coupling of Cascaded Instruments" section.

8.13.8.1 I/Q LO Source

SSG6082A-V can use internal oscillator signal or external frequency source as the LO signal. You can set it by pressing I/Q > *I/Q Control* > *I/Q LO Source*.

When using an external source as the LO signal, the external source will be input through the **[LO IN]** connector on the rear panel of the SSG6082A-V.

NOTE: SSG6082A-V cannot verify the frequency of the input oscillator signal. It is recommended that you input a signal with exactly the same frequency.

8.13.8.2 I/Q LO Output

Press *I/Q LO Output* to turn on the output of the LO signal, whether the LO signal is the internal oscillator signal or the external frequency source. After turning it on, the internal or external LO signal will be output by the **[LO OUT]** connector on the rear panel of the SSG6082A-V.

8.14 UTILITY

The UTILITY settings of the RF signal source include system settings and file management.

8.14.1 System

8.14.1.1 Settings

1. Language

Set the display language of the RF signal source. The signal source supports Chinese and English menu, help and interface display.

Press UTILITY > *Settings* > *Language* to expand drop down list, and then select the desired language.

2. Screen Saver

Set the state of screen saver. When screen saver is switched on, screen saver will be enabled if no action is taken within the specified time. Click the touch screen or press any key to resume.

Press UTILITY > *Settings* > *Screen Saver* to expand drop down list, and then select “off”, “10 s”, “1 min”, “5 min”, “15 min”, “30 min”, “1 hour” or “2 hour”.

3. Setup Type

Set the type of parameter configuration to be loaded when the instrument startup.

Press UTILITY > *Settings* > *Power On* to expand drop down list, and then select “Default” or “Last”.

- Default: The factory defined default settings will be loaded at power-on. For more details, please refer to “Table 8-5 Default Settings”.
- Last: The system setting before the last power-off will be loaded automatically at power-on.

4. Preset Type

Set the parameters for the Preset configuration of the instrument.

Press UTILITY > *Settings* > *Preset Type* to expand drop down list, and then select “Default” or “User”.

- Default: The default settings will be loaded when PRESET is pressed. For more details, please refer to “Table 8-5 Default Settings”.

- User: The user specified configuration will be loaded when PRESET is pressed.

NOTE: After selecting the preset type as "User", the file management interface will automatically open to allow the user to load the configuration file. You can also click  to change the configuration file.

5. Factory Reset

Restore the instrument configuration to factory settings.

Press UTILITY > *Settings* > *Factory Reset*, set the instrument parameters and status to factory defaults.

To restore factory settings, in addition to loading the default settings, the following functions and parameters will also be configured.

Table 8-2 Factory Default

Parameters	Default Value
Settings	
Language	Chinese/English (depend on factory configuration)
Screen Saver	Off
Setup Type	Default
Preset Type	Default
Beeper	On
Power On Line	Off
Ref Frequency Type	Fixed 10M
10M Adjustment	Off
Interface	
DHCP State	On
Auto DNS	Off
VNC Operable	On
FTP State	On
Hostname	Consistent with product model
GPIB Address	18
Level	

Flatness	Empty list
Sweep	
List sweep	Keep only one default sweep point “1,1.5 GHz, -140 dBm, 50 ms”
Pulse	
Pulse Train	Keep only one default pulse “1, 1 ms, 1 ms, 1”

6. Reset & Clear

“Reset & Clear” will restore the instrument configuration to factory settings, as well as clean up files stored by users in “Local” folder.

Press UTILITY > *Settings* > *Reset & Clear* to set the instrument parameters and status to factory defaults and clean up local files.

7. Beeper

Set whether the beeper make a sound when clicking any button, input box or check box.

Press UTILITY > *Settings* > *Beeper* to switch the beeper state.

8. Power On Line

Set the instrument power on sequence. In some situations, you may want the instrument to automatically restart if the line power is restored.

- Off: If line power is available, you need to manually press the power key on the front panel to start the instrument.
- On: If line power is available, the instrument starts automatically. This is an idea feature for automatic or remote tests that may be difficult to physically reach.

Press UTILITY > *Settings* > *Power On Line* to switch the state.

9. 10M Adjustment

Please see the “9 Reference Source Settings” chapter for details.

10. Time Setting

Set the display time of the instrument.

Press UTILITY > *Settings* > *Time Setting* , then move the cursor to specified location and change the time by inputting the value.

11. Log Info

The log function mainly records the operation records and some important event records during the operation of the system. When certain problems occur, it can provide some prompt information or traceback record information to users and developers.

