SG Series PG Series

SCPI
APPLICATION GUIDE

Vector Signal Generator
SCPI Application Guide



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KAROGIC

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1. Version Management

Updated Description Sheet

Version Number	Content	Time
V2.8.0	Added: List sweep commands and examples.	29/10/2026
V2.7.6.1	Initial version	16/10/2026

2. Overview

This guide describes the configuration and use of the SCPI functionality integrated into SGStudio software, helping users remotely control SG and PG Series instruments through SCPI commands. It covers an introduction to SCPI functionality, communication and connection methods, control port settings, command format, typical application examples, and the SCPI command reference.

3. Preparation

Only SGStudio software with GUI version 2.7.6.1 or later supports SCPI control.

Before using the SCPI remote control function, start SGStudio and ensure that the instrument is properly connected. Go to "System" -> "SCPI", enable the SCPI function, and confirm the current data and control port numbers.

Note: Keep SGStudio running while using SCPI remote control.

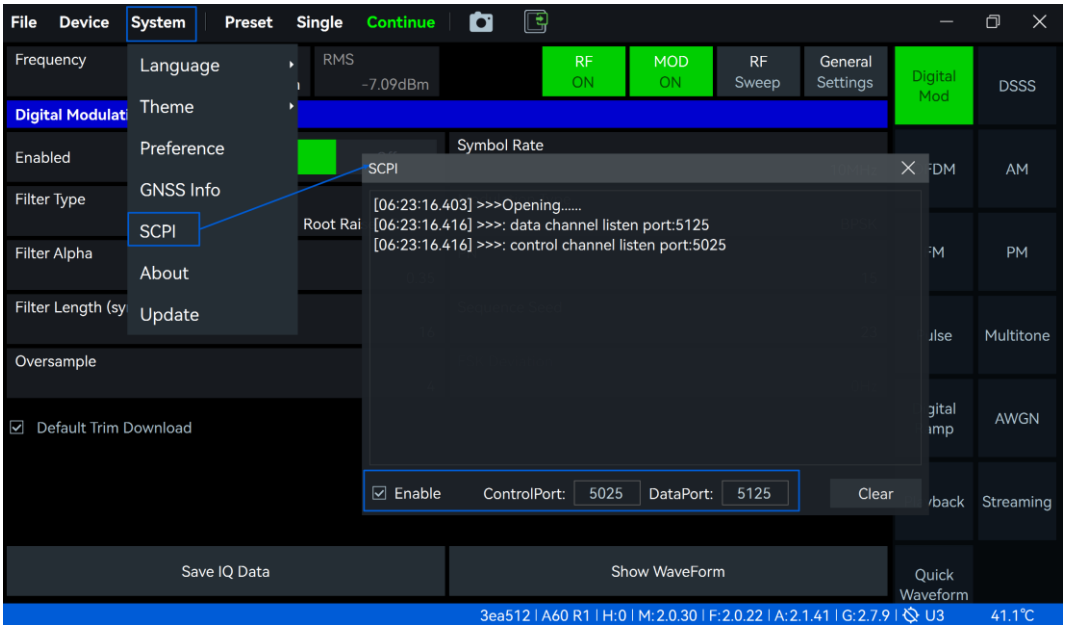

Figure 1 Enabling the SCPI Function

4. SCPI Communication

When the control program and SGStudio are running on the same host computer, use localhost **(127.0.0.1)** for communication. When the control program and SGStudio are running on different host computers, use the **IP address of the host computer running SGStudio**.

SCPI remote control uses TCP socket communication. The default listening port is 5025. The port number can be changed as required.

Remote control is supported through communication methods such as TCP Socket and VISA. Development environments such as LabVIEW and Python can be used to send SCPI commands (such as *IDN?) to control instrument parameters, query status, and read data.

5. SCPI Command Format

5.1 Command Format

SCPI commands use a hierarchical tree structure. Keywords at different levels are separated by a colon (:), and commands and their parameters are separated by a space. A question mark (?) appended to the end of a command indicates a query for the corresponding parameter, status, or data.

5.2 Symbol Description

1. **Angle brackets <>:** Indicate a parameter that must be specified by the user. Replace the parameter with an actual value when using the command.

   For example, in FREQ:CENT <Frequency>, Frequency cannot be empty; otherwise, the command is invalid.
2. **Square brackets []:** Indicate an optional keyword that may be omitted when using the abbreviated command.

   For example, [SENSe:]FREQuency:CENTer? can be abbreviated as FREQuency:CENTer?.
3. **Vertical bar |:** Indicates a choice between multiple parameter options, for example, ON | OFF.
4. **Question mark ?:** Indicates a query command used to query the current parameter or status.

5.3 Command Abbreviation

In SCPI command keywords, uppercase letters indicate the shortest valid form, while lowercase letters indicate the optional portion that may be omitted.

For example, [SENSe:]FREQuency:CENTer? can be abbreviated as FREQ:CENT?.

6. SCPI Command Description

6.1 General Commands

6.1.1 System Information

***IDN?**

Function	Retrieves basic instrument information.
Query	*IDN?
Setting	Not supported.
Example	Query: *IDN? Response: "DeviceID:4e9e123832363435,FPGA:2_0_22,Bus:2_0_1,Mcu:2_0_30,E1O:0_1_29"
Remarks	The response consists of five comma-separated fields: instrument UID, FPGA version, Bus version, MCU version, and EIO version.

6.1.2 Error Query

***ERR?**

Function	Queries error information in the SCPI error queue.
Query	*ERR?
Setting	Not supported.
Example	Query: *ERR? Response: "0, No error"
Remarks	The response consists of an error code and error description separated by a comma.

6.1.3 Clear Error Buffer

***CLS**

Function	Clears the error buffer.
Query	Not supported.
Setting	*CLS
Example	Set: *CLS
Remarks	After this command is executed, the currently buffered SCPI error information is cleared.

6.1.4 Restore Default Configuration

***RST**

Function	Restores the default parameter configuration for the current operating mode.
Query	Not supported.
Setting	*RST
Example	Set: *RST
Remarks	After this command is executed, the instrument returns to the default operating state.

6.1.5 Frequency

FREQ:CENT

Function	Sets or queries the RF frequency.
Query	[SENSe:]FREQuency:CENTer?
Setting	[SENSe:]FREQuency:CENTer <Number>
Example	Query: FREQ:CENT? Response: 1000000000 Set: FREQ:CENT 2000000000
Remarks	<Number> specifies the frequency in Hz. The setting range depends on the frequency range supported by the current instrument.

6.1.6 Power

POW:LEV

Function	Sets or queries the RF output power.
Query	[SENSe:]POWer:LEVel?
Setting	[SENSe:]POWer:LEVel <Number>
Example	Query: POW:LEV? Response: -20 Set: POW:LEV -10
Remarks	<Number> specifies the power in dBm. The setting range depends on the power range supported by the current instrument.

6.1.7 RF Output State

OUTP:STAT

Function	Sets or queries the RF output state.
Query	[SENSe:]OUTPut:STATe?
Setting	[SENSe:]OUTPut:STATe <State>
Example	Query: OUTP:STAT? Response: "OFF" Set: OUTP:STAT ON
Remarks	<State> specifies the RF output state and can be set to ON or OFF. ON enables RF output; OFF disables RF output.

6.1.8 Modulation State

OUTP:MOD:STAT

Function	Sets or queries the master modulation state.
Query	[SENSe:]OUTPut:MODulation:STATe?
Setting	[SENSe:]OUTPut:MODulation:STATe <State>
Example	Query: OUTP:MOD:STAT? Response: "OFF" Set: OUTP:MOD:STAT ON
Remarks	<State> specifies the master modulation state and can be set to ON | OFF. ON enables modulation; OFF disables modulation.

6.2 Sweep

6.2.1 Sweep Enable

SWE:STAT

Function	Sets or queries the sweep enable state.
Query	[SENSe:]SWEep:STATe?
Setting	[SENSe:]SWEep:STATe <State>
Example	Query: SWE:STAT? Response: "OFF" Set: SWE:STAT ON
Remarks	<State> specifies the sweep enable state and can be set to ON | OFF. ON enables sweeping, and the instrument performs a frequency or power sweep using the current sweep type and related parameters; OFF disables sweeping.

