

Vector Network Analyzer SCPI Application Guide



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1. Version Management

Updated Description Sheet

Version Number	Content	Time
V1.0	Initial version	23/10/2026

2. Overview

This guide describes the configuration and use of the SCPI functionality integrated into VNStudio software, helping users remotely control VN and PN 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

Before using the SCPI remote control function, start VNStudio and ensure that the instrument is properly connected. Go to "System" -> "SCPI", enable the SCPI function, and confirm the current listening address and port number.

Note: Keep VNStudio running while using SCPI remote control.

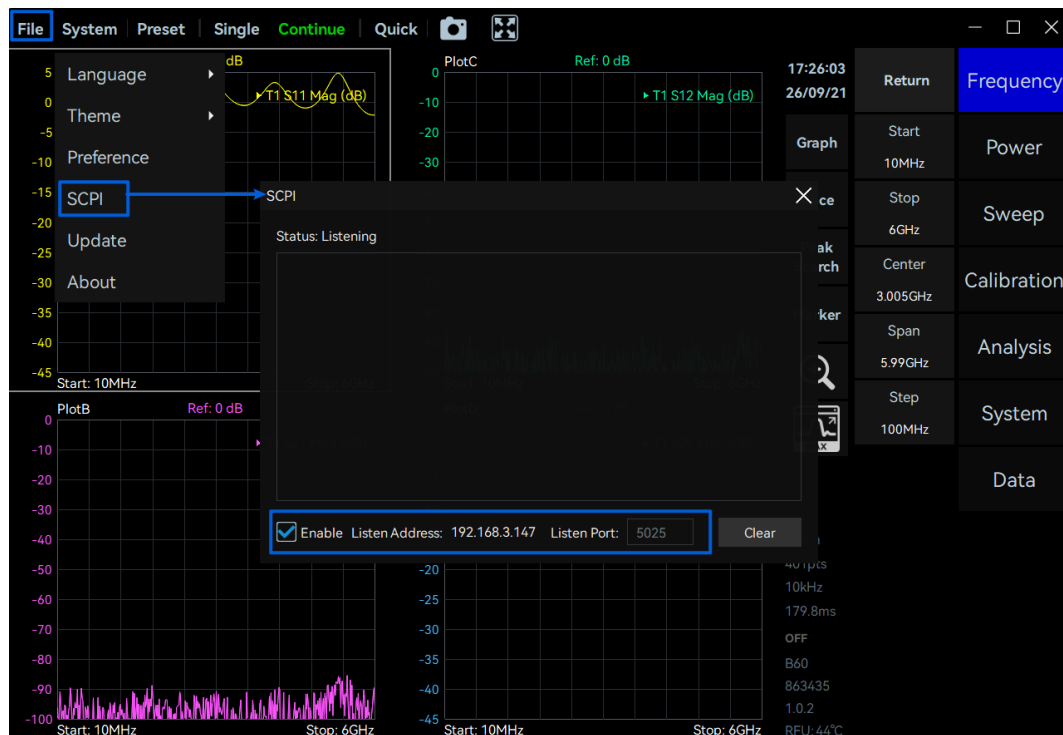


Figure 1 SCPI Enable and Listening Port Settings

4. SCPI Communication

When the control program and VNStudio are running on the same host computer, use **localhost (127.0.0.1)** or the listening address displayed in the VNStudio SCPI settings interface for communication. When the control program and VNStudio are running on different host computers, use the **IP address of the host computer running VNStudio**.

SCPI remote control uses TCP socket communication. The default listening port is 5025. The port number can be changed as required. When establishing a connection, use the listening address and port number currently displayed in the VNStudio SCPI settings interface.

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 for instrument parameter configuration, status queries, sweep control, and measurement data acquisition.

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.
2. Question mark ?: Indicates a query command.
3. Vertical bar |: Indicates a choice between multiple parameter options, for example, TRUE | FALSE.

5.3 Command Abbreviation

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

For example: VNA:FREQuency:START? can be abbreviated as: VNA:FREQ:START?

All examples in this guide use the abbreviated uppercase command form.