Press UTILITY > *Settings* > *Time Setting* to view the log list of the RF signal source.

In the log info interface, you can also save or clear the log content.

8.14.1.2 System Info

Press UTILITY > *System Info* to view the instrument's system information, including:

- Model
- Host ID
- Serial Number
- Software Version
- Uboot-OS Version
- Startup Times
- Hardware Information

8.14.1.3 Interface

Press UTILITY > *Interface* to view the instrument's remote control interface information. Please see “10 Interface Settings” chapter for details.

8.14.1.4 Self Test

Press UTILITY > *Self Test* to enter the system's self-test interface.

1. LCD Test

Press *LCD Test* to enter the screen detection.

The RF signal source cycles through the red, green and blue pixels of the display to verify whether there are dot defects on the screen.

Press 7 to change the color and press 8 to exit.

2. Key Test

Press *Key Test* to enter the keyboard test interface. Press the function keys at the front panel one by one and observe whether the corresponding key is checked. If not, an error may have occurred in the key. To exit the test, press 8 three times or click the screen.

3. LED Test

Press *LED Test* to enter the LED test interface. Press 7 to light or extinguish the key light of the button MOD ON/OFF and RF ON/OFF and press 8 to exit the test.

4. Board Test

Press *Board Test* to enter the board test interface. Test whether writing and reading are normal for CPLD and FPGA.

5. Touch Test

Press *Touch Test* to enter the touch screen test interface. Click the marks on the interface to test the touch screen and press 8 to exit the test.

8.14.1.5 Shutdown

Press the power button for two seconds to turn off the signal source. Or follow the steps below to power off the instrument:

UTILITY > *System* > *Shutdown* .

8.14.1.6 Preset

Reset parameter settings according to the type of preset.

Press UTILITY > *Preset* to reset the parameters.

8.14.1.7 Update

Press UTILITY > *Update* , and select the update file. Then click *Recall* to update the system software. The progress bar will appear on the screen while updating and the instrument will restart

automatically if updates succeed or pop-up prompt box if updates fail.

8.14.1.8 Option

Press UTILITY > *Option* , to enter the option interface. Click the drop-down box under the "Install" group box to choose the license type need to be installed. Enter a license in the input box and click *Install* to finish the license installing.

If the installations succeed, the prompt message "license was successfully installed" will be pop-up. If not, the prompt message "license was entered incorrectly" will be pop-up.

NOTE: The SSG comes with trial options that have a finite number of uses. It allows users to evaluate the options without purchasing them. You can find the remaining number of trials at the top of the option interface. When the remaining time of a certain function is zero, the function will be disabled. When a license is successfully installed for a certain function, the remaining times will be shown as "--" and the type of the license will be permanent, which means users have unrestricted access to the function.

Please refer to the data sheet for the option types of SSG6082A-V.

8.14.1.9 Help

The built-in help system provides help information for each function and menu option on the front panel.

1. Press UTILITY > *Help* to enter help interface.
2. Click to enter the corresponding directory.

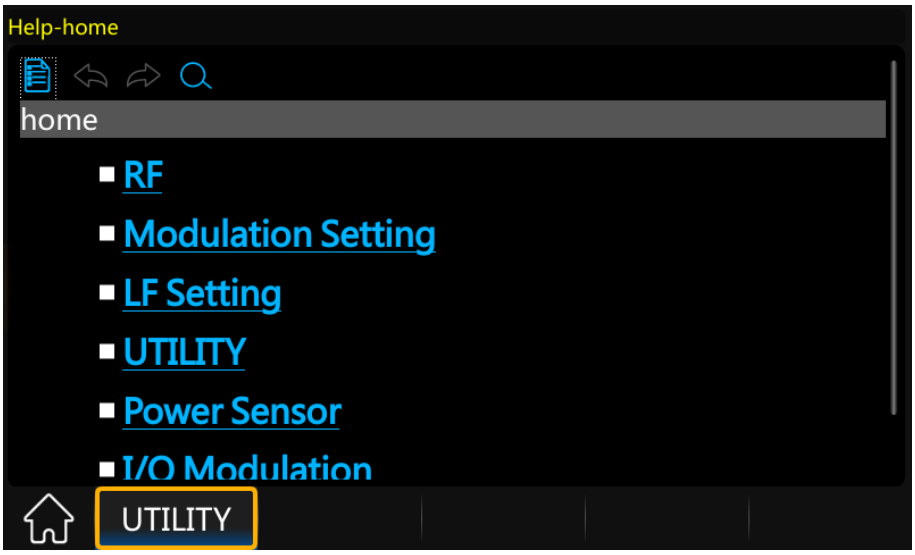


Figure 8-24 Help interface

8.14.1.10 Contact Us

Press UTILITY > *Contact Us* to view the contact information for SIGLENT. You can contact us to solve the problems meet in practical use. You can also write *info@siglent.com* or call your local SIGLENT sales office for support.