6.2.2 Sweep Type

SWE:MODE

Function	Sets or queries the sweep type.
Query	[SENSe:]SWEep:MODE?
Setting	[SENSe:]SWEep:MODE <Mode>
Example	Query: SWE:MODE? Response: "FREQ" Set: SWE:MODE POWER
Remarks	<Mode> specifies the sweep type and can be set to FREQ | POWER | LIST. FREQ selects frequency sweep; POWER selects power sweep; LIST selects list sweep.

6.2.3 Frequency Sweep Start Frequency

SWE:FREQ:STAR

Function	Sets or queries the start frequency of the frequency sweep.
Query	[SENSe:]SWEep:FREQuency:STARt?
Setting	[SENSe:]SWEep:FREQuency:STARt <Number>
Example	Query: SWE:FREQ:STAR? Response: 100000000 Set: SWE:FREQ:STAR 1500000000
Remarks	<Number> specifies the start frequency of the frequency sweep in Hz. This parameter is used in FREQ sweep mode. The setting range depends on the frequency range supported by the current instrument.

6.2.4 Frequency Sweep Stop Frequency

SWE:FREQ:STOP

Function	Sets or queries the stop frequency of the frequency sweep.
Query	[SENSe:]SWEep:FREQuency:STOP?
Setting	[SENSe:]SWEep:FREQuency:STOP <Number>
Example	Query: SWE:FREQ:STOP? Response: 2000000000 Set: SWE:FREQ:STOP 6000000000
Remarks	<Number> specifies the stop frequency of the frequency sweep in Hz. This parameter is used in FREQ sweep mode. The setting range depends on the frequency range supported by the current instrument.

6.2.5 Frequency Sweep Step

SWE:FREQ:STEP

Function	Sets or queries the frequency sweep step.
Query	[SENSe:]SWEep:FREQuency:STEP?
Setting	[SENSe:]SWEep:FREQuency:STEP <Number>
Example	Query: SWE:FREQ:STEP? Response: 1000000 Set: SWE:FREQ:STEP 20000000
Remarks	<Number> specifies the frequency sweep step in Hz. This parameter is used in FREQ sweep mode to set the frequency interval between adjacent sweep points.

6.2.6 Power Sweep Start Power

SWE:POW:STAR

Function	Sets or queries the start power of the power sweep.
Query	[SENSe:]SWEep:POWer:STARt?
Setting	[SENSe:]SWEep:POWer:STARt <Number>
Example	Query: SWE:POW:STAR? Response: -20 Set: SWE:POW:STAR -30
Remarks	<Number> specifies the start power of the power sweep in dBm. This parameter is used in POWER sweep mode. The setting range depends on the power range supported by the current instrument.

6.2.7 Power Sweep Stop Power

SWE:POW:STOP

Function	Sets or queries the stop power of the power sweep.
Query	[SENSe:]SWEep:POWer:STOP?
Setting	[SENSe:]SWEep:POWer:STOP <Number>
Example	Query: SWE:POW:STOP? Response: -19 Set: SWE:POW:STOP -10
Remarks	<Number> specifies the stop power of the power sweep in dBm. This parameter is used in POWER sweep mode. The setting range depends on the power range supported by the current instrument.

6.2.8 Power Sweep Step

SWE:POW:STEP

Function	Sets or queries the power sweep step.
Query	[SENSe:]SWEep:POWer:STEP?
Setting	[SENSe:]SWEep:POWer:STEP <Number>
Example	Query: SWE:POW:STEP? Response: 1 Set: SWE:POW:STEP 2
Remarks	<Number> specifies the power sweep step in dB. This parameter is used in POWER sweep mode to set the power interval between adjacent sweep points.

6.2.9 Sweep Dwell Time

SWE:DWEL

Function	Sets or queries the sweep dwell time.
Query	[SENSe:]SWEep:DWELl?
Setting	[SENSe:]SWEep:DWELl <Number>
Example	Query: SWE:DWEL? Response: 0.001 Set: SWE:DWEL 0.1

Remarks	<Number> specifies the total dwell time at each sweep point in seconds. This time includes the parameter configuration time for the sweep point and the signal dwell time after configuration is complete.

6.2.10 Frequency List

LIST:FREQ

Function	Sets or queries the frequency list.
Query	[SENSe:]LIST:FREQuency?
Setting	[SENSe:]LIST:FREQuency <FrequencyList>
Example	Query: LIST:FREQ? Response: "1000000000,2000000000,3000000000" Set: LIST:FREQ 1000MHz,1001MHz,1002MHz
Remarks	<FrequencyList> specifies the frequency list. The default unit is Hz; kHz, MHz, and GHz are also supported. The frequency setting range depends on the range supported by the current instrument. This command updates only the frequency column in the List draft and does not automatically add or delete table rows. When creating a point table for the first time, power and dwell-time columns of equal length must also be set before the list appears. For an existing valid point table, this command can directly overwrite the frequency column; the number of frequency values must equal the number of frequency points. If the point table is empty, a query returns "".

6.2.11 Frequency Point Count

LIST:FREQ:POIN

Function	Queries the number of frequency points.
Query	[SENSe:]LIST:FREQuency:POINts?
Setting	Not supported.
Example	Query: LIST:FREQ:POIN? Response: 3
Remarks	Returns the number of points in the complete draft frequency list, regardless of the STARt/STOP subrange. Returns 0 if the point table is empty.

6.2.12 Power List

LIST:POW

Function	Sets or queries the power list.
Query	[SENSe:]LIST:POWer?
Setting	[SENSe:]LIST:POWer <PowerList>
Example	Query: LIST:POW? Response: "-10,-10,-10" Set: LIST:POW -10,0,10
Remarks	<PowerList> specifies the power list in dBm. The setting range depends on the power range supported by the current instrument. This command updates the power column in the List draft. The column length must match the frequency and dwell-time columns. For other point-table rules, see Section 6.2.10, Frequency List.

6.2.13 Power Point Count

LIST:POW:POIN

Function	Queries the number of power points.
Query	[SENSe:]LIST:POWer:POINts?
Setting	Not supported.
Example	Query: LIST:POW:POIN? Response: 3
Remarks	Returns the number of points in the complete draft power list, regardless of the STARt/STOP subrange. Returns 0 if the point table is empty.

6.2.14 Per-Point Dwell Time

LIST:DWEL:LIST

Function	Sets or queries the per-point dwell-time column.
Query	[SENSe:]LIST:DWELI:LIST?
Setting	[SENSe:]LIST:DWELI:LIST <DwellList>
Example	Query: LIST:DWEL:LIST? Response: "1000,5000,10000" Set: LIST:DWEL:LIST 10000,15000,20000

Remarks	<DwellList> specifies the per-point dwell-time column in μs. This column must have the same length as the frequency and power columns. The setting range is 1 ms to 1000 s.

6.2.15 Per-Point Dwell Time Point Count

LIST:DWEL:LIST:POIN

Function	Queries the number of points in the per-point dwell-time column.
Query	[SENSe:]LIST:DWELl:LIST:POINts?
Setting	Not supported.
Example	Query: LIST:DWEL:LIST:POIN? Response: 3
Remarks	Returns the number of points in the draft per-point dwell-time column, regardless of the STARt/STOP subrange. Returns 0 if the point table is empty.

6.2.16 Global Dwell Time

LIST:DWEL

Function	Sets or queries the global dwell time.
Query	[SENSe:]LIST:DWELl?
Setting	[SENSe:]LIST:DWELl <DwellTime>
Example	Query: LIST:DWEL? Response: 0.01 Set: LIST:DWEL 0.02
Remarks	<DwellTime> specifies the global dwell time in seconds. It is used as the common dwell time only when LIST:DWEL:MODE is GLOBal. The setting range is 1 ms to 1000 s.

6.2.17 Dwell Time Mode

LIST:DWEL:MODE

Function	Sets or queries the dwell-time mode.
Query	[SENSe:]LIST:DWELl:MODE?
Setting	[SENSe:]LIST:DWELl:MODE <Mode>
Example	Query: LIST:DWEL:MODE?

