Keysight X-Series Signal Generators

N5171B/72B/73B EXG

N5181B/82B/83B MXG

SCPI Command Reference

KEYSIGHT TECHNOLOGIES

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a. Press the **Help** key, and then the key for which you wish help.

1 SCPI Basics

This chapter describes how SCPI information is organized and presented in this reference. An overview of the SCPI language is also provided.

This chapter contains the following sections:

Command Reference Information

SCPI Command Listings

The Table of Contents lists the Standard Commands for Programmable Instruments (SCPI) without the parameters. The SCPI subsystem name will generally have the first part of the command in parenthesis that is repeated in all commands within the subsystem. The title(s) beneath the subsystem name is the remaining command syntax. The following example demonstrates this listing:

Communication Subsystem (:SYSTem:COMMunicate)
  :LAN:IP
    :LAN:SUBNet

The following examples show the complete commands from the above Table of Contents listing:

:SYSTem:COMMunicate:LAN:IP
:SYSTem:COMMunicate:LAN:SUBNet

Key and Data Field Cross Reference

The index is set up so applicable key and data field names can be cross-referenced to the appropriate SCPI command. There are two headings in the index where the key and data field names can be found:

– individual softkey, or data field name (i.e. To look up the communication subsystem topic on Default Gateway softkey refer to Default Gateway softkey.)
– subsystem name (i.e. To look for the Default Gateway softkey (in the Communication Subsystem), refer to the heading labeled: “communication subsystem keys”.)

Supported Field

Within each command section, the “Supported” heading describes which signal generator configurations are supported by the SCPI command. When “All Models” is shown next to this heading, all signal generator configurations are supported by the SCPI command. When “All with Option xxx” is shown next to this heading, only the stated option(s) is supported.

SCPI Basics

This section describes the general use of the SCPI language for Keysight X-Series signal generators. It is not intended to teach you everything about the SCPI language; the SCPI Consortium or IEEE can provide that level of detailed information. For a list of the specific commands available for the signal generator, refer to the table of contents.

For additional information, refer to the following publications:

- IEEE Standard 488.1-2003, IEEE Standard For Higher Performance Protocol for the Standard Digital Interface for Programmable Instrumentation. New York, NY, 2003.
- IEEE Standard 488.2-1992, IEEE Standard Codes, Formats, Protocols and Command Commands for Use with ANSI/IEEE Standard 488.1-1987. New York, NY, 1998.

Common Terms

The following terms are used throughout the remainder of this section:

Command — A command is an instruction in SCPI consisting of mnemonics (keywords), parameters (arguments), and punctuation. You combine commands to form messages that control instruments.

Controller — A controller is any device used to control the signal generator, for example a computer or another instrument.

Event Command — Some commands are events and cannot be queried. An event has no corresponding setting; it initiates an action at a particular time.

Program Message — A program message is a combination of one or more properly formatted commands. Program messages are sent by the controller to the signal generator.

Query — A query is a special type of command used to instruct the signal generator to make response data available to the controller. A query ends with a question mark. Generally you can query any command value that you set.

Response Message — A response message is a collection of data in specific SCPI formats sent from the signal generator to the controller. Response messages tell the controller about the internal state of the signal generator.

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Command Syntax

A typical command is made up of keywords prefixed with colons (:). The keywords are followed by parameters. The following is an example syntax statement:

```
[:SOURce]:PULM:INTernal:FREQuency
<frequency>|MAXimum|MINimum|UP|DOWN
```

In the example above, the `:INTernal:FREQuency` portion of the command immediately follows the `:PULM` portion with no separating space. The portion following the `:INTernal`, `<frequency>|MAXimum|MINimum|UP|DOWN`, are the parameters (argument for the command statement). There is a separating space (white space) between the command and its parameter.

Additional conventions in syntax statements are shown in Table 1-1 and Table 1-2.

Table 1-1 **Special Characters in Command Syntax**

Characters	Meaning	Example
|	A vertical stroke between keywords or parameters indicates alternative choices. For parameters, the effect of the command varies depending on the choice.	[:SOURce]:AM: MOD DEEP|NORMal DEEP or NORMal are the choices.
[ ]	Square brackets indicate that the enclosed keywords or parameters are optional when composing the command. These implied keywords or parameters will be executed even if they are omitted.	[:SOURce]:FREQuency[:CW]? SOURce and CW are optional items.
< >	Angle brackets around a word (or words) indicate they are not to be used literally in the command. They represent the needed item.	[:SOURce]:FREQuency: STARt <value><unit> In this command, the words <value> and <unit> should be replaced by the actual frequency and unit. :FREQuency:STARt 2.5GHz

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Table 1-2 Command Syntax

Characters, Keywords, and Syntax	Example
Upper-case lettering indicates the minimum set of characters required to execute the command. But, each mode of the command must be in either short form or the complete long form (no in-between). Example: Correct: :FREQ :FREQuency Incorrect: :FREQuenc	[:SOURce]:FREQuency[:CW]?, FREQ is the minimum requirement.
Lower-case lettering indicates the portion of the command that is optional; it can either be included with the upper-case portion of the command or omitted. This is the flexible format principle called forgiving listening. Refer to "Command Parameters and Responses" on page 37 for more information.	:FREQuency Either :FREQ, :FREQuency, or :FREQUENCY is correct.
When a colon is placed between two command mnemonics, it moves the current path down one level in the command tree. Refer to "Command Tree" on page 36 more information on command paths.	:TRIGger:OUTPut:POLarity? TRIGger is the root level keyword for this command.
If a command requires more than one parameter, you must separate adjacent parameters using a comma. Parameters are not part of the command path, so commas do not affect the path level.	[:SOURce]:LIST: DWELl <value>,<value>
A semicolon separates two commands in the same program message without changing the current path.	:FREQ 2.5GHz;:POW 10dBm
White space characters, such as <tab> and <space>, are generally ignored as long as they do not occur within or between keywords. However, you must use white space to separate the command from the parameter, but this does not affect the current path.	:FREQ uency or :POWer :LEVel are not allowed. A <space> between :LEVel and 6.2 is mandatory. :POWer:LEVel 6.2

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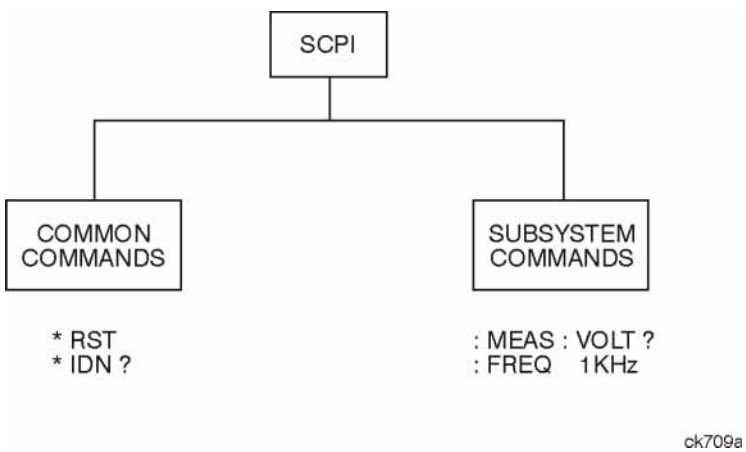
Command Types

Commands can be separated into two groups: common commands and subsystem commands. Figure 1-1, shows the separation of the two command groups.

Common commands are used to manage status registers, synchronization, and data storage and are defined by IEEE 488.2. They are easy to recognize because they all begin with an asterisk. For example `*IDN?`, `*OPC`, and `*RST` are common commands. Common commands are not part of any subsystem and the signal generator interprets them in the same way, regardless of the current path setting.

Subsystem commands are distinguished by the colon (`:`). The colon is used at the beginning of a command statement and between keywords, as in `:FREQuency[:CW?]`. Each command subsystem is a set of commands that roughly correspond to a functional block inside the signal generator. For example, the power subsystem (`:POWer`) contains commands for power generation, while the status subsystem (:STATus) contains commands for controlling status registers.

Figure 1-1 Command Types



Command Tree

Most programming tasks involve subsystem commands. SCPI uses a structure for subsystem commands similar to the file systems on most computers. In SCPI, this command structure is called a command tree and is shown in Figure 1-2.

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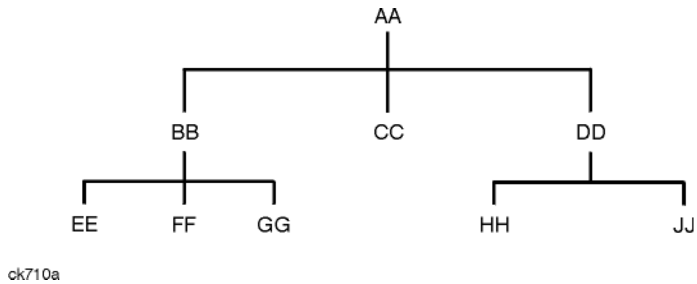
Figure 1-2 Simplified Command Tree



The command closest to the top is the root command, or simply "the root." Notice that you must follow a particular path to reach lower level commands. In the following example, `:POWer` represents AA, `:ALC` represents BB, `:SOURce` represents GG. The complete command path is `:POWer:ALC:SOURce?` (:AA:BB:GG).

Paths Through the Command Tree

To access commands from different paths in the command tree, you must understand how the signal generator interprets commands. The parser, a part of the signal generator firmware, decodes each message sent to the signal generator. The parser breaks up the message into component commands using a set of rules to determine the command tree path used. The parser keeps track of the current path (the level in the command tree) and where it expects to find the next command statement. This is important because the same keyword may appear in different paths. The particular path is determined by the keyword(s) in the command statement.

A message terminator, such as a `<new line>` character, sets the current path to the root. Many programming languages have output statements that automatically send message terminators.

NOTE The current path is set to the root after the line-power is cycled or when `*RST` is sent.

Command Parameters and Responses

SCPI defines different data formats for use in program and response messages. It does this to accommodate the principle of forgiving listening and precise talking. For more information on program data types refer to IEEE 488.2.

Forgiving listening means the command and parameter formats are flexible.

For example, with the `:FREQuency:REFerence:STATe ON|OFF|1|0` command, the signal generator accepts `:FREQuency:REFerence:STATe ON`, `:FREQuency:REFerence:STATe 1`, `:FREQ:REF:STAT ON`, `:FREQ:REF:STAT 1` to turn on the frequency reference mode.

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Each parameter type has one or more corresponding response data types. A setting that you program using a numeric parameter returns either real or integer response data when queried. Response data (data returned to the controller) is more concise and restricted, and is called precise talking.

Precise talking means that the response format for a particular query is always the same.

For example, if you query the power state (`:POWer:ALC:STATe?`) when it is on, the response is always 1, regardless of whether you previously sent `:POWer:ALC:STATe 1` or `:POWer:ALC:STATe ON`. Table shows the response for a given parameter type.

Parameter Types	**Response Data Types**
Numeric	Real, Integer
Extended Numeric	Real, Integer
Discrete	Discrete
Boolean	Numeric Boolean
String	String
Definite Block	Arbitrary byte data[a]

a. (i.e. text, binary, discrete, real, integer, etc.-).

Numeric Parameters

Numeric parameters are used in both common and subsystem commands. They accept all commonly used decimal representations of numbers including optional signs, decimal points, and scientific notation.

If a signal generator setting is programmed with a numeric parameter which can only assume a finite value, it automatically rounds any entered parameter which is greater or less than the finite value. For example, if a signal generator has a programmable output impedance of 50 or 75 ohms, and you specified 76.1 for the output impedance, the value is rounded to 75. The following are examples of numeric parameters:

100	no decimal point required
100.	fractional digits optional
–1.23	leading signs allowed
4.56E<space>3	space allowed after the E in exponential
–7.89E–001	use either E or e in exponential
+256	leading + allowed
.5	digits left of decimal point optional

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Extended Numeric Parameters

Most subsystems use extended numeric parameters to specify physical quantities. Extended numeric parameters accept all numeric parameter values and other special values as well.

The following are examples of extended numeric parameters:

100	any simple numeric value
1.2GHz	GHz can be used for exponential (E009)
200MHz	MHz can be used for exponential (E006)
–100mV	negative 100 millivolts
10DEG	10 degrees

Extended numeric parameters also include the following special parameters:

DEFault	resets the parameter to its default value
UP	increments the parameter
DOWN	decrements the parameter
MINimum	sets the parameter to the smallest possible value
MAXimum	sets the parameter to the largest possible value

Discrete Parameters

Discrete parameters use mnemonics to represent each valid setting. They have a long and a short form, just like command mnemonics. You can mix upper and lower case letters for discrete parameters.

The following examples of discrete parameters are used with the command `:TRIGger[:SEQuence]:SOURce BUS|IMMediate|EXTernal`.

BUS	GPIB, LAN, or USB triggering
IMMediate	immediate trigger (free run)
EXTernal	external triggering

Although discrete parameters look like command keywords, do not confuse the two. In particular, be sure to use colons and spaces properly. Use a colon to separate command mnemonics from each other and a space to separate parameters from command mnemonics.

The following are examples of discrete parameters in commands:

```
TRIGger:SOURce BUS
TRIGger:SOURce IMMediate
TRIGger:SOURce EXTernal
```

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Boolean Parameters

Boolean parameters represent a single binary condition that is either true or false. The two-state boolean parameter has four arguments. The following list shows the arguments for the two-state boolean parameter:

ON	boolean true, upper/lower case allowed
OFF	boolean false, upper/lower case allowed
1	boolean true
0	boolean false

String Parameters

String parameters allow ASCII strings to be sent as parameters. Single or double quotes are used as delimiters.

The following are examples of string parameters:

```
'This is valid'
"This is also valid"
'SO IS THIS'
```

Real Response Data

Real response data represent decimal numbers in either fixed decimal or scientific notation. Most high-level programming languages that support signal generator input/output (I/O) handle either decimal or scientific notation transparently.

The following are examples of real response data:

+4.000000E+010, –9.990000E+002

–9.990000E+002

+4.0000000000000E+010

+1

0

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Integer Response Data

Integer response data are decimal representations of integer values including optional signs. Most status register related queries return integer response data.

The following are examples of integer response data:

0	signs are optional
+100	leading + allowed
–100	leading – allowed
256	never any decimal point

Discrete Response Data

Discrete response data are similar to discrete parameters. The main difference is that discrete response data only returns the short form of a particular mnemonic, in all upper case letters.

The following are examples of discrete response data:

IMM

EXT

INT

NEG

Numeric Boolean Response Data

Boolean response data returns a binary numeric value of one or zero.

String Response Data

String response data are similar to string parameters. The main difference is that string response data returns double quotes, rather than single quotes. Embedded double quotes may be present in string response data. Embedded quotes appear as two adjacent double quotes with no characters between them.

The following are examples of string response data:

```
"This is a string"

"one double quote inside brackets: [""]"

"Hello!"
```

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Program Messages

The following commands will be used to demonstrate the creation of program messages:

`[:SOURce]:FREQuency:STARt`	`[:SOURce]:FREQuency:STOP`
`[:SOURce]:FREQuency[:CW]`	`[:SOURce]:POWer[:LEVel]:OFFSet`

Example 1

```
:FREQuency:STARt 500MHz;STOP 1000MHz
```

This program message is correct and will not cause errors; `STARt` and `STOP` are at the same path level. It is equivalent to sending the following message:

```
FREQuency:STARt 500MHz;FREQuency:STOP 1000MHz
```

Example 2

```
:POWer 10DBM;:OFFSet 5DB
```

This program message will result in an error. The message makes use of the default
`POWer[:LEVel]` node (root command). When using a default node, there is no change to the current path position. Since there is no command `OFFSet` at the root level, an error results.

The following example shows the correct syntax for this program message:

```
:POWer 10DBM;:POWer:OFFSet 5DB
```

Example 3

```
:POWer:OFFSet 5DB;POWer 10DBM
```

This program message results in a command error. The path is dropped one level at each colon. The first half of the message drops the command path to the lower level command `OFFSet`; `POWer` does not exist at this level.

The `POWer 10DBM` command is missing the leading colon and when sent, it causes confusion because the signal generator cannot find `POWer` at the `POWer:OFFSet` level. By adding the leading colon, the current path is reset to the root. The following shows the correct program message:

```
:POWer:OFFSet 5DB;:POWer 10DBM
```

Example 4

```
FREQ 500MHz;POW 4DBM
```

In this example, the keyword short form is used. The program message is correct because it utilizes the default nodes of `:FREQ[:CW]` and `:POW[:LEVel]`. Since default nodes do not affect the current path, it is not necessary to use a leading colon before `FREQ` or `POW`.

File Name Variables

File name variables designate a data file and file path. File name variables are used in the SCPI command syntax whenever files are accessed. The name of the file is always required, but the file path can sometimes be optional or be designated using different formats. The following table shows these different file path formats:

Format	File Name Variable	Example
Format 1	"<file name>"	"Test_Data"
Format 2	"<file name@msus>"	"Test_Data@SEQ"[a]
Format 3	`"<msus:file name>"`	"SEQ:Test_Data"
Format 4	`"</user/directory/file name>"`	"/USER/SEQ/Test_Data"

a. Included for backwards compatibility. Not the recommended syntax.

Formats 2–4 offer programming flexibility and are equivalent. Format 1 can only be used with SCPI commands that imply the path name as part of the command syntax. Typically, SCPI load commands that access user-data files do not need to have a file path designated.

See Table 1-3 on page 45 for information on file types and directories.

NOTE **The maximum length for a file name is 23 characters, excluding the file path.**

Example Using Format 1

`:CORR:FLAT:LOAD "FLAT_DATA"`

The preceding example loads user-flatness data from a file called `FLAT_DATA` located in the **USERFLAT** directory. No file path is needed as the command syntax implies the directory where the file is located.

Example Using Format 2

`:MEM:COPY "IQ_DATA@SNVWFM","Test_DATA@WFM1"`

The preceding example copies a file named IQ_DATA located in the `WAVEFORM` directory to a file named Test_DATA in volatile waveform memory (`BBG`).

Example Using Format 3

`:MEM:COPY "SNVWFM:IQ_DATA","WFM1:Test_DATA"`

The preceding example copies a file named IQ_DATA located in the `WAVEFORM` directory to a file named Test_DATA in volatile waveform memory (`BBG`).