8.14.2 File

Press UTILITY > *Store/Recall* to enter file management page.

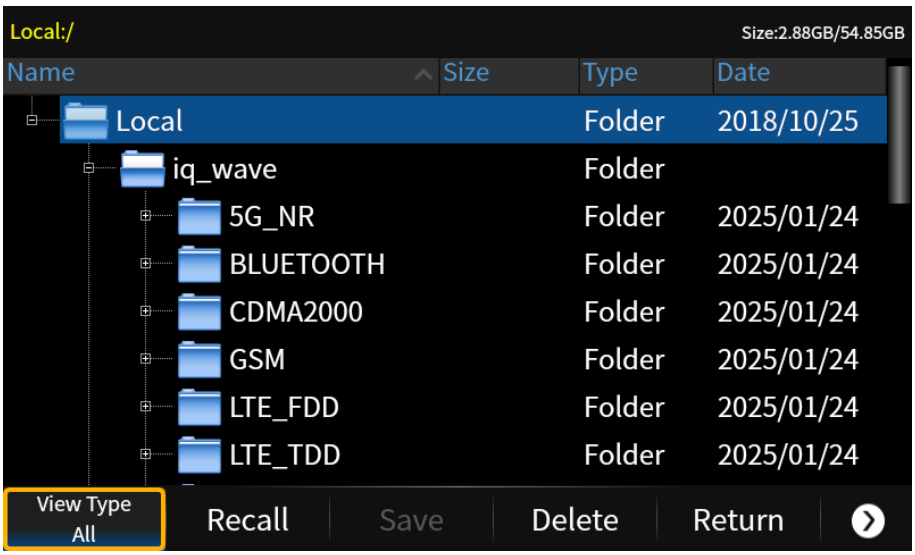


Figure 8-25 File management page

In the file management page, the top bar displays the currently selected path, folder or file, as well as the size of the used memory and available memory in the Local path or USB flash drive. A file list is displayed in the middle of the interface. You can select files and fold or expand folders by tapping the touch screen. You can also use the up and down keys to select files and the left and right keys to collapse or expand folders. The bottom bar of the interface displays operation buttons. The specific operations are as follows.

1. View Type

Click *View Type* to change the type of files to show, including “All”, “State” and “Update”.

Table 8-3 File Type

File Type		File Extension	Description
All	Data	LSW	Sweep list file
		UFLT	Flatness correction file
		PULSTRN	Pulse train file
		ARB	IQ waveform segment file
		MARKER	IQ waveform segment marker file
		HEADER	IQ waveform segment header file
		SEQ	IQ waveform sequence file
		SHEADER	IQ waveform sequence header file
		MULSTATE	IQ Multitone file
		UDATA	PN sequence file of I/Q modulation
		MAP	Constellation diagram file of I/Q modulation
		ML	ARB multi-carrier list file for I/Q modulation
		FREQRESP	Vector compensation s2p file list
		DAC	Reference oscillator code file
		TAR.GZ	System running log
		TXT	Power sensor log file
	State	XML	System state file
	Update	CFG	Configuration update file
		ADS	System update file

2. Recall

Click *Recall* to load the selected file.

3. Save

Click *Save* to save the file with corresponding type according to the type of data.

4. Delete

Click *Delete* to delete the selected file or folder.

5. New Dir

Click *New Dir* to create new folders.

6. Rename

Click *Rename* to rename a file or folder.

7. Copy

Click *Copy* to copy the selected file or folder.

8. Paste

Click *Paste* to paste the copied file or folder to specified location.

8.15 Shortcut Keys

There are some shortcut keys on the front panel of the RF signal source to quickly perform specific functions. These shortcut keys include:

Table 8-4 Shortcut Keys

Shortcut Keys	Function
PRESET	Quick preset
HOME	Quick return to home page
ESC	Exit remote mode or edit mode
TRIG	Execute key trigger
MOD ON/OFF	Modulation master switch
RF ON/OFF	RF output switch

8.15.1 PRESET

Recall the preset settings and restore the signal generator to a specified state.