	Response: "LIST" Set: LIST:DWEL:MODE GLOB
Remarks	<Mode> can be set to GLOBal | LIST. GLOBal uses the common dwell time specified by DwellTime for all points; LIST uses the per-point dwell times in DwellList.

6.2.18 Execution Range Start

LIST:IND:STAR

Function	Sets or queries the start index of the List execution range.
Query	[SENSe:]LIST:INDex:STARt?
Setting	[SENSe:]LIST:INDex:STARt <Index>
Example	Query: LIST:IND:STAR? Response: 0 Set: LIST:IND:STAR 1
Remarks	<Index> specifies the start of the execution range using a zero-based index. SCPI index 0 corresponds to row 1 in the software, index 1 corresponds to row 2, and so on. The setting range is 0 to the point-table length minus 1, and the start index must not be greater than the stop index. This command changes the actual List execution range. After modifying it, execute LIST:LEARn to submit the new execution range and start the sweep.

6.2.19 Execution Range Stop

LIST:IND:STOP

Function	Sets or queries the stop index of the List execution range.
Query	[SENSe:]LIST:INDex:STOP?
Setting	[SENSe:]LIST:INDex:STOP <Index>
Example	Query: LIST:IND:STOP? Response: 4 Set: LIST:IND:STOP 2
Remarks	<Index> specifies the end of the execution range. The setting range is from the start index to the point-table length minus 1. For the relationship between SCPI indexes and software row numbers and for how to submit and start the modified range, see Execution Range Start.

6.2.20List Point Table Submission

LIST:LEAR

Function	Validates the List draft and generates an immutable committed snapshot.
Query	Not supported.
Setting	[SENSe:]LIST:LEARn
Example	Set: LIST:LEAR Error query: *ERR?
Remarks	This command has no parameters. It validates the frequency, power, and dwell-time columns and the execution range, then generates the List point-table configuration to be applied. All three columns must be nonempty and have the same length. After executing the command, use *ERR? to query the validation and submission result. A return value of 0 indicates that submission succeeded, but does not indicate that the device has completed asynchronous application.

6.2.21 List Trigger Source

LIST:TRIG:SOUR

Function	Sets or queries the List trigger source.
Query	[SENSe:]LIST:TRIGger:SOURce?
Setting	[SENSe:]LIST:TRIGger:SOURce <Source>
Example	Query: LIST:TRIG:SOUR? Response: "SINGLE" Set: LIST:TRIG:SOUR EXT
Remarks	<Source> specifies the List trigger mode and can be set to AUTO | SINGle | EXTernal. AUTO selects automatic triggering. After the List starts, the selected range defined by STARt and STOP runs continuously. SINGle selects software single triggering. After this mode is set, the List waits for a software trigger. Each execution of LIST:TRIGger:EXECute runs the entire selected range once. EXTernal selects external triggering. Each valid external trigger signal runs the entire selected range once. SINGle and EXTernal are not single-point execution modes.

6.2.22Software Trigger Execution

LIST:TRIG:EXEC

Function	Requests one software trigger in LIST mode.
Query	Not supported.
Setting	[SENSe:]LIST:TRIGger:EXECute
Example	Set: LIST:TRIG:EXEC Error query: *ERR?
Remarks	This command has no parameters. In LIST mode, it requests one software trigger that executes the entire selected range once.

6.2.23List Running State

LIST:RUNN

Function	Queries the current List running state.
Query	[SENSe:]LIST:RUNNing?
Setting	Not supported.
Example	Query: LIST:RUNN? Response: 0
Remarks	The query returns 0 | 1. It returns 1 when sweep enable and RF output are both on and the device has completed asynchronous application of the List sweep configuration. It returns 0 when either switch is off or configuration application is not complete. This query is not a hardware busy bit or a sweep-completion indicator and cannot be used during a single run or while waiting for a trigger to determine whether the current point or one run has completed. It also does not guarantee that the RF waveform meets timing specifications; observe the actual waveform on the instrument.

6.2.24Frequency Mode

FREQ:MODE

Function	Sets or queries the fixed-carrier or List carrier plan.
Query	[SENSe:]FREQuency:MODE?
Setting	[SENSe:]FREQuency:MODE <Mode>
Example	Query: FREQ:MODE? Response: "CW" Set: FREQ:MODE LIST
Remarks	<Mode> specifies the frequency mode and can be set to CW | LIST. CW selects fixed-frequency mode; LIST selects List mode. When LIST is selected, the instrument validates and submits the current point table, enables sweeping, and requests asynchronous application of the List sweep configuration.

6.3 General Settings

6.3.1 Reference Clock Source

ROSC:SOUR

Function	Sets or queries the reference clock source.
Query	[SENSe:]ROSCillator:SOURce?
Setting	[SENSe:]ROSCillator:SOURce <Source>
Example	Query: ROSC:SOUR? Response: "Internal" Set: ROSC:SOUR EXTernal
Remarks	<Source> specifies the reference clock source and can be set to INTernal | EXTernal. INTernal selects the instrument's internal reference clock; EXTernal selects the external input reference clock.

6.3.2 External Reference Clock Frequency

ROSC:FREQ

Function	Sets or queries the external reference frequency.
Query	[SENSe:]ROSCillator:FREQuency?
Setting	[SENSe:]ROSCillator:FREQuency <Number>
Example	Query: ROSC:FREQ? Response: 10000000 Set: ROSC:FREQ 10000000
Remarks	<Number> specifies the external reference frequency in Hz. This parameter sets or queries the frequency of the external reference clock.

6.3.3 Reference Clock Output

ROSC:OUTP:STAT

Function	Sets or queries the reference clock output state.
Query	[SENSe:]ROSCillator:OUTPut:STATe?
Setting	[SENSe:]ROSCillator:OUTPut:STATe <State>
Example	Query: ROSC:OUTP:STAT? Response: "OFF" Set: ROSC:OUTP:STAT ON
Remarks	<State> specifies the reference clock output state and can be set to ON | OFF. ON enables the reference clock output, and the instrument outputs a reference clock signal through the reference clock output connector; OFF disables the reference clock output.

6.3.4 Trigger Source

TRIG:SEQ:SOUR

Function	Sets or queries the trigger source.
Query	[SENSe:]TRIGer:SEQuence:SOURce?
Setting	[SENSe:]TRIGer:SEQuence:SOURce <Source>
Example	Query: TRIG:SEQ:SOUR? Response: "BUS" Set: TRIG:SEQ:SOUR EXTernal
Remarks	<Source> specifies the trigger source and can be set to BUS | EXTernal | XPPS. BUS selects bus triggering; EXTernal selects external triggering; XPPS selects GNSS XPPS triggering, which requires the internal GNSS to be locked. The XPPS frequency is configured through the GNSS parameters.

6.3.5 Trigger Input Action

TRIG:SEQ:ACT

Function	Sets or queries the trigger input action.
Query	[SENSe:]TRIGer:SEQuence:ACTion?
Setting	[SENSe:]TRIGer:SEQuence:ACTion <Action>
Example	Query: TRIG:SEQ:ACT? Response: "Sweep" Set: TRIG:SEQ:ACT HOP
Remarks	<Action> specifies the trigger input action and can be set to SWEep | HOP. SWEep starts one preset frequency or power sweep after a valid trigger is received. HOP performs one step change each time a valid trigger is received, switching to the next RF state in the preset sweep path.

6.3.6 Trigger Input Edge

TRIG:SEQ:SLOP

Function	Sets or queries the trigger edge.
Query	[SENSe:]TRIGer:SEQuence:SLOPe?
Setting	[SENSe:]TRIGer:SEQuence:SLOPe <Slope>
Example	Query: TRIG:SEQ:SLOP? Response: "Rising" Set: TRIG:SEQ:SLOP FALLing
Remarks	<Slope> specifies the active edge of the trigger signal and can be set to RISing | FALLing. RISing selects the rising edge of the trigger signal as the active trigger event; FALLing selects the falling edge as the active trigger event.