6. SCPI Command Description

6.1 General and System Control

6.1.1 System Information

***IDN?**

Function	Retrieves basic instrument information.
Query	*IDN?
Setting	Not supported.
Example	Query: *IDN? Response: Harogic,VNB-60,335B37863435,1.6.5
Remarks	The returned result consists of four comma-separated fields in the following order: manufacturer, model, serial number, and Service Version.

6.1.2 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.

6.1.3 Operation Complete Query

***OPC?**

Function	Queries whether all preceding operations have been completed.
Query	*OPC?
Setting	Not supported.
Example	Query: *OPC? Response: 1
Remarks	1 indicates that all preceding operations have been completed.

6.1.4 Event Status Register Query

***ESR?**

Function	Reads the Standard Event Status Register.
Query	*ESR?
Setting	Not supported.
Example	Query: *ESR? Response: 0
Remarks	Returns the decimal value of the Standard Event Status Register. The returned value is the sum of the weights corresponding to the individual event status bits.

6.1.5 Query Supported SCPI Command List

***LST?**

Function	Queries the list of SCPI commands supported by the current server.
Query	*LST?
Setting	Not supported.
Example	Query: *LST? Response: #47711 *CLS *ESE? *ESE *ESR? *OPC? *OPC *WAI *LST? *IDN? *RST DEVIce:DISConnect DEVIce:CONNect? DEVIce:CONNect ...
Remarks	The returned SCPI command list is encapsulated in IEEE 488.2 definite-length block format. The commands in the list are separated by line breaks, with one command per line.

6.1.6 Query Connected Devices

DEVIce:CONNect?

Function	Queries information about the currently connected device.
Query	DEVIce:CONNect?
Setting	Not supported.
Example	Query: DEV:CONN? Response: 3354373E3435
Remarks	Returns the serial number of the currently connected device. If no device is connected, SERVER_NOT_READY is returned.

6.1.7 Save Parameter Configuration File

CLIENT:SETUP:SAVE <filename>

Function	Saves the current VNStudio project configuration.
Query	Not supported.
Setting	CLIENT:SETUP:SAVE <filename>
Example	Set: CLIENT:SETUP:SAVE "D:/VNA/project.vnaz"
Remarks	Saves the current VNStudio project configuration. The file path must be a valid path on the host computer running VNStudio.

6.1.8 Load Saved Parameter Configuration File

CLIENT:SETUP:LOAD? <filename>

Function	Loads a previously saved VNStudio project configuration.
Query	Not supported.
Setting	CLIENT:SETUP:LOAD? <filename>
Example	Set: CLIENT:SETUP:LOAD? "D:/VNA/project.vnaz"
Remarks	Loads a previously saved project configuration. Returns TRUE if the configuration is loaded successfully; otherwise, returns GATEWAY_EXECUTION_ERROR.

6.1.9 PLL Settling Time

DEV:CONF:PLLSETT

Function	Sets or queries the PLL settling time.
Query	DEVice:CONFiguration:PLLSETTlingdelay?
Setting	DEVice:CONFiguration:PLLSETTlingdelay <Number>
Example	Query: DEV:CONF:PLLSETT? Response: 200 Set: DEV:CONF:PLLSETT 200
Remarks	<Number> is an integer in μ s. Range: 10–255.

6.1.10 Reference Clock Source

DEV:REF:IN

Function	Sets or queries the reference clock source.
Query	DEVIce:REFerence:IN?
Setting	DEVIce:REFerence:IN <mode>
Example	Query: DEVIce:REFerence:IN? Response: INT Set: DEV:REF:IN EXT
Remarks	<mode>: INT EXT. INT selects the internal reference clock source; EXT selects the external reference clock source.

6.2 Device Status and Capabilities

6.2.1 Query PLL Unlock Status

DEV:STA:UNLO?

Function	Queries whether the PLL is unlocked.
Query	DEVIce:STAtus:UNLOcked?
Setting	Not supported.
Example	Query: DEV:STA:UNLO? Response: FALSE
Remarks	Return values: TRUE FALSE. TRUE indicates that the PLL is unlocked; FALSE indicates that the PLL is locked.