- Press UTILITY > *Settings* > *Preset Type* to select "Default" or "User". When selecting the preset type as "User", you need to select the preset state file.
- Press PRESET , and the instrument will recall the default settings or user settings. The default settings are shown in the table below.

Table 8-5 Default Settings

Parameter	Default Value
RF	
RF State	Off
Frequency	
Frequency	8 GHz
Freq Offset	0 Hz
Phase Offset	0 deg
Level	
Level	-140 dBm

Level Offset	0 dB
ALC State	Auto
Flatness	Off
Sweep	
Sweep State	Off
Sweep Mode	Continuous
Direction	Up
Trigger Mode	Auto
Point Trigger	Auto
Trigger Slope	Positive
Step Sweep	
Step Sweep State	On
Start Freq	8 GHz
Stop Freq	8 GHz
Start Level	-140 dBm
Stop Level	-140 dBm
Sweep Points	11
Dwell Time	30 ms
Sweep Space	Linear
Sweep Shape	Sawtooth
List Sweep	
List Sweep State	Off
ANALOG MOD	
ANALOG MOD State	Off
AM	
AM State	Off
AM Source	Int
AM Shape	Sine
AM Rate	1 kHz
AM Depth	50 %

FM	
FM State	Off
FM Source	Int1
FM Shape1	Sine
FM Deviation1	100 kHz
FM Rate1	10 kHz
PM	
PM State	Off
PM Source	Int
PM Shape	Sine
PM Rate	10 kHz
PM Deviation	1 rad
Pulse	
Pulse State	Off
Pulse Source	Int
Pulse Mode	Single
Pulse Period	10 ms
Pulse Width	2 ms
Double Pulse Delay	4 ms
#2 Width	2 ms
Pulse Trigger	Auto
Trig Delay	140 ns
Trigger Slope	Positive
Trig Polarity	Normal
Pulse Train	Off
Trigger Out	On
Pulse Out	Off
Pulse Out Polarity	Normal
LF	
LF Source	

LF State	Off
LF Shape	Sine
LF Frequency	1 kHz
LF Level	500 mVpp
LF Offset	0 uV
LF Phase	0 deg
LF Sweep	
Sweep State	Off
Start Freq	500 Hz
Stop Freq	1.5 kHz
Center Freq	1 kHz
Freq Span	1 kHz
Sweep Time	1 s
Trigger Mode	Auto
Sweep Shape	Sawtooth
Trigger Mode	Linear
Direction	Up
IQ MOD	
IQ MOD State	Off
Custom	
Custom State	Off
Data Setup	PN23
Seed (Hex)	7FFFFF
Symbol Rate	1 MSps
Symbol Length	2048
Mod Type	16QAM
Gray	Off
Filter Type	RootCosine
Filter Alpha	0.5
Filter Length	128

Oversampling	4
ARB	
ARB State	Off
Select Waveform	*NONE
Multi-BBG Settings	
Multi-BBG Sync Type	Off
ARB Setup	
Sample Clock	2 MHz
Modulator Atten Type	Auto
Modulation Atten	0 dB
Real Time AWGN	Off
Output Mux	Carrier+Noise
Power Control Mode	Total
Total Power	0 dBm
Carrier to Noise Ratio Format	C/N
Carrier to Noise Ratio	0 dB
Carrier Bandwidth	1 Hz
Flat Noise Bandwidth	1 Hz
Filter Type	None
Baseband Offset	Off
Multi Carrier	
Waveform Name	MULTICARRIER
Power Reference	Peak
Carrier Table	Empty
Signal Period Mode	LCM
Marker Utilities	
Marker Number	1
Output Mux	1
Marker Polarity	Positive
Pulse/RF Blank	Off

Marker Delay	0 us
Set Markers	1,1,0
Waveform Utilities	
Select Segment	*NONE
Scaling	100 %
Clipping Type	|I+jQ|
Clip |I+jQ| to	100 %
Trigger	
Trigger Type	Continuous
Continuous Mode	Free Run
I/Q Control	
I/Q Mod State	Off
I/Q Source	Internal
I/Q RF Compensation	On
Vector Correction	Off
I/Q Adjustment	
I/Q Adjustment	On
Gain Balance	0 dB
I Offset	0 %
Q Offset	0 %
Quad Angle Adjustment	0 deg
Skew	0 ps
Delay	0 ns
Phase Offset	0 deg
I/Q Output	
I/Q Output State	Off
I/Q Output Level	0 uV
I Output Bias	0 uV
Q Output Bias	0 uV
I Output Offset	0 uV

Q Output Offset	0 uV
I/Q Output Gain Balance	0 dB
Quad Angle Adjustment	0 deg
I/Q Output Skew	0 ps
I/Q Output Delay	0 ns
I/Q Output Phase Offset	0 deg
Compensation	Off
I/Q Swap	Off
I/Q LO Source	Int
I/Q LO Output	Off
Multitone	
Multitone State	Off
Tone Number	2
Single Side	Off
Tone Spacing	500 kHz
AWGN	
AWGN State	Off
Bandwidth	10 MHz

8.15.2 HOME

Press the HOME button in any menu to quickly return to the main interface.