6.3.7 Trigger Output Action

TRIG:SEQ:OUTP:ACT

Function	Sets or queries the trigger output action.
Query	[SENSe:]TRIGer:SEQuence:OUTPut:ACTion?
Setting	[SENSe:]TRIGer:SEQuence:OUTPut:ACTion <Action>
Example	Query: TRIG:SEQ:OUTP:ACT? Response: SWEep Set: TRIG:SEQ:OUTP:ACT HOP
Remarks	<Action> specifies the trigger output action and can be set to SWEep | HOP. SWEep outputs one trigger signal after a complete frequency or power sweep is completed; HOP outputs one trigger signal after each frequency hop is completed.

6.3.8 Trigger Output Edge

TRIG:SEQ:OUTP:SLOP

Function	Sets or queries the trigger output edge.
Query	[SENSe:]TRIGer:SEQuence:OUTPut:SLOPe?
Setting	[SENSe:]TRIGer:SEQuence:OUTPut:SLOPe <Slope>
Example	Query: TRIG:SEQ:OUTP:SLOP? Response: "RISing" Set: TRIG:SEQ:OUTP:SLOP FALLing
Remarks	<Slope> specifies the active edge of the trigger output signal and can be set to RISing | FALLing. RISing selects the rising edge as the active trigger output edge; FALLing selects the falling edge as the active trigger output edge.

6.3.9 Trigger Output State

TRIG:SEQ:OUTP:STAT

Function	Sets or queries the trigger output state.
Query	[SENSe:]TRIGer:SEQuence:OUTPut:STATe?
Setting	[SENSe:]TRIGer:SEQuence:OUTPut:STATe <State>
Example	Query: TRIG:SEQ:OUTP:STAT? Response: "ON" Set: TRIG:SEQ:OUTP:STAT ON
Remarks	<State> specifies the trigger output state and can be set to ON | OFF. ON enables trigger output. When the currently configured trigger output condition is met, the instrument outputs one trigger signal through the trigger output connector; OFF disables trigger output, and no trigger signal is output.

6.3.10 LO Mode

LOO:MOD

Function	Sets or queries the LO mode.
Query	[SENSe:]LOOutput:MODe?
Setting	[SENSe:]LOOutput:MODe <Mode>
Example	Query: LOO:MOD? Response: "AUTO" Set: LOO:MOD LOWSpur
Remarks	<Mode> specifies the LO mode and can be set to AUTO | LOWSpur | LOWPhaseNoise. AUTO selects automatic mode, in which the instrument automatically selects the optimal operating parameters based on the current output frequency, frequency step, and operating state; LOWSpur selects low-spur mode, which optimizes the LO output spectrum, suppresses fractional spurs and related parasitic components, and improves spectral purity; LOWPhaseNoise selects low-phase-noise mode, which adjusts the phase-locked loop control strategy to improve signal phase stability and optimize close-in phase noise.

6.3.11 RF Output Port

RFO:PORT

Function	Sets or queries the RF output port.
Query	[SENSe:]RFOutput:PORT?
Setting	[SENSe:]RFOutput:PORT <Port>
Example	Query: RFO:PORT? Response: "Standard" Set: RFO:PORT HIGHPower
Remarks	<Port> specifies the RF output port and can be set to STANdard | HIGHPower. STANdard selects the standard RF output port; HIGHPower selects the optional high-power RF output port.

6.3.12 Low-Power Mode

LOO:LOW:POW

Function	Sets or queries low-power mode.
Query	[SENSe:]LOOutput:LOW:POWer?
Setting	[SENSe:]LOOutput:LOW:POWer <State>
Example	Query: LOO:LOW:POW? Response: "OFF" Set: LOO:LOW:POW ON
Remarks	<State> specifies the low-power mode state and can be set to ON | OFF. ON enables low-power mode, placing the instrument in a low-power operating state to reduce overall power consumption; OFF disables low-power mode.

6.4 Digital Modulation

6.4.1 Digital Modulation State

DMOD:STAT

Function	Sets or queries the digital modulation state.
Query	[SENSe:]DMODulation:STATe?
Setting	[SENSe:]DMODulation:STATe <State>

Example	Query: DMOD:STAT? Response: "OFF" Set: DMOD:STAT ON
Remarks	<State> specifies the digital modulation state and can be set to ON | OFF. ON enables digital modulation mode. OFF disables digital modulation mode.

6.4.2 Digital Modulation Type

DMOD:TYPE

Function	Sets or queries the digital modulation type.
Query	[SENSe:]DMODulation:TYPE?
Setting	[SENSe:]DMODulation:TYPE <Type>
Example	Query: DMOD:TYPE? Response: "QAM64" Set: DMOD:TYPE QPSK
Remarks	<Type> specifies the digital modulation type and can be set to BPSK | QPSK | OQPSK | PSK8 | PSK16 | QAM16 | QAM64 | QAM256 | QAM1024 | FSK2 | FSK4 | FSK8 | FSK16 | ASK2 | ASK4 | ASK8 | DBPSK | DQPSK | Pi4DQPSK | D8PSK | APSK16.

6.4.3 Symbol Rate

DMOD:SRAT

Function	Sets or queries the digital modulation symbol rate.
Query	[SENSe:]DMODulation:SRATe?
Setting	[SENSe:]DMODulation:SRATe <Rate>
Example	Query: DMOD:SRAT? Response: 1000000 Set: DMOD:SRAT 10000000
Remarks	<Rate> specifies the symbol rate of the digitally modulated signal, that is, the number of symbols transmitted per second, in Hz. The symbol rate is limited by the maximum sampling rate supported by the instrument and the current oversampling rate. It must satisfy symbol rate ≤ maximum sampling rate / oversampling rate. The actual setting range depends on the current instrument model and configuration.

6.4.4 Filter Type

DMOD:FILT:TYPE

Function	Sets or queries the digital modulation filter type.
Query	[SENSe:]DMODulation:FILTer:TYPE?
Setting	[SENSe:]DMODulation:FILTer:TYPE <Type>
Example	Query: DMOD:FILT:TYPE? Response: "RootRaisedCosine" Set: DMOD:FILT:TYPE RaisedCosine
Remarks	<Type> specifies the filter type for the digitally modulated baseband waveform and can be set to RECTangular | RCOSine | RRCosine | GAUSsian | HSIne. RECTangular selects a rectangular filter; RCOSine selects a raised-cosine filter; RRCosine selects a root-raised-cosine filter; GAUSsian selects a Gaussian filter; HSIne selects a half-sine filter.

6.4.5 Filter Roll-Off Factor

DMOD:FILT:ALPH

Function	Sets or queries the digital modulation filter roll-off factor.
Query	[SENSe:]DMODulation:FILTer:ALPHa?
Setting	[SENSe:]DMODulation:FILTer:ALPHa <Alpha>
Example	Query: DMOD:FILT:ALPH? Response: 0.35 Set: DMOD:FILT:ALPH 0.25
Remarks	<Alpha> specifies the roll-off factor of the digital modulation filter. This parameter is valid only when the filter type is set to RCOSine, RRCosine, or GAUSsian. The setting range for RCOSine and RRCosine is [0.025, 1]; The setting range for GAUSsian is [0.15, 2.5].

6.4.6 Filter Length

DMOD:FILT:LENG

Function	Sets or queries the digital modulation filter length.
Query	[SENSe:]DMODulation:FILTer:LENGth?
Setting	[SENSe:]DMODulation:FILTer:LENGth <Length>
Example	Query: DMOD:FILT:LENG? Response: 16 Set: DMOD:FILT:LENG 14
Remarks	<Length> specifies the digital modulation filter length. The setting must be an even number and satisfy 2 <= <Length> <= 400 / oversampling rate. A longer filter provides a response closer to the ideal filter but increases waveform generation computation and latency.

6.4.7 Oversampling Rate

DMOD:OVER

Function	Sets or queries the digital modulation oversampling rate.
Query	[SENSe:]DMODulation:OVERsample?
Setting	[SENSe:]DMODulation:OVERsample <Oversample>
Example	Query: DMOD:OVER? Response: 6 Set: DMOD:OVER 8
Remarks	<Oversample> specifies the oversampling rate of the digitally modulated signal, that is, the number of samples per symbol. It can be set to an even number in the range [2, 32].