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Example Using Format 4

```
:MEM:COPY
"/USER/WAVEFORM/IQ_DATA","/USER/BBG1/WAVEFORM/IQ_DATA"
```

The preceding example copies a file named IQ_DATA located in the `WAVEFORM` directory to a file named IQ_DATA in volatile waveform memory (`BBG`).

The following examples show commands, with different formats, that can be used to download a waveform file named Test_Data into the signal generator's volatile waveform memory (BBG):

Command Syntax Format 3

```
:MEMory:DATA "WFM1:Test_Data",#ABC
```

Command Syntax Format 4

```
:MEMory:DATA "/USER/BBG1/WAVEFORM/Test_Data",#ABC
```

These commands are equivalent. The data block, #ABC, is described as follows:

#	This character indicates the beginning of the data block
A	Number of digits in the byte count B
B	Byte count in C
C	Waveform data

Refer to ":DATA" on page 165 and the Programming Guide for more information on data blocks and downloading waveform data.

File Types and Directory Structure

The signal generator uses a computer directory model structure for file storage. The top level directory is called the USER directory. All other directories are subdirectories located under the USER directory. Each subdirectory is dedicated to the type of data stored. For example, the BIN directory is used to store binary data whereas the **MARKERS** directory is used to store marker data.

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NOTE

When the USB media is used, the files on the USB media are stored in a single directory (i.e. USER/). Each file has an extension (i.e. .waveform, .list, .markers, .state, etc.-). The SCPI commands use the paths shown in Table 1-3 on page 45 and the associated examples. But when viewed, the USB media, will not display these directories. Instead the file extensions will be displayed. For more information on the USB media capability refer to the Programming Guide and to the Users Guide.

The instrument's directory /USER/NONVOLATILE contains either the internal storage and USB media non-volatile files stored with the filename extensions: .waveform, .list, .markers, .state, etc.-. This directory is useful when ftp is used.

The following table lists signal generator the subdirectories and file paths where file types are stored.

Table 1-3 File Types and Directory Structures

File System	File Type	File Path	MSUS Path
BINARY[a]	BIN	/USER/BIN	BINARY:
HDR1 - volatile arbitrary waveform header file[a]	HDR1	/USER/BBG1/HEADER	HDR1:
LIST - sweep list file	LIST	/USER/LIST	LIST:
MKR1 - volatile arbitrary waveform marker file[a]	MKR1	/USER/BBG1/MARKERS	MKR1:
NVHDR - non-volatile arbitrary waveform header file[a]	NVHDR	/USER/HEADER	NVHDR:
NVMKR - non-volatile arbitrary waveform marker file[a]	NVMKR	/USER/MARKERS	NVMKR:
NVWFM - non-volatile arbitrary waveform file[a]	NVWFM	/USER/WAVEFORM	NVWFM:
SEQ - ARB sequence file[a]	SEQ	/USER/SEQ	SEQ:
STATE	STATE	/USER/STATE	STATE:
USERFLAT - user-flatness file	UFLT	/USER/USERFLAT	USERFLAT:
WFM1 - volatile waveform file[a]	WAVEFORM	/USER/BBG1/WAVEFORM	WFM1:

a. This feature does not apply to analog signal generator models.

MSUS (Mass Storage Unit Specifier) Variable

The variable `"<msus>"` enables a command to be file type specific when working with user files. Some commands use it as the only command parameter, while others can use it in conjunction with a file name when a command is not file type specific. When used with a file name, it is similar to

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Format 2 in the File Name Variables section on page 43. The difference is the file type specifier (msus) occupies its own variable and is not part of the file name syntax.

The following examples illustrate the usage of the variable "<msus>" when it is the only command parameter:

Command Syntax with the msus variable

```
:MMEMory:CATalog? "<msus>"
```

Command Syntax with the file system

```
:MMEMory:CATalog? "LIST:"
```

The variable "<msus>" is replaced with "LIST:". When the command is executed, the output displays only the files from the List file system.The following examples illustrate the usage of the variable "<file name>" with the variable "<msus>":

Command Syntax with the file name and msus variables

```
:MMEMory:DELete[:NAME] "<file name>",["<msus>"]
```

Command Syntax with the file name and file system

```
:MMEMory:DELete:NAME "LIST_1","LIST:"
```

The command from the above example cannot discern which file system LIST_1 belongs to without a file system specifier and will not work without it. When the command is properly executed, LIST_1 is deleted from the List file system.

The following example shows the same command, but using Format 2 from the File Name Variables section on page 43:

```
:MMEMory:DELete:NAME "LIST_1@LIST"
```

When a file name is a parameter for a command that is not file system specific, either format ("<file name>","<msus>" or "<file name@msus>") will work.

Refer to Table 1-3 on page 45 for a listing of the file systems and types.

Quote Usage with SCPI Commands

As a general rule, programming languages require that SCPI commands be enclosed in double quotes as shown in the following example:

```
":FM:EXTernal:IMPedance 600"
```

However when a string is the parameter for a SCPI command, additional quotes or other delimiters may be required to identify the string. Your programming language may use two sets of doublequotes, one set of single quotes, or back slashes with quotes to signify the string parameter. The following examples illustrate these different formats:

SCPI Basics

`"MEMory:LOAD:LIST ""myfile"""` used in BASIC programming languages

`"MEMory:LOAD:LIST \"myfile\""` used in C, C++, Java, and PERL

`"MEMory:LOAD:LIST 'myfile'"` accepted by most programming languages

Consult your programming language reference manual to determine the correct format.

Binary, Decimal, Hexadecimal, and Octal Formats

Command values may be entered using a binary, decimal, hexadecimal, or octal format. When the binary, hexadecimal, or octal format is used, their values must be preceded with the proper identifier. The decimal format (default format) requires no identifier and the signal generator assumes this format when a numeric value is entered without one. The following list shows the identifiers for the formats that require them:

– #B identifies the number as a binary numeric value (base-2).

– #H identifies the number as a hexadecimal alphanumeric value (base-16).

– #Q identifies the number as a octal alphanumeric value (base-8).

The following are examples of SCPI command values and identifiers for the decimal value 45:

#B101101	binary equivalent
#H2D	hexadecimal equivalent
#Q55	octal equivalent

The following example sets the RF output power to 10 dBm (or the equivalent value for the currently selected power unit, `such as DBUV` or **DBUVEMF**) using the hexadecimal value 000A:

```
:POW #H000A
```

A unit of measure, such as `dBm` or `mV`, will not work with the values when using a format other than decimal.

SCPI Basics

2 Basic Function Commands

This chapter describes SCPI commands for subsystems dedicated to signal generator operations common to most MXG and EXG X-Series signal generators.

This chapter contains the following sections:

Correction Subsystem ([:SOURce]:CORRection)

:FLATness:FREQuency

Supported All Models

`[:SOURce]:CORRection:FLATness:FREQuency? <point>`

This command returns the frequency value of the <point> queried.

Range 1 to 3,201

Key Entry **# Points**

:FLATness:INITialize:FSTep

Supported All Models

CAUTION The current flatness data will be overwritten once this command is executed. If needed, save the current data. Refer to the :FLATness:STORe command for storing user flatness files.

`[:SOURce]:CORRection:FLATness:INITialize:FSTep`

This command replaces the loaded user flatness data with the settings from the current step array data points.

The maximum number of user flatness points is 3,201. When copying the step array settings over to a user flatness file, ensure that the number of points in the step array do not exceed the maximum user flatness points.

See also ":FLATness:STEP:POINts" on page 51.

Range 1 to 3,201

Key Entry **Load Cal Array From Step Array**

:FLATness:LOAD

Supported All Models

`[:SOURce]:CORRection:FLATness:LOAD "<file name>"`

This command loads a user–flatness correction file. The "<file name>" variable is the name of the file located in the Catalog of USERFLAT Files. The directory path is implied in the command and need not be specified in the file name parameter. For more information on file name syntax, refer to "File Name Variables" on page 43.

Key Entry **Load From Selected File**

:FLATness:PAIR

Supported All Models

`[:SOURce]:CORRection:FLATness:PAIR <freq.>[<freq suffix>], <corr.>[<corr suffix>]`

This command sets a frequency and amplitude correction pair.

The maximum number of points that can be entered is 3,201.

<corr.>	This variable is the power correction.
Range	Frequency range varies and is model dependent. Refer to the instrument's **Data Sheet**.
Key Entry	**Configure Cal Array**

:FLATness:POINts

Supported All Models

`[:SOURce]:CORRection:FLATness:POINts?`

This query returns the number of points in the user–flatness correction file.

:FLATness:PRESet

Supported All Models

CAUTION The current correction data will be overwritten once this command is executed. Save the current data if needed. Refer to :FLATness:STORe command for storing user–flatness files.

`[:SOURce]:CORRection:FLATness:PRESet`

This command presets the user–flatness correction to a factory–defined setting that consists of one point.

Key Entry **Preset List**

:FLATness:STEP:POINts

Supported All Models

```
[:SOURce]:CORRection:FLATness:STEP:POINts <points>
|MAXimum|MINimum|DEFault|
[:SOURce]:CORRection:FLATness:STEP:POINts?[MAXimum|MINimum]
```

This command is used to define the number of points in the user flatness calibration step array.

See also :FLATness:STEP:STARt and :FLATness:STEP:STOP commands.

***RST** 2

Range	2 to 3,201
Key Entry	**# Points**

:FLATness:STEP:STARt

Supported	All Models

```
[:SOURce]:CORRection:FLATness:STEP:STARt <freq><unit>
|MAXimum|MINimum|DEFault|
[:SOURce]:CORRection:FLATness:STEP:STARt? [MAXimum|MINimum]
```

This command sets the start frequency for the user flatness calibration step array. See also, :FLATness:STEP:POINts and :FLATness:STEP:STOP commands.

***RST**	The preset value is model/option dependent. Refer to the instrument's **Data Sheet**.
Range	The range is model/option dependent. Refer to the instrument's **Data Sheet**.
Key Entry	**Freq Start**

:FLATness:STEP:STOP

Supported	All Models

```
[:SOURce]:CORRection:FLATness:STEP:STOP <freq><unit>
|MAXimum|MINimum|DEFault|
[:SOURce]:CORRection:FLATness:STEP:STOP? [MAXimum|MINimum]
```

This command sets the stop frequency for the user flatness calibration step array. See also, :FLATness:STEP:POINts and :FLATness:STEP:STARt commands.

***RST**	The preset value is model/option dependent. Refer to the instrument's **Data Sheet**.
Range	The range is model/option dependent. Refer to the instrument's **Data Sheet**.
Key Entry	**Freq Stop**

:FLATness:STORe

Supported	All Models

```
[:SOURce]:CORRection:FLATness:STORe "<file name>"
```

This command stores the current user–flatness correction data to a file named by the `:CORRection:FLATness:STORe` command. The directory path is implied in the command and need not be specified in the "<file name>" variable.

Key Entry	**Store To File**

Remarks For information on file name syntax, refer to "File Name Variables" on page 43.

:PMETer:CHANnel

Supported All Models

```
[:SOURce]:CORRection:PMETer:CHANnel A|B
[:SOURce]:CORRection:PMETer:CHANnel?
```

This command selects the channel setting on the external power meter for user flatness calibration.

Default Channel A

Key Entry **Power Meter Channel A B**

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:PMETer:COMMunicate:LAN:DEVice

Supported All Models

```
[:SOURce]:CORRection:PMETer:COMMunicate:LAN:DEVice
<deviceName>
[:SOURce]:CORRection:PMETer:COMMunicate:LAN:DEVice?
```

This command enters a VXI–11 device name for a power meter that is being controlled by the signal generator for user flatness calibration. If connecting directly to the power meter, enter the name as specified on your power meter documentation. If connecting through a LAN–GPIB gateway, enter the SICL address of the power meter.

Key Entry **PM VXI–11 Device Name**

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:PMETer:COMMunicate:LAN:IP

Supported All Models

```
[:SOURce]:CORRection:PMETer:COMMunicate:LAN:IP <ipAddress>
[:SOURce]:CORRection:PMETer:COMMunicate:LAN:IP?
```

This command sets the internet protocol (IP) address for a power meter that is controlled by the signal generator for user flatness calibration. If connecting to a GPIB power meter through a LAN–GPIB gateway, this command sets the IP address of the gateway.

Key Entry **Power Meter IP Address**

Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.
	Ensure that the power meter IP address is different from the signal generator address.

:PMETer:COMMunicate:LAN:PORT

Supported All Models

```
[:SOURce]:CORRection:PMETer:COMMunicate:LAN:PORT
<portNumber>
[:SOURce]:CORRection:PMETer:COMMunicate:LAN:PORT?
```

This command sets the IP port number on the power meter that is controlled by the signal generator for users flatness calibration.

Key Entry	Power Meter IP Port
`5025`	Standard mode. The command enables standard mode for simple programming.
`5024`	Telnet mode. The command enables the telnet SCPI service for programming.

NOTE For firmware versions <A.01.51, the default telnet mode is 5023. For firmware versions A.01.51 and greater, telnet port 5023 is still available for backwards compatibility.

Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.
	For more information on standard mode and telnet SCPI mode, refer to the **Programming Guide**.

:PMETer:COMMunicate:TYPE

Supported All Models

```
[:SOURce]:CORRection:PMETer:COMMunicate:TYPE
SOCKets|SOCKETS|VXI11|USB
[:SOURce]:CORRection:PMETer:COMMunicate:TYPE?
```

This command sets the type of control connection for communication with the external power meter for user flatness calibration.

Default Sockets

Key Entry	Connection Type
`SOCKets or SOCKETS`	The command enables the power meter for sockets LAN control through the signal generator.

`VXI11`	The command enables the power meter for VXI-11 control through the signal generator. A power meter with GPIB can be controlled through VXI-11 using a LAN-GPIB gateway.
`USB`	The command enables the power meter for USB control through the signal generator.
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:PMETer:COMMunicate:USB:DEVice

Supported All Models

```
[:SOURce]:CORRection:PMETer:COMMunicate:USB:DEVice <device>
```

```
[:SOURce]:CORRection:PMETer:COMMunicate:USB:DEVice?
```

This command selects the USB device to be used for user flatness calibration. The query returns the USB device identification.

Key Entry	**USB Device**
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:PMETer:COMMunicate:USB:LIST?

Supported All Models

```
[:SOURce]:CORRection:PMETer:COMMunicate:USB:LIST?
```

The query returns a listing of all connected USB devices.

Key Entry	**USB Device**
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

[:STATe]

Supported All Models

```
[:SOURce]:CORRection[:STATe] ON|OFF|1|0
[:SOURce]:CORRection[:STATe]?
```

This command enables or disables the user–flatness corrections.

***RST**	0
Key Entry	**Flatness Off On**

Digital Modulation Subsystem—N5172B/82B ([:SOURce])

:BURSt:STATe

Supported N5172B/82B

```
[:SOURce]:BURSt:STATe ON|OFF|1|0
[:SOURce]:BURSt:STATe?
```

This command enables or disables the burst envelope function.

***RST** 0

Key Entry **Burst Envelope Off On**

:DM:CORRection:OPTimization

Supported N5172B/82B

```
[:SOURce]:DM:CORRection:OPTimization RFOut|EXTernal
[:SOURce]:DM:CORRection:OPTimization?
```

This command enables the internal optimized path to accommodate I/Q signals.

EXT	This choice applies correction terms to provide a calibrated signal at the IQ output. When the I/Q Output is selected, the RF signals at the RF Output are uncalibrated.
RFO	This choice applies correction terms to provide a calibrated signal at the RF output. When the RF Output is selected, the I/Q signals at the I/Q Output are uncalibrated.

***RST** RFO

Key Entry **Correction Optimized Path**

:DM:EXTernal:INPut:ATTen

Supported N5172B/82B

```
[:SOURce]:DM:EXTernal:INPut:ATTen <val><unit>
[:SOURce]:DM:EXTernal:INPut:ATTen?
```

This command sets the attenuation level for the external I/Q signals being modulated through the signal generator RF path. The variable <val> is expressed in decibels (dB).

Example

```
:DM:EXT:INP:ATT 10
```

The preceding example sets the modulator attenuator to 10 dB.

***RST** +2.00000000E+000

Range 0 to 40 dB

Key Entry **Modulator Atten Manual Auto**

:DM:EXTernal:INPut:ATTen:AUTO

Supported N5172B/82B

```
[:SOURce]:DM:EXTernal:INPut:ATTen:AUTO ON|OFF|1|0
[:SOURce]:DM:EXTernal:INPut:ATTen:AUTO?
```

This command enables or disables the external I/Q attenuator auto mode. The auto mode will be switched to manual if the signal generator receives a AUTO OFF or AUTO 0 command.

ON (1) This choice sets the external I/Q attenuator to auto mode which optimizes the attenuation setting for the current signal generator settings.

OFF (0) This choice sets the attenuator to manual mode and holds the attenuator at its current setting.

Example

```
:DM:EXT:INP:ATT:AUTO OFF
```

The preceding example sets the external I/Q attenuator to manual mode.

***RST** 1

Key Entry **Modulator Atten Manual Auto**

:DM:EXTernal:INPut:ATTen:LEVel

Supported N5172B/82B

```
[:SOURce]:DM:EXTernal:INPut:ATTen:LEVel <val><volt_units>
[:SOURce]:DM:EXTernal:INPut:ATTen:LEVel?
```

This command sets the I/Q signal voltage level at the external I/Q inputs. The voltage level set with this command is used as the input level setting for automatic attenuation.

Example

```
:DM:EXT:INP:ATT:LEV 100MV
```

The preceding example sets the voltage level for the I and Q inputs to 100 millivolts.

***RST** +4.00000000E–001

Range .05 to 1 Volt

Key Entry **I/Q Output Atten**

:DM:EXTernal:INPut:ATTen:LEVel:MEASurement

Supported	N5172B/82B

```
[:SOURce]:DM:EXTernal:INPut:ATTen:LEVel:MEASurement
```

This command measures the RMS value of the external I/Q signal. The external input level must be set to **Measure**.

