

# LibreVNA SCPI Programming Guide

November 13, 2022

## Contents

<b>1</b>	<b>Introduction</b>	<b>4</b>
<b>2</b>	<b>SCPI Server Configuration</b>	<b>4</b>
<b>3</b>	<b>General Syntax</b>	<b>4</b>
<b>4</b>	<b>Commands</b>	<b>5</b>
4.1	General Commands . . . . .	5
4.1.1	*IDN . . . . .	5
4.1.2	*LST . . . . .	5
4.2	Device Commands . . . . .	5
4.2.1	DEVIce:DISCOnnect . . . . .	5
4.2.2	DEVIce:CONNect . . . . .	5
4.2.3	DEVIce:LIST . . . . .	6
4.2.4	DEVIce:MODE . . . . .	6
4.2.5	DEVIce:REFerence:OUT . . . . .	7
4.2.6	DEVIce:REFerence:IN . . . . .	7
4.2.7	DEVIce:STATus:UNLOcked . . . . .	7
4.2.8	DEVIce:STATus:ADCOVERload . . . . .	8
4.2.9	DEVIce:STATus:UNLEVel . . . . .	8
4.2.10	DEVIce:INFo:FWREVisIon . . . . .	8
4.2.11	DEVIce:INFo:HWREVisIon . . . . .	8
4.2.12	DEVIce:INFo:TEMPeratures . . . . .	9
4.2.13	DEVIce:INFo:LIMits:MINFrequency . . . . .	9
4.2.14	DEVIce:INFo:LIMits:MAXFrequency . . . . .	9
4.2.15	DEVIce:INFo:LIMits:MINIFBW . . . . .	9
4.2.16	DEVIce:INFo:LIMits:MAXIFBW . . . . .	9
4.2.17	DEVIce:INFo:LIMits:MAXPoints . . . . .	9
4.2.18	DEVIce:INFo:LIMits:MINPOWer . . . . .	10
4.2.19	DEVIce:INFo:LIMits:MAXPOWer . . . . .	10
4.2.20	DEVIce:INFo:LIMits:MINRBW . . . . .	10
4.2.21	DEVIce:INFo:LIMits:MAXRBW . . . . .	10
4.2.22	DEVIce:INFo:LIMits:MAXHARMonicfrequency . . . . .	10
4.3	VNA Commands . . . . .	11
4.3.1	VNA:SWEEP . . . . .	11
4.3.2	VNA:FREQuency:SPAN . . . . .	11
4.3.3	VNA:FREQuency:START . . . . .	11
4.3.4	VNA:FREQuency:CENTer . . . . .	12
4.3.5	VNA:FREQuency:STOP . . . . .	12

4.3.6	VNA:FREQuency:FULL	12
4.3.7	VNA:FREQuency:ZERO	12
4.3.8	VNA:POWer:START	12
4.3.9	VNA:POWer:STOP	13
4.3.10	VNA:ACQuisition:IFBW	13
4.3.11	VNA:ACQuisition:POINTS	13
4.3.12	VNA:ACQuisition:AVG	14
4.3.13	VNA:ACQuisition:AVGLEVel	14
4.3.14	VNA:ACQuisition:FINished	14
4.3.15	VNA:ACQuisition:LIMit	14
4.3.16	VNA:ACQuisition:SINGLE	15
4.3.17	VNA:STIMulus:LVL	15
4.3.18	VNA:STIMulus:FREQuency	15
4.3.19	VNA:TRACe:LIST	15
4.3.20	VNA:TRACe:DATA	16
4.3.21	VNA:TRACe:AT	16
4.3.22	VNA:TRACe:TOUCHSTONE	17
4.3.23	VNA:TRACe:MAXFrequency	17
4.3.24	VNA:TRACe:MINFrequency	17
4.3.25	VNA:TRACe:MAXAmplitude	18
4.3.26	VNA:TRACe:MINAmplitude	18
4.3.27	VNA:TRACe:NEW	18
4.3.28	VNA:TRACe:RENAME	18
4.3.29	VNA:TRACe:PAUSE	18
4.3.30	VNA:TRACe:RESUME	19
4.3.31	VNA:TRACe:PAUSED	19
4.3.32	VNA:TRACe:PARAMeter	19
4.3.33	VNA:TRACe:TYPE	19
4.3.34	VNA:CALibration:ACTivate	19
4.3.35	VNA:CALibration:ACTIVE	20
4.3.36	VNA:CALibration:NUMber	20
4.3.37	VNA:CALibration:RESET	20
4.3.38	VNA:CALibration:ADD	20
4.3.39	VNA:CALibration:TYPE	21
4.3.40	VNA:CALibration:PORT	21
4.3.41	VNA:CALibration:STANDARD	21
4.3.42	VNA:CALibration:MEASure	21
4.3.43	VNA:CALibration:BUSY	22
4.3.44	VNA:CALibration:SAVE	22
4.3.45	VNA:CALibration:LOAD	22
4.4	Signal Generator Commands	22
4.4.1	GENerator:FREQuency	22
4.4.2	GENerator:LVL	23
4.4.3	GENerator:PORT	23
4.5	Spectrum Analyzer Commands	23
4.5.1	SA:FREQuency:SPAN	23
4.5.2	SA:FREQuency:START	24
4.5.3	SA:FREQuency:CENTer	24
4.5.4	SA:FREQuency:STOP	24
4.5.5	SA:FREQuency:FULL	25
4.5.6	SA:FREQuency:ZERO	25

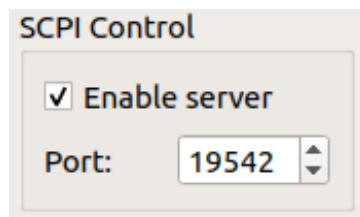
4.5.7	SA:ACQquisition:RBW	25
4.5.8	SA:ACQquisition:WINDow	25
4.5.9	SA:ACQquisition:DETEctor	25
4.5.10	SA:ACQquisition:AVG	26
4.5.11	SA:ACQquisition:AVGLEVel	26
4.5.12	SA:ACQquisition:FINIshed	27
4.5.13	SA:ACQquisition:LIMit	27
4.5.14	SA:ACQquisition:SINGLE	27
4.5.15	SA:ACQquisition:SIGid	27
4.5.16	SA:TRACKing:ENable	28
4.5.17	SA:TRACKing:PORT	28
4.5.18	SA:TRACKing:LVL	28
4.5.19	SA:TRACKing:OFFset	28
4.5.20	SA:TRACKing:NORMalize:ENable	29
4.5.21	SA:TRACKing:NORMalize:MEASure	29
4.5.22	SA:TRACKing:NORMalize:LVL	29
4.5.23	SA:TRACe:LIST	29
4.5.24	SA:TRACe:DATA	30
4.5.25	SA:TRACe:AT	30
4.5.26	SA:TRACe:MAXFrequency	30
4.5.27	SA:TRACe:MINFrequency	31
4.5.28	SA:TRACe:MAXAmplitude	31
4.5.29	SA:TRACe:MINAmplitude	31
4.5.30	SA:TRACe:NEW	31
4.5.31	SA:TRACe:RENAME	31
4.5.32	SA:TRACe:PAUSE	32
4.5.33	SA:TRACe:RESUME	32
4.5.34	SA:TRACe:PAUSED	32
4.5.35	SA:TRACe:PARAMeter	32
4.5.36	SA:TRACe:TYPE	32

## 1 Introduction

The LibreVNA-GUI contains a TCP server that can be used to control the LibreVNA with SCPI commands.