6.4.8 FSK Frequency Deviation

DMOD:FSK:DEV

Function	Sets or queries the FSK modulation frequency deviation.
Query	[SENSe:]DMODulation:FSK:DEViation?
Setting	[SENSe:]DMODulation:FSK:DEViation <Deviation>

Example	Query: DMOD:FSK:DEV? Response: 1000000 Set: DMOD:FSK:DEV 100000
Remarks	<Deviation> specifies the FSK modulation frequency deviation in Hz. It is valid only when the digital modulation type is set to FSK2 | FSK4 | FSK8 | FSK16.

6.4.9 PN Order

DMOD:PNS

Function	Sets or queries the digital modulation PN order.
Query	[SENSe:]DMODulation:PNSeed?
Setting	[SENSe:]DMODulation:PNSeed <PN>
Example	Query: DMOD:PNS? Response: 15 Set: DMOD:PNS 9
Remarks	<PN> specifies the PN order used to generate the pseudorandom sequence for digital modulation. The setting range is 4 to 24.

6.4.10 Random Seed

DMOD:SEQ:SEED

Function	Sets or queries the digital modulation sequence seed.
Query	[SENSe:]DMODulation:SEQuence:SEED?
Setting	[SENSe:]DMODulation:SEQuence:SEED <Seed>
Example	Query: DMOD:SEQ:SEED? Response: 23 Set: DMOD:SEQ:SEED 30
Remarks	<Seed> specifies the random seed for the PN sequence generator and sets the initial value used to generate the pseudorandom sequence. The setting range is 1 to 2147483647.

6.5 Direct-Sequence Spread Spectrum

6.5.1 DSSS State

DSSS:STAT

Function	Sets or queries the direct-sequence spread spectrum modulation state.
Query	[SENSe:]DSSS:STATe?
Setting	[SENSe:]DSSS:STATe <State>
Example	Query: DSSS:STAT? Response: "OFF" Set: DSSS:STAT ON
Remarks	<State> specifies the direct-sequence spread spectrum (DSSS) state and can be set to ON | OFF. ON enables DSSS; OFF disables DSSS.

6.5.2 Modulation Type

DSSS:TYPE?

Function	Queries the DSSS modulation type.
Query	[SENSe:]DSSS:TYPE?
Setting	Not supported.
Example	Query: DSSS:TYPE? Response: "BPSK"
Remarks	This command queries the modulation type used by the current direct-sequence spread spectrum (DSSS) mode. The current DSSS mode supports only BPSK modulation.

6.5.3 DSSS Symbol Rate

DSSS:SRAT

Function	Sets or queries the DSSS symbol rate.
Query	[SENSe:]DSSS:SRATe?
Setting	[SENSe:]DSSS:SRATe <Rate>
Example	Query: DSSS:SRAT? Response: 1000000 Set: DSSS:SRAT 300000
Remarks	<Rate> specifies the symbol rate of the original data before DSSS spreading, that is, the number of symbols transmitted per second, in Hz.

6.5.4 Spreading Code Order

DSSS:CODE

Function	Sets or queries the DSSS spreading code.
Query	[SENSe:]DSSS:CODE?
Setting	[SENSe:]DSSS:CODE <Code>
Example	Query: DSSS:CODE? Response: 5 Set: DSSS:CODE 6
Remarks	<Code> specifies the order of the spreading code used by DSSS. The setting range is 4 to 16.

6.5.5 DSSS Filter Type

DSSS:FILT:TYPE

Function	Sets or queries the DSSS filter type.
Query	[SENSe:]DSSS:FILTer:TYPE?
Setting	[SENSe:]DSSS:FILTer:TYPE <Type>
Example	Query: DSSS:FILT:TYPE? Response: "RootRaisedCosine" Set: DSSS:FILT:TYPE GAUSsian
Remarks	<Type> specifies the pulse-shaping filter type used by the DSSS baseband signal and can be set to RECTangular | RCOSine | RRCosine | GAUSsian | HSIne. RECTangular selects a rectangular filter, RCOSine selects a raised-cosine filter, RRCosine selects a root-raised-cosine filter, GAUSsian selects a Gaussian filter, and HSIne selects a half-sine filter.

6.5.6 DSSS Filter Roll-Off Factor

DSSS:FILT:ALPH

Function	Sets or queries the DSSS filter roll-off factor.
Query	[SENSe:]DSSS:FILTer:ALPHa?
Setting	[SENSe:]DSSS:FILTer:ALPHa <Alpha>
Example	Query: DSSS:FILT:ALPH? Response: 0.35 Set: DSSS:FILT:ALPH 0.25

Remarks	<Alpha> specifies the roll-off factor of the DSSS pulse-shaping filter. This parameter is valid only when the filter type is set to RCOSine, RRCosine, or GAUSsian. The setting range is 0.025 to 1 for RCOSine and RRCosine and 0.15 to 2.5 for GAUSsian.

6.5.7 DSSS Filter Length

DSSS:FILT:LENG

Function	Sets or queries the DSSS filter length.
Query	[SENSe:]DSSS:FILTer:LENGth?
Setting	[SENSe:]DSSS:FILTer:LENGth <Length>
Example	Query: DSSS:FILT:LENG? Response: 8 Set: DSSS:FILT:LENG 10
Remarks	<Length> specifies the length of the DSSS pulse-shaping filter. The setting must be an even number and satisfy 2 <= <Length> <= 400 / oversampling rate.

6.5.8 DSSS Random Seed

DSSS:SEQ:SEED

Function	Sets or queries the DSSS sequence seed.
Query	[SENSe:]DSSS:SEQuence:SEED?
Setting	[SENSe:]DSSS:SEQuence:SEED <Seed>
Example	Query: DSSS:SEQ:SEED? Response: 23 Set: DSSS:SEQ:SEED 30
Remarks	<Seed> specifies the initial value of the DSSS pseudorandom sequence generator. The setting range is 1 to 2147483647.

6.5.9 DSSS Oversampling Rate

DSSS:OVER

Function	Sets or queries the DSSS oversampling rate.
Query	[SENSe:]DSSS:OVERsample?
Setting	[SENSe:]DSSS:OVERsample <Oversample>
Example	Query: DSSS:OVER? Response: 4 Set: DSSS:OVER 6
Remarks	<Oversample> specifies the DSSS oversampling rate, that is, the number of samples per chip period. It can be set to an even number in the range [2, 32].

6.6 Orthogonal Frequency-Division Multiplexing

6.6.1 OFDM State

OFDM:STAT

Function	Sets or queries the orthogonal frequency-division multiplexing (OFDM) state.
Query	[SENSe:]OFDM:STATe?
Setting	[SENSe:]OFDM:STATe <State>
Example	Query: OFDM:STAT? Response: "OFF" Set: OFDM:STAT ON
Remarks	<State> specifies the orthogonal frequency-division multiplexing (OFDM) state and can be set to ON | OFF. ON enables OFDM; OFF disables OFDM.

6.6.2 OFDM Subcarrier Modulation Type

OFDM:MOD:TYPE

Function	Sets or queries the OFDM subcarrier modulation type.
Query	[SENSe:]OFDM:MODulation:TYPE?
Setting	[SENSe:]OFDM:MODulation:TYPE <Type>
Example	Query: OFDM:MOD:TYPE? Response: "QPSK" Set: OFDM:MOD:TYPE BPSK
Remarks	<Type> specifies the digital modulation type used for active OFDM data subcarriers. It can be set to BPSK | QPSK | PSK8 | PSK16 | QAM16 | QAM64 | QAM256.

6.6.3 OFDM FFT Size

OFDM:FFT:SIZE

Function	Sets or queries the OFDM FFT size.
Query	[SENSe:]OFDM:FFT:SIZE?
Setting	[SENSe:]OFDM:FFT:SIZE <Size>
Example	Query: OFDM:FFT:SIZE? Response: 64 Set: OFDM:FFT:SIZE 128

Remarks	<Size> specifies the number of OFDM FFT points, that is, the total number of subcarriers configured in one OFDM symbol. It can be set to 16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048.