6.2.2 ADC Overload Status

DEV:STA:ADCOVER?

Function	Queries whether the ADC is overloaded.
Query	DEVIce:STAtus:ADCOVERload?
Setting	Not supported.
Example	Query: DEV:STA:ADCOVER? Response: FALSE
Remarks	Return values: TRUE FALSE. TRUE indicates an ADC overload condition; FALSE indicates that the ADC is not overloaded.

6.2.3 Output Level Status

DEV:STA:UNLEV?

Function	Queries whether the output level is abnormal.
Query	DEVIce:STatus:UNLEVel?
Setting	Not supported.
Example	Query: DEV:STA:UNLEV? Response: FALSE
Remarks	Return values: TRUE FALSE. TRUE indicates an abnormal output level; FALSE indicates that the output level is normal.

6.2.4 Device Firmware Version

DEV:INF:FWREV?

Function	Queries the device firmware version.
Query	DEVIce:INFo:FWREVIsion?
Setting	Not supported.
Example	Query: DEV:INF:FWREV? Response: 1.6.3
Remarks	Returns the current device firmware version in the format <major>.<minor>.<patch>, representing the major, minor, and patch version numbers, respectively.

6.2.5 Device Hardware Version

DEV:INF:HWREV?

Function	Queries the device hardware version.
Query	DEVIce:INFo:HWREVIsion?
Setting	Not supported.
Example	Query: DEV:INF:HWREV? Response: HAR0 Rev.0
Remarks	Returns the current device hardware version.

6.2.6 Measurement Frequency Range

DEV:INF:LIM:MINF?

DEV:INF:LIM:MAXF?

Function	Queries the minimum and maximum measurement frequencies supported by the device.
Query	DEVIce:INFo:LIMits:MINFrequency? DEVIce:INFo:LIMits:MAXFrequency?
Setting	Not supported.
Example	Minimum measurement frequency query: DEV:INF:LIM:MINF? Response: 9000 Maximum measurement frequency query: DEV:INF:LIM:MAXF? Response: 6.4e+09
Remarks	The default unit is Hz. Use these commands to query the frequency range supported by the current device before configuring the measurement frequency.

6.2.7 IF Bandwidth Range

DEV:INF:LIM:MINIFBW?

DEV:INF:LIM:MAXIFBW?

Function	Queries the minimum and maximum IF bandwidths supported by the device.
Query	DEVIce:INFo:LIMits:MINIFBW? DEVIce:INFo:LIMits:MAXIFBW?
Setting	Not supported.
Example	Minimum IF bandwidth query: DEV:INF:LIM:MINIFBW? Response: 15 Maximum IF bandwidth query: DEV:INF:LIM:MAXIFBW? Response: 75000
Remarks	The default unit is Hz. Use these commands to query the IF bandwidth range supported by the current device before configuring the IF bandwidth.

6.2.8 Maximum Number of Sweep Points

DEV:INF:LIM:MAXP?

Function	Queries the maximum number of points allowed for a single sweep.
Query	DEVIce:INFo:LIMits:MAXPoints?
Setting	Not supported.
Example	Query: DEV:INF:LIM:MAXP? Response: 2048
Remarks	Returns the maximum number of points allowed for a single sweep.

6.2.9 Output Power Range

DEV:INF:LIM:MINPOW?

DEV:INF:LIM:MAXPOW?

Function	Queries the minimum and maximum output power supported by the device.
Query	DEVIce:INFo:LIMits:MINPOWER? DEVIce:INFo:LIMits:MAXPOWER?
Setting	Not supported.
Example	Minimum output power query: DEV:INF:LIM:MINPOW? Response: -40 Maximum output power query: DEV:INF:LIM:MAXPOW? Response: 5
Remarks	The returned values are in dBm.

6.2.10 Temperature

DEV:INF:TEMP?

Function	Queries the RFU temperature.
Query	DEVIce:INFo:TEMPeratures?
Setting	Not supported.
Example	Query: DEV:INF:TEMP? Response: 44
Remarks	Returns the current RFU temperature in °C.