## 2 SCPI Server Configuration

The server is configurable in the preferences: `Window > Preferences > General`



If enabled, it will accept any TCP connection at the configured port. Once the connection is established, it can be used to send SCPI commands and receive replies. Only one connection at a time is possible, if a second connection is created, the first one will be closed by the LibreVNA-GUI. Alternatively, a port can be manually configured by setting the “port” argument:

```
./LibreVNA-GUI --port 1234
```

This enables the SCPI server at the specified port, regardless of what is configured in the preferences (useful for starting multiple instances at different ports at the same time). If no graphical user interface is required, the LibreVNA-GUI can be hidden:

```
./LibreVNA-GUI --port 1234 --no-gui
```

## 3 General Syntax

The syntax follows the usual SCPI rules:

- All commands are case insensitive (implicitly converted to uppercase before evaluated)
- The command tree is organized in branches, separated by a colon:

```
:VNA:TRACE:LIST?
```

- Multiple commands can be concatenated in one line using a semicolon:

```
:DEVICE:CONNECT;:DEVICE:INFO:FWRRevision?
```

- If a command starts with a colon it is evaluated from the root branch, otherwise the last used branch is assumed:

```
:VNA:FREQUENCY:START 1000000  
STOP 2000000 #No colon, VNA:FREQUENCY branch was used before
```

- Branches and commands can be abbreviated by using only the uppercase part of their name, the following commands are identical:

```
:DEVICE:INFO:LIMITS:MINFREQUENCY?  
:DEV:INF:LIM:MINF?
```

- Every command generates a (possibly empty) response, terminated with a newline character.

- Some commands require additional arguments that have to be passed after the command (separated by spaces):

```
: DEV : REF : OUT 10
```

- Two types of commands are available:
  - **Events** change a setting or trigger an action. They usually have an empty response (unless there was an error).
  - **Queries** request information. They end with a question mark.
 Some commands are both events and queries, depending on whether the question mark is present:

```
: VNA : FREQ : SPAN 50000000 # Set the span
: VNA : FREQ : SPAN? # Read the current span
```

## 4 Commands

### 4.1 General Commands

#### 4.1.1 \*IDN

Query:

<b>Effect:</b>	Returns the identifications string
<b>Syntax:</b>	*IDN?
<b>Parameters:</b>	None
<b>Return value:</b>	LibreVNA-GUI

#### 4.1.2 \*LST

Query:

<b>Effect:</b>	Lists all available commands
<b>Syntax:</b>	*LST?
<b>Parameters:</b>	None
<b>Return value:</b>	List of commands, separated by newline

### 4.2 Device Commands

This section contains general device commands, available regardless of the current mode.

#### 4.2.1 DEVIce:DISConnect

Event:

<b>Effect:</b>	Disconnects from the device
<b>Syntax:</b>	DEVIce:DISConnect
<b>Parameters:</b>	None

#### 4.2.2 DEVIce:CONNect

Event:

<b>Effect:</b>	Connects to a device. If no serialnumber is specified, the connection is made with the first device found
----------------	---

<b>Syntax:</b>	DEVIce:CONNect [<serialnumber>]
<b>Parameters:</b>	<serialnumber> Serialnumber of the device that should be connected

Example

```
: DEV : CONN 206039903350
```

Query:

<b>Effect:</b>	Queries the serial number of the connected device
<b>Syntax:</b>	DEVIce:CONNect?
<b>Parameters:</b>	None
<b>Return value:</b>	<serialnumber> or “Not connected”

Example

```
: DEV : CONN ?
206039903350
```

#### 4.2.3 DEVIce:LIST

Query:

<b>Effect:</b>	Lists all available devices by their serial numbers
<b>Syntax:</b>	DEVIce:LIST?
<b>Parameters:</b>	None
<b>Return value:</b>	List of serialnumbers

Example

```
: DEV : LIST ?
206039903350 , 208939A23350
```

#### 4.2.4 DEVIce:MODE

Event:

<b>Effect:</b>	Switches the device to the specified mode
<b>Syntax:</b>	DEVIce:MODE <mode>
<b>Parameters:</b>	<mode>: VNA: set to vector analyzer GEN: set to signal generator SA: set to spectrum analyzer

Example

```
: DEV : MODE VNA
```

Query:

<b>Effect:</b>	Queries the currently active mode
<b>Syntax:</b>	DEVice:MODE?
<b>Parameters:</b>	None
<b>Return value:</b>	<mode>: VNA: set to vector analyzer GEN: set to signal generator SA: set to spectrum analyzer

#### Example

```
: DEV : MODE ?
VNA
```

#### 4.2.5 DEVice:REFerence:OUT

##### Event:

<b>Effect:</b>	Sets the reference output frequency
<b>Syntax:</b>	DEVice:REFerence:OUT <freq>
<b>Parameters:</b>	<freq> in MHz, either 0 (disabled), 10 or 100

##### Query:

<b>Effect:</b>	Queries the reference output frequency
<b>Syntax:</b>	DEVice:REFerence:OUT?
<b>Parameters:</b>	None
<b>Return value:</b>	Output frequency in MHz

#### 4.2.6 DEVice:REFerence:IN

##### Event:

<b>Effect:</b>	Set the reference input mode
<b>Syntax:</b>	DEVice:REFerence:IN <mode>
<b>Parameters:</b>	<mode>: INT: use internal reference EXT: use external reference AUTO: automatic reference switching

##### Query:

<b>Effect:</b>	Queries the reference source
<b>Syntax:</b>	DEVice:REFerence:IN?
<b>Parameters:</b>	None
<b>Return value:</b>	INT or EXT

#### 4.2.7 DEVice:STAtus:UNLOcked

##### Query:

<b>Effect:</b>	Queries the PLL lock error flag
----------------	---------------------------------

<b>Syntax:</b>	DEVIce:STAtus:UNLOcked?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

#### 4.2.8 DEVIce:STAtus:ADCOVERload

Query:

<b>Effect:</b>	Queries the ADC overload error flag
<b>Syntax:</b>	DEVIce:STAtus:ADCOVERload?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

#### 4.2.9 DEVIce:STAtus:UNLEVel

Query:

<b>Effect:</b>	Queries the output level error flag
<b>Syntax:</b>	DEVIce:STAtus:UNLEVel?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

#### 4.2.10 DEVIce:INFo:FWREVIion

Query:

<b>Effect:</b>	Returns the firmware revision of the connected device
<b>Syntax:</b>	DEVIce:INFo:FWREVIion?
<b>Parameters:</b>	None
<b>Return value:</b>	<major>.<minor>.<patch>

Example

```
: DEV : INF : FWREV ?
1 . 0 . 0
```

#### 4.2.11 DEVIce:INFo:HWREVIion

Query:

<b>Effect:</b>	Returns the hardware revision of the connected device
<b>Syntax:</b>	DEVIce:INFo:HWREVIion?
<b>Parameters:</b>	None
<b>Return value:</b>	<revision>, single char

Example

```
: DEV : INF : HWREV ?
B
```



#### 4.2.12 DEVice:INFo:TEMPeratures

Query:

<b>Effect:</b>	Queries the temperatures of certain chips
<b>Syntax:</b>	DEVice:INFo:TEMPeratures?
<b>Parameters:</b>	None
<b>Return value:</b>	<source>/<I.LO>/<CPU>

Example

```
: DEV : INF : TEMP ?  
45/51/31
```

#### 4.2.13 DEVice:INFo:LIMits:MINFrequency

Query:

<b>Effect:</b>	Queries the lowest frequency the device can measure
<b>Syntax:</b>	DEVice:INFo:LIMits:MINFrequency?
<b>Parameters:</b>	None
<b>Return value:</b>	lowest frequency in Hz

#### 4.2.14 DEVice:INFo:LIMits:MAXFrequency

Query:

<b>Effect:</b>	Queries the highest frequency the device can measure
<b>Syntax:</b>	DEVice:INFo:LIMits:MAXFrequency?
<b>Parameters:</b>	None
<b>Return value:</b>	highest frequency in Hz

#### 4.2.15 DEVice:INFo:LIMits:MINIFBW

Query:

<b>Effect:</b>	Queries the lowest IF bandwidth setting
<b>Syntax:</b>	DEVice:INFo:LIMits:MINIFBW?
<b>Parameters:</b>	None
<b>Return value:</b>	lowest possible IF bandwidth in Hz

#### 4.2.16 DEVice:INFo:LIMits:MAXIFBW

Query:

<b>Effect:</b>	Queries the highest IF bandwidth setting
<b>Syntax:</b>	DEVice:INFo:LIMits:MAXIFBW?
<b>Parameters:</b>	None
<b>Return value:</b>	highest possible IF bandwidth in Hz

#### 4.2.17 DEVice:INFo:LIMits:MAXPoints

Query:

<b>Effect:</b>	Queries the maximum number of points per sweep
<b>Syntax:</b>	DEVIce:INFo:LIMits:MAXPoints?
<b>Parameters:</b>	None
<b>Return value:</b>	maximum number of points

#### 4.2.18 DEVIce:INFo:LIMits:MINPOWer

Query:

<b>Effect:</b>	Queries the minimum output power
<b>Syntax:</b>	DEVIce:INFo:LIMits:MINPOWer?
<b>Parameters:</b>	None
<b>Return value:</b>	minimum output power in dBm

#### 4.2.19 DEVIce:INFo:LIMits:MAXPOWer

Query:

<b>Effect:</b>	Queries the maximum output power
<b>Syntax:</b>	DEVIce:INFo:LIMits:MAXPOWer?
<b>Parameters:</b>	None
<b>Return value:</b>	maximum output power in dBm

#### 4.2.20 DEVIce:INFo:LIMits:MINRBW

Query:

<b>Effect:</b>	Queries the lowest resolution bandwidth setting
<b>Syntax:</b>	DEVIce:INFo:LIMits:MINRBW?
<b>Parameters:</b>	None
<b>Return value:</b>	lowest possible resolution bandwidth in Hz

#### 4.2.21 DEVIce:INFo:LIMits:MAXRBW

Query:

<b>Effect:</b>	Queries the highest resolution bandwidth setting
<b>Syntax:</b>	DEVIce:INFo:LIMits:MAXRBW?
<b>Parameters:</b>	None
<b>Return value:</b>	highest possible resolution bandwidth in Hz

#### 4.2.22 DEVIce:INFo:LIMits:MAXHARMonicfrequency

Query:

<b>Effect:</b>	Queries the (theoretical) maximum frequency when using harmonic mixing in VNA mode
<b>Syntax:</b>	DEVIce:INFo:LIMits:MAXHARMonicfrequency?
<b>Parameters:</b>	None
<b>Return value:</b>	maximum frequency in Hz

### 4.3 VNA Commands

These commands change or query VNA settings. Although most of them are available regardless of the current device mode, they usually only have an effect once the VNA mode is active (e.g. it is possible to change the span while in signal generator mode but it does not effect the LibreVNA until the mode is switched to VNA). Certain commands (like taking a calibration measurement) are only available in VNA mode and will return an error if another mode is active.

#### 4.3.1 VNA:SWEEP

##### Event:

<b>Effect:</b>	Sets the type of the sweep
<b>Syntax:</b>	VNA:SWEEP
<b>Parameters:</b>	<type>, either FREQUENCY or POWER

##### Query:

<b>Effect:</b>	Queries the currently selected type
<b>Syntax:</b>	VNA:SWEEP?
<b>Parameters:</b>	None
<b>Return value:</b>	<type>, either FREQUENCY or POWER

#### 4.3.2 VNA:FREQUENCY:SPAN

##### Event:

<b>Effect:</b>	Sets the span of the sweep
<b>Syntax:</b>	VNA:FREQUENCY:SPAN
<b>Parameters:</b>	<span>, in Hz

##### Query:

<b>Effect:</b>	Queries the currently selected span
<b>Syntax:</b>	VNA:FREQUENCY:SPAN?
<b>Parameters:</b>	None
<b>Return value:</b>	span in Hz

#### 4.3.3 VNA:FREQUENCY:START

##### Event:

<b>Effect:</b>	Sets the start frequency of the sweep
<b>Syntax:</b>	VNA:FREQUENCY:START
<b>Parameters:</b>	<start frequency>, in Hz

##### Query:

<b>Effect:</b>	Queries the currently selected start frequency
<b>Syntax:</b>	VNA:FREQUENCY:START?
<b>Parameters:</b>	None
<b>Return value:</b>	start frequency in Hz

#### 4.3.4 VNA:FREQUENCY:CENTER

##### Event:

<b>Effect:</b>	Sets the center frequency of the sweep
<b>Syntax:</b>	VNA:FREQUENCY:CENTER
<b>Parameters:</b>	<center frequency>, in Hz

##### Query:

<b>Effect:</b>	Queries the currently selected center frequency
<b>Syntax:</b>	VNA:FREQUENCY:CENTER?
<b>Parameters:</b>	None
<b>Return value:</b>	center frequency in Hz

#### 4.3.5 VNA:FREQUENCY:STOP

##### Event:

<b>Effect:</b>	Sets the stop frequency of the sweep
<b>Syntax:</b>	VNA:FREQUENCY:STOP
<b>Parameters:</b>	<stop frequency>, in Hz