6.6.4 OFDM Sampling Rate

OFDM:SRAT

Function	Sets or queries the OFDM waveform sampling rate.
Query	[SENSe:]OFDM:SRATe?
Setting	[SENSe:]OFDM:SRATe <Rate>
Example	Query: OFDM:SRAT? Response: 20000000 Set: OFDM:SRAT 30000000
Remarks	<Rate> specifies the sampling rate of the OFDM baseband waveform in Hz.

6.6.5 Number of OFDM Symbols

OFDM:SYMB:COUN

Function	Sets or queries the number of OFDM symbols.
Query	[SENSe:]OFDM:SYMBol:COUNt?
Setting	[SENSe:]OFDM:SYMBol:COUNt <Count>
Example	Query: OFDM:SYMB:COUN? Response: 16 Set: OFDM:SYMB:COUN 20
Remarks	<Count> specifies the number of OFDM symbols contained in one generated OFDM signal. The parameter is an integer with a setting range of 2 to 16384.

6.6.6 Number of OFDM Left Guard Subcarriers

OFDM:GUAR:BAND:LEFT

Function	Sets or queries the number of OFDM left guard subcarriers.
Query	[SENSe:]OFDM:GUARd:BAND:LEFT?
Setting	[SENSe:]OFDM:GUARd:BAND:LEFT <Count>
Example	Query: OFDM:GUAR:BAND:LEFT? Response: 6 Set: OFDM:GUAR:BAND:LEFT 7
Remarks	<Count> specifies the number of subcarriers used for the guard band on the low-frequency side of the OFDM spectrum. The parameter is an integer.

6.6.7 Number of OFDM Right Guard Subcarriers

OFDM:GUAR:BAND:RIGHT

Function	Sets or queries the number of OFDM right guard subcarriers.
Query	[SENSe:]OFDM:GUARd:BAND:RIGHT?
Setting	[SENSe:]OFDM:GUARd:BAND:RIGHT <Count>
Example	Query: OFDM:GUAR:BAND:RIGHT? Response: 5 Set: OFDM:GUAR:BAND:RIGHT 6
Remarks	<Count> specifies the number of subcarriers used for the guard band on the high-frequency side of the OFDM spectrum. The parameter is an integer.

6.6.8 OFDM Guard Interval (%)

OFDM:GUAR:INT:RAD

Function	Sets or queries the OFDM guard interval ratio.
Query	[SENSe:]OFDM:GUARd:INTerval:RADio?
Setting	[SENSe:]OFDM:GUARd:INTerval:RADio <Ratio>
Example	Query: OFDM:GUAR:INT:RAD? Response: 25 Set: OFDM:GUAR:INT:RAD 30

Remarks	<Ratio> specifies the OFDM guard interval ratio. The parameter is an integer in the range 0 to 100, in %.

6.6.9 OFDM Guard Interval

OFDM:GUAR:INT?

Function	Queries the number of samples corresponding to the current OFDM guard interval.
Query	[SENSe:]OFDM:GUARd:INTerval?
Setting	Not supported.
Example	Query: OFDM:GUAR:INT? Response: 16
Remarks	Returns the number of samples corresponding to the current OFDM guard interval. The return value is an integer in samples. The number of guard interval samples is determined by the current FFT size and guard interval ratio: guard interval samples = FFT size x guard interval ratio.

6.6.10 OFDM Window Length Ratio

OFDM:WIND:LENG:RAD

Function	Sets or queries the OFDM window length ratio.
Query	[SENSe:]OFDM:WINDow:LENGth:RADio?
Setting	[SENSe:]OFDM:WINDow:LENGth:RADio <Ratio>
Example	Query: OFDM:WIND:LENG:RAD? Response: 50 Set: OFDM:WIND:LENG:RAD 60
Remarks	<Ratio> specifies the OFDM window function length ratio. The parameter is an integer in the range 0 to 100, in %.

6.6.11 OFDM Window Length

OFDM:WIND:LENG?

Function	Queries the number of samples corresponding to the current OFDM one-sided window length.
Query	[SENSe:]OFDM:WINDow:LENGth?

Setting	Not supported.
Example	Query: OFDM:WIND:LENG? Response: 8
Remarks	This command queries the number of samples corresponding to the one-sided window function length for the current OFDM configuration. The return value is an integer in samples.

6.6.12 OFDM Windowing Enable

OFDM:WIND

Function	Sets or queries the OFDM windowing state.
Query	[SENSe:]OFDM:WINDowed?
Setting	[SENSe:]OFDM:WINDowed <State>
Example	Query: OFDM:WIND? Response: "ON" Set: OFDM:WIND OFF
Remarks	<State> specifies the OFDM windowing state and can be set to ON | OFF. ON enables windowing, and the instrument applies a window to the time-domain waveform of the OFDM symbols using the current window length ratio; OFF disables windowing.

6.6.13 OFDM Subcarrier Spacing

OFDM:CARR:SPAC?

Function	Queries the current OFDM subcarrier spacing.
Query	[SENSe:]OFDM:CARRier:SPACing?
Setting	Not supported.
Example	Query: OFDM:CARR:SPAC? Response: 312500
Remarks	This command queries the frequency spacing between two adjacent subcarriers for the current OFDM configuration. The return value is in Hz. The subcarrier spacing is determined by the current sampling rate and FFT size: subcarrier spacing = sampling rate / FFT size.

6.7 Amplitude Modulation

6.7.1 AM State

AM:STAT

Function	Sets or queries the AM state.
Query	[SENSe:]AM:STATe?
Setting	[SENSe:]AM:STATe <State>
Example	Query: AM:STAT? Response: "OFF" Set: AM:STAT ON
Remarks	<State> specifies the amplitude modulation (AM) state and can be set to ON | OFF. ON enables AM; OFF disables AM.

6.7.2 AM Modulation Depth

AM:DEPT

Function	Sets or queries the AM modulation depth.
Query	[SENSe:]AM:DEPTh?
Setting	[SENSe:]AM:DEPTh <Depth>
Example	Query: AM:DEPT? Response: 50 Set: AM:DEPT 75
Remarks	<Depth> specifies the AM modulation depth in %. The setting range is 1% to 100%.

6.7.3 AM Modulation Rate

AM:INT:FREQ

Function	Sets or queries the AM modulation rate.
Query	[SENSe:]AM:INTernal:FREQuency?
Setting	[SENSe:]AM:INTernal:FREQuency <Frequency>
Example	Query: AM:INT:FREQ? Response: 1000 Set: AM:INT:FREQ 1500

Remarks	<Frequency> specifies the frequency of the AM internal modulation signal in Hz. The setting range is 1 Hz to 10 MHz.

6.7.4 AM Modulation Waveform

AM:INT:FUNC:SHAP

Function	Sets or queries the AM modulation waveform.
Query	[SENSe:]AM:INTernal:FUNCtion:SHAPe?
Setting	[SENSe:]AM:INTernal:FUNCtion:SHAPe <Shape>
Example	Query: AM:INT:FUNC:SHAP? Response: "Sine" Set: AM:INT:FUNC:SHAP SQUare
Remarks	<Shape> specifies the waveform type of the AM internal modulation signal and can be set to SINe | SQUare | TRIangle | RAMP. SINe selects a sine wave, SQUare selects a square wave, TRIangle selects a triangular wave, and RAMP selects a ramp wave.

6.8 Frequency Modulation

6.8.1 FM State

FM:STAT

Function	Sets or queries the FM state.
Query	[SENSe:]FM:STATe?
Setting	[SENSe:]FM:STATe <State>
Example	Query: FM:STAT? Response: "ON" Set: FM:STAT ON
Remarks	<State> specifies the frequency modulation (FM) state and can be set to ON | OFF. ON enables FM; OFF disables FM.

6.8.2 FM Frequency Deviation

FM:DEV

Function	Sets or queries the FM frequency deviation.
Query	[SENSe:]FM:DEViation?
Setting	[SENSe:]FM:DEViation <Deviation>
Example	Query: FM:DEV? Response: 1000 Set: FM:DEV 5000
Remarks	<Deviation> specifies the FM frequency deviation in Hz.