8.15.3 ESC

This shortcut key has the following functions:

- Press this key to switch the instrument from remote control to manual control.
- During parameter editing, press this key to clear the input and exit parameter editing mode.
- In a dialog box containing an "ESC" button, press this key to close the dialog box.
- Exit the current menu and return to the previous menu.

8.15.4 TRIG

This shortcut key has the following functions:

- When the trigger mode of RF sweep is Key, press this key once to trigger a sweep.
- When the point trigger mode of RF sweep is Key, press this key once to trigger a point sweep.
- When the trigger mode of pulse modulation is Key, press this key once to start a pulse modulation.
- When the trigger mode of LF sweep is Key, press this key once to trigger a LF sweep.
- When the trigger mode of IQ modulation is Key, press this key once to trigger an IQ modulation.

8.15.5 MOD ON/OFF

Press this key to turn on the RF modulation, the key backlight turns on, and the MOD icon in the user interface status bar changes from gray to blue. Press this key again to turn off all the modulations, the key backlight turns off, and the MOD icon in the user interface status bar changes from blue to gray.

8.15.6 RF ON/OFF

Press this key to turn on the RF output, the key backlight turns on, and the RF icon in the user interface status bar changes from gray to blue. Press this key again to turn off the RF output, the key backlight turns off, and the RF icon in the user interface status bar changes from blue to gray.

9 Reference Source Settings

Press UTILITY > *Settings* > *Ref Source Setting* to set the reference frequency type, external reference frequency and 10M internal reference correction.

NOTE: Users can refer to the examples in the "7.2 Synchronizing Instruments" section.

The reference frequency type of SSG6082A-V can be set to fixed 10M and variable frequency.

9.1 Fixed 10M

When the *Ref Frequency Type* is set to "Fixed 10M", the **[REF IN]** connector on the rear panel of SSG6082A-V can receive an external reference signal with a frequency of 10 MHz.

- When an external reference signal with a frequency of 10 MHz is connected, the *Clock Source* is displayed as "External", and the user interface status bar will display a blue "EXT REF" logo. At this time, the clock source of the RF signal source is the external signal.
- When there is no external reference signal with a frequency of 10 MHz, the *Clock Source* is displayed as "Internal". At this time, the clock source of the RF signal source is the internal clock.

9.1.1 10M Adjustment

SSG6082A-V has a built-in internal reference oscillator OCXO, which can generate a 10MHz internal reference source.

When the *Ref Frequency Type* is set to "Fixed 10M", click the *10M Adjustment* button to correct the frequency of the internal clock of the RF signal source. Users needs to connect a frequency meter to the **[10MHz OUT]** connector on the rear panel, and adjust the reading of the frequency meter by modifying the codeword of the reference oscillator to correct the frequency of the internal clock of the RF signal source.

Click the button of *10M Adjustment* to enter the reference oscillator setting interface:

- Press *10M Adjustment* to turn on or off this function.
- Press *Ref Osc Code* to set the codeword of the reference oscillator.
- Press *Save Ref Osc Setting* to save “*.dac” file to store the Ref Oscillator Code you currently set.
- Press *Recall Ref Osc Setting* to recall the Ref Oscillator Code you have stored.
- Press *Reset to default* to set the Ref Oscillator Code to default value, and the reference frequency will reset to the original value, too.

NOTE: Users can refer to the example in section “7.3 Correcting 10 MHz Internal Reference Source”.

9.2 Variable Frequency

When the *Ref Frequency Type* is set to "Variable", the **[REF IN]** connector on the rear panel of SSG6082A-V can receive an external reference signal with a frequency of 1 MHz ~ 100 MHz. At this time, the clock source of the RF signal source only uses the external signal, and the *Clock Source* is always displayed as "External".

Users need to first set the frequency of the external reference signal to be input in *Ext Frequency*, and then input the external reference signal to the **[REF IN]** connector on the rear panel of SSG6082A-V.