##### Query:

<b>Effect:</b>	Queries the currently selected stop frequency
<b>Syntax:</b>	VNA:FREQUENCY:STOP?
<b>Parameters:</b>	None
<b>Return value:</b>	stop frequency in Hz

#### 4.3.6 VNA:FREQUENCY:FULL

##### Event:

<b>Effect:</b>	Sets the device to the maximum span possible
<b>Syntax:</b>	VNA:FREQUENCY:FULL
<b>Parameters:</b>	None

#### 4.3.7 VNA:FREQUENCY:ZERO

##### Event:

<b>Effect:</b>	Sets the device to zero span mode
<b>Syntax:</b>	VNA:FREQUENCY:ZERO
<b>Parameters:</b>	None

#### 4.3.8 VNA:POWER:START

##### Event:

<b>Effect:</b>	Sets the start power of the power sweep
<b>Syntax:</b>	VNA:POWER:START
<b>Parameters:</b>	<start power>, in dBm

Query:

<b>Effect:</b>	Queries the currently selected start power
<b>Syntax:</b>	VNA:POWer:START?
<b>Parameters:</b>	None
<b>Return value:</b>	start power in dBm

#### 4.3.9 VNA:POWer:STOP

Event:

<b>Effect:</b>	Sets the stop power of the power sweep
<b>Syntax:</b>	VNA:POWer:STOP
<b>Parameters:</b>	<stop power>, in dBm

Query:

<b>Effect:</b>	Queries the currently selected stop power
<b>Syntax:</b>	VNA:POWer:STOP?
<b>Parameters:</b>	None
<b>Return value:</b>	stop power in dBm

#### 4.3.10 VNA:ACQquisition:IFBW

Event:

<b>Effect:</b>	Sets the IF bandwidth
<b>Syntax:</b>	VNA:ACQquisition:IFBW
<b>Parameters:</b>	<IF bandwidth>, in Hz

Query:

<b>Effect:</b>	Queries the currently selected IF bandwidth
<b>Syntax:</b>	VNA:ACQquisition:IFBW?
<b>Parameters:</b>	None
<b>Return value:</b>	IF bandwidth in Hz

#### 4.3.11 VNA:ACQquisition:POINTS

Event:

<b>Effect:</b>	Sets the number of points per sweep
<b>Syntax:</b>	VNA:ACQquisition:POINTS
<b>Parameters:</b>	<points>

Query:

<b>Effect:</b>	Queries the currently selected number of points
<b>Syntax:</b>	VNA:ACQquisition:POINTS?
<b>Parameters:</b>	None
<b>Return value:</b>	points

#### 4.3.12 VNA:ACquisition:AVG

Event:

<b>Effect:</b>	Sets the number of sweeps over which a moving average is calculated
<b>Syntax:</b>	VNA:ACquisition:AVG
<b>Parameters:</b>	<averaging sweeps>

Query:

<b>Effect:</b>	Queries the currently configured number of sweeps
<b>Syntax:</b>	VNA:ACquisition:AVG?
<b>Parameters:</b>	None
<b>Return value:</b>	<averaging sweeps>

#### 4.3.13 VNA:ACquisition:AVGLEvel

Query:

<b>Effect:</b>	Queries the number of sweeps that have been acquired by the average function.
<b>Syntax:</b>	VNA:ACquisition:AVGLEvel?
<b>Parameters:</b>	None
<b>Return value:</b>	<acquired sweeps>

<acquired sweeps> resets to zero whenever a setting is changed. It is incremented at the end of each sweep, but will not go above the number of configured sweeps for the averaging.

Example (assuming <averaging sweep> = 3):

# of active sweep	<acquired sweeps>
1	0
2	1
3	2
4	3
5	3

#### 4.3.14 VNA:ACquisition:FINished

Query:

<b>Effect:</b>	Queries whether the average filter has reached a steady state (that is <acquired sweeps> = <averaging sweeps>)
<b>Syntax:</b>	VNA:ACquisition:FINished?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

#### 4.3.15 VNA:ACquisition:LIMit

Query:

<b>Effect:</b>	Queries the status of limits that maybe set up on any graph
<b>Syntax:</b>	VNA:ACquisition:LIMit?
<b>Parameters:</b>	None
<b>Return value:</b>	PASS or FAIL

#### 4.3.16 VNA:ACQuisition:SINGLE

##### Event:

<b>Effect:</b>	Configures the VNA for single or continuous sweep
<b>Syntax:</b>	VNA:ACQuisition:SINGLE
<b>Parameters:</b>	TRUE or FALSE

##### Query:

<b>Effect:</b>	Queries whether the VNA is set up for single sweep
<b>Syntax:</b>	VNA:ACQuisition:SINGLE?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

If single sweep is enabled, the acquisition is stopped when the required number of averages have been reached. There are two ways to trigger a new sweep:

- Change any sweep setting (e.g. center frequency)
- Issue the command again (i.e. VNA:ACQ:SINGLE TRUE always triggers a new sweep)

#### 4.3.17 VNA:STIMulus:LVL

##### Event:

<b>Effect:</b>	Sets the output power of the stimulus signal when sweep type is frequency
<b>Syntax:</b>	VNA:STIMulus:LVL
<b>Parameters:</b>	<power>, in dBm

##### Query:

<b>Effect:</b>	Queries the currently selected output power
<b>Syntax:</b>	VNA:STIMulus:LVL?
<b>Parameters:</b>	None
<b>Return value:</b>	power in dBm

#### 4.3.18 VNA:STIMulus:FREQuency

##### Event:

<b>Effect:</b>	Sets the frequency of the stimulus signal when sweep type is power
<b>Syntax:</b>	VNA:STIMulus:FREQuency
<b>Parameters:</b>	<freq>, in Hz

##### Query:

<b>Effect:</b>	Queries the currently selected frequency
<b>Syntax:</b>	VNA:STIMulus:FREQuency?
<b>Parameters:</b>	None
<b>Return value:</b>	frequency in Hz

#### 4.3.19 VNA:TRACe:LIST

##### Query:

<b>Effect:</b>	Lists the names of all available traces
<b>Syntax:</b>	VNA:TRACe:LIST?
<b>Parameters:</b>	None
<b>Return value:</b>	comma-separated list of trace name

Example

```
VNA:TRAC:LIST?
S11,S12,S21,S22
```

**4.3.20 VNA:TRACe:DATA**

Query:

<b>Effect:</b>	Returns the data of a trace
<b>Syntax:</b>	VNA:TRACe:DATA?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	comma-separated list of tuples [x, real(y), imag(y)]

Depending on the sweep and possible configured math operations, x may be either frequency, power or time.