Key Entry	**Do External Input Level Measurement**

:DM:EXTernal:INPut:ATTen:MODE

Supported	N5172B/82B

```
[:SOURce]:DM:EXTernal:INPut:ATTen:MODE
DEFault|MANual|MEASure
[:SOURce]:DM:EXTernal:INPut:ATTen:MODE?
```

This command selects the external measurement used to set the attenuator level. The modulation attenuation must be in `Auto` mode and is enabled by the :DM:EXTernal:INPut:ATTen:AUTO command.

DEFault	Use this choice to set the external I/Q input level to the default value of 500.0 mV.
MANual	Use this choice to manually set the external input level. The input level is set by using the :DM:EXTernal:INPut:ATTen:LEVel command.
MEASurement	This choice uses a real–time measurement of the external input level to set the attenuator level. The measurement will be used to set the attenuator level setting and is performed by using the :DM:EXTernal:INPut:ATTen:LEVel:MEASurement command.

Example

```
:DM:EXT:INP:ATT:MODE MAN
```

The preceding example sets manual as the method for setting the external I/Q input level.

***RST**	DEFault
Key Entry	**Ext Input Level (nnn mV) Default Man Meas**

:DM:EXTernal:POLarity

Supported	N5172B/82B

```
[:SOURce]:DM:EXTernal:POLarity NORMal|INVert|INVerted
[:SOURce]:DM:EXTernal:POLarity?
```

This command, for backward compatibility with older signal generator models, selects normal or inverted I/Q routing of signals going out of the rear-panel I and Q output connectors. In the inverted mode, the Q input is routed to the I modulator and the I input is routed to the Q modulator.

Example

```
:DM:EXT:POL INV
```

The preceding example inverts I and Q signal routing.

***RST**	NORM
Key Entry	**Int Phase Polarity Normal Invert**

:DM:INTernal:CHANnel:CORRection[:STATe]

Supported	N5172B/82B

```
[:SOURce]:DM:INTernal:CHANnel:CORRection[:STATe] ON|OFF|1|0
[:SOURce]:DM:INTernal:CHANnel:CORRection[:STATe]?
```

This command enables and disables the RF and baseband magnitude and phase corrections across the 160 MHz baseband bandwidth, at the current frequency.

When this feature is on, arbitrary frequency switching while the baseband is on will take up to an additional 3.3ms (typical) to 6.8ms the first time that frequency is specified. After that, switching to that frequency will take up to an additional 1.3ms. Up to 1024 unique frequencies can be cached before the oldest cache will be forgotten. If a frequency sweep is activated, then the calculation and caching will occur up front for the first 1024 unique frequencies, and all further unique frequencies will have the characteristics of arbitrary frequency switching.

If the I/Q correction optimized path is set to Ext I/Q Output, then only the baseband corrections are applied and the frequency switching is unaffected.

This correction is convolved with the ACP internal I/Q channel optimization filter and the equalization filter, if they are active. The resulting filter is truncated to 256 taps.

Example

```
:DM:INT:CHAN:CORR ON
```

The preceding example enables the internal channel correction calibration.

Key Entry	**Int Channel Correction Off On**

:DM:INTernal:CHANnel:OPTimization

Supported	N5172B/82B

```
[:SOURce]:DM:INTernal:CHANnel:OPTimization EVM|ACP
[:SOURce]:DM:INTernal:CHANnel:OPTimization?
```

This command selects between optimizing the internal I/Q channel for EVM (in channel performance) at the expense of ACP (out of channel performance) or optimizing for ACP at the expense of EVM.

EVM is an 80% Nyquist filter (160 MHz wide) with a wide transition band. When an equalization filter is active, this filter is not active.

ACP is an 80% Nyquist filter (160 MHz wide) with a narrow transition band, thus reducing images for wide-band signals. This filter will be convolved with the active equalization filter, the result of which will be truncated to the center 256 taps.

***RST**	EVM
Key Entry	**Optimize Int I/Q Channel EVM ACP**

:DM:INTernal:EQUalization:FILTer:SELect

Supported	N5172B/82B

```
[:SOURce]:DM:INTernal:EQUalization:FILTer:SELect "Filter"
[:SOURce]:DM:INTernal:EQUalization:FILTer:SELect?
```

This command selects the FIR file to use as the equalization filter. Equalization filters are typically complex and must have an oversample ratio of 1. The filter must not have more than 256 taps (512 coefficients for a complex filter). The equalization filter operates at 200 MHz, so all equalization filters must be resampled to 200 MHz if they are sampled at some other rate.

***RST**	No file selected
Key Entry	**Select Filter**

:DM:INTernal:EQUalization:FILTer:STATe

Supported	N5172B/82B

```
[:SOURce]:DM:INTernal:EQUalization:FILTer:STATe ON|OFF|1|0
[:SOURce]:DM:INTernal:EQUalization:FILTer:STATe?
```

This command enables or disables the I/Q internal equalization filter. This filter can be used to correct and/or impair the RF and external I/Q outputs for the internal I/Q source. This filter will be convolved with the ACP internal I/Q Channel Optimization filter if that filter is selected, the result of which will be truncated to the center 256 taps. The equalization filter operates at 200 MHz, so all equalization filters must be resampled to 200 MHz if they are sampled at some other rate.

NOTE **Applying I/Q Delay or I/Q Timing Skew will reduce the actual number of coefficients available in the hardware by 2 taps for every integral step of 5ns of delay or 10 ns of skew.**

***RST**	Off

Key Entry	**Int Equalization Off On**

:DM:IQADjustment:DELay

Supported	N5172B/82B

```
[:SOURce]:DM:IQADjustment:DELay <value><unit>
[:SOURce]:DM:IQADjustment:DELay?
```

This command enables you to change the absolute phase of both I and Q with respect to triggers and markers. A positive value delays I and Q. This value affects both the external I/Q out signals and the baseband signal modulated on the RF output. This adjustment does not affect external I/Q inputs.

The variable <value> is expressed in seconds.

***RST**	+0.00000000E+000
Range	–400 το 400 νανοσεχονδσ (νσ)
Key Entry	**I/Q Delay**
Remarks	This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:CMRange

Supported	N5172B/82B

```
[:SOURce]:DM:IQADjustment:EXTernal:CMRange COARse|FINE
[:SOURce]:DM:IQADjustment:EXTernal:CMRange?
```

This command sets the common mode offset range voltage (COARse or FINE) for both the in–phase (I) and quadrature–phase (Q) signals going out of the rear panel I and Q output connectors.

The common mode offset range is expressed in units of volts (mV–V). The COARse range corresponds to a pre–existing adjustment range of ±2.5 V. When the FINE range is enabled, the common mode offset is limited to ±100 mV.

***RST**	COAR
Range	–2.5 to 2.5 V (Coarse), –100 to 100 mV (Fine)
Key Entry	**Common Mode I/Q Offset Range**
Remarks	This command is effective only if the state of the I/Q adjustment function is set to on. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:COFFset

Supported	N5172B/82B

```
[:SOURce]:DM:IQADjustment:EXTernal:COFFset <value>
[:SOURce]:DM:IQADjustment:EXTernal:COFFset?
```

This command sets the common mode offset voltage for both the in–phase (I) and quadrature–phase (Q) signals going to the rear panel I and Q output connectors.

The variable <value> is expressed in units of volts (mV–V).

***RST**	+0.00000000E+000
Range	–2.5 to 2.5 V
Key Entry	**Common Mode I/Q Offset**
Remarks	This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:DIOFfset

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:EXTernal:DIOFfset <value>
[:SOURce]:DM:IQADjustment:EXTernal:DIOFfset?
```

This command sets the differential offset voltage for an in–phase (I) signal routed to the I output connectors.

The variable <value> is expressed in units of volts (mV–V).

***RST**	+0.00000000E+000
Range	–25 to 25 mV
Key Entry	**Diff. Mode I Offset**
Remarks	This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:DQOFfset

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:EXTernal:DQOFfset <value>
[:SOURce]:DM:IQADjustment:EXTernal:DQOFfset?
```

This command sets the differential offset voltage for a quadrature–phase (Q) signal routed to the Q output connectors.

***RST**	+0.00000000E+000
Range	–25 to 25 mV
Key Entry	**Diff. Mode Q Offset**

Remarks This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:INPut:GAIN

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:EXTernal:INPut:GAIN <val>
[:SOURce]:DM:IQADjustment:EXTernal:INPut:GAIN?
```

This command adjusts the External Input I/Q Gain Balance.

The variable <val> is expressed in units of decibels (dB), and the minimum increment is 0.001dB.

***RST** +0.00000000E+000

Range –1 to 1

Key Entry **External Input I/Q Gain Balance**

:DM:IQADjustment:EXTernal:IOFFset

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:EXTernal:IOFFset <value>
[:SOURce]:DM:IQADjustment:EXTernal:IOFFset?
```

This command sets the offset voltage for a signal applied to the external I Input connector.

The variable <value> is expressed in units of volts (mV–V).

***RST** +0.00000000E+000

Key Entry **External Input I Offset**

Range –100 to 100 mV

Remarks This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:QOFFset

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:EXTernal:QOFFset <value>
[:SOURce]:DM:IQADjustment:EXTernal:QOFFset?
```

This command sets the offset voltage for a signal applied to the External Q Input connector.

The variable <value> is expressed in units of volts (mV–V).

***RST** +0.00000000E+000

Range	–100 to 100 mV
Key Entry	**External Input Q Offset**
Remarks	This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:EXTernal:QSKew

Supported	N5172B/82B

```
[:SOURce]:DM:IQADjustment:EXTernal:QSKew <value>
[:SOURce]:DM:IQADjustment:EXTernal:QSKew?
```

CAUTION This Q phase angle adjustment is uncalibrated.

This command adjusts the phase angle (quadrature skew) between the I and Q vectors by increasing or decreasing the Q phase angle. This command adjusts the signals externally input to the signal generator's front-panel Q input connector. For more information on this connector, refer to the User's Guide.

The <value> variable is expressed in degrees with a minimum resolution of 0.1.

If the signal generator is operating at frequencies greater than 3.3 GHz, quadrature skew settings greater than ±5 degrees will not be within specifications.

Positive skew increases the angle from 90 degrees while negative skew decreases the angle from 90 degrees. When the quadrature skew is zero, the phase angle between the I and Q vectors is 90 degrees.

This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

Example

```
:DM:IQAD:EXT:QSK 4.5
```

The preceding example increases the phase angle by 4.5 degrees.

***RST**	+0.00000000E+000
Range	–200 to +200
Key Entry	**Quadrature Angle Adjustment**

:DM:IQADjustment:GAIN

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:GAIN <value><unit>
[:SOURce]:DM:IQADjustment:GAIN?
```

This command adjusts the ratio of I to Q while preserving the composite, vector magnitude. Adding gain (+x dB) to the signal increases the I component and decreases the Q component proportionally. Reducing gain (–x dB) decreases the I component and increases the Q component proportionally.

The variable <value> is expressed in units of decibels (dB).

***RST**	+0.00000000E+000
Range	–1 to 1
Key Entry	**I/Q Gain Balance**
Remarks	This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:IOFFset

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:IOFFset <value><unit>
[:SOURce]:DM:IQADjustment:IOFFset?
```

This command adjusts the I channel offset value.

When using this command to minimize the LO feedthrough signal, optimum performance is achieved when the command is sent after all other I/Q path commands are executed, such as those that change the internal phase polarity or adjust the modulator attenuator. If other adjustments are made after minimizing is performed, the LO feedthrough signal may increase.

The variable <value> is expressed in units of percent with a minimum resolution of 0.025.

***RST**	+0.00000000E+000
Range	–20.000 to 20.000
Key Entry	**I Offset**
Remarks	This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:PHASe

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:PHASe <value><unit>
[:SOURce]:DM:IQADjustment:PHASe?
```

This feature allows adjustment of the absolute phase of the internal I/Q channel by rotating both I and Q, and so adjusting the relative phase of the RF carrier. For MXGs with Option 012, this is the only way to adjust the phase for a unit with an external LO.

NOTE **The I/Q signal will be scaled down by 0.7071 for all phase offsets except 0. Use -360 or +360, if it is desirable to maintain a constant power level with the ALC off while adjusting the I/Q phase.**

The variable <value> is expressed in units of degrees with a resolution of 0.01 degrees. <unit> can be nothing or DEG for degrees.

***RST**	+0.00000000E+000
Range	–360.000 to 360.000
Key Entry	**I/Q Phase**

:DM:IQADjustment:QOFFset

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:QOFFset

[:SOURce]:DM:IQADjustment:QOFFset?
```

This command adjusts the Q channel offset value.

When using this command to minimize the LO feedthrough signal, optimum performance is achieved when the command is sent after all other I/Q path commands are executed, such as those that change the internal phase polarity or adjust the modulator attenuator. If other adjustments are made after minimizing is performed, the LO feedthrough signal may increase.

The variable <value> is expressed in units of percent with a minimum resolution of 0.025.

***RST**	+0.00000000E+000
Range	–20.000 to 20.000
Key Entry	**Q Offset**
Remarks	This command is effective only if the state of the I/Q adjustment function is set to on. Refer to the :DM:IQADjustment[:STATe] command.

:DM:IQADjustment:QSKew

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:QSKew <value>
[:SOURce]:DM:IQADjustment:QSKew?
```

This command adjusts the phase angle (quadrature skew) between the I and Q vectors by increasing or decreasing the Q phase angle.

The <value> variable is expressed in degrees with a minimum resolution of 0.1.

If the signal generator is operating at frequencies greater than 3.3 GHz, quadrature skew settings greater than ±5 degrees will not be within specifications.

Positive skew increases the angle from 90 degrees while negative skew decreases the angle from 90 degrees. When the quadrature skew is zero, the phase angle between the I and Q vectors is 90 degrees.

This command is effective only if the state of the I/Q adjustment function is set to ON. Refer to the :DM:IQADjustment[:STATe] command.

Example

```
:DM:IQAD:QSK 4.5
```

The preceding example increases the phase angle by 4.5 degrees.

***RST**	+0.00000000E+000
Range	–1E1 to +1E1
Key Entry	**Quadrature Angle Adjustment**

:DM:IQADjustment:SKEW

Supported N5172B/82B

```
[:SOURce]:DM:IQADjustment:SKEW <value>
[:SOURce]:DM:IQADjustment:SKEW?
```

This command changes the I/Q skew which is a time delay difference between the I and Q signals. Equal and opposite skew is applied to both I and Q and affects the RF Output and I/Q output paths simultaneously. A positive value delays the I signal relative to the Q signal, and a negative value delays the Q signal relative to the I signal.

Example

```
:DM:IQAD:SKEW 5E-9
```

The preceding example sets the time delay difference between the I and Q signals to 5 nanoseconds.

***RST**	+0.00000000E+000
Range	–800 to +800 ns

Key Entry	**I/Q Skew**

:DM:IQADjustment[:STATe]

Supported	N5172B/82B

```
[:SOURce]:DM:IQADjustment[:STATe] ON|OFF|1|0
[:SOURce]:DM:IQADjustment[:STATe]?
```

This command enables or disables the I/Q adjustments.

Example

```
:DM:IQAD 1
```

The preceding example enables I/Q adjustments.

***RST**	0
Key Entry	**I/Q Adjustments Off On**
Key Path	**I/Q > I/Q Adjustments Off On**

:DM:POLarity[:ALL]

Supported	N5172B/82B

```
[:SOURce]:DM:POLarity[:ALL] NORMal|INVert
[:SOURce]:DM:POLarity?
```

This command sets the digital phase polarity.

NORMal	This choice selects normal phase polarity for the I and Q signals.
INVert	This choice inverts the Q channel signal.
***RST**	NORM
Key Entry	**Int Phase Polarity Normal Invert**

:DM:SOURce

Supported	N5172B/82B

```
[:SOURce]:DM:SOURce EXTernal|INTernal|SUM
[:SOURce]:DM:SOURce?
```

This command selects the I/Q modulator source.

This softkey is found under the I/Q menu.

EXTernal	This choice selects a 50 ohm impedance for the I and Q input connectors and routes the applied signals to the I/Q modulator.

INTernal	This choice selects the internal baseband generator as the source for the I/Q modulator and requires Option 65x.
Sum	This choice selects the internal baseband generator and combines that signal with an external source and routes the applied signals to the I/Q modulator and requires Option 65x.
***RST**	INT

Key Entry **External** **Internal** **Sum**

:DM:SRATio

Supported N5172B/82B

```
[:SOURce]:DM:SRATio <val><unit>
[:SOURce]:DM:SRATio?
```

This command sets the power level difference (ratio) between the source one and source two signals when the two signals are summed together. A positive ratio value reduces the amplitude for source two, while a negative ratio value reduces the amplitude for source one.

***RST**	+0.00000000E+000
Range	± 50 dB
Key Entry	**Summing Ratio (SRC1/SRC2) x.xx dB**

:DM:STATe

Supported N5172B/82B

```
[:SOURce]:DM:STATe ON|OFF|1|0
[:SOURce]:DM:STATe?
```

This command enables or disables the I/Q modulator.

The I/Q modulator is enabled whenever a digital format is turned on.

The `I/Q` annunciator will be shown on the signal generator display whenever the I/Q modulator is on.

ON (1)	This choice enables the internal I/Q modulator.
OFF (0)	This choice disables the internal I/Q modulator. You can turn off the I/Q with this choice even though a digital format is enabled. With this configuration, the RF output signal will not be modulated, but the I/Q signals may be present at the rear panel I and Q outputs depending on the rear panel output selection.
***RST**	0
Key Entry	**I/Q Off On**

Frequency Subsystem ([:SOURce])

:FREQuency:CENTer

Supported All Models

```
[:SOURce]:FREQuency:CENTer <num>[<freq_suffix>]|UP|DOWN
[:SOURce]:FREQuency:CENTer? [MAXimum|MINimum]
```

This command sets the center frequency for a step sweep. The center frequency symmetrically divides the selected frequency span and is coupled to the start and stop frequency settings. The frequency range and reset values are dependent on the signal generator model and option number.

The query returns the start and stop frequencies if the optional MAXimum or MINimum are used.

***RST** The preset value is model/option dependent. Refer to the instrument’s **Data Sheet**.

Range The range is model/option dependent. Refer to the instrument’s **Data Sheet**.

Example

```
:FREQ:CENT .5 GHz
```

The preceding example sets the center frequency for a sweep to .5 GHz.