- When the frequency of the connected external reference signal is consistent with the setting in *Ext Frequency*, the user interface status bar will display a blue "EXT REF" logo.
- When the frequency of the connected external reference signal is inconsistent with the setting in *Ext Frequency*, the user interface status bar will display a blue "EXT REF" logo, but will also prompt "REF UNLOCK".
- When no external signal is connected, the user interface status bar will prompt "REF UNLOCK".

10 Interface Settings

Press UTILITY > *Interface* to enter the instrument's remote control interface setting page.

10.1 LAN Settings

10.1.1 Network Configuration

The RF signal source supports LXI standard network configuration.

- IP Setting

IP addresses can be assigned dynamically or statically. Open the *DHCP state* to set a dynamic IP. At this time, the DHCP server will automatically configure the IP address, subnet mask and gateway according to the current network conditions, and the user does not need to set it. Turn off the DHCP state and set a static IP. Users need to customize the IP address, subnet mask and gateway.

- Auto DNS

DNS can also be configured dynamically or statically. The static method requires manual input of the DNS address, and the automatic method directly uses the information returned by the DHCP server.

10.1.2 Network reset (LCI)

The LCI mechanism is to prevent incorrect network configuration or forgotten configuration information from causing the device to be unable to modify or access the network.

Click the LXI button to enter the network reset interface, which includes the device identification indicator light LXI, the *LAN Reset* button, and a list of items affected by the network reset.

- You can click the *LAN Reset* button to reset the network.
- The RF signal source supports the LXI standard web interface. On the VNC home page of the signal source, click the *Start* button of *Instrument Identification*, and you can see the device identification indicator light LXI flashing on the network reset interface.

10.2 Web Settings

Web Settings include the settings of VNC Operable state, FTP state, Hostname and Web password. Press UTILITY > *Interface* and scroll the scroll bar on the right side of the window to see the entire Web Settings content.

10.2.1 VNC Operable

Turn the Web control function on or off by turning the *VNC Operable* button on or off. When the VNC operation is enabled, users can control the instrument through a Web browser. Enter the IP address of the signal generator in a Web browser, and you can log in to the VNC.

If you want to control the instrument or send SCPI in the VNC, a dialog box will pop up where you need to enter your login password. You can set the log in password in *Web Password Settings* .

10.2.2 FTP State

When the FTP state is turned on, users can download files in the "Local" folder of the signal generator to a personal computer through the free software FileZilla, or upload files from a personal computer to the "Local" folder of the signal generator. You can view the application example "7.15 Download/Upload Files Using FTP (LAN)".

10.2.3 Hostname

Set the hostname of the signal generator. If the host resides on the same network segment as the signal generator, you can enter http://Hostname. local in the web browser to log in to the VNC.

10.2.4 Web Password

Press *Web Password Settings* to enter the Web Password Setting interface. You can change the password by entering the Current password, New Password and Confirm password. You can also set the password to the default value "siglent" by clicking the "Reset to default" button.

10.3 GPIB Settings

Set the GPIB address from 1 to 30. A SIGLENT USB-GPIB adapter should be connected to the USB Host port of the RF signal source to expand the instrument's USB interface into a GPIB interface.

11 Remote Control

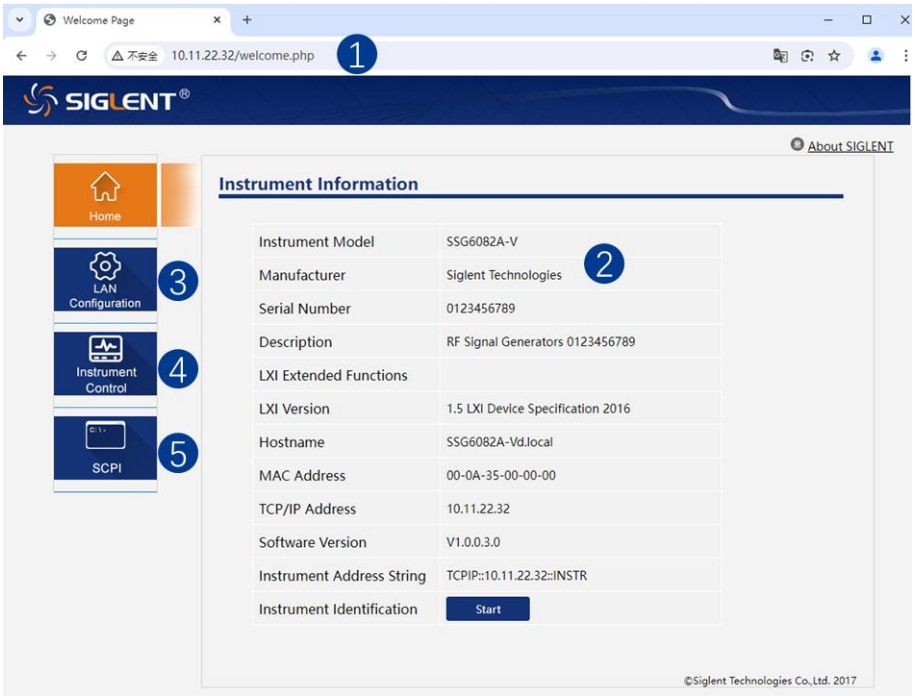
The RF signal source has USB, LAN and USB-GPIB interfaces. Based on these three interfaces, users can achieve remote control of RF signal source in a variety of ways.