Example

```
:VNA:TRAC:DATA? S11
[1e+6,0.400172,0.0377869],
[6.67556e+8,-0.0922281,-0.00990373],
[1.33411e+9,-0.0341439,-0.0331184],
[2.00067e+9,0.00750893,0.0490847],
[2.66722e+9,0.0472666,-0.175552],
[3.33378e+9,-0.106545,-0.00952825],
[4.00033e+9,-0.102039,0.0890605],
[4.66689e+9,0.0464292,0.118183],
[5.33344e+9,0.13223,-0.00780554],
[6e+9,-0.0314859,-0.246024]
```

Note: actual response will not include newlines between data points, only at the end

**4.3.21 VNA:TRACe:AT**

Query:

<b>Effect:</b>	Returns the data at a specific frequency (possibly interpolated)
<b>Syntax:</b>	VNA:TRACe:AT?
<b>Parameters:</b>	<trace>, either by name or by index <frequency>, in Hz
<b>Return value:</b>	real,imag (or "NaN,NaN" if specified frequency is invalid)

Example

```
:VNA:TRAC:AT? S11 1200000000
-0.0458452,-0.028729
```



#### 4.3.22 VNA:TRACe:TOUCHSTONE

Query:

<b>Effect:</b>	Returns the content of multiple trace according to the touchstone format
<b>Syntax:</b>	VNA:TRACe:TOUCHSTONE?
<b>Parameters:</b>	<trace1>,<trace2>,<trace3>,...
<b>Return value:</b>	Touchstone file content in ASCII

Some additional constraints apply:

- The number of specified traces must be a square number. The number of ports in the touchstone file is inferred from that.
- Only frequency domain traces are allowed.
- All traces must have the same number of points and the same start/stop frequency.
- The order in which the traces are specified matters and depending on its index and each trace must be a reflection or transmission measurement:
  - Assuming that  $n$  is the number of ports of the desired touchstone file, the  $n * n$  number of traces must be specified in this order:

$$S_{11}...S_{1n}, S_{21}...S_{2n}, \dots, S_{n1}...S_{nn}$$

- For every trace  $S_{ij}$ , the trace must contain a reflection measurement if  $i = j$  and a transmission measurement if  $i \neq j$ .
- Traces can be specified either by name or by index.
- A deviation from any of these points (invalid number of traces, non-existing trace, wrong order, ...) will result in an error being returned.

#### Example

```

:VNA:TRACE:TOUCHSTONE? S11 S12 S21 S22
# GHZ S RI R 50
1.000000000000 1.000497817993 0.010679213330 0.000013886895
  -0.000054684886 -0.000023392624 -0.000021111371
  0.401717424393 0.702864229679
1.002000000000 1.000323534012 0.010577851906 -0.000011075452
  -0.000013504875 0.000000477609 -0.000007789199
  0.413144201040 0.696514129639
...

```

#### 4.3.23 VNA:TRACe:MAXFrequency

Query:

<b>Effect:</b>	Returns the highest frequency contained in the trace
<b>Syntax:</b>	VNA:TRACe:MAXFrequency?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	maximum frequency in Hz

#### 4.3.24 VNA:TRACe:MINFrequency

Query:

<b>Effect:</b>	Returns the lowest frequency contained in the trace
----------------	---

<b>Syntax:</b>	VNA:TRACe:MINFrequency?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	maximum frequency in Hz

#### 4.3.25 VNA:TRACe:MAXAmplitude

Query:

<b>Effect:</b>	Returns the datapoint with the highest amplitude in the trace
<b>Syntax:</b>	VNA:TRACe:MAXAmplitude?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	<frequency>,<real>,<imag> of the highest amplitude point

Example

```
:VNA:TRAC:MAXA? S21
5.66406e+9, -6.21766e-5, -0.000795846
```

#### 4.3.26 VNA:TRACe:MINAmplitude

Query:

<b>Effect:</b>	Returns the datapoint with the lowest amplitude in the trace
<b>Syntax:</b>	VNA:TRACe:MINAmplitude?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	<frequency>,<real>,<imag> of the lowest amplitude point

#### 4.3.27 VNA:TRACe:NEW

Event:

<b>Effect:</b>	Creates a new trace
<b>Syntax:</b>	VNA:TRACe:NEW
<b>Parameters:</b>	<trace name>

#### 4.3.28 VNA:TRACe:RENAME

Event:

<b>Effect:</b>	Changes the name of a trace
<b>Syntax:</b>	VNA:TRACe:RENAME
<b>Parameters:</b>	<trace>, either by name or by index <new name>

#### 4.3.29 VNA:TRACe:PAUSE

Event:

<b>Effect:</b>	Pauses (freezes) a trace
<b>Syntax:</b>	VNA:TRACe:PAUSE
<b>Parameters:</b>	<trace>, either by name or by index

#### 4.3.30 VNA:TRACe:RESUME

Event:

<b>Effect:</b>	Resumes (unfreezes) a trace
<b>Syntax:</b>	VNA:TRACe:RESUME
<b>Parameters:</b>	<trace>, either by name or by index

#### 4.3.31 VNA:TRACe:PAUSED

Query:

<b>Effect:</b>	Queries whether a trace is paused
<b>Syntax:</b>	VNA:TRACe:PAUSED?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	TRUE or FALSE

#### 4.3.32 VNA:TRACe:PARAMeter

Event:

<b>Effect:</b>	Sets the measurement parameter that is stored in the trace
<b>Syntax:</b>	VNA:TRACe:PARAMeter
<b>Parameters:</b>	<trace>, either by name or by index <parameter>, options are S11, S12, S21 or S22

Query:

<b>Effect:</b>	Queries the measurement parameter of a trace
<b>Syntax:</b>	VNA:TRACe:PARAMeter?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	S11, S12, S21 or S22

#### 4.3.33 VNA:TRACe:TYPE

Event:

<b>Effect:</b>	Sets the storage type of a trace
<b>Syntax:</b>	VNA:TRACe:TYPE
<b>Parameters:</b>	<trace>, either by name or by index <type>, options are OVERWRITE, MAXHOLD or MINHOLD

Query:

<b>Effect:</b>	Queries the storage type of a trace
<b>Syntax:</b>	VNA:TRACe:TYPE?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	OVERWRITE, MAXHOLD or MINHOLD

#### 4.3.34 VNA:CALibration:ACTivate

Event:

<b>Effect:</b>	Activates a specific calibration. This command fails if the required measurements have not been taken yet
<b>Syntax:</b>	VNA:CALibration:ACTivate
<b>Parameters:</b>	<type>

Query:

<b>Effect:</b>	Queries the currently available calibration types
<b>Syntax:</b>	VNA:CALibration:ACTivate?
<b>Parameters:</b>	None
<b>Return value:</b>	comma-separated list of available calibration types

#### 4.3.35 VNA:CALibration:ACTIVE

Query:

<b>Effect:</b>	Queries the currently active calibration type
<b>Syntax:</b>	VNA:CALibration:ACTIVE?
<b>Parameters:</b>	None
<b>Return value:</b>	Currently active calibration type