Key Entry **Freq Center**

:FREQuency:CHANnels:BAND

Supported All Models

```
[:SOURce]:FREQuency:CHANnels:BAND
NBASe|NMOBile|BPGSm|MPGSm|BEGSm|MEGSm|
BRGSm|MRGSm|BDCS|MDCS|BPCS|MPCS|B450|GM450|B480|B850BDCS|M48
0|B850|M850|B8|M8|B15|M15|B390|B420|B460|B915|M380|M410|M450
|M870|PHS|DECT
[:SOURce]:FREQuency:CHANnels:BAND?
```

This command sets the frequency of the signal generator by specifying a frequency channel band. The frequency channel state must be enabled for this command to work.

Refer to the :FREQuency:CHANnels[:STATe] command.

SCPI Parameter	Frequency Channel Band Selected	Standard
NBASe	Standard Base	NADC
NMOBile	Standard Mobile	NADC

SCPI Parameter	Frequency Channel Band Selected	Standard
BPGSm	P-Gsm 900 Base	GSM
MPGSm	P-Gsm 900 Mobile	GSM
BEGSm	E-Gsm 900 Base	GSM
MEGSm	E-Gsm 900 Mobile	GSM
BRGSm	R-Gsm 900 Base	GSM
MRGSm	R-Gsm 900 Mobile	GSM
BDCS	DCS 1800 Base	GSM
MDCS	DCS 1800 Mobile	GSM
BPCS	PCS 1900 Base	GSM
MPCS	PCS 1900 Mobile	GSM
B450	Gsm 450 Base	GSM
GM450	Gsm 450 Mobile	GSM
B480	Gsm 480 Base	GSM
M480	Gsm 480 Mobile	GSM
B850	Gsm 850 Base	GSM
M850	Gsm 850 Mobile	GSM
B8	800MHz Base	PDC
M8	800MHz Mobile	PDC
B15	1500MHz Base	PDC
M15	1500MHz Mobile	PDC
B390	Base 390-400	TETRA
B420	Base 420-430	TETRA
B460	Base 460-470	TETRA
B915	Base 915-921	TETRA
M380	Mobile 380-390	TETRA
M410	Mobile 410-420	TETRA
M450	Mobile 450-460	TETRA
M870	Mobile 870-876	TETRA
PHS	Standard PHS	PHS
DECT	Standard DECT	DECT

Example

`:FREQ:CHAN:BAND DECT`

The preceding example sets the frequency band to standard DECT.

***RST** BPGS

Key Entry

P-GSM Base **E-GSM Base** **R-GSM Base** **DCS Base**

PCS Base **GSM 450 Base** **GSM 480 Base** **GSM 850 Base**

NADC Base **800MHz Base** **1500MHz Base**

Tetra Base 390/400 **Tetra Base 420/430** **Tetra Base 460/470**

Tetra Base 915/921 **PHS Standard** **DECT Standard**

P-GSM Mobile **E-GSM Mobile** **R-GSM Mobile** **DCS Mobile**

PCS Mobile **GSM 450 Mobile** **GSM 480 Mobile** **GSM 850 Mobile**

NADC Mobile **800MHz Mobile** **1500MHz Mobile**

Tetra Mobile 380/390 **Tetra Mobile 410/420** **Tetra Mobile 450/460**

Tetra Mobile 870/876

:FREQuency:CHANnels:NUMBer

Supported All Models

```
[:SOURce]:FREQuency:CHANnels:NUMBer <number>
[:SOURce]:FREQuency:CHANnels:NUMBer?
```

This command sets the frequency of the signal generator by specifying a channel number of a given frequency band.

The channel band and channel state must be enabled for this command to work. Refer to the :FREQuency:CHANnels[:STATe] command.

Example

```
:FREQ:CHAN:NUMB 24
```

The preceding example sets the channel number to 24 for the current band.

***RST** +1

Range	P-GSM Base/Mobile:	1–24
	E-GSM and R-GSM Base/Mobile:	1–1023
	DCS Base/Mobile:	512–885
	PCS Base/Mobile:	512–900
	GSM-450 Base/Mobile:	259–293
	GSM-480 Base/Mobile:	306–340
	GSM-850 Base/Mobile:	128–251
	NADC Base/Mobile:	1–1023
	800MHz Base/Mobile:	0–640
	1500MHz Base/Mobile:	0–960
	TETRA 380/390 Mobile:	3600–4000
	TETRA 390/4000 Base:	3600–4000
	TETRA 410/420 Mobile:	800–1200
	TETRA 420/430 Base:	800–1200
	TETRA 460/470: 2400 through 2800	2400–2800
	TETRA 870/876 Mobile:	600–640
	TETRA 915/921 Base:	600–940
	PHS Standard:	1–255
	DECT Standard:	0–9

Key Entry **Channel Number**

:FREQuency:CHANnels[:STATe]

Supported All Models

```
[:SOURce]:FREQuency:CHANnels[:STATe] ON|OFF|1|0
[:SOURce]:FREQuency:CHANnels[:STATe]?
```

This command enables or disables the frequency channel and band selection. The signal generator frequency will be set to the channel frequency when the state is on. To set frequency channel bands refer to the :FREQuency:CHANnels:BAND command.

Example

```
:FREQ:CHAN ON
```

The preceding example turns on the frequency channel.

***RST**	0
Key Entry	**Freq Channels Off On**

:FREQuency[:CW]

Supported	All Models

```
[:SOURce]:FREQuency[:CW] <value><unit>
[:SOURce]:FREQuency[:CW]?
```

This command sets the signal generator output frequency.

***RST**	The preset value is model/option dependent. Refer to the instrument’s **Data Sheet**.
Range	The range is model/option dependent. Refer to the instrument’s **Data Sheet**.
Remarks	A frequency change may affect the current output power. Refer to the [:LEVel][:IMMediate][:AMPLitude] command for the correct specified frequency and amplitude settings. To set the frequency mode refer to the :FREQuency:MODE command.

:FREQuency:FIXed

Supported	All Models

```
[:SOURce]:FREQuency:FIXed <val><unit>|UP|DOWN
[:SOURce]:FREQuency:FIXed?
```

This command sets the signal generator output frequency, or increments or decrements the current RF frequency setting.

`<val>`	A frequency value.
`UP`	Increases the current frequency setting by the value set with the front-panel up-arrow key.
`DOWN`	Decreases the current frequency setting by the value set with the front-panel down-arrow key.

***RST**	Option 501: +10000000000000E+09
	Option 503: +30000000000000E+09
	Option 506: +60000000000000E+09

Range Option 501: 9kHz–1GHz

Option 503: 9kHz–3GHz

Option 506: 9kHz–6GHz

Remarks To set the frequency mode to FIXed, refer to :FREQuency:MODE.

A frequency change may affect the current output power. Refer to [:LEVel][:IMMediate][:AMPLitude] for the correct specified frequency and amplitude settings.

:FREQuency:LSPurs:STATe

Supported All Models

```
[:SOURce]:FREQuency:LSPurs:STATe ON|OFF|1|0
[:SOURce]:FREQuency:LSPurs:STATe?
```

This command enables the mode to improve non-harmonics performance (low spurs mode). Enabling this mode affects switching speed.

1	This choice enables the mode to improve non-harmonics.
0	This choice disables the mode to improve non-harmonics.
***RST**	0
Key Entry	Improve non-harmonics

:FREQuency:MODE

Supported All Models

```
[:SOURce]:FREQuency:MODE CW|FIXed|LIST
[:SOURce]:FREQuency:MODE?
```

This command sets the frequency mode of the signal generator to CW or swept.

CW and FIXed	These choices are synonymous with one another and stops a frequency sweep, allowing the Keysight MXG to operate at a set frequency. Refer to the :FREQuency[:CW] command for setting the frequency in the CW mode and to the :FREQuency:FIXed command for setting the frequency in the FIXed mode.

LIST	This choice selects the swept frequency mode. If sweep triggering is set to immediate along with continuous sweep mode, executing the command starts the LIST or STEP frequency sweep.

NOTE To perform a frequency and amplitude sweep, you must also select LIST as the power mode. See the :MODE command for selecting the list mode for an amplitude sweep.

***RST** CW

Key Entry **Freq** **Freq Off**

:FREQuency:MULTiplier

Supported All Models

```
[:SOURce]:FREQuency:MULTiplier &lt;value&gt;
[:SOURce]:FREQuency:MULTiplier?
```

This command sets the multiplier for the signal generator carrier frequency. This displayed frequency equals the actual frequency times the multiplier.

***RST**	+1.00000000E+000
Range	Negative values: -1000 to -0.001
	Positive values: 0.001 to 1000
Key Entry	**Freq Multiplier**
Remarks	For any multiplier other than one, the `MULT` indicator is shown in the frequency area of the display.

:FREQuency:OFFSet

Supported All Models

```
[:SOURce]:FREQuency:OFFSet &lt;value&gt;&lt;unit&gt;
[:SOURce]:FREQuency:OFFSet?
```

This command sets the frequency offset.

The query of this command returns a value equal to the original output frequency times the multiplier value, plus the frequency offset value. This displayed frequency equals the actual frequency times the multiplier.

When an offset has been entered, the `OFFS` indicator is turned on in the frequency area of the display.

The frequency offset state is turned on when any non–zero value is entered; entering zero will turn it off. Refer to the :FREQuency:OFFSet:STATe command for setting the offset state independent of entering offset values.

***RST** +0.0000000000000E+00

Range –200 to 200 GHz

Key Entry **Freq Offset**

:FREQuency:OFFSet:STATe

Supported All Models

```
[:SOURce]:FREQuency:OFFSet:STATe ON|OFF|1|0
[:SOURce]:FREQuency:OFFSet:STATe?
```

This command enables or disables the offset frequency.

***RST** 0

Key Entry **Freq Offset**

Remarks Entering OFF (0) will set the frequency offset to 0 Hz.

:FREQuency:REFerence

Supported All Models

```
[:SOURce]:FREQuency:REFerence <value><unit>
[:SOURce]:FREQuency:REFerence?
```

This command sets the output reference frequency.

***RST** +0.0000000000000E+00

Range The range is model/option dependent. Refer to the instrument's **Data Sheet**.

Key Entry **Freq Ref Set**

:FREQuency:REFerence:SET

Supported All Models

```
[:SOURce]:FREQuency:REFerence:Set
```

This command sets the current CW output frequency, along with any offset, as a 0 hertz reference value.

***RST** +0.0000000000000E+00

Key Entry **Freq Ref Set**

:FREQuency:REFerence:STATe

Supported All Models

```
[:SOURce]:FREQuency:REFerence:STATe ON|OFF|1|0
[:SOURce]:FREQuency:REFerence:STATe?
```

This command enables or disables the frequency reference mode.

When the frequency reference mode is on, subsequent frequency parameters are set relative to the reference value.

***RST**	0
Key Entry	**Freq Ref Off On**

:FREQuency:SPAN

Supported	All Models

```
[:SOURce]:FREQuency:SPAN <num>[<freq_suffix>]|UP|DOWN
[:SOURce]:FREQuency:SPAN? [MAXimum|MINimum]
```

This command sets the length of the frequency range for a step sweep. Span setting is symmetrically divided by the selected center frequency and is coupled to the start and stop frequency settings. The span range is dependent on the signal generator model and option number.

Example

```
:FREQ:SPAN 100MHz
```

The preceding example sets the frequency span to 100 megahertz.

***RST**	+0.0000000000000E+00
Key Entry	**Freq Span**

:FREQuency:STARt

Supported	All Models

```
[:SOURce]:FREQuency:STARt <value><unit>
[:SOURce]:FREQuency:STARt?
```

This command sets the first frequency point in a step sweep.

***RST**	The preset value is model/option dependent. Refer to the instrument's **Data Sheet**.
Range	The range is model/option dependent. Refer to the instrument's **Data Sheet**.
Key Entry	**Freq Start**

:FREQuency:STOP

Supported	All Models

```
[:SOURce]:FREQuency:STOP <value><unit>
[:SOURce]:FREQuency:STOP?
```

This command sets the last frequency point in a step sweep.

***RST**	The preset value is model/option dependent. Refer to the instrument's **Data Sheet**.
Range	The range is model/option dependent. Refer to the instrument's **Data Sheet**.
Key Entry	**Freq Stop**

:PHASe:REFerence

Supported All Models

```
[:SOURce]:PHASe:REFerence
```

This command sets the current output phase as a zero reference.

Subsequent phase adjustments are set relative to the new reference.

Key Entry **Phase Ref Set**

:PHASe[:ADJust]

Supported All Models

```
[:SOURce]:PHASe[:ADJust] <value><unit>
[:SOURce]:PHASe[:ADJust]?
```

This command adjusts the phase of the modulating signal.

The query will only return values in radians.

***RST** +0.00000000E+000

Range	Radians: –3.14 to 3.14 RAD	Degrees: –180 to 179 DEG

Key Entry **Adjust Phase**

:ROSCillator:BANDwidth:EXTernal

Supported All Models

```
[:SOURce]:ROSCillator:BANDwidth:EXTernal
<value>[<units>]|NARRow|WIDE|MINimum|MAXimum|DEFault
[:SOURce]:ROSCillator:BANDwidth:EXTernal? |MINimum|MAXimum|
```

This command selects the external frequency bandwidth as the source for the measurement.

For values greater than 9.5 Hz, 73 Hz is used.

***RST**	+9.50000000E+000
Range	.5 or 73 Hz
Key Entry	**Ref Oscillator Ext Bandwidth**

:ROSCillator:FREQuency:BBG

Supported All Models

```
[:SOURce]:ROSCillator:FREQuency:EXTernal <value>
[:SOURce]:ROSCillator:FREQuency:EXTernal?
```

This command sets the frequency of the internal baseband generator reference oscillator.

***RST**	`+1.0000000000000E+07 Hz`
Range	`+1.0000000000000E+06 to +5.0000000000000E+07 Hz`
Key Entry	**Ref Oscillator Ext Freq**

:ROSCillator:FREQuency:EXTernal

Supported All Models

```
[:SOURce]:ROSCillator:FREQuency:EXTernal <value>
[:SOURce]:ROSCillator:FREQuency:EXTernal?
```

This command makes External Ref Frequency the active function. The value that you enter sets the frequency of the external reference oscillator.

***RST**	`+1.0000000000000E+07 Hz`
Range	`+1.0000000000000E+06 to +5.0000000000000E+07 Hz`
Key Entry	**Ref Oscillator Ext Freq**
Remarks	If the entered frequency does not match the frequency of the entered reference, an unlocked condition will occur and an error message will appear.

:ROSCillator:OVEN:STATe

Supported All Models

```
[:SOURce]:ROSCillator:OVEN:STATe ON|OFF|1|0
[:SOURce]:ROSCillator:OVEN:STATe?
```

This command turns the 10 MHz oven oscillator on or off.

***RST**	1
Key Entry	**Oven Oscillator On Off**

:ROSCillator:OVEN:TUNE

Supported All Models

```
[:SOURce]:ROSCillator:OVEN:TUNE <value>
[:SOURce]:ROSCillator:OVEN:TUNE?
```

This command tunes the internal oven oscillator frequency.

The user value offsets the factory tuned value (the value is added to the factory calibrated DAC value). The tune value of 0 sets the factory calibrated value.

***RST**	+0.00000000E+000
Range	–4096 to +4096
Key Entry	**Oven Oscillator Tune**

:ROSCillator:SOURce

Supported All Models

```
[:SOURce]:ROSCillator:SOURce INTernal|EXTernal|BBG
[:SOURce]:ROSCillator:SOURce?
```

This command sets the current reference oscillator source: INT (internal), EXT (external), or BBG (internal baseband generator).

:ROSCillator:SOURce:AUTO

Supported All Models

```
[:SOURce]:ROSCillator:SOURce:AUTO ON|OFF|1|0
[:SOURce]:ROSCillator:SOURce:AUTO?
```

This command enables or disables the ability of the signal generator to automatically select between the internal and an external reference oscillator.

ON (1)	This choice enables the signal generator to detect when a valid reference signal is present at the 10 MHz IN connector and automatically switches from internal to external frequency reference.
OFF (0)	This choice selects the internal reference oscillator and disables the automatic switching capability between the internal and an external frequency reference.
***RST**	1
Key Entry	**Ref Oscillator Source Auto Off On**

:ROSCillator:OVEN:TUNE

Supported All Models

```
[:SOURce]:ROSCillator:OVEN:TUNE <value>
[:SOURce]:ROSCillator:OVEN:TUNE?
```

This command tunes the internal VCTXCO oscillator frequency.

The user value offsets the factory tuned value (the value is added to the factory calibrated DAC value). The tune value of 0 sets the factory calibrated value.

***RST**	+0.00000000E+000
Range	–8192 to +8191
Key Entry	**Ref Oscillator Tune**

List/Sweep Subsystem ([:SOURce])

A complete sweep setup requires commands from other subsystems. Table shows the function and location of these other commands.

Table 2-1 **Location of Commands from the other Subsystems**

Sweep Type	Function	Command Location	Key Entry under Sweep/List key
List and Step	Configuring frequency sweep	page 75	**Freq Off On**
	Configuring amplitude sweep	page 114	**Amptd Off On**
	Configuring frequency and amplitude sweep[a]	page 75 page 114	**Freq & Amptd Off On**
	Enables or Disables the waveform sweep	page 389	**Waveform Off On**
	Set up and control sweep triggering[b]	page 242	See the "Trigger Subsystem"
List	Load a list sweep file	page 186	**Load From Selected File**
	Store list sweep data to a file	page 182	**Store To File**
	Selects the waveform for the current waveform sequence	page 75 page 84 page 91	no softkey
List Sweep Options Flags	This command enables specific options during a list sweep.	page 86	no softkey. Refer to Table 2-2 on page 87
Step	Start frequency sweep	page 78	**Freq Start**
	Store list sweep data to a file	page 182	**Store To File**
	Start amplitude sweep	page 116	**Amptd Start**
	Stop amplitude sweep	page 116	**Amptd Stop**

a. Execute both commands to start or stop a frequency and amplitude sweep.
b. For point to point triggering, see ":LIST:TRIGger:SOURce" on page 90.

:LIST:CPOint?