6.3 Measurement Parameter Settings

6.3.1 Sweep Mode

VNA:SWEEP

Function	Sets or queries the sweep mode.
Query	VNA:SWEEP?
Setting	VNA:SWEEP <mode>
Example	Query: VNA:SWEEP? Response: FREQUENCY Set: VNA:SWEEP POWER
Remarks	<mode>: FREQUENCY POWER CW. FREQUENCY selects frequency sweep mode, POWER selects power sweep mode, and CW selects zero-span CW mode. When CW is selected, the center frequency of the current frequency range is used as the CW frequency, and the start and stop frequencies are set to the same value. In FREQUENCY mode, the linear or logarithmic frequency sweep type can be further configured using the VNA:SWEETYPE command.

6.3.2 Frequency Sweep Type

VNA:SWEETYPE

Function	Sets or queries the frequency sweep type.
Query	VNA:SWEETYPE?
Setting	VNA:SWEETYPE <type>
Example	Query: VNA:SWEETYPE? Response: LOG Set: VNA:SWEETYPE LIN
Remarks	Prerequisite: Before setting or querying this parameter, set the sweep mode to frequency sweep using VNA:SWEEP FREQUENCY. <type>: LIN LOG. LIN selects linear frequency sweep, and LOG selects logarithmic frequency sweep.

6.3.3 Start Frequency

VNA:FREQ:START

Function	Sets or queries the start frequency of the frequency sweep.
Query	VNA:FREQuency:START?
Setting	VNA:FREQuency:START <frequency>
Example	Query: VNA:FREQ:START? Response: 10000000 Set: VNA:FREQ:START 1000000000
Remarks	<frequency> is specified in Hz. The value must be within the frequency range supported by the current device.

6.3.4 Stop Frequency

VNA:FREQ:STOP

Function	Sets or queries the stop frequency of the frequency sweep.
Query	VNA:FREQuency:STOP?
Setting	VNA:FREQuency:STOP <frequency>
Example	Query: VNA:FREQ:STOP? Response: 6000000000 Set: VNA:FREQ:STOP 5000000000
Remarks	<frequency> is specified in Hz. The value must not exceed the maximum measurement frequency supported by the current device.

6.3.5 Power Sweep Start Power

VNA:POW:START

Function	Sets or queries the start power of the power sweep.
Query	VNA:POWer:START?
Setting	VNA:POWer:START <power>
Example	Query: VNA:POW:START? Response: -40 Set: VNA:POW:START -30
Remarks	Prerequisite: Before setting this parameter, set the sweep mode to power sweep using VNA:SWEEP POWER; otherwise, the setting will not take effect. <power> can be specified to two decimal places. The default unit is dBm.

6.3.6 Power Sweep Stop Power

VNA:POW:STOP

Function	Sets or queries the stop power of the power sweep.
Query	VNA:POWer:STOP?
Setting	VNA:POWer:STOP <power>
Example	Query: VNA:POW:STOP? Response: 0 Set: VNA:POW:STOP 5
Remarks	Prerequisite: Before setting this parameter, set the sweep mode to power sweep using VNA:SWEEP POWER; otherwise, the setting will not take effect. <power> can be specified to two decimal places. The default unit is dBm.

6.3.7 Frequency Sweep Source Power

VNA:STIM:LVL

Function	Sets or queries the source power for the frequency sweep.
Query	VNA:STIMulus:LVL?
Setting	VNA:STIMulus:LVL <power>
Example	Query: VNA:STIM:LVL? Response: -10 Set: VNA:STIM:LVL -20
Remarks	Prerequisite: Before setting this parameter, set the sweep mode to frequency sweep using VNA:SWEEP FREQUENCY; otherwise, the setting will not take effect. The default unit for <power> is dBm.

6.3.8 Power Sweep Fixed Frequency

VNA:STIM:FREQ

Function	Sets or queries the fixed frequency for the power sweep.
Query	VNA:STIMulus:FREQuency?
Setting	VNA:STIMulus:FREQuency <frequency>
Example	Query: VNA:STIM:FREQ? Response: 3005000000 Set: VNA:STIM:FREQ 1000000000
Remarks	Prerequisite: Before setting this parameter, set the sweep mode to power sweep using VNA:SWEEP POWER; otherwise, the setting will not take effect. The default unit for <frequency> is Hz.