6.8.3 FM Modulation Rate

FM:INT:FREQ

Function	Sets or queries the FM modulation rate.
Query	[SENSe:]FM:INTernal:FREQuency?
Setting	[SENSe:]FM:INTernal:FREQuency <Frequency>
Example	Query: FM:INT:FREQ? Response: 1000 Set: FM:INT:FREQ 5000
Remarks	<Frequency> specifies the frequency of the FM internal modulation signal in Hz. The setting range is 1 Hz to 10 MHz.

6.8.4 FM Modulation Waveform

FM:INT:FUNC:SHAP

Function	Sets or queries the FM modulation waveform.
Query	[SENSe:]FM:INTernal:FUNCtion:SHAPe?
Setting	[SENSe:]FM:INTernal:FUNCtion:SHAPe <Shape>
Example	Query: FM:INT:FUNC:SHAP? Response: "Sine" Set: FM:INT:FUNC:SHAP SQUare
Remarks	<Shape> specifies the waveform type of the FM internal modulation signal and can be set to SINe | SQUare | TRIangle | RAMP. SINe selects a sine wave, SQUare selects a square wave, TRIangle selects a triangular wave, and RAMP selects a ramp wave.

6.9 Phase Modulation

6.9.1 PM State

PM:STAT

Function	Sets or queries the PM state.
Query	[SENSe:]PM:STATe?
Setting	[SENSe:]PM:STATe <State>
Example	Query: PM:STAT? Response: "OFF" Set: PM:STAT ON
Remarks	<State> specifies the phase modulation (PM) state and can be set to ON | OFF. ON enables PM; OFF disables PM.

6.9.2 PM Phase Deviation

PM:DEV

Function	Sets or queries the PM phase deviation.
Query	[SENSe:]PM:DEViation?
Setting	[SENSe:]PM:DEViation <Deviation>
Example	Query: PM:DEV? Response: 57.2957795130823 Set: PM:DEV 45
Remarks	<Deviation> specifies the PM phase deviation in degrees. The setting range is 0 degrees to 360 degrees.

6.9.3 PM Initial Phase

PM:INIT:PHAS

Function	Sets or queries the initial phase of the PM signal.
Query	[SENSe:]PM:INITial:PHASe?
Setting	[SENSe:]PM:INITial:PHASe <Phase>
Example	Query: PM:INIT:PHAS? Response: 0 Set: PM:INIT:PHAS 90
Remarks	<Phase> specifies the initial phase of the PM signal in degrees. The setting range is -180 degrees to 180 degrees.

6.9.4 PM Modulation Rate

PM:INT:FREQ

Function	Sets or queries the PM modulation rate.
Query	[SENSe:]PM:INTernal:FREQuency?
Setting	[SENSe:]PM:INTernal:FREQuency <Frequency>
Example	Query: PM:INT:FREQ? Response: 1000 Set: PM:INT:FREQ 2000
Remarks	<Frequency> specifies the frequency of the PM internal modulation signal in Hz. The setting range is 1 Hz to 10 MHz.

6.9.5 PM Modulation Waveform

PM:INT:FUNC:SHAP

Function	Sets or queries the PM modulation waveform.
Query	[SENSe:]PM:INTernal:FUNCtion:SHAPe?
Setting	[SENSe:]PM:INTernal:FUNCtion:SHAPe <Shape>
Example	Query: PM:INT:FUNC:SHAP? Response: "Sine" Set: PM:INT:FUNC:SHAP SQUare
Remarks	<Shape> specifies the waveform type of the PM internal modulation signal and can be set to SINe | SQUare | TRIangle | RAMP. SINe selects a sine wave, SQUare selects a square wave, TRIangle selects a triangular wave, and RAMP selects a ramp wave.

6.10 Pulse Modulation

6.10.1 Pulse Modulation State

PULM:STAT

Function	Sets or queries the pulse modulation state.
Query	[SENSe:]PULM:STATe?
Setting	[SENSe:]PULM:STATe <State>
Example	Query: PULM:STAT? Response: "OFF" Set: PULM:STAT ON
Remarks	<State> specifies the pulse modulation state and can be set to ON | OFF. ON enables pulse modulation; OFF disables pulse modulation.

6.10.2 Pulse Width

PULM:INT:WIDT

Function	Sets or queries the pulse width.
Query	[SENSe:]PULM:INTernal:WIDTh?
Setting	[SENSe:]PULM:INTernal:WIDTh <Width>
Example	Query: PULM:INT:WIDT? Response: 0.001 Set: PULM:INT:WIDT 0.01
Remarks	<Width> specifies the duration of the pulse high level in seconds.

6.10.3 Period

PULM:INT:PER

Function	Sets or queries the pulse period.
Query	[SENSe:]PULM:INTernal:PERiod?
Setting	[SENSe:]PULM:INTernal:PERiod <Period>
Example	Query: PULM:INT:PER? Response: 0.0000004 Set: PULM:INT:PER 0.0000004
Remarks	<Period> specifies the pulse repetition period in seconds.

6.10.4 Duty Cycle

PULM:INT:RAD

Function	Sets or queries the pulse duty cycle.
Query	[SENSe:]PULM:INTernal:RADio?
Setting	[SENSe:]PULM:INTernal:RADio <Ratio>
Example	Query: PULM:INT:RAD? Response: 50 Set: PULM:INT:RAD 25
Remarks	<Ratio> specifies the pulse duty cycle in %.

6.11 Multi-Tone

6.11.1 Multi-Tone State

MTON:STAT

Function	Sets or queries the multi-tone state.
Query	[SENSe:]MTONe:STATe?
Setting	[SENSe:]MTONe:STATe <State>
Example	Query: MTON:STAT? Response: "OFF" Set: MTON:STAT ON
Remarks	<State> specifies the multi-tone state and can be set to ON | OFF. ON enables the multi-tone function; OFF disables the multi-tone function.

6.11.2 Number of Tones

MTON:COUN

Function	Sets or queries the number of tones in the multi-tone signal.
Query	[SENSe:]MTONe:COUNt?
Setting	[SENSe:]MTONe:COUNt <Count>
Example	Query: MTON:COUN? Response: 2 Set: MTON:COUN 5
Remarks	<Count> specifies the number of discrete tones to generate. The parameter is an integer and must be at least 2.

6.11.3 Frequency Spacing

MTON:SPAC

Function	Sets or queries the frequency spacing of the multi-tone signal.
Query	[SENSe:]MTONe:SPACing?
Setting	[SENSe:]MTONe:SPACing <Spacing>
Example	Query: MTON:SPAC? Response: 1000000 Set: MTON:SPAC 2000000

Remarks	<Spacing> specifies the frequency spacing between two adjacent discrete tones in Hz. (number of tones - 1) x frequency spacing <= the playback bandwidth of the instrument.

6.11.4 Phase

MTON:PHAS:MODE

Function	Sets or queries the phase mode of the multi-tone signal.
Query	[SENSe:]MTONe:PHASe:MODE?
Setting	[SENSe:]MTONe:PHASe:MODE <Mode>
Example	Query: MTON:PHAS:MODE? Response: "Fixed" Set: MTON:PHAS:MODE RANDom
Remarks	<Mode> specifies how the initial phase of each discrete tone is generated and can be set to FIXed | RANDom | PARAbolic. FIXed selects fixed phase mode; RANDom selects random phase mode; PARAbolic selects parabolic phase mode.

6.11.5 Phase Random Seed

MTON:SEED

Function	Sets or queries the random seed for multi-tone random phase mode.
Query	[SENSe:]MTONe:SEED?
Setting	[SENSe:]MTONe:SEED <Seed>
Example	Query: MTON:SEED? Response: 23 Set: MTON:SEED 25
Remarks	<Seed> specifies the initial seed used by the pseudorandom number generator in multi-tone random phase mode. This parameter is used mainly when the phase mode is set to RANDom and controls the generation of the random initial phase for each discrete tone.