Supported All Models

`[:SOURce]:LIST:CPOint?`

This query returns the current sweep point.

:LIST:DIRection

Supported All Models

```
[:SOURce]:LIST:DIRection UP|DOWN
[:SOURce]:LIST:DIRection?
```

This command sets the direction of a list or step sweep.

UP	This choice enables a sweep in an ascending order: – first to last point for a list sweep – start to stop for a step sweep
DOWN	This choice reverses the direction of the sweep.
***RST**	UP
Key Entry	**Sweep Direction Down Up**

:LIST:DWELl

Supported All Models

```
[:SOURce]:LIST:DWEL1 <value>,<value>
[:SOURce]:LIST:DWEL1?
```

This command sets the dwell time for the current list sweep points.

Dwell time is used when IMMediate is the trigger source. Refer to the :LIST:TRIGger:SOURce command for the trigger setting.

The dwell time is the amount of time the sweep is guaranteed to pause after setting the frequency and/or power for the current point.

The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

The variable <value> is expressed in units of seconds with a 0.000001 (mS).

NOTE **The dwell time (<value>) does not begin until the signal generator has settled for the current frequency and/or amplitude change.**

Range 100E–6

:LIST:DWELl:POINts?

Supported All Models

```
[:SOURce]:LIST:DWELl:POINts?
```

This command queries the signal generator for the number of dwell points in the current list sweep file.

:LIST:DWELl:TYPE

Supported All Models

```
[:SOURce]:LIST:DWEL1:TYPE LIST|STEP
[:SOURce]:LIST:DWEL1:TYPE?
```

This command toggles the dwell time for the list sweep points between the values defined in the list sweep and the value for the step sweep.

LIST	This choice selects the dwell times from the list sweep. Refer to the :LIST:DWELl command for setting the list dwell points.
STEP	This choice selects the dwell time from the step sweep. Refer to the :SWEep:DWELl command for setting the step dwell.
***RST**	LIST
Key Entry	**Dwell Type List Step**

:LIST:FREQuency

Supported All Models

```
[:SOURce]:LIST:FREQuency <value>,<value>
[:SOURce]:LIST:FREQuency?
```

This command sets the frequency values for the current list sweep points.

The maximum number of list sweep points is 3,201.

The variable <value> is expressed in units of hertz (Hz).

The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

Range The range is model/option dependent. Refer to the instrument's **Data Sheet**.

:LIST:FREQuency:POINts

Supported All Models

```
[:SOURce]:LIST:FREQuency:POINts?
```

This command queries the current list sweep file for the number of frequency points.

:LIST:MANual

Supported All Models

```
[:SOURce]:LIST:MANual <value>|UP|DOWN
[:SOURce]:LIST:MANual?
```

This command sets a list or step sweep point as the current sweep point controlling the frequency and power output.

If list or step mode is controlling frequency or power, or both, then the indexed point in the respective list(s) will be used.

Entering a value with this command will have no effect, unless MANual is the selected mode. Refer to the :LIST:MODE command for setting the proper mode.

If the point selected is beyond the length of the longest enabled list, then the point will be set to the maximum possible point, and an error will be generated.

Range	List Sweep: 1 to 3,201	Step Sweep: 2 to 65535
Key Entry	**Manual Point**	

:LIST:MODE

Supported All Models

```
[:SOURce]:LIST:MODE AUTO|MANual
[:SOURce]:LIST:MODE?
```

This command sets the operating mode for the current list or step sweep.

AUTO	This choice enables the selected sweep type to perform a sweep of all points.
MANual	This choice enables you to select a single sweep point. The selected point controls the frequency and/or amplitude according to the sweep type. Refer to the :LIST:MANual command for selecting a sweep point.
***RST**	AUTO
Key Entry	**Manual Mode Off On**

:LIST:OPTions

Supported All Models

```
[:SOURce]:LIST:OPTions <val>,<val>
[:SOURce]:LIST:OPTions?
[:SOURce]:LIST:OPTions:POINts?
```

This command enables specific options during a list sweep. The command adds the capability to suppress FM, fM, and AM on any list sweep point. Additionally, frequency, power, and/or a waveform transition can be suppressed resulting in no synthesizer, no output, or no waveform playing interruption during a transition.

This is a SCPI command only feature. There is no signal generator user interface displayed indication that these option flags are in use. The option flag list is preset to empty when list sweep is preset with the defaults. Otherwise, the option flag changes are persistent.

See also ":LIST:TYPE:LIST:INITialize:PRESet" on page 91.

Table 2-2 List Sweep Options Flag.

Bit #	Bit Value	Option if set
0	1	Suppress Frequency Change
1	2	Suppress Power Change
2	4	Suppress Waveform Change
3	8	Suppress FM and fM
4	16	Suppress AM

NOTE

The table represents the value of a bit flag.

If a bit is not set, then the option is ignored (not applied).

If FM, fM is not turned on, the FM, fM suppression does nothing.

The FM, fM should be typically as in CW mode.

The AM suppressing is accomplished by grounding the input to the AM modulator, no other reconfiguration of HW is performed.

The AM should be set up in CW mode.

Example

```
FM:DEV 1E6
```

FM:STAT ON

LIST:FREQ 1E9,2E9,3E9,4E9

```
LIST:OPT 8,0,8,0
```

The preceding example sets up FM then a frequency list of 1, 2, 3, 4 GHz and suppresses FM on every other list sweep point (points 1 and 3 will have FM suppressed, points 2 & 4 will have FM enabled).

:LIST:POWer

Supported All Models

```
[:SOURce]:LIST:POWer <value>,<value>
[:SOURce]:LIST:POWer?
```

This command sets the amplitude for the current list sweep points.

The maximum number of list sweep points is 3,201.

Range See also [:LEVel][:IMMediate][:AMPLitude] command for output power ranges.

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:LIST:POWer:POINts

Supported All Models

```
[:SOURce]:LIST:POWer:POINts?
```

This command queries the number of power points in the current list sweep file.

:LIST:RETRace

Supported All Models

```
[:SOURce]:LIST:RETRace ON|OFF|1|0
[:SOURce]:LIST:RETRace?
```

This command configures the sweep to retrace to the first sweep point, or stop at the last sweep point upon completion of each sweep.

ON (1) The sweep retraces to the first sweep point.

OFF (0) The sweep stays at the last sweep point of the completed sweep and stays there until sweep is initiated and triggered again. When sweep is initiated and triggered again, the sweep point moves to the first point of the sweep.

***RST** 1

Key Entry **Sweep Retrace Off On**

:LIST:TRIGger:EXTernal:SOURce

Supported All Models

```
:LIST:TRIGger:EXTernal:SOURce TRIGger[1]|TRIGger2|PULSe
:LIST:TRIGger:EXTernal:SOURce?
```

This command selects the external trigger source. With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1 This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

TRIGger2 This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

PULSe	This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.

Example

```
:LIST:TRIG:EXT:SOUR PULS
```

The preceding example sets the external trigger source to the PULSE BNC.

***RST** TRIGger1

Key Entry **Trigger 1** **Trigger 2** **Pulse**

:LIST:TRIGger:INTernal:SOURce

Supported All Models

```
:LIST:TRIGger:INTernal:SOURce PVIDeo|PSYNc
:LIST:TRIGger:INTernal:SOURce?
```

This command selects the internal trigger source.

PVIDeo	This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.
PSYNc	This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.

Example

```
:LIST:TRIG:INT:SOUR PVID
```

The preceding example sets the internal trigger source to Pulse Video.

***RST** PSYN

Key Entry **Pulse Video** **Pulse Sync**

:LIST:TRIGger:SLOPe

Supported All Models

```
:LIST:TRIGger:SLOPe POSitive|NEGative
:LIST:TRIGger:SLOPe?
```

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :LIST:TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :LIST:TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

POSitive	The signal generator triggers an event when it detects a rising edge on the source signal

NEGative	The signal generator triggers an event when it detects a falling edge on the source signal
***RST**	POS
Key Entry	**Int/Ext Trigger Polarity Neg Pos**

:LIST:TRIGger:SOURce

Supported All Models

```
[:SOURce]:LIST:TRIGger:SOURce
BUS|IMMediate|EXTernal|INTernal|KEY|TIMer|MANual
[:SOURce]:LIST:TRIGger:SOURce?
```

This command sets the point trigger source for a list or step sweep event.

BUS	This choice enables GPIB triggering using the `*TRG` or `GET` command, or LAN and USB triggering using the `*TRG` command.
IMMediate	This choice enables immediate triggering of the sweep event.
EXTernal	This choice enables the triggering of a sweep event by an externally applied signal at the TRIGGER IN connector.
INTernal	This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.
KEY	This choice enables triggering by pressing the front-panel **Trigger** key.
TIMer	This choice enables the trigger timer.

Example

```
:LIST:TRIG:SOUR BUS
```

The preceding example sets the trigger source to the instrument BUS.

***RST** IMM

Key Entry	Bus	Free Run	Ext	Int	Trigger Key	Timer Trigger

:LIST:TYPE

Supported All Models

```
[:SOURce]:LIST:TYPE LIST|STEP
[:SOURce]:LIST:TYPE?
```

This command toggles between the two types of sweep.

LIST	This type of sweep has arbitrary frequencies and amplitudes.
STEP	This type of sweep has equally spaced frequencies and amplitudes.
***RST**	STEP
Key Entry	**Sweep Type List Step**

:LIST:TYPE:LIST:INITialize:FSTep

Supported All Models

CAUTION The current list sweep data will be overwritten once this command is executed. If needed, save the current data. Refer to the ":STORe:LIST" command for storing list sweep files.

```
[:SOURce]:LIST:TYPE:LIST:INITialize:FSTep
```

This command replaces the loaded list sweep data with the settings from the current step sweep data points.

You can load only one sweep list at a time.

The maximum number of list sweep points is 3,201. When copying the step sweep settings over to a list sweep, ensure that the number of points in the step sweep do not exceed the maximum list sweep points.

Key Entry **Load List From Step Sweep**

:LIST:TYPE:LIST:INITialize:PRESet

Supported All Models

CAUTION The current list sweep data will be overwritten once this command is executed. If needed, save the current data. Refer to the ":STORe:LIST" command for storing list sweep files.

```
[:SOURce]:LIST:TYPE:LIST:INITialize:PRESet
```

This command replaces the current list sweep data with a factory–defined file consisting of one point at a frequency, amplitude, and dwell time.

Key Entry **Preset List**

:LIST:WAVeform

Supported N5172B/82B

CAUTION The current list sweep data will be overwritten once this command is executed. If needed, save the current data. Refer to the ":STORe:LIST" command for storing list sweep files.

```
[:SOURce]:LIST:WAVeform <name>,<name>
[:SOURce]:LISt:WAVeform?
```

This command sets the waveform values for the current list waveform sequence.

NOTE Except for the sample clock rate, unspecified fields in the header result in the default settings of the dual arb's settings being used (i.e. not the current arb's settings). The sample clock rate must be specified for the file header of the waveform file being played. If the sample clock rate is unspecified in the file header, the instrument generates a header error.

Example

```
:LIST:WAV "WFM1:RAMP_TEST_WFM","WFM1:SINE_TEST_WFM"
```

The preceding example loads the waveforms `RAMP_TEST_WFM` and `SINE_TEST_WFM` into the waveform section of the List Table.

Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:LIST:WAVeform:POINts

Supported	N5172B/82B

```
[:SOURce]:LIST:WAVeform:POINts?
```

This query returns the number of waveform points in the current list sweep file.

:SWEep:ATTen:PROTection[:STATe]

Supported	All Models

```
[:SOURce]:SWEep:ATTen:PROTection[:STATe] ON|OFF|1|0
[:SOURce]:SWEep:ATTen:PROTection[:STATe]?
```

This command enables protection for the mechanical attenuator by automatically turning on Atten Hold during frequency and/or power step sweeps.

This may cause unleveled RF output to occur for certain sweep configurations. Disabling this attenuator protection will allow the sweep to optimally set both the automatic leveling control (ALC) and output attenuation at each sweep point.

ON (1)	This choice enables attenuator protection.
OFF (0)	This choice disables attenuator protection. When the attenuator protection is disabled, the step dwell time will be set to a minimum of 50 ms as a precaution.

Example

```
:SWE:ATT:PROT 0
```

The preceding example disables attenuator protection.

***RST**	1
Key Entry	Step Atten Protection On Off

:SWEep:CPOINt?

Supported	All Models

```
[:SOURce]:SWEep:CPOINt?
```

This query returns the current sweep point in any mode.

:SWEep:DWELl

Supported	All Models

```
[:SOURce]:SWEep:DWELl <value>
[:SOURce]:SWEep:DWELl?
```

This command enables you to set the dwell time for a step sweep.

The variable <value> is expressed in units of seconds with a 0.001 resolution.

The dwell time is the amount of time the sweep is guaranteed to pause after setting the frequency and/or power for the current point.

NOTE **The dwell time (<value>) does not begin until the signal generator has settled for the current frequency and/or amplitude change.**

***RST**	+2.00000000E–003
Range	0.0001 to 100
Key Entry	**Step Dwell**
Remarks	Dwell time is used when the trigger source is set to `IMMediate.` Refer to the :LIST:TRIGger:SOURce command for the trigger setting.

:SWEep[:FREQuency]:STEP[:LINear]

Supported	All Models

```
[:SOURce]:SWEep[:FREQuency]:STEP:[LINear] <value><unit>
[:SOURce]:SWEep[:FREQuency]:STEP:[LINear]?
```

This command sets the step size for a linear step sweep in frequency (difference between frequency points).

The variable <value> is expressed in units of frequency, specifies by the variable <unit> (as Hz, kHz, MHz, or GHz).

NOTE: Setting the step size will determine the number of points in the step sweep based on the current start and stop frequencies. Due to the integer number of step points, the step size may be adjusted in order to yield a true linear sweep between the start and stop frequencies.

***RST**	0.00 Hz
Key Entry	LIN Freq Step

:SWEep[:FREQuency]:STEP:LOGarithmic

Supported	All Models

```
[:SOURce]:SWEep[:FREQuency]:STEP:LOGarithmic <value>
[:SOURce]:SWEep[:FREQuency]:STEP:LOGarithmic?
```

This command sets the step size for a logarithmic step sweep in frequency (ratio between frequency points).

The variable <value> is expressed as a percentage (%).

NOTE: Setting the step size will determine the number of points in the step sweep based on the current start and stop frequencies. Due to the integer number of step points, the step size may be adjusted in order to yield a true linear sweep between the start and stop frequencies.

***RST**	0.00
Key Entry	LOG Freq Step

:SWEep:GENeration

Supported	All Models

```
[:SOURce]:SWEep:GENeration ANALog|STEPped
[:SOURce]:SWEep:GENeration?
```

This command sets the sweep type.

ANALog	This choice selects an analog sweep.
STEPped	This choice selects a step sweep.

Example

```
:SWE:GEN STEP
```

The preceding example selects a step sweep.

***RST**	STEP
Key Entry	**Sweep Type**

:SWEep:POINts

Supported	All Models

```
[:SOURce]:SWEep:POINts <value>
[:SOURce]:SWEep:POINts?
```

This command defines the number of step sweep points.

***RST**	101
Range	2 to 65535
Key Entry	**# Points**

:SWEep:SPACing

Supported	All Models

```
[:SOURce]:SWEep:SPACing LINear|LOGarithmic
[:SOURce]:SWEep:SPACing?
```

This command enables the signal generator linear or logarithmic sweep modes. These commands require the signal generator to be in step mode.

The instrument uses the specified start frequency, stop frequency, and number of points for both linear and log sweeps.

***RST**	LIN
Key Entry	**Step Spacing LIN LOG**

Marker Subsystem–N5173B/83B ([:SOURce])

:MARKer:AMPLitude[:STATe]

Supported N5173B/83B

```
[:SOURce]:MARKer:AMPLitude[:STATe] ON|OFF|1|0
[:SOURce]:MARKer:AMPLitude[:STATe]?
```

This command sets the amplitude marker state for the currently activated markers. When the state is switched on, the RF output signal exhibits a spike with a magnitude relative to the power level at each marker’s set frequency. (To set the magnitude of the spike, refer to the :MARKer:AMPLitude:VALue command.)

Example

```
:MARK:AMPL ON
```

The preceding example enables amplitude markers.

***RST**	0
Key Entry	**Amplitude Markers Off On**

:MARKer:AMPLitude:VALue

Supported N5173B/83B

```
[:SOURce]:MARKer:AMPLitude:VALue <num>[DB]
[:SOURce]:MARKer:AMPLitude:VALue?
```

This command sets the relative power for the amplitude spikes at each marker’s set frequency when the amplitude marker mode is activated. (To activate the amplitude markers, refer to the :MARKer:AMPLitude[:STATe] command.)

Example

```
:MARK:AMPL:VAL 4DB
```

The preceding example sets the relative marker power to 4 dB for all markers.

***RST**	2 dB
Range	–10 to +10 dB
Key Entry	**Marker Value**

:MARKer:AOFF

Supported N5173B/83B

```
[:SOURce]:MARKer:AOFF
```

This command turns off all active markers.

Key Entry **Turn Off Markers**

:MARKer:DELTa

Supported N5173B/83B

```
[:SOURce]:MARKer:DELTa? <num>,<num>
```

This query returns the frequency difference between two amplitude markers. The variables <num> are used to designate the marker numbers.

Example

```
:MARK:DELT? 1,2
```

The preceding example returns the frequency difference between amplitude markers 1 and 2.

Range 0 to 19

:MARKer:MODe

Supported N5173B/83B

```
[:SOURce]:MARKer:MODE FREQuency|DELTa
[:SOURce]:MARKer:MODE?
```

This command sets the frequency mode for all markers.

FREQuency	The frequency values for the markers are absolute.
DELTa	The frequency values for the markers are relative to the designated reference marker. The reference marker must be designated before this mode is selected. (See the :MARKer:REFerence command to select a reference marker.)

Example

```
:MARK:MODE DELT
```

The preceding example sets the marker mode to delta.

***RST** FREQuency

Key Entry **Marker Delta Off On**

:MARKer:REFerence

Supported N5173B/83B

```
[:SOURce]:MARKer:REFerence <marker>
[:SOURce]:MARKer:REFerence?
```

This command designates the reference marker when using markers in delta mode. The variable <marker> designates the marker number.