6.3.9 IF Bandwidth

VNA:ACQ:IFBW

Function	Sets or queries the IF bandwidth.
Query	VNA:ACQ:IFBW?
Setting	VNA:ACQ:IFBW <bandwidth>
Example	Query: VNA:ACQ:IFBW? Response: 10000 Set: VNA:ACQ:IFBW 75000
Remarks	The default unit for <bandwidth> is Hz. The value must be within the IF bandwidth range supported by the device.

6.3.10 Dwell Time

VNA:ACQ:DWELL

Function	Sets or queries the dwell time at each sweep point.
Query	VNA:ACQ:DWELLtime?
Setting	VNA:ACQ:DWELLtime <time>
Example	Query: VNA:ACQ:DWELL? Response: 0 Set: VNA:ACQ:DWELL 0.01
Remarks	The default unit for <time> is s, with a resolution of 1 μ s.

6.3.11 Number of Averages

VNA:ACQ:AVG

Function	Sets or queries the number of averages applied to complete sweeps.
Query	VNA:ACQ:AVG?
Setting	VNA:ACQ:AVG <count>
Example	Query: VNA:ACQ:AVG? Response: 1 Set: VNA:ACQ:AVG 3
Remarks	<count> is an integer in the range [1,99] and specifies the number of complete sweeps averaged by the client.

6.3.12 Number of Sweep Points

VNA:ACQ:POINTS

Function	Sets or queries the number of points in a single sweep.
Query	VNA:ACQ:POINTS?
Setting	VNA:ACQ:POINTS <points>
Example	Query: VNA:ACQ:POINTS? Response: 401 Set: VNA:ACQ:POINTS 1001
Remarks	<points> is a positive integer and must not exceed the maximum number of sweep points supported by the device. Use DEVIce:INFo:LIMits:MAXPoints? to query the maximum number of sweep points.

6.4 Sweep and Acquisition Control

6.4.1 Start Sweep

VNA:ACQ:RUN

Function	Starts a sweep or queries the current sweep running status.
Query	VNA:ACQquisition:RUN?
Setting	VNA:ACQquisition:RUN
Example	Query: VNA:ACQ:RUN? Response: TRUE Set: VNA:ACQ:RUN
Remarks	The set command requires no parameter and returns no response when executed successfully. The query returns TRUE FALSE. TRUE indicates that a sweep is running; FALSE indicates that no sweep is running.

6.4.2 Stop Sweep

VNA:ACQ:STOP

Function	Stops the current sweep.
Query	Not supported.
Setting	VNA:ACQquisition:STOP
Example	Set: VNA:ACQ:STOP
Remarks	The set command requires no parameter and returns no response when executed successfully. After the sweep is stopped, use VNA:ACQ:RUN to restart the sweep.

6.4.3 Single/Continuous Sweep

VNA:ACQ:SINGLE

Function	Sets or queries the single/continuous sweep state.
Query	VNA:ACQ:isition:SINGLE?
Setting	VNA:ACQ:isition:SINGLE <state>
Example	Query: VNA:ACQ:SINGLE? Response: FALSE Set: VNA:ACQ:SINGLE TRUE
Remarks	<state>: TRUE FALSE. TRUE enables single sweep mode; FALSE restores continuous sweep mode. In single sweep mode, each VNA:ACQ:SINGLE TRUE command triggers a new sweep.

6.4.4 Current Sweep Frequency Position

VNA:ACQ:FREQ?

Function	Queries the current sweep frequency.
Query	VNA:ACQ:isition:FREQuency?
Setting	Not supported.
Example	Query: VNA:ACQ:FREQ? Response: 1.11706e+09
Remarks	Returns the frequency corresponding to the current sweep position. The default unit is Hz.

6.4.5 Current Sweep Power Position

VNA:ACQ:POW?

Function	Queries the current power position during a power sweep.
Query	VNA:ACQ:isition:POWer?
Setting	Not supported.
Example	Query: VNA:ACQ:POW? Response: -20
Remarks	Returns the power corresponding to the current sweep position. The default unit is dBm.