6.12 Digital Ramp Sweep

6.12.1 Digital Ramp Sweep State

RAMP:STAT

Function	Sets or queries the digital ramp sweep state.
Query	[SENSe:]RAMP:STATe?
Setting	[SENSe:]RAMP:STATe <State>
Example	Query: RAMP:STAT? Response: "OFF" Set: RAMP:STAT ON
Remarks	<State> specifies the digital ramp sweep state and can be set to ON | OFF. ON enables digital ramp sweep; OFF disables digital ramp sweep.

6.12.2 Sweep Span

RAMP:SPAN

Function	Sets or queries the frequency span of the digital ramp sweep.
Query	[SENSe:]RAMP:SPAN?
Setting	[SENSe:]RAMP:SPAN <Span>
Example	Query: RAMP:SPAN? Response: 20000000 Set: RAMP:SPAN 10000000
Remarks	<Span> specifies the frequency span of the digital ramp sweep in Hz.

6.12.3 Sweep Time

RAMP:TIME

Function	Sets or queries the digital ramp sweep time.
Query	[SENSe:]RAMP:TIME?
Setting	[SENSe:]RAMP:TIME <Time>
Example	Query: RAMP:TIME? Response: 0.001 Set: RAMP:TIME 0.01
Remarks	<Time> specifies the time required to complete one sweep over the configured frequency span, in seconds.

6.12.4 Sweep Period

RAMP:PER

Function	Sets or queries the digital ramp sweep period.
Query	[SENSe:]RAMP:PERiod?
Setting	[SENSe:]RAMP:PERiod <Period>
Example	Query: RAMP:PER? Response: 0.2 Set: RAMP:PER 0.2
Remarks	<Period> specifies the repetition period of the digital ramp sweep, that is, the interval between the start times of two adjacent ramp sweeps, in seconds.

6.13 Additive White Gaussian Noise

6.13.1 AWGN State

AWGN:STAT

Function	Sets or queries the additive white Gaussian noise state.
Query	[SENSe:]AWGN:STATe?
Setting	[SENSe:]AWGN:STATe <State>
Example	Query: AWGN:STAT? Response: "OFF" Set: AWGN:STAT ON
Remarks	<State> specifies the additive white Gaussian noise (AWGN) state and can be set to ON | OFF. ON enables AWGN; OFF disables AWGN.

6.13.2 AWGN Bandwidth

AWGN:BWID

Function	Sets or queries the AWGN bandwidth.
Query	[SENSe:]AWGN:BWIDth?
Setting	[SENSe:]AWGN:BWIDth <Bandwidth>
Example	Query: AWGN:BWID? Response: 40000000 Set: AWGN:BWID 60000000
Remarks	<Bandwidth> specifies the effective frequency range of the AWGN signal in Hz.

6.13.3 AWGN Length

AWGN:LENG

Function	Sets or queries the AWGN length.
Query	[SENSe:]AWGN:LENGth?
Setting	[SENSe:]AWGN:LENGth <Length>
Example	Query: AWGN:LENG? Response: 0.01 Set: AWGN:LENG 0.1
Remarks	<Length> specifies the duration of one AWGN signal instance in seconds.

7. Example

7.1 Python Examples

1. Connect the instrument correctly, start SGStudio, click "System" -> "SCPI", and select "Enable" to enable SCPI remote control;
2. Use Python to establish a TCP Socket connection to SGStudio and send SCPI commands to configure digital modulation and RF output parameters.

```
import socket
HOST = "127.0.0.1"
PORT = 5025
sock = socket.create_connection((HOST, PORT), timeout=10)
print("SCPI connected")
```

[9] ✓ 0.0s

```
SCPI connected
```

```
# Configure digital modulation
# Enable digital modulation
sock.sendall(b"DMOD:STAT ON\n")
sock.sendall(b"DMOD:STAT?\n")
print("Digital Modulation:", sock.recv(4096).decode().strip())

# Set modulation type to BPSK
sock.sendall(b"DMOD:TYPE BPSK\n")
sock.sendall(b"DMOD:TYPE?\n")
print("Modulation Type:", sock.recv(4096).decode().strip())

# Set symbol rate to 10 MHz
sock.sendall(b"DMOD:SRAT 10000000\n")
sock.sendall(b"DMOD:SRAT?\n")
print("Symbol Rate:", sock.recv(4096).decode().strip(), "Hz")
```

[10] ✓ 0.0s

```
Digital Modulation: "ON"
Modulation Type: "BPSK"
Symbol Rate: 10000000 Hz
```

```
# Configure RF output
# Set carrier frequency to 1 GHz
sock.sendall(b"FREQ:CENT 1000000000\n")
sock.sendall(b"FREQ:CENT?\n")
print("Frequency:", sock.recv(4096).decode().strip(), "Hz")

# Set output power to 0 dBm
sock.sendall(b"POW:LEV 0\n")
sock.sendall(b"POW:LEV?\n")
print("Power:", sock.recv(4096).decode().strip(), "dBm")

# Enable RF output
sock.sendall(b"OUTP:STAT ON\n")
sock.sendall(b"OUTP:STAT?\n")
print("RF Output:", sock.recv(4096).decode().strip())
```

[11] ✓ 0.0s

```
Frequency: 1000000000 Hz
Power: 0 dBm
RF Output: "ON"
```

Figure 2 Outputting a BPSK Signal with Python

7.2 List Sweep Examples

7.2.1 Automatic Continuous List Sweep

The following example configures four sweep points with frequencies ranging from 1000 MHz to 1003 MHz and an output power of −30 dBm at each point. The dwell times are 10 ms, 15 ms, 20 ms, and 25 ms, respectively.

Command Example:

```
*RST
*CLS
LIST:FREQ 1000MHz,1001MHz,1002MHz,1003MHz
LIST:POW -30,-30,-30,-30
LIST:DWEL:LIST 10000,15000,20000,25000
LIST:DWEL:MODE LIST
LIST:IND:STAR 0
LIST:IND:STOP 3
LIST:TRIG:SOUR AUTO
LIST:LEAR
*ERR?
FREQ:MODE LIST
OUTP:STAT ON
OUTP:STAT?
FREQ:MODE?
LIST:RUNN?
```

Expected Results: *ERR? returns 0; OUTP:STAT? returns ON; and FREQ:MODE? returns LIST. Once the device completes the asynchronous configuration, LIST:RUNN? returns 1, and the instrument continuously cycles through rows 1 to 4.

Note: Device configurations are applied asynchronously. When the above commands are sent consecutively, the final LIST:RUNN? query may return 0, indicating that the configurations requested by FREQ:MODE LIST and OUTP:STAT ON have not yet been fully applied. After completing the command sequence, query LIST:RUNN? separately and repeatedly until it returns 1. The *OPC? and *WAI commands only indicate that the current command processing has completed; they do not wait for the asynchronous device configuration to finish.

7.2.2 Software Single-Trigger Sweep

The following example configures three sweep points and sets the global dwell time to 20 ms. In global dwell time mode, a dwell column containing identical values is still required to satisfy the current configuration validation.

Command Example:

```
*RST
*CLS
LIST:FREQ 1000MHz,1001MHz,1002MHz
LIST:POW -30,-30,-30
LIST:DWEL:LIST 20000,20000,20000
LIST:DWEL:MODE GLOB
LIST:DWEL 0.02
LIST:IND:STAR 0
LIST:IND:STOP 2
LIST:TRIG:SOUR SING
LIST:LEAR
*ERR?
FREQ:MODE LIST
OUTP:STAT ON
LIST:TRIG:SOUR?
LIST:RUNN?
```

Once LIST:TRIG:SOUR? returns SINGLE and the device has completed the asynchronous configuration, send the following commands to execute one sweep:

```
LIST:TRIG:EXEC
*ERR?
```

Expected Result: Each time LIST:TRIG:EXEC is sent, the instrument executes one complete sweep over the selected range.

Note: A return value of 1 from LIST:RUNN? indicates that the list sweep configuration has been applied. The falling edge of this status cannot be used to determine whether a single sweep has completed. To verify actual sweep execution, monitor the RF output.

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