Example

```
:MARK:REF 6
```

The preceding example sets marker 6 as the reference marker.

***RST**	0
Range	0 to 19
Key Entry	**Delta Ref Set**

:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19:FREQuency

Supported N5173B/83B

```
[:SOURce]:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|1
7|18|19:FREQuency <freq>|MAXimum|MINimum
[:SOURce]:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|1
7|18|19:FREQuency? [MAXimum|MINimum]
```

This command sets the marker frequency. The frequency value must be between the start and stop frequencies set for the sweep.

Example

```
:MARK6 ON
```

The preceding example turns marker 6 on.

***RST**	0
Key Entry	**Marker On Off**

:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|17|18|19[:STATe]

Supported N5173B/83B

```
[:SOURce]:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|1
7|18|19[:STATe] ON|OFF|1|0
[:SOURce]:MARKer[0]|1|2|3|4|5|6|7|8|9|10|11|12|13|14|15|16|1
7|18|19[:STATe]?
```

This command turns a marker on or off. Marker 0 is the default if the marker designator [n] is not specified.

Example

```
:MARK6 ON
```

The preceding example turns marker 6 on.

***RST**	0
Key Entry	**Marker On Off**

Power Subsystem ([:SOURce]:POWer)

:ALC:BANDwidth

Supported All Models

```
[:SOURce]:POWer:ALC:BANDwidth|BWIDth <num>freq suffix]
[:SOURce]:POWer:ALC:BANDwidth|BWIDth?
```

This command overrides the signal generator's automatic ALC bandwidth selection with the users specific selection. For waveforms with varying amplitudes, high crest factors, or both, the recommended ALC loop bandwidth is the low bandwidth setting of the generator. Limiting the loop bandwidth of the ALC circuit will prevent the ALC from sampling the fast rising edges of pulsed waveforms. A limited, or narrow bandwidth will result in a longer ALC sample time and a more accurate representation of the signal's level.

***RST** 200 (2kHz when ALC:BAND:BWID is set to AUTO)

Key Entry	Auto	200 Hz	2 kHz	20 kHz

Remarks Use this command when the ALC state is set to On. This command will override the automatic ALC bandwidth selection set by the :ALC:BANDwidth|BWIDth:AUTO command.

:ALC:BANDwidth|BWIDth:AUTO

Supported All Models

```
[:SOURce]:POWer:ALC:BANDwidth|BWIDth:AUTO ON|OFF|1|0
[:SOURce]:POWer:ALC:BANDwidth|BWIDth:AUTO?
```

This command turns the bandwidth (BW) auto state on or off.

The bandwidth auto function allows the signal generator to automatically select a bandwidth for the automatic leveling control (ALC) circuit.

ON (1) This choice allows the signal generator to automatically select an ALC BW. The selection of the ALC BW depends on the signal generator modulation type.

OFF (0) This choice disables automatic selection of the ALC BW.

***RST** 1

Key Entry **Auto**

Remarks For more information on ALC bandwidth, refer to the **User's Guide**.

:ALC:LEVel

Supported All Models

```
[:SOURce]:POWer:ALC:LEVel <value><unit>
[:SOURce]:POWer:ALC:LEVel?
```

This command sets the automatic leveling control (ALC) level. Use this command after setting the attenuation auto mode to On. Refer to :ATTenuation:AUTO command for setting the attenuation auto mode.

The ALC is used to maintain the signal generator's output power level by compensating for power fluctuations due to drift, band changes, or load variations. After you set the ALC level, the signal generator's output power is monitored and corrected so that the power level setting is maintained.

Example

```
:POW:ALC:LEV 10DB
```

The preceding example sets the ALC to 10 dB.

***RST**	+1.00000000E+000
Range	–20 to 20
Key Entry	**Set ALC Level**

:ALC:SEARch

Supported All Models

```
[:SOURce]:POWer:ALC:SEARch ON|OFF|1|0|ONCE
[:SOURce]:POWer:ALC:SEARch?
```

This command executes a power search routine that temporarily activates the ALC, calibrates the power of the current RF output, and then disconnects the ALC circuitry. The power search mode is active only when the ALC state is Off, and the RF output is On.

ON (1)	This choice sets the power search mode to automatic (**Auto**). In automatic mode, the power search calibration routine is executed whenever an instrument setting is modified that affects RF output power. This includes changes to frequency, amplitude and modulation.
OFF (0)	This choice sets the power search mode to **Manual and** disables the automatic power search calibration routine. The power level must be calibrated by explicitly sending the `ONCE` command. If there is a change in frequency or amplitude the `ONCE` command must be sent again.

ONCE	This choice executes a single power search calibration at the current RF output frequency and amplitude setting. This command can be used when the power search mode is in automatic or manual.
***RST**	1

Key Entry			
Key Entry	**AMPTD**	**ALC Off**	**Power Search**
	Auto	**Manual**	**Do Power Search**

Remarks If power search fails, the output power of the instrument will be set to minimum and must be recovered with an instrument preset.

Refer to the :ALC[:STATe] command for setting the ALC state.

:ALC:SEARch:REFerence

Supported All Models

```
[:SOURce]:POWer:ALC:SEARch:REFerence
RMS|FIXed|MANual|MODulated
[:SOURce]:POWer:ALC:SEARch:REFerence?
```

This command sets the reference source used by the power search calibration routine. The reference source provides a steady state signal during the power search calibration.

RMS	This choice uses the I/Q system as the reference source for the power search calibration. When the power search calibration routine is executing, the I/Q system provides a DC bias on the I/Q modulator equivalent to the rms value of the current I/Q data. The rms value is derived from the waveform file header or calculated using the current I/Q data
FIXed	This choice uses the I/Q system as the reference source for the power search calibration. When `FIXed` is active, the I/Q system uses a fixed level of 1.0 volt to provide a DC bias on the I/Q modulator during the power search calibration.
MANual	This choice uses the I/Q system as the reference source for the power search calibration. When `MANual` is selected, the user can specify the DC bias on the I/Q modulator during the power search calibration. The level is chosen using the :ALC:SEARch:REFerence:LEVel command.

MODulated	This choice disables the power search reference source. During the power search calibration, the current RF output signal is measured to calibrate the output level. If the output signal is amplitude modulated at a slow rate or is bursted, power errors can be introduced at the RF output. For CW signals the power search reference is disabled.
***RST**	FIXed (With BBG License only.)

Key Entry **Power Search Reference Fixed Mode**

Remarks MXG without the BBG license are defaulted to MOD mode.

:ALC:SEARch:REFerence:LEVel

Supported All Models

```
[:SOURce]:POWer:ALC:SEARch:REFerence:LEVel <value>
[:SOURce]:POWer:ALC:SEARch:REFerence:LEVel?
```

This command sets the DC bias voltage value for a manual power search.

***RST** +1.00000000+000

Range 0 to 1.414 V

Key Entry **Power Search Manual Level**

:ALC:SEARch:SPAN:START

Supported All Models

```
[:SOURce]:POWer:ALC:SEARch:SPAN:START <value><units>
[:SOURce]:POWer:ALC:SEARch:SPAN:START?
```

This command sets the start frequency for a span power search over a user specified range.

The start frequency has no default value. The start frequency value will be the last value set before powering off the instrument.

Key Entry **Start Frequency**

:ALC:SEARch:SPAN:STOP

Supported All Models

```
[:SOURce]:POWer:ALC:SEARch:SPAN:STOP <value><units>
[:SOURce]:POWer:ALC:SEARch:SPAN:STOP?
```

This command sets the stop frequency for a span power search over a user specified range.

The stop frequency has no default value. The stop frequency value will be the last value set before powering off the instrument.

Key Entry **Stop Frequency**

:ALC:SEARch:SPAN:TYPE

Supported All Models

```
[:SOURce]:POWer:ALC:SEARch:SPAN:TYPE FULL|USER
[:SOURce]:POWer:ALC:SEARch:SPAN:TYPE?
```

This command enables you to select the frequency range for a span power search. You can specify the range (USER) or you can select the full range (FULL) of the signal generator.

Key Entry **Span Type User Full**

:ALC:SEARch:SPAN[:STATe]

Supported All Models

```
[:SOURce]:POWer:ALC:SEARch:SPAN[:STATe] ON|OFF|1|0
[:SOURce]:POWer:ALC:SEARch:SPAN[:STATe]?
```

This command enables (1) or disables (0) the span mode, allowing you to perform power searches over a selected range of frequencies. The power search corrections are then stored and used whenever the signal generator is tuned within the selected range.

Key Entry **Span**

:ALC:SOURce

Supported All Models

```
[:SOURce]:POWer:ALC:SOURce INTernal|DIODe
[:SOURce]:POWer:ALC:SOURce?
```

This command enables you to select an automatic level control (ALC) source. You can select the internal ALC source, an external detector source, or a millimeter–wave source module. Refer to the **User's Guide** for more information on ALC leveling, bandwidth, and the power search function.

Example

```
:POW:ALC:SOUR DIOD
```

The preceding example selects an external detector as the source (the unit must be connected to the signal generator).

***RST** INT

Key Entry **Leveling Mode**

:ALC:SOURce:EXTernal:COUPling

Supported All Models

```
[:SOURce]:POWer:ALC:SOURce:EXTernal:COUPling <value>DB
[:SOURce]:POWer:ALC:SOURce:EXTernal:COUPling?
```

This command sets the external detector coupling factor. Use this command when DIODe is the selected ALC source (Refer to the :ALC:SOURce command.)

Example

```
:POW:ALC:SOUR:EXT:COUP 20DB
```

The preceding example sets the external coupling factor to 20 dB.

***RST**	+1.60000000E+001
Range	–200 to 200 dB.
Key Entry	**Ext Detector Coupling Factor**

:ALC:SOURce:PMServo:CHANnel

Supported All Models

```
[:SOURce]:POWer:ALC:SOURce:PMServo:CHANnel A|B
[:SOURce]:POWer:ALC:SOURce:PMServo:CHANnel?
```

This command sets the power meter channel used for servo mode

Example

```
:POW:ALC:SOUR:PMS:CHAN A
```

***RST**	A
Range	A/B
Key Entry	**Power Meter Channel (A|B)**

:ALC:SOURce:PMServo:INCRement

Supported All Models

```
[:SOURce]:POWer:ALC:SOURce:PMServo:INCRement <value>
[:SOURce]:POWer:ALC:SOURce:PMServo:INCRement?
```

This command sets the increment percentage of a measured power delta in the Power Meter Servo mode. By default this value is 100%, meaning that the system output power is adjusted by the measured value. This percentage can be lowered to assure that no overshoot takes place – at the cost of additional measurement/adjustment cycles. This command works in conjunction with the STARt and STOP commands.

Example

```
:POW:ALC:SOUR:PMS:INCR 75
```

The preceding example sets the power increment to 75% of the measured delta.

***RST**	100
Range	10 to 100 in %
Key Entry	**Power Meter Servo overshoot protection power increment**

:ALC:SOURce:PMServo:MAXimum

Supported	All Models

```
[:SOURce]:POWer:ALC:SOURce:PMServo:MAXimum <value>
[:SOURce]:POWer:ALC:SOURce:PMServo:MAXimum?
```

This command adds device power protection by setting an RF output power protection limit while using the Power Meter Servo mode. The system restricts the actual RF output power to this value and will show UNLEVELED if the desired output power exceeds the value.

Example

```
:POW:ALC:SOUR:PMS:MAX 10 dBm
```

The preceding example limits the RF output power to a maximum of 10 dBm when in Power Meter Servo mode.

***RST**	30 dBm
Range	MIN to MAX RF output power of the system (option dependent)
Key Entry	**Power Meter Servo mode RF Output power limit**

:ALC:SOURce:PMServo:SERRor

Supported	All Models

```
[:SOURce]:POWer:ALC:SOURce:PMServo:SERRor <value>
[:SOURce]:POWer:ALC:SOURce:PMServo:SERRor?
```

This command sets the allowed settling error for the power meter servo mode. Measurement/adjustment cycles will be executed until this power delta is achieved.

Example

```
:POW:ALC:SOUR:PMS:SERR 0.2dB
```

***RST**	0.2 dB
Range	0.02 dB - 10 dB
Key Entry	**Settling Error**

:ALC:SOURce:PMServo:STARt

Supported All Models

```
[:SOURce]:POWer:ALC:SOURce:PMServo:STARt <value>
[:SOURce]:POWer:ALC:SOURce:PMServo:STARt?
```

This command sets the relative initial power when leveling with the Power Meter Servo mode. The default of 0 dB means that the system starts with the power it thinks is needed (based on output power, offset and reference) but this might lead to power overshoots in certain cases (especially when the offset is not set up correctly). This value allows to specify an additional safe-margin to start the measure/adjust cycles lower than the target power to protect the device from power overshoots. This command works in conjunction with the INCrement and STOP commands.

Example

```
:POW:ALC:SOUR:PMS:STAR -3 dB
```

The preceding example sets the relative initial power for power meter servo approach to -3 dB.

***RST**	0 dB
Range	–50 to 0 dB.
Key Entry	**Power Meter Servo overshoot protection relative start power**

:ALC:SOURce:PMServo:STOP

Supported All Models

```
[:SOURce]:POWer:ALC:SOURce:PMServo:STOP <value>
[:SOURce]:POWer:ALC:SOURce:PMServo:STOP?
```

This command sets the final threshold for when the remaining measured power delta from the Power Meter Servo mode will be applied in full (100%) instead of the specified increment. This command works in conjunction with the STARt and INCrement commands.

Example

```
:POW:ALC:SOUR:PMS:STOP 3 dB
```

The preceding example sets the threshold from when on Power Meter Servo mode incremental iterations stop and the remaining power is adjusted in one jump to the size of the 3 dB.

***RST**	1 dB
Range	0 to 50 dB.
Key Entry	**Power Meter Servo mode overshoot protection increment threshold**

:ALC[:STATe]

Supported All Models

```
[:SOURce]:POWer:ALC[:STATe] ON|OFF|1|0
[:SOURce]:POWer:ALC[:STATe]?
```

This command enables or disables the automatic leveling control (ALC) circuit. The query returns the current state of the ALC.

***RST**	1
Key Entry	**ALC Off On**
Remarks	The purpose of the ALC circuit is to hold output power at a desired level by adjusting the signal generator's power circuits to compensate for power drift. Power drift occurs over time and changes in temperature. Refer to the **User's Guide** for more information on the ALC.

:ALC:TRANsition:REFerence

Supported N5172B/82B

```
[:SOURce]:POWer:ALC:TRANsition:REFerence
RMS|MODulated|NBModulated
[:SOURce]:POWer:ALC:TRANsition:REFerence?
```

This command determines the ALC settling mode during frequency transitions when the IQ modulator is on.

RMS	This choice is the default behavior. The IQ is set to an idle state and a CW only signal plays during frequency transitions.
Mod	This choice leaves the IQ on during frequency transition and also leaves the ALC in the default wide bandwidth mode for fast switching. Although this choice results in switching times that are equivalent to RMS mode, there is the possibility of leveling at the wrong power level.
NBMod	This choice leaves the IQ on during frequency transitions but sets the ALC bandwidth to a narrow bandwidth. Doing this increases the switching time but allows for a more accurate amplitude level.
***RST**	RMS
Key Entry	**ALC Transition Reference RMS Mod NBMod**
Remarks	RMS is the default behavior and in most cases is the best choice for this setting. Refer to the **User's Guide** for more information on the ALC.

:ALCHold:EXTernal:SOURce

Supported All Models

```
:ALCHold:EXTernal:SOURce TRIGger[1]|TRIGger2|PULSe
:ALCHold:EXTernal:SOURce?
```

This command selects the external ALC Hold source. The ALC is held when the signal line is low (0V) and is not held (i.e. leveling) when the voltage is a TTL high (5V).

With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1	This choice selects the TRIG 1 BNC as the external source for the ALC Hold signal.
TRIGger2	This choice selects the TRIG 2 BNC as the external source for the ALC Hold signal.
PULSe	This choice selects the PULSE BNC as the external source for the ALC Hold signal.

Example

```
:ALCH:EXT:SOUR PULS
```

The preceding example sets the external ALC Hold source to the PULSE BNC.

***RST** TRIGger1

Key Entry	Trigger 1	Trigger 2	Pulse

:ALCHold:EXTernal[:STATe]

Supported All Models

```
[:SOURce]:POWer:ALCHold:EXTernal[:STATe] ON|OFF|1|0
[:SOURce]:POWer:ALCHold:EXTernal[:STATe]?
```

This command enables (1) or disables (0) the External ALC Hold control. If Ext ALC Hold is on, the external BNC input is selected using the :ALCHold:EXTernal:SOURce command.

***RST** 0

Key Entry **Ext ALC Hold Off On**

:ALTernate:AMPLitude

Supported N5172B/82B

```
[:SOURce]:POWer:ALTernate:AMPLitude <val><units>
[:SOURce]:POWer:ALTernate:AMPLitude?
```

This command sets the delta value for the alternate amplitude.

The variable <val> is expressed in units of decibels (dB).

***RST**	+0.00000000E+000
Range	–174 to 174

Key Entry **Desired Delta**

Remarks	The actual RF output amplitude is equal to the Alternate Amplitude Delta value plus the RF output amplitude; this sum cannot exceed the minimum and maximum amplitude limits of the signal generator. For example, if the Alternate Amplitude Delta is set to –174 dB and the RF output amplitude is set to 20 dB, the sum is equal to –154 dB.

:ALTernate:TRIGger:EXTernal[:SOURce]

Supported N5172B/82B

```
[:SOURce]:POWer:ALTernate:TRIGger:EXTernal[:SOURce]
BBTRigger1|BBTRigger2|PTRig|EVENt1
[:SOURce]:POWer:ALTernate:TRIGger:EXTernal[:SOURce]?
```

This command sets the external trigger source for the alternate amplitude signal when :ALTernate:TRIGger[:SOURce] is set to External.