11.1 Remote Control via SCPI

Based on the above mentioned interfaces, the RF signal source supports remote control by sending SCPI commands to the instrument through NI-VISA, Telnet or Socket connection. For details, please refer to the programming manual of this product.

11.2 Web Control

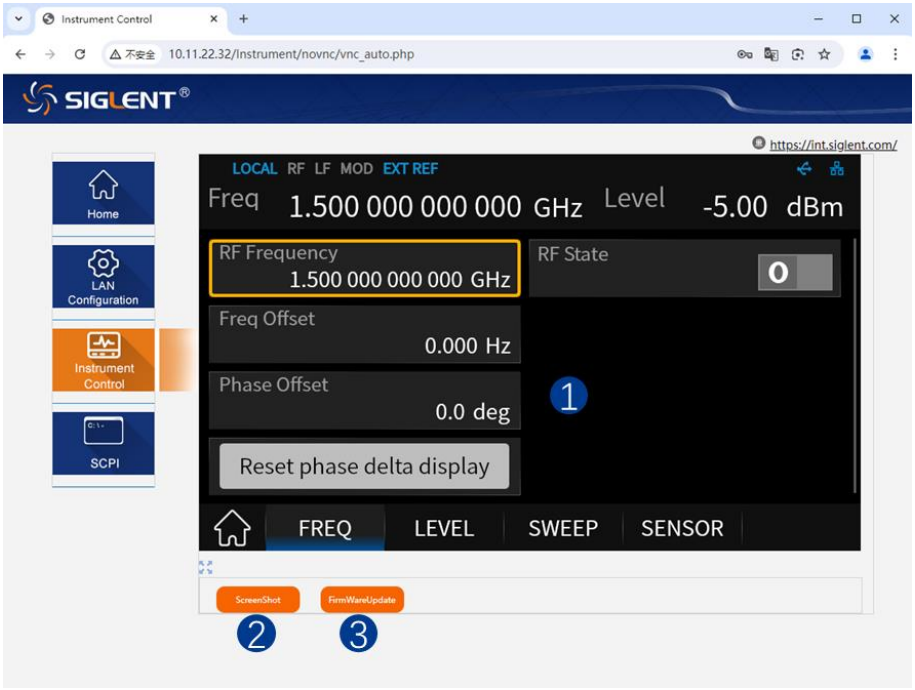
The RF signal source also supports user access and control through a web browser. Users can access the RF signal source by entering the instrument IP address in the browser address bar.



1. Input the IP address of the instrument
2. Instrument information
3. LAN configuration
4. Click here to recall the instrument control interface
5. Click here to send SCPI

NOTE: For details on the settings of the web page control switch, web page access password and IP address, please refer to the "10 Interface Settings" section.

Below is the instrument control interface over WebServer:



1. Display and control area of the instrument. The display in this area is a copy of the instrument display. Using the mouse to operate in the area is equivalent to directly operating on the display of the instrument
2. Click here to perform a screenshot
3. Click here to perform a firmware upgrade

12 Troubleshooting

The following lists the possible faults and troubleshooting methods that may occur during the use of the RF signal source. When you encounter these faults, please follow the corresponding steps to handle them. If the problem remains, please contact **SIGLENT** as soon as possible.