6.4.6 CW Sweep Time Position

VNA:ACQ:TIME?

Function	Queries the current sweep time position in CW mode.
Query	VNA:ACQuisition:TIME?
Setting	Not supported.
Example	Query: VNA:ACQ:TIME? Response: 0.035464
Remarks	Prerequisite: The sweep mode must be set to CW. Returns the time corresponding to the current sweep position. The default unit is s.

6.4.7 Total Single-Sweep Time

VNA:ACQ:SWE:TIME?

Function	Queries the total time required for all enabled traces in the current interface to complete one sweep.
Query	VNA:ACQuisition:SWEep:TIME?
Setting	Not supported.
Example	Query: VNA:ACQ:SWE:TIME? Response: 0.1801731
Remarks	Returns the total time required for all enabled traces in the current interface to complete one sweep. The default unit is s. This time varies depending on the number of enabled traces and the associated sweep parameters.

6.5 Measurement Data Acquisition

6.5.1 Acquire Specified Trace Data

VNA:TRAC:DATA?

Function	Queries the complete complex data for the specified S-parameter trace.
Query	VNA:TRACe:DATA? <trace>
Setting	Not supported.
Example	Query: VNA:TRAC:DATA? S11 Response: [10000000,-0.96659,0.04029],[24975000,-0.973159,0.0731841], [39950000,-0.969651,0.121074],[54925000,-0.967058,0.159662], [69900000,-0.963755,0.199096],[84875000,-0.959427,0.239114], [99850000,-0.954077,0.279537],[114825000,-0.947781,0.320763],...
Remarks	<trace>: S11 S12 S21 S22. The returned data for each sweep point consists of the x value, real part, and imaginary part. Depending on the current sweep mode, x represents frequency, power, or time.

7. Example

This example assumes that the required measurement parameters have already been configured and calibration has been completed in VNStudio on the host computer. It demonstrates only how to use SCPI commands to query the current measurement configuration and sweep status, and to acquire S11 trace data.

1. Start VNStudio, ensure that the instrument is properly connected, and complete the required measurement parameter configuration and calibration. Go to System → SCPI, select Enable to enable SCPI remote control.
2. Use Python to establish a TCP socket connection. Send SCPI commands to query the current measurement parameters, sweep status, and sweep time, and acquire the S11 trace data.

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

def query(command):
    sock.sendall((command + "\n").encode("utf-8"))
    response = sock.recv(65536)
    return response.decode("utf-8").strip()

[8] ✓ 0.0s

# Query device information.
response = query("CLIENT:INFO?")
print("Device:", response)

[9] ✓ 0.0s
... Device: VNB-60,335837863435,1.0.2,4

# Query current measurement settings.
response = query("VNA:SWEEP?"); print("Sweep mode:", response)
response = query("VNA:FREQ:START?"); print("Start frequency (Hz):", response)
response = query("VNA:FREQ:STOP?"); print("Stop frequency (Hz):", response)
response = query("VNA:ACQ:IFBW?"); print("IF bandwidth (Hz):", response)
response = query("VNA:ACQ:POINTS?"); print("Sweep points:", response)

[10] ✓ 0.0s
... Sweep mode: FREQUENCY
Start frequency (Hz): 10000000
Stop frequency (Hz): 6000000000
IF bandwidth (Hz): 10000
Sweep points: 401

# Query acquisition status.
response = query("VNA:ACQ:RUN?"); print("Running:", response)
response = query("VNA:ACQ:SWE:TIME?"); print("Sweep time (s):", response)

[11] ✓ 0.0s
... Running: TRUE
Sweep time (s): 0.1805599

# Query S11 trace data.
response = query("VNA:TRAC:DATA? S11")
print("S11 Data:", response)

[15] ✓ 0.0s
... S11 Data: [10000000,-0.966573,0.0399637],[24975000,-0.973261,0.0727771],[39950000,-0.969689,0.120825],
```

Figure 2 Query Measurement Configuration and Acquire S11 Trace Data Using Python

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