BBTRigger1	This choice requires an external trigger to the selected rear panel BB TRIG 1BNC to toggle the RF output power between main and alternate amplitudes.
BBTRigger2	This choice requires an external trigger to the selected rear panel BB TRIG 2 BNC to toggle the RF output power between main and alternate amplitudes.
PTRig	This choice requires an external trigger to the selected rear panel PAT TRIG BNC to toggle the RF output power between main and alternate amplitudes.
EVENt1	This choice requires an external trigger to the selected rear panel EVENT 1 BNC to toggle the RF output power between main and alternate amplitudes.
***RST**	BBTR1

Key Entry	**BB TRIG 1 BNC**	**BB TRIG 2 BNC**	**EVENT 1 BNC**	**PAT TRIG BNC**

:ALTernate:TRIGger[:SOURce]

Supported N5172B/82B

```
[:SOURce]:POWer:ALTernate:TRIGger[:SOURce] INTernal|EXTernal
[:SOURce]:POWer:ALTernate:TRIGger[:SOURce]?
```

This command sets the trigger source for the alternate amplitude signal.

INTernal	The baseband generator triggers each timeslot to output a power level set with either the user-selected main or alternate amplitude parameter. This choice requires a baseband generator option. Each timeslot is allowed to output power with a user-selected main or alternate amplitude.
EXTernal	This choice requires an external trigger to the selected rear panel connector (see :ALTernate:TRIGger:EXTernal[:SOURce]) to toggle the RF output power between main and alternate amplitudes.
***RST**	MAN

Key Entry **Alt Ampl Trigger**

:ALTernate[:STATe]

Supported N5172B/82B

```
[:SOURce]:POWer:ALTernate:STATe ON|OFF|1|0
[:SOURce]:POWer:ALTernate:STATe?
```

This command enables or disables the alternate amplitude.

NOTE: Alternate amplitude should not be selected for more than 100ms at a time or the power may drift.

***RST** 0

Key Entry **Alt Ampl Off On**

:ATTenuation

Supported All Models

```
[:SOURce]:POWer:ATTenuation <value><unit>
[:SOURce]:POWer:ATTenuation?
```

This command sets the signal generator's attenuator level. Before setting the attenuator level, set the ":ATTenuation:AUTO" function to Off which will disable ALC control.

In normal operation the attenuator level is selected by the signal generator's automatic loop control (ALC) which maintains the output power by adjusting internal circuits to compensate for any power fluctuations due to drift, band changes, or load variations. In some applications, such as fast pulse, the ALC may not respond quickly enough to compensate for the pulse rise times. In this case you can set the attenuator and override any ALC adjustments.

The output power is the ALC level minus the attenuator setting. The attenuator is set in increments of 5 dB.

Example

```
:POW:ATT 10DB
```

The preceding example sets the attenuator to 10 dB.

***RST**	+115
Range	0 to 115 dB
Key Entry	**Set Atten**

:ATTenuation:AUTO

Supported	All Models

```
[:SOURce]:POWer:ATTenuation:AUTO ON|OFF|1|0
[:SOURce]:POWer:ATTenuation:AUTO?
```

This command sets the state of the attenuator auto mode function.

ON (1)	This selection allows the signal generator's automatic level control (ALC) to adjust the attenuator so that a specified RF power level, at the Keysight MXG's RF output connector, is maintained.
OFF (0)	This choice allows for a user–selected attenuator setting that is not affected by the signal generator's ALC circuitry. The OFF (0) selection can be used to eliminate power discontinuity normally associated with attenuator switching during power adjustments.
***RST**	1
Key Entry	**Atten Hold Off On**
Remarks	Refer to the ":ALC:LEVel" on page 100.

:ATTenuation:BYPass

Supported	All Models

```
[:SOURce]:POWer:ATTenuation:BYPass ON|OFF|1|0
[:SOURce]:POWer:ATTenuation:BYPass?
```

This command enables or disables the attenuator bypass setting. The attenuator hold mode must be enabled to use this command.

ON (1)	This selection allows the signal generator's automatic level control (ALC) to adjust the attenuator hold mode. Output power is controlled solely by the ALC setting.
OFF (0)	This choice allows for a user–selected attenuator setting combined with the ALC setting.
***RST**	0
Key Entry	**Atten Bypass Off On**

:HARMonics

Supported All Models

```
[:SOURce]:POWer:HARMonics[:STATe] ON|OFF|1|0
[:SOURce]:POWer:HARMonics?
```

This command enables or disables the optimize harmonics setting. The optimize harmonics mode modifies the attenuator and automatic level control (ALC) settings to give optimal harmonics performance. Optimize harmonics mode does not change the RF output power. The attenuator hold mode cannot be enabled while this mode is active, and modulations cannot be enabled while this mode is active.

ON (1)	This selection allows the signal generator to optimize harmonics by modifying the attenuator and automatic level control settings.
OFF (0)	This selection disables the optimize harmonics mode.
***RST**	0
Key Entry	**Optimize Harmonics**

[:LEVel][:IMMediate]:OFFSet

Supported All Models

```
[:SOURce]:POWer[:LEVel][:IMMediate]:OFFSet <value><unit>
[:SOURce]:POWer[:LEVel][:IMMediate]:OFFSet?
```

This command sets the power offset value.

***RST**	+0.00000000E+000
Range	–200 to 200 dB
Key Entry	**Amptd Offset**
Remarks	This simulates a power level at a test point beyond the RF OUTPUT connector without changing the actual RF output power. The offset value only affects the displayed amplitude setting.

You can enter an amplitude offset any time in either normal operation or amplitude reference mode.

[:LEVel][:IMMediate][:AMPLitude]

Supported All Models

```
[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]
<value><unit>
[:SOURce]:POWer[:LEVel][:IMMediate][:AMPLitude]?
```

This command sets the RF output power.

***RST** –1.10000000E+002 (Standard) or –1.44000000E+002 (Option 1EQ)

Key Entry **AMPTD**

Remarks For information on the ranges for this command and the specified values, refer to the instrument's **Data Sheet**.

[:LEVel]:MINimum:LIMit

Supported All Models w/Option HAL

```
[:SOURce]:POWer[:LEVel]:MINimum:LIMit LOW|HIGH
[:SOURce]:POWer[:LEVel]:MINimum:LIMit?
```

This command selects the RF Off power minimum level to LOW or HIGH. When set to HIGH, the RF Output Attenuator is set for maximum attenuation. When set to LOW, the internal RF modulators are biased off further reducing the output signal level.

Key Entry **Minimum Power**

Remarks Option HAL is a special operating mode that does not use the ALC modulator to shut off the RF output when the RF is off. When option HAL is active the pulse and ALC modulators are left on. The RF output attenuator is used to shut off the output level. The result being the output power will not decrease as much when the RF is off. Command reports undefined header error if option is not enabled.

:MODE

Supported All Models

```
[:SOURce]:POWer:MODE FIXed|LIST
[:SOURce]:POWer:MODE?
```

This command sets the signal generator power mode to fixed or swept.

FIXed	This choice stops a power sweep, allowing the signal generator to operate at a fixed power level. Refer to the [:LEVel][:IMMediate][:AMPLitude] command for setting the output power level.
LIST	This choice selects the swept power mode. If sweep triggering is set to immediate along with continuous sweep mode, executing the command starts the LIST or STEP power sweep.

NOTE To perform a frequency and amplitude sweep, you must also select LIST as the frequency mode. See also the :FREQuency:MODE command for selecting the list mode for a frequency sweep.

***RST** FIX

Key Entry **SWEEP Amptd Off On**

NOISe:[STATe]

Supported All Models

```
[:SOURce]:POWer:NOISe:[STATe] ON|OFF|1|0
[:SOURce]:POWer:NOISe:[STATe]?
```

This command enables the optimize signal to noise (S/N) ratio state. The command optimizes the attenuator and ALC setting to give the optimal signal to noise performance. It does not change the RF output power. The query returns an integer.

Default S/N Off

Key Entry **Optimize S/N Off On**

Remarks

An example of this feature is when the S/N is off, and the output power is set to –10 dBm, the ALC rises to 0 dBm. The resulting attenuation is 10 dB.

When the Optimize S/N is enabled (ON), and the output power is set to –10 dBm, the ALC increases to maximum (i.e. 20 dBm). The attenuator increases to 30 dB, resulting in a 20 dB increased S/N for better dynamic range.

Can not go beyond maximum ALC.

It is limited to CW operation.

This mode is mutually exclusive with **Attenuator Hold**, and any modulation type. A settings conflict error will be generated if Attenuator Hold or any modulation is activated when **Optimize S/N** is enabled.

:PROTection[:STATe]

Supported All models

```
[:SOURce]:POWer:PROTection[:STATe] ON|OFF|1|0
[:SOURce]:POWer:PROTection[:STATe]?
```

This command enables or disables the power search protection function. The power search protection function sets the attenuator to its maximum level whenever a power search is initiated. This can be used to protect devices that are sensitive to high average power or high power changes. The trade off on using the power protection function is decreased attenuator life, as the attenuator will switch to its maximum setting during a power search.

NOTE **Continual or excessive use of the power search protection function can decrease attenuator life.**

ON (1)	Causes the attenuator to switch to and hold its maximum level setting during a power search.
OFF (0)	Sets the attenuator to normal mode. The attenuator is not used during power search.

Example

```
:POW:PROT ON
```

The preceding example enables the power inhibit function.

***RST**	0
Key Entry	**RF During Power Search Normal Minimum**

:REFerence

Supported All Models

```
[:SOURce]:POWer:REFerence <value><unit>
[:SOURce]:POWer:REFerence?
```

This command sets the power level for the signal generator RF output reference.

The RF output power is referenced to the value entered in this command.

***RST**	+0.00000000E+000
Range	–400 to 300 dBm
Key Entry	**Amptd Ref Set**

:REFerence:STATe

Supported All Models

```
[:SOURce]:POWer:REFerence:STATe ON|OFF|1|0
[:SOURce]:POWer:REFerence:STATe?
```

This command enables or disables the RF output reference.

Once the reference state is ON, all subsequent output power settings are set relative to the reference value.

ON (1)	This choice will set the power reference state to ON. The unit displayed for commands, ":ANNotation:AMPLitude:UNIT" and ":POWer" will be expressed in dB.
OFF (0)	This choice will set the power reference state to OFF.
***RST**	0
Key Entry	**Amptd Ref Off On**
Remarks	Amplitude offsets can be used with the amplitude reference mode.

:STARt

Supported All Models

```
[:SOURce]:POWer:STARt <value><unit>
[:SOURce]:POWer:STARt?
```

This command sets the first amplitude point in a step sweep.

***RST**	–1.10000000E+002 (Standard) and –1.44000000E+002 (Option 1EQ)
Range	Refer to the [:LEVel][:IMMediate][:AMPLitude] command for the output power ranges.
Key Entry	**Amptd Start**

:STOP

Supported All Models

```
[:SOURce]:POWer:STOP <value><unit>
[:SOURce]:POWer:STOP?
```

This command sets the last amplitude point in a step sweep.

***RST**	–1.10000000E+002 (Standard) and –1.44000000E+002 (Option 1EQ)
Range	Refer to the [:LEVel][:IMMediate][:AMPLitude] command for the output power ranges.

Key Entry **Amptd Stop**

:USER:MAX

Supported All Models

```
[:SOURce]:POWer:USER:MAX <ampl>
[:SOURce]:POWer:USER:MAX?
```

This command enables the user to specify a maximum output power level that is lower than the instrument's normal maximum output power. This affects all modes of power operation. The query returns the value of the output power level.

***RST** 30 dBm

Key Entry **User Power Max**

:USER:ENABle

Supported All Models

```
[:SOURce]:POWer:USER:ENABle ON|OFF|1|0
[:SOURce]:POWer:USER:ENABle?
```

This command enables or disables the user settable maximum output power limit.

Key Entry **User Power Max Enable:**

Vector Modulation Subsystem—N5172B/82B ([:SOURce]:IQ)

:AUX:INPut:STRobe[:MODE]

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:AUX:INPut:STRobe[:MODE] FREE|USER
[:SOURce]:IQ:AUX:INPut:STRobe[:MODE]?
```

This command sets the mode that is used for latching AUX port input data.

If the signal generator is in serial (.vs. parallel) mode, the input strobe mode will always be free-run. If parallel mode is selected, user can choose either free-run or user-input-strobe mode.

FREE	Input data to AUX port is in free-run mode (the signal generator latches new input data on its own internal schedule).
USER	Input data to AUX port is in user external input strobe mode (user supplies some strobe signal to let the signal generator know when to latch data).
***RST**	FREE
Key Entry	Input Strobe Free Run User

:AUX:INPut:STRobe:SLOPe

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:AUX:INPut:STRobe:SLOPe POSitive|NEGative
[:SOURce]:IQ:AUX:INPut:STRobe:SLOPe?
```

This command controls the polarity of the user external input strobe signal.

The external-input-strobe signal must be at least 200ns wide, and user must hold assert 16 input data bits stable 20ns before the active edge of the user input strobe and hold the data stable for at least 100ns after the active edge of the user input strobe.

POSitive	The signal generator looks for a rising edge of the external strobe signal to latch the data.
NEGative	The signal generator looks for a falling edge of the external strobe signal to latch the data.
***RST**	POS
Key Entry	Input Strobe Polarity Neg Pos

:AUX:OPERating:MODE

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:AUX:OPERating:MODE DEDicated|MULTiplexed
[:SOURce]:IQ:AUX:OPERating:MODE?
```

This command sets the operating mode for real-time applications.

NOTE: This command is not supported by all real-time applications

DEDicated Configures the AUX I/O port operating mode to Dedicated for real-time applications.

MULTiplexed Configures the AUX I/O port operating mode to Multiplexed for real-time applications.

***RST** DED

Key Entry **Operating Mode** **Dedicated** **Multiplexed**

:AUX:OUTPut:STRobe:SLOPe

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:AUX:OUTPut:STRobe:SLOPe POSitive|NEGative
[:SOURce]:IQ:AUX:OUTPut:STRobe:SLOPe?
```

This command controls the polarity of the AUX output sample clock.

The output sample clock indicates that the signal generator has latched the 16 input data bits. The signal generator will output this signal in either free-run or external-input-strobe mode. The user can select the polarity of the output-strobe signal using this command.

POSitive The signal generator will assert a pulse with a rising edge to indicate when it has latched the 16 input data bits.

NEGative The signal generator will assert a pulse with a falling edge to indicate when it has latched the 16 input bits. The output pulse will be at least 200 ns wide.

***RST** POS

Key Entry Output Strobe Polarity Neg Pos

:OPERating:MODE

Supported N5172B or N5182B with Option UN7 or 003 or 004

CAUTION When the Baseband Operating Mode is changed, the current contents of volatile waveform memory are erased

```
[:SOURce]:IQ:OPERating:MODE PRIMary|BERT|N5102A
[:SOURce]:IQ:OPERating:MODE?
```

This command changes the Baseband Operating Mode between three different ARB FPGA images; each ARB FPGA image changes the supported features available while in the selected mode.

PRIMary All signal generator features are available in this mode except BERT and N5102A functionality.

This choice selects the PXB Input ARB FPGA image. For backwards compatibility, selecting the Primary Baseband Operating Mode sets the I/Q Digital Bus Connectivity to PXB.

BERT Requires Keysight N5172B EXG or N5182B MXG X-Series signal generators with Option UN7.

All signal generator features are available in this mode; all BERT features are also available, but N5102A is not available in this mode.

This choice selects the BERT ARB FPGA image and contains all functionality and features from the B.01.65 PXB Input FPGA image.

For backwards compatibility, selecting the BERT Baseband Operating Mode sets the I/Q Digital Bus Connectivity to PXB.

N5102A Requires Keysight N5172B EXG or N5182B MXG X-Series signal generators with Option 003 or 004 or both.

All signal generator features are available in this mode; all N5102A features are also available, but BERT is not available in this mode.

For backwards compatibility, selecting the N5102A Baseband Operating Mode sets the I/Q Digital Bus Connectivity to N5102A.

***RST** N/A

Remarks The selected Baseband Operating Mode is a persistent instrument setting and its value is maintained through power cycles, Preset, or *RST.

:OUTPut:IMPairments:AWGN:BANDwidth|BWIDth

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:BANDwidth|BWIDth
<value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:BANDwidth|BWIDth?
```

This command sets the flat noise bandwidth, which is typically set wider than the signal bandwidth. There will be roll-off of the noise outside of this bandwidth.

***RST** 1 Hz

Range Option 653: 1 Hz–60 MHz

Option 655: 1 Hz–120 MHz

Option 656: 1 Hz–80 MHz

Option 657: 1 Hz–160 MHz

Key Entry Flat Noise Bandwidth

:OUTPut:IMPairments:AWGN:EBNO

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:EBNO <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:EBNO?
```

This command allows the signal to noise ratio to be set using the Eb/No (energy per bit over noise power density at the receiver) form. This requires the signal bit rate to be set properly.

(SNR)dB = (Eb/No)dB + 10log(bitRate/signalBandwidth)

***RST** 0 dBm

Range –100 to 100 dBm

Key Entry Eb/No

:OUTPut:IMPairments:AWGN:IBWidth

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:IBWidth <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:IBWidth?
```

This value determines the non-AUTO value of the noise integration bandwidth. This is the bandwidth over which to sum the noise for the purposes of SNR (or Eb/No). Often, it is the symbol rate or chip rate of the signal in question.

***RST**	1 Hz
Range	1 Hz–200 MHz
Key Entry	Integration Bandwidth

:OUTPut:IMPairments:AWGN:IBWidth:AUTO

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:IBWidth:AUTO ON|OFF|1|0
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:IBWidth:AUTO?
```

This is a new feature that allows the currently ON application to control the noise integration bandwidth. For applications that have no clear noise integration bandwidth, such as Dual Arb, the auto mode is effectively OFF.

***RST**	1
Key Entry	**Integration Bandwidth Manual Auto**

:OUTPut:IMPairments:AWGN:MUX SUM|SIGNal|NOISe

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:MUX SUM|SIGNal|NOISe
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:MUX?
```

This value allows diagnostic control of additive noise. The intended purpose of this feature is to allow direct measurement of just the signal or noise contribution to the total power (assuming that the ALC is off). The system will still behave as if both the noise and the signal are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

SUM	The sum of both the noise and the signal will be output from the internal baseband generator.
SIGNal	Only the signal will be output from the internal baseband generator.
NOISe	Only noise will be output from the internal baseband generator.
***RST**	SUM
Key Entry	Output Mux

:OUTPut:IMPairments:AWGN:POWer:CONTrol[:MODE]

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:CONTrol[:MODE]
TOTal|SIGNal|NOISe|NCHannel
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:CONTrol[:MODE]?
```

Sets the mode of power control while noise is on.