#### 4.3.36 VNA:CALibration:NUMBER

Query:

<b>Effect:</b>	Queries the number of available calibration measurements
<b>Syntax:</b>	VNA:CALibration:NUMBER?
<b>Parameters:</b>	None
<b>Return value:</b>	<number of configured measurements>

#### 4.3.37 VNA:CALibration:RESET

Event:

<b>Effect:</b>	Resets the calibration. Deactivates the calibration and deletes all measurements.
<b>Syntax:</b>	VNA:CALibration:RESET
<b>Parameters:</b>	None

#### 4.3.38 VNA:CALibration:ADD

Event:

<b>Effect:</b>	Adds a new empty calibration measurement.
<b>Syntax:</b>	VNA:CALibration:ADD
<b>Parameters:</b>	<type> Measurement type, one of: OPEN SHORT LOAD THROUGH ISOLATION [<standard>], calibration kit standard name, optional

#### 4.3.39 VNA:CALibration:TYPE

Query:

<b>Effect:</b>	Returns the type of the specified measurement
<b>Syntax:</b>	VNA:CALibration:TYPE?
<b>Parameters:</b>	<measurement number>
<b>Return value:</b>	Measurement type, one of: OPEN SHORT LOAD THROUGH ISOLATION

#### 4.3.40 VNA:CALibration:PORT

Event:

<b>Effect:</b>	Sets the port for the specified measurement
<b>Syntax:</b>	VNA:CALibration:PORT
<b>Parameters:</b>	<measurement number> <port number>

Query:

<b>Effect:</b>	Returns the port for the specified measurement
<b>Syntax:</b>	VNA:CALibration:PORT?
<b>Parameters:</b>	<measurement number>
<b>Return value:</b>	<port number>

#### 4.3.41 VNA:CALibration:STANDARD

Event:

<b>Effect:</b>	Sets the calibration standard which will be used for the specified measurement
<b>Syntax:</b>	VNA:CALibration:STANDARD
<b>Parameters:</b>	<measurement number> <standard name>

Query:

<b>Effect:</b>	Returns the standard name for the specified measurement
<b>Syntax:</b>	VNA:CALibration:STANDARD?
<b>Parameters:</b>	<measurement number>
<b>Return value:</b>	Name of used calibration standard (from calibration kit)

#### 4.3.42 VNA:CALibration:MEASure

Event:

<b>Effect:</b>	Starts a calibration measurement. This command fails if no device is connected, the VNA mode is not active or a calibration measurement is already in progress.
<b>Syntax:</b>	VNA:CALibration:MEASure
<b>Parameters:</b>	<measurement 1>,<measurement 2>,...

Any number of measurements can be specified (by their number). These measurements will be taken simultaneously. This only works if they are measuring different ports (e.g. measure SHORT on port 1 and OPEN on port 2). If colliding measurements are specified (e.g. SHORT on port 1 and LOAD on port 1), an error is returned and no measurements are started.

#### 4.3.43 VNA:CALibration:BUSY

Query:

<b>Effect:</b>	Queries whether a calibration measurement is ongoing
<b>Syntax:</b>	VNA:CALibration:BUSY?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

#### 4.3.44 VNA:CALibration:SAVE

Event:

<b>Effect:</b>	Saves the active calibration to a file
<b>Syntax:</b>	VNA:CALibration:SAVE
<b>Parameters:</b>	<filename>

Important points when saving/loading calibration files through SCPI commands:

- Filenames must be either absolute or relative to the location of the GUI application.
- SCPI parsing implicitly capitalizes all commands, the file will be saved using only uppercase letters. Similarly, it is not possible to load a file whose filename contains lowercase characters.
- If the LibreVNA-GUI (and thus also the SCPI server) is running on a different machine than the SCPI client, the calibration files will be saved/loaded from the machine that runs the GUI.

#### 4.3.45 VNA:CALibration:LOAD

Query:

<b>Effect:</b>	Loads a calibration file
<b>Syntax:</b>	VNA:CALibration:LOAD?
<b>Parameters:</b>	<filename>
<b>Return value:</b>	TRUE or FALSE

### 4.4 Signal Generator Commands

These commands change or query signal generator settings. Although most of them are available regardless of the current device mode, they usually only have an effect once the generator mode is active.

#### 4.4.1 GENerator:FREQuency

Event:

<b>Effect:</b>	Sets the output frequency
<b>Syntax:</b>	GENerator:FREQuency
<b>Parameters:</b>	<frequency>, in Hz

Query:

<b>Effect:</b>	Queries the selected output frequency
<b>Syntax:</b>	GENerator:FREQuency?
<b>Parameters:</b>	None
<b>Return value:</b>	frequency in Hz

#### 4.4.2 GENerator:LVL

##### Event:

<b>Effect:</b>	Sets the output power
<b>Syntax:</b>	GENerator:LVL
<b>Parameters:</b>	<output level>, in dBm

##### Query:

<b>Effect:</b>	Queries the selected output power
<b>Syntax:</b>	GENerator:LVL?
<b>Parameters:</b>	None
<b>Return value:</b>	output level in dBm

#### 4.4.3 GENerator:PORT

##### Event:

<b>Effect:</b>	Sets the active output port
<b>Syntax:</b>	GENerator:PORT
<b>Parameters:</b>	<output port> 0: output disabled 1: output signal at port 1 2: output signal at port 2

##### Query:

<b>Effect:</b>	Queries the selected output
<b>Syntax:</b>	GENerator:PORT?
<b>Parameters:</b>	None
<b>Return value:</b>	output port

### 4.5 Spectrum Analyzer Commands

These commands change or query spectrum analyzer settings. Although most of them are available regardless of the current device mode, they usually only have an effect once the spectrum analyzer mode is active.

#### 4.5.1 SA:FREQuency:SPAN

##### Event:

<b>Effect:</b>	Sets the span of the sweep
<b>Syntax:</b>	SA:FREQuency:SPAN
<b>Parameters:</b>	<span>, in Hz

Query:

<b>Effect:</b>	Queries the currently selected span
<b>Syntax:</b>	SA:FREQUENCY:SPAN?
<b>Parameters:</b>	None
<b>Return value:</b>	span in Hz

#### 4.5.2 SA:FREQUENCY:START

Event:

<b>Effect:</b>	Sets the start frequency of the sweep
<b>Syntax:</b>	SA:FREQUENCY:START
<b>Parameters:</b>	<start frequency>, in Hz

Query:

<b>Effect:</b>	Queries the currently selected start frequency
<b>Syntax:</b>	SA:FREQUENCY:START?
<b>Parameters:</b>	None
<b>Return value:</b>	start frequency in Hz

#### 4.5.3 SA:FREQUENCY:CENTER

Event:

<b>Effect:</b>	Sets the center frequency of the sweep
<b>Syntax:</b>	SA:FREQUENCY:CENTER
<b>Parameters:</b>	<center frequency>, in Hz

Query:

<b>Effect:</b>	Queries the currently selected center frequency
<b>Syntax:</b>	SA:FREQUENCY:CENTER?
<b>Parameters:</b>	None
<b>Return value:</b>	center frequency in Hz

#### 4.5.4 SA:FREQUENCY:STOP

Event:

<b>Effect:</b>	Sets the stop frequency of the sweep
<b>Syntax:</b>	SA:FREQUENCY:STOP
<b>Parameters:</b>	<stop frequency>, in Hz

Query:

<b>Effect:</b>	Queries the currently selected stop frequency
<b>Syntax:</b>	SA:FREQUENCY:STOP?
<b>Parameters:</b>	None
<b>Return value:</b>	stop frequency in Hz



#### 4.5.5 SA:FREQuency:FULL

Event:

<b>Effect:</b>	Sets the device to the maximum span possible
<b>Syntax:</b>	SA:FREQuency:FULL
<b>Parameters:</b>	None

#### 4.5.6 SA:FREQuency:ZERO

Event:

<b>Effect:</b>	Sets the device to zero span mode
<b>Syntax:</b>	SA:FREQuency:ZERO
<b>Parameters:</b>	None

#### 4.5.7 SA:ACQuisition:RBW

Event:

<b>Effect:</b>	Sets the resolution bandwidth
<b>Syntax:</b>	SA:ACQuisition:IFBW
<b>Parameters:</b>	<resolution bandwidth>, in Hz

Query:

<b>Effect:</b>	Queries the currently selected resolution bandwidth
<b>Syntax:</b>	SA:ACQuisition:IFBW?
<b>Parameters:</b>	None
<b>Return value:</b>	resolution bandwidth in Hz

#### 4.5.8 SA:ACQuisition:WINDow

Event:

<b>Effect:</b>	Sets the type of window used in the acquisition
<b>Syntax:</b>	SA:ACQuisition:WINDow
<b>Parameters:</b>	<windowtype> NONE KAISER HANN FLATTOP

Query:

<b>Effect:</b>	Queries the currently selected type of window
<b>Syntax:</b>	SA:ACQuisition:WINDow?
<b>Parameters:</b>	None
<b>Return value:</b>	NONE, KAISER, HANN or FLATTOP

#### 4.5.9 SA:ACQuisition:DETEctor

Event:

<b>Effect:</b>	Sets the detector type
<b>Syntax:</b>	SA:ACQquisition:DETECTOR
<b>Parameters:</b>	<detector> +PEAK -PEAK NORMAL SAMPLE AVERAGE

Query:

<b>Effect:</b>	Queries the currently selected detector type
<b>Syntax:</b>	SA:ACQquisition:DETECTOR?
<b>Parameters:</b>	None
<b>Return value:</b>	+PEAK, -PEAK, NORMAL, SAMPLE or AVERAGE

#### 4.5.10 SA:ACQquisition:AVG

Event:

<b>Effect:</b>	Sets the number of sweeps over which a moving average is calculated
<b>Syntax:</b>	SA:ACQquisition:AVG
<b>Parameters:</b>	<sweeps>

Query:

<b>Effect:</b>	Queries the currently configured number of sweeps
<b>Syntax:</b>	SA:ACQquisition:AVG?
<b>Parameters:</b>	None
<b>Return value:</b>	sweeps

#### 4.5.11 SA:ACQquisition:AVGLEVEL

Query:

<b>Effect:</b>	Queries the number of sweeps that have been acquired by the average function.
<b>Syntax:</b>	SA:ACQquisition:AVGLEVEL?
<b>Parameters:</b>	None
<b>Return value:</b>	<acquired sweeps>

<acquired sweeps> resets to zero whenever a setting is changed. It is incremented at the end of each sweep, but will not go above the number of configured sweeps for the averaging.

Example (assuming <averaging sweep> = 3):

# of active sweep	<acquired sweeps>
1	0
2	1
3	2
4	3
5	3

#### 4.5.12 SA:ACQquisition:FINished

Query:

<b>Effect:</b>	Queries whether the average filter has reached a steady state (that is <acquired sweeps> = <averaging sweeps>)
<b>Syntax:</b>	SA:ACQquisition:FINished?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

#### 4.5.13 SA:ACQquisition:LIMit

Query:

<b>Effect:</b>	Queries the status of limits that maybe set up on any graph
<b>Syntax:</b>	SA:ACQquisition:LIMit?
<b>Parameters:</b>	None
<b>Return value:</b>	PASS or FAIL

#### 4.5.14 SA:ACQquisition:SINGLE

Event:

<b>Effect:</b>	Configures the spectrum analyzer for single or continuous sweep
<b>Syntax:</b>	SA:ACQquisition:SINGLE
<b>Parameters:</b>	TRUE or FALSE

Query:

<b>Effect:</b>	Queries whether the spectrum analyzer is set up for single sweep
<b>Syntax:</b>	SA:ACQquisition:SINGLE?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

If single sweep is enabled, the acquisition is stopped when the required number of averages have been reached. There are two ways to trigger a new sweep:

- Change any sweep setting (e.g. center frequency)
- Issue the command again (i.e. SA:ACQ:SINGLE TRUE always triggers a new sweep)

#### 4.5.15 SA:ACQquisition:SIGid

Event:

<b>Effect:</b>	Enables/disables signal identification
<b>Syntax:</b>	SA:ACQquisition:SIGid
<b>Parameters:</b>	<enabled>, option are TRUE, FALSE, 1 or 0

Query:

<b>Effect:</b>	Queries whether signal identification is enabled
<b>Syntax:</b>	SA:ACQquisition:SIGid?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

#### 4.5.16 SA:TRACKing:ENable

Event:

<b>Effect:</b>	Enables/disables the tracking generator
<b>Syntax:</b>	SA:TRACKing:ENable
<b>Parameters:</b>	<enabled>, option are TRUE, FALSE, 1 or 0

Query:

<b>Effect:</b>	Queries whether tracking generator is enabled
<b>Syntax:</b>	SA:TRACKing:ENable?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

#### 4.5.17 SA:TRACKing:PORT

Event:

<b>Effect:</b>	Sets the output port of the tracking generator
<b>Syntax:</b>	SA:TRACKing:PORT
<b>Parameters:</b>	<port>, either 1 or 2

Query:

<b>Effect:</b>	Queries the output port of the tracking generator
<b>Syntax:</b>	SA:TRACKing:PORT?
<b>Parameters:</b>	None
<b>Return value:</b>	1 or 2

#### 4.5.18 SA:TRACKing:LVL

Event:

<b>Effect:</b>	Sets the output power of the tracking generator
<b>Syntax:</b>	SA:TRACKing:LVL
<b>Parameters:</b>	<output level>, in dBm

Query:

<b>Effect:</b>	Queries the selected output power of the tracking generator
<b>Syntax:</b>	SA:TRACKing:LVL?
<b>Parameters:</b>	None
<b>Return value:</b>	output level in dBm

#### 4.5.19 SA:TRACKing:OFFset

Event:

<b>Effect:</b>	Sets the offset frequency of the tracking generator
<b>Syntax:</b>	SA:TRACKing:OFFset
<b>Parameters:</b>	<offset>, in Hz

Query:

<b>Effect:</b>	Queries the selected offset frequency of the tracking generator
<b>Syntax:</b>	SA:TRACKing:OFFset?
<b>Parameters:</b>	None
<b>Return value:</b>	offset in Hz

#### 4.5.20 SA:TRACKing:NORMalize:ENable

Event:

<b>Effect:</b>	Enables/disables normalization. If the span has changed since the last active normalization, a normalization measurement is also started.
<b>Syntax:</b>	SA:TRACKing:NORMAlize:ENable
<b>Parameters:</b>	<enabled>, option are TRUE, FALSE, 1 or 0

Query:

<b>Effect:</b>	Queries whether tracking generator normalization is enabled
<b>Syntax:</b>	SA:TRACKing:NORMAlize:ENable?
<b>Parameters:</b>	None
<b>Return value:</b>	TRUE or FALSE

#### 4.5.21 SA:TRACKing:NORMalize:MEASure

Event:

<b>Effect:</b>	Triggers a new normalization measurement
<b>Syntax:</b>	SA:TRACKing:NORMAlize:MEASure
<b>Parameters:</b>	None

#### 4.5.22 SA:TRACKing:NORMalize:LVL

Event:

<b>Effect:</b>	Sets the reference level for the normalization
<b>Syntax:</b>	SA:TRACKing:NORMAlize:LVL
<b>Parameters:</b>	<normalization level>, in dBm

Query:

<b>Effect:</b>	Queries the selected reference level for the normalization
<b>Syntax:</b>	SA:TRACKing:NORMAlize:LVL?
<b>Parameters:</b>	None
<b>Return value:</b>	normalization level in dBm

#### 4.5.23 SA:TRACe:LIST

Query:

<b>Effect:</b>	Lists the names of all available traces
<b>Syntax:</b>	SA:TRACe:LIST?
<b>Parameters:</b>	None

<b>Return value:</b>	comma-separated list of trace name
----------------------	------------------------------------

Example

```
VNA:TRAC:LIST?  
Port1,Port2
```

#### 4.5.24 SA:TRACe:DATA

Query:

<b>Effect:</b>	Returns the data of a trace
<b>Syntax:</b>	SA:TRACe:DATA?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	comma-separated list of tuples [x, dBm]

Example

```
:SA:TRACE:DATA? PORT1  
[9.75e+8, -100.351],  
[9.7505e+8, -95.7394],  
[9.751e+8, -97.5749],  
[9.7515e+8, -96.9667],  
[9.752e+8, -96.2391],  
[9.7525e+8, -94.8761],  
[9.753e+8, -96.0805],  
[9.7535e+8, -95.7997],  
[9.754e+8, -95.2021],  
[9.7545e+8, -96.3472]
```

Note: actual response will not include newlines between data points, only at the end

#### 4.5.25 SA:TRACe:AT

Query:

<b>Effect:</b>	Returns the data at a specific frequency (possibly interpolated)
<b>Syntax:</b>	SA:TRACe:AT?
<b>Parameters:</b>	<trace>, either by name or by index <frequency>, in Hz
<b>Return value:</b>	<dBm> or "NaN" if specified frequency is invalid)

Example

```
:SA:TRAC:AT? Port1 1000000000  
-96.424
```

#### 4.5.26 SA:TRACe:MAXFrequency

Query:

<b>Effect:</b>	Returns the highest frequency contained in the trace
<b>Syntax:</b>	SA:TRACe:MAXFrequency?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	maximum frequency in Hz

#### 4.5.27 SA:TRACe:MINFrequency

Query:

<b>Effect:</b>	Returns the lowest frequency contained in the trace
<b>Syntax:</b>	SA:TRACe:MINFrequency?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	maximum frequency in Hz

#### 4.5.28 SA:TRACe:MAXAmplitude

Query:

<b>Effect:</b>	Returns the datapoint with the highest amplitude in the trace
<b>Syntax:</b>	SA:TRACe:MAXAmplitude?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	<frequency>,<dBm> of the highest amplitude point

Example

```
: SA:TRAC:MAXA? Port1
9.63e+8, -12.534
```

#### 4.5.29 SA:TRACe:MINAmplitude

Query:

<b>Effect:</b>	Returns the datapoint with the lowest amplitude in the trace
<b>Syntax:</b>	SA:TRACe:MINAmplitude?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	<frequency>,<dBm> of the lowest amplitude point

#### 4.5.30 SA:TRACe:NEW

Event:

<b>Effect:</b>	Creates a new trace
<b>Syntax:</b>	SA:TRACe:NEW
<b>Parameters:</b>	<trace name>

#### 4.5.31 SA:TRACe:RENAME

Event:

<b>Effect:</b>	Changes the name of a trace
<b>Syntax:</b>	SA:TRACe:RENAME

<b>Parameters:</b>	<trace>, either by name or by index <new name>
--------------------	---

#### 4.5.32 SA:TRACe:PAUSE

Event:

<b>Effect:</b>	Pauses (freezes) a trace
<b>Syntax:</b>	SA:TRACe:PAUSE
<b>Parameters:</b>	<trace>, either by name or by index

#### 4.5.33 SA:TRACe:RESUME

Event:

<b>Effect:</b>	Resumes (unfreezes) a trace
<b>Syntax:</b>	SA:TRACe:RESUME
<b>Parameters:</b>	<trace>, either by name or by index

#### 4.5.34 SA:TRACe:PAUSED

Query:

<b>Effect:</b>	Queries whether a trace is paused
<b>Syntax:</b>	SA:TRACe:PAUSED?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	TRUE or FALSE

#### 4.5.35 SA:TRACe:PARAMeter

Event:

<b>Effect:</b>	Sets the measurement parameter that is stored in the trace
<b>Syntax:</b>	SA:TRACe:PARAMeter
<b>Parameters:</b>	<trace>, either by name or by index <parameter>, options are PORT <sub>1</sub> and PORT <sub>2</sub>

Query:

<b>Effect:</b>	Queries the measurement parameter of a trace
<b>Syntax:</b>	SA:TRACe:PARAMeter?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	PORT <sub>1</sub> or PORT <sub>2</sub>

#### 4.5.36 SA:TRACe:TYPE

Event:

<b>Effect:</b>	Sets the storage type of a trace
<b>Syntax:</b>	SA:TRACe:TYPE
<b>Parameters:</b>	<trace>, either by name or by index <type>, options are OVERWRITE, MAXHOLD or MINHOLD



**Query:**

<b>Effect:</b>	Queries the storage type of a trace
<b>Syntax:</b>	SA:TRACe:TYPE?
<b>Parameters:</b>	<trace>, either by name or by index
<b>Return value:</b>	OVERWRITE, MAXHOLD or MINHOLD