1. The screen is still black with no display after power on:
   1) Check the power supply:
      - Check that the power connector is connected correctly.
      - Check that the power switch is turned on.
   2) Check whether the fan rotates normally:
      - If the fan rotates and the screen does not light up, the screen connection cable may be loose.
      - If the fan does not rotate, it means the instrument has not been successfully powered on. Please refer to step 2.
   3) Check whether the fuse is burned out. If the fuse needs to be changed, please contact **SIGLENT** timely and return the instrument to the factory for replacement by **SIGLENT** authorized maintenance personnel.
   4) After completing the above checks, please restart the instrument. If you still cannot start the product normally, please contact **SIGLENT**.

2. No response when pressing keys or key strings:
   1) After powering on, confirm whether all buttons are unresponsive.
   2) Press UTILITY > *Self Test* > *Key Test* to confirm whether there is any unresponsive button or key string phenomenon.
   3) If the above fault exists, it may be that the keyboard connection cable is loose or the keyboard is damaged. Please do not disassemble the instrument yourself and contact **SIGLENT** in time.

3. The settings are correct but the waveform output is incorrect:
   1) No RF output
      - Check whether the signal cable is firmly connected to the **[RF OUTPUT 50Ω]** port.
      - Check the connecting cable for damage.
      - Check whether the RF ON/OFF button light is on. If it is not lit, press the key to light

it, and the RF icon in the status bar of the user interface turns blue. At this point the RF ON/OFF output is turned on correctly.

- Check whether the signal output amplitude is too small and adjust the output amplitude appropriately.

2) No modulation on RF output

- Check whether the signal cable is firmly connected to the **[RF OUTPUT 50Ω]** port.
- Check the connecting cable for damage.
- Check whether the MOD ON/OFF and RF ON/OFF button lights are on, and check whether the modulation switch is turned on.
- Check whether the modulation parameters are appropriate and adjust the modulation parameters appropriately.
- If using an external modulation source, make sure the external source is connected correctly and has an output, and it should work within the specified range of the signal source.

4. Sweep function abnormality

1) Sweeping stalled

The user interface displays a sweeping progress bar in the frequency/level area, indicating that the sweeping operation is in progress. If stagnation occurs, there are a few things you should check:

- Turn on at least one sweep type: Press SWEEP > *Sweep State* and select "Freq", "Level" or "Freq & Level".
- If it is single sweep mode, click *Execute single sweep* and when the trigger conditions are met, a sweep will be started.
- If the sweep trigger mode is not automatic trigger, set the sweep trigger mode to "Auto" to determine whether the sweep trigger loss is blocking the sweep.
- If the point trigger mode is not automatic, set the point trigger mode of the sweep to "Auto" to determine whether point trigger loss is blocking the sweep.
- Determine whether the dwell time is too large or too small, resulting in no visible sweeps.

2) There is no change in amplitude in list or step sweep

- Make sure the sweep type is set to Level or Freq & Level.
- If the current sweep type is set to frequency, the amplitude value does not change.

5. The USB storage device cannot be recognized:

   1) Check whether the USB storage device can work normally.

   2) Make sure the USB interface can work normally.

   3) Make sure that the USB storage device being used is a flash storage type. This signal source does not support hardware storage type.

   4) Restart the instrument and then insert the USB storage device to check it.

   5) If the USB storage device still cannot be used normally, please contact **SIGLENT**.

6. Inaccurate measurement results or insufficient accuracy:

   Users can obtain detailed descriptions of technical indicators from the data sheet to calculate system errors and check measurement results and accuracy issues. To achieve the performance specifications listed in this manual, you need to:

   1) Check if the RF signal source is within the calibration period (1 year).

   2) Verify that the RF signal source has been warmed up for at least 30 minutes before testing.

   3) Check that the performance of the test equipment used meets the requirements.

   4) Ensure that the test equipment used is within the calibration cycle.

   5) Check if the test equipment used is under the working conditions required by its manual.

   6) Check if all connections are tightened.

7. Pop-up Message:

The instrument may display prompt messages, error messages or status messages according to the current working status. These messages can help you to use the instrument correctly and are not instrument failures.

About SIGLENT

SIGLENT is an international high-tech company, concentrating on R&D, sales, production and services of electronic test & measurement instruments.

SIGLENT first began developing digital oscilloscopes independently in 2002. After more than a decade of continuous development, SIGLENT has extended its product line to include digital oscilloscopes, isolated handheld oscilloscopes, function/arbitrary waveform generators, RF/MW signal generators, spectrum analyzers, vector network analyzers, digital multimeters, DC power supplies, electronic loads and other general purpose test instrumentation. Since its first oscilloscope was launched in 2005, SIGLENT has become the fastest growing manufacturer of digital oscilloscopes. We firmly believe that today SIGLENT is the best value in electronic test & measurement.

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