TOTal	The total power and SNR are independent variables and the signal power, channel noise power, and total noise power are dependent variables set by the total power, SNR and the rest of the noise settings. The signal power, channel noise power, and total noise power will change as any noise parameter is adjusted to keep the total power and the SNR at their last specified values.
SIGNal	The signal power and SNR are independent variables and the total power, channel noise power, and total noise power are dependent variables set by the signal power, SNR and the rest of the noise settings. The total power, channel noise power, and total noise power will change as any noise parameter is adjusted to keep the signal power and the SNR at their last specified values.
NOISe	The total noise power and SNR are independent variables and the total power, channel noise power, and signal power are dependent variables set by the total noise power, SNR and the rest of the noise settings. The total power, channel noise power, and signal power will change as any noise parameter is adjusted to keep the total noise power and the SNR at their last specified values.
NCHannel	The channel noise power and SNR are independent variables and the total power, total noise power, and signal power are dependent variables set by the channel noise power, SNR and the rest of the noise settings. The total power, total noise power, and signal power will change as any noise parameter is adjusted to keep the channel noise power and the SNR at their last specified values.
***RST**	TOT
Key Entry	Power Control Mode

:OUTPut:IMPairments:AWGN:POWer:NOISe:CHANnel

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:NOISe:CHANnel
<value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:NOISe:CHANnel?
```

Set the current channel noise power level if noise is on. In the "Channel Noise" control mode, the total power will be adjusted to achieve the specified channel noise power and the channel noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the channel noise power setting appropriately to maintain the SNR.

In the other control modes, this will adjust the total power once for the specified channel noise power level, after which the channel noise power could change if any noise parameters are adjusted.

The range varies based on the bounds of the total power that results from the noise settings.

***RST**	–110 dBm
Range	Varies based on the bounds of the total power that results from the noise settings
Key Entry	Noise Power In Channel

:OUTPut:IMPairments:AWGN:POWer:NOISe:TOTal

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:NOISe:TOTal
<value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:NOISe:TOTal?
```

Set the current channel noise power level if noise is on. In the "Channel Noise" control mode, the total power will be adjusted to achieve the specified channel noise power and the channel noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the channel noise power setting appropriately to maintain the SNR.

In the other control modes, this will adjust the total power once for the specified channel noise power level, after which the channel noise power could change if any noise parameters are adjusted.

The range varies based on the bounds of the total power that results from the noise settings.

***RST**	–169.03 dBm
Range	Varies based on the bounds of the total power that results from the noise settings

Key Entry Total Noise Power

:OUTPut:IMPairments:AWGN:POWer:SIGNal

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:SIGNal <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:POWer:SIGNal?
```

Sets the current signal power level if noise is on. In the "Signal" control mode, the total power will be adjusted to achieve the specified signal power and the signal power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the signal power setting appropriately to maintain the S/N ratio.

In the other control modes, this will adjust the total power once for the specified signal power level, after which the signal power could change if any noise parameters are adjusted.

The range varies based on the bounds of the total power that results from the noise settings.

Range Varies based on the bounds of the total power that results from the noise settings

Key Entry Signal Power

:OUTPut:IMPairments:AWGN:SBRate

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SBRate <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SBRate?
```

This value adjusts the signal bit rate (gross bit rate) for purposes of calculating the Eb/No (energy per bit over noise power density at the receiver). Adjusting this parameter will have an immediate impact on the SNR as appropriate for the last specified Eb/No. The signal bit rate is a saved instrument state that is recorded in the waveform header for Arb waveforms.

This value is only used if [:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNRFormat is EBNO and the application currently on does not define a reference channel for Eb/No.

Range 1 bps to 999 Mbps

Key Entry Reference Signal Bit Rate

:OUTPut:IMPairments:AWGN:SNR

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNR <value>
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNR?
```

This command sets the Signal to Noise Ratio (SNR). This is the value of the noise power as a ratio of signal power to noise power. Signal power equals the total modulated signal power before noise is added. When noise is added, the power output from the signal generator may not change; it is the sum of signal power and the added noise power. This value can be changed in real time while the waveform is playing.

***RST**	0 dB
Range	-100 dB to 100 dB
Key Entry	Signal to Noise Ratio

:OUTPut:IMPairments:AWGN:SNRFormat

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNRFormat SNR|EBNO
[:SOURce]:IQ:OUTPut:IMPairments:AWGN:SNRFormat?
```

This command sets the variable controlling the ratio of signal power to noise power in the noise integration bandwidth.

SNR	Selects Signal to Noise Ratio (SNR) to control the ratio of signal power to noise power in the noise integration bandwidth.
EBNO	Selects energy per chip over noise power density at the receiver (Ec/No) to control the ratio of signal power to noise power in the noise integration bandwidth.
***RST**	SNR
Key Entry	Signal to Noise Ratio Format

:OUTPut:IMPairments:AWGN[:STATe]

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:AWGN[:STATe] ON|OFF|1|0
[:SOURce]:IQ:OUTPut:IMPairments:AWGN[:STATe]?
```

This command enables or disables the additive white Gaussian noise.

***RST**	0

Key Entry Real-Time AWGN On Off

:OUTPut:IMPairments:PHASe:NOISe:F1

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:F1 <value>
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:F1?
```

This command sets the desired start frequency offset of the flat phase noise. The actual value of f1 varies logarithmically depending on the value of the stop frequency (f2). As f2 increases in value, the adjustment becomes coarser. The effect of this value can only be determined by examining the graphic on the front panel or the actual output.

NOTE: This phase noise is added to the base phase noise of the instrument.

f1 must always be less than or equal to f2. Setting f1 higher than f2 will cause f2 to be set to the value of f1.

***RST**	1 kHz
Range	0 Hz to 77.50052449 MHz
Key Entry	Desired Start Freq(F1)

:OUTPut:IMPairments:PHASe:NOISe:F2

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:F2 <value>
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:F2?
```

This command sets the desired stop frequency offset of the flat phase noise. The actual value of f2 varies logarithmically. As f2 increases in value, the adjustment becomes coarser. The effect of this value can only be determined by examining the graphic on the front panel or the actual output.

NOTE: This phase noise is added to the base phase noise of the instrument.

f2 must always be greater than or equal to f1. Setting f2 less than f1 will cause f1 to be set to the value of f2.

***RST**	30 kHz
Range	0 Hz to 77.50052449 MHz
Key Entry	Desired Start Freq(F2)

:OUTPut:IMPairments:PHASe:NOISe:LMID

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:LMID <value>
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe:LMID?
```

This command sets the desired flat phase noise power (Lmid). The actual value can vary by approximately 0.28 dBc/Hz. The effect of this value can only be determined by examining the graphic on the front panel or the actual output.

NOTE: This phase noise is added to the base phase noise of the instrument.

***RST**	-70 dBc/Hz
Range	-300 dBc/Hz to 100 dBc/Hz The range of Lmid varies depending on the value of the stop frequency (f2). The range decreases as f2 increases.
Key Entry	Desired Flat Amplitude(Lmid)

:OUTPut:IMPairments:PHASe:NOISe[:STATe]

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe[:STATe]
ON|OFF|1|0
[:SOURce]:IQ:OUTPut:IMPairments:PHASe:NOISe[:STATe]?
```

This command enables or disables the real-time phase noise impairment.

NOTE: This phase noise is added to the base phase noise of the instrument.

The actual performance of the phase noise can only be determined by examining the graphic on the front panel or the actual output, as the parameters simply guide the phase noise response.

***RST**	0
Key Entry	Phase Noise On Off

:OUTPut[1]:TRIGger:CONTinuous[:TYPE] FREE|TRIGger

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut[1]:TRIGger:CONTinuous[:TYPE]
FREE|TRIGger
[:SOURce]:IQ:OUTPut[1]:TRIGger:CONTinuous[:TYPE]?
```

This SCPI command sets the behavior of the per output channel triggering.

FREE	With this choice, the signal will flow freely through the output channel.
TRIGger	With this choice, the output will start after a trigger is received.
***RST**	FREE

Key Entry **Free Run** **Trigger and Run**

:OUTPut[1]:TRIGger:EXTernal:DELay

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:DELay <value>
[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:DELay?
```

This command adds an external trigger delay (in seconds). The value you enter sets a delay time between when an external trigger is received and when it is applied to the signal.

This key is active only if you select external (Ext) as the trigger source.

***RST**	0 ns
Range	0 ns to 41 s
Key Entry	Ext Delay Time

:OUTPut[1]:TRIGger:EXTernal:POLarity

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:POLarity
POSitive|NEGative
[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:POLarity?
```

This command sets the polarity of the external trigger source to trigger on a positive edge or negative edge.

***RST**	POS
Key Entry	Ext Polarity Neg Pos

:OUTPut[1]:TRIGger:EXTernal:SOURce

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:SOURce
EPTRigger[1]|EPTRigger2
[:SOURce]:IQ:OUTPut[1]:TRIGger:EXTernal:SOURce?
```

Selects the trigger source for the external trigger.

EPTRigger1	This choice selects the PATT TRIG IN 1 rear panel connector (AUX I/O) as the external trigger source.
EPTRigger2	This choice selects the PATT TRIG IN 2 rear panel connector (AUX I/O) as the external trigger source.
***RST**	EPTRigger1
Key Entry	Ext Source

:OUTPut[1]:TRIGger:SOURce

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut[1]:TRIGger:SOURce KEY|BUS|EXTernal
[:SOURce]:IQ:OUTPut[1]:TRIGger:SOURce?
```

This command sets the source of a trigger to allow this output channel to play.

KEY	This choice enables triggering by pressing the front-panel **Trigger** key.
BUS	This choice enables GPIB triggering using the `*TRG` or `GET` command, or LAN and USB triggering using the `*TRG` command.
EXTernal	This choice enables the triggering by an externally applied signal specified by the :OUTPut[1]:TRIGger:EXTernal:SOURce command.
***RST**	EXT

Key Entry	**Trigger Key**	**Bus**	**Ext**

:OUTPut[1]:TRIGger:STATus

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
[:SOURce]:IQ:OUTPut[1]:TRIGger:STATus?
```

This query reports the current play status of the output channel.

Table 2-3 Trigger Status Bit Description

Bit 0 - Output is ON	
0	Output is off, triggering is inactive
1	Output is on, triggering is active
Bit 1 - Output is waiting for a trigger	
0	Output is not waiting for a trigger (playing or stopped)

Table 2-3 Trigger Status Bit Description

1	Output is waiting for a trigger (shown as “ARMED” indicator where normally the name of the application is shown)
Bit 2 - Output is running	
0	Output is currently paused or stopped
1	Output is currently playing
Bit 3 - Output has received a trigger since last trigger setup	
0	No trigger ever received
1	A trigger has been set in the past
Bit 4 - External input clock is phase locked	
0	Not phase locked
1	Phase locked
Bit 5 - Synchronization (realignment) trigger	
0	Out of Sync (shown as “NO SYNC” indicator where normally “UNLOCK” and “DAC OVER” is shown
1	In Sync
Bit 6 - MultiBoxSync waiting	
0	Not awaiting sync
1	Awaiting sync
Bit 7 - MultiBoxSync is synchronized	
0	Out of sync
1	In sync

3 System Commands

This chapter describes SCPI commands for subsystems dedicated to peripheral signal generator operations common to all Keysight X-Series signal generators.

This chapter contains the following sections:

Calibration Subsystem (:CALibration)

:ALC:MODulator:BIAS

Supported All Models

`:CALibration:ALC:MODulator:BIAS`

This command performs the ALC modulator bias calibration. The adjustment compensates for ALC open loop power drift due to temperature and humidity.

Key Entry	**Execute ALC Modulator Bias Adjustment**
Remarks	Use this calibration when the instrument is being used in the ALC open loop mode.

:BBG:SKEW RFOut|EXTernal

Supported N5172B, N5182B

`:CALibration:BBG:SKEW EXTernal, <value in pS>`

`:CALibration:BBG:SKEW? EXTernal`

This command enters a calibration value that will correct the inherent External Output I/Q skew due to differences in the I/Q physical paths.

EXTernal[1]|2:DC

Supported All Models

`:CALibration:EXTernal[1]|2:DC`

This command initiates a DC offset calibration for the external source specified.

NOTE

If the calibration is performed with a DC signal applied, any deviation provided by the DC signal will be removed and the new zero reference point will be at the applied DC level.

Key Entry	**External DC Cal**
Remarks	Use this calibration for externally applied DC signals.

:IQ:DC

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:CALibration:IQ:DC`

This command performs a one to two second adjustment that is not traceable to a standard. However, it will minimize errors associated with IQ gain, quadrature, and offset voltages. This adjustment minimizes errors for the current signal generator setting and at a single frequency. The DC adjustment is volatile and must be repeated with each signal generator setting change. This command can be sent while the RF On/Off is set to Off and the adjustment will still be valid when the RF is enabled. IQ must be on to perform this adjustment.

The I/Q DC adjustment is dependent upon a number of instrument settings. If any of the instrument settings change, the adjustment will become invalid. The dependent instrument settings are:

– RF frequency
– I/Q attenuation level
– Baseband generator settings
– I/Q polarity settings
– Baseband filter settings
– I/Q calibration (the I/Q DC calibration will be invalidated if any other I/Q calibration is executed or if the **Revert to Factory Default** key is pressed)
– Temperature (±5 degrees Celsius)
– **I/Q Off On** set to On
– **I/Q Correction Optimized Path** (must be set to **RF Output**). Refer to ":DM:CORRection:OPTimization" on page 56.
– **I/Q Source** (must be set to **Internal**). Refer to ":DM:SOURce" on page 68.

The following instrument states will not invalidate the I/Q DC calibration:

– Power level changes
– I/Q Impairments

Key Entry	**Execute Cal** (with **Calibration Type User Full** set to DC)

:IQ:DEFault

Supported	N5172B/82B

`:CALibration:IQ:DEFault`

This command will restore the original factory calibration data for the internal I/Q modulator.

Key Entry	**Revert to Default Cal Settings**

:IQ:FULL

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:CALibration:IQ:FULL`

This command performs an adjustment to the I/Q offset, gain and quadrature for the full–frequency range (regardless of the start and stop frequency settings) and stores the results in the signal generator's firmware.

This calibration should be run when the ambient temperature has varied by at least ±5 degrees Celsius from the ambient temperature at which the previous calibration was run.

Key Entry	**Execute Cal** (with **Calibration Type User Full** set to Full)
Remarks	Start and stop frequencies will default to the full frequency range of the signal generator.

:IQ:STARt

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:CALibration:IQ:STARt <value><unit>
:CALibration:IQ:STARt?
```

This command sets the start frequency and automatically sets the calibration type to User for an I/Q calibration.

The start frequency must be less than the current value of the stop frequency.

Range	Option 503: 5 MHz to 3 GHz
	Option 506: 5 MHz to 6 GHz

Key Entry	**Start Frequency**
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST.`

:IQ:STOP

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:CALibration:IQ:STOP <value><unit>
:CALibration:IQ:STOP?
```

This command sets the stop frequency and automatically sets the calibration type to User for an I/Q calibration.

The stop frequency must be greater than the current value of the start frequency.

Range	Option 503: 5 MHz to 3 GHz
	Option 506: 5 MHz to 6 GHz

Key Entry **Stop Frequency**

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:IQ:TYPE

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:CALibration:IQ:TYPE DC|USER|FULL
:CALibration:IQ:TYPE?
```

This command sets the IQ calibration type.

Key Entry **Calibration Type DC User Full**

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:IQ:[:USER]

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:CALibration:IQ[:USER]
```

This command performs a IQ calibration according to the IQ calibration type. For information on selecting the type of IQ calibration, refer to ":IQ:TYPE" on page 137.

This calibration should be run when the ambient temperature has varied by at least ±5 degrees Celsius from the ambient temperature at which the previous calibration was run.

Key Entry **Execute Cal**

Communication Subsystem (:SYSTem:COMMunicate)

NOTE The settings enabled by the LAN commands are not affected by signal generator power–on, preset, or `*RST`.

:GPIB:ADDRess

Supported All Models

```
:SYSTem:COMMunicate:GPIB:ADDRess <number>
:SYSTem:COMMunicate:GPIB:ADDRess?
```

This command sets the signal generator's GPIB address.

Range 0 to 30

Key Entry **GPIB Address**

:GTLocal

Supported All Models

```
:SYSTem:COMMunicate:GTLocal
```

This command sets the signal generator to local mode which enables front panel operation.

Key Entry **Local**

:LAN:CONFig

Supported All Models

```
:SYSTem:COMMunicate:LAN:CONFig MANual|AUTO
:SYSTem:COMMunicate:LAN:CONFig?
```

NOTE The SCPI query for the LAN setup returns the last power on state setting, which may or may not be the currently displayed setting.

This command sets the signal generator's Internet protocol (IP) address.

`MANual` The user assigns an IP address to the signal generator.

`AUTO` The network assigns an IP address to the signal generator with a fall back to Auto–IP if DHCP fails. If both DHCP and Auto–IP fail, manual configuration will be used.

Example

```
:SYST:COMM:LAN:CONF DHCP
```

The preceding example sets up the signal generator LAN configuration to use a DHCP IP address.

Key Entry **LAN Config**

Remarks The SCPI query returns the current setting, not the saved setting.

:LAN:DEFaults

Supported All Models

`:SYSTem:COMMunicate:LAN:DEFaults`

This command restores the instrument's LAN settings to their factory default values.

Key Entry **Restore LAN Settings to Default Values**

Key Path **Utility > I/O Config > Lan Setup > Advanced Settings > More 2 of 2 > Restore LAN Settings to Default Values**

:LAN:DESCription

Supported All Models

```
:SYSTem:COMMunicate:LAN:DESCription <string>
:SYSTem:COMMunicate:LAN:DESCription?
```

This command defines the instrument's web description. The query returns the current saved setting.

Remarks If queried and there is no current LAN description the default web description value is returned.

LAN description is displayed on the homepage for the Keysight MXG.

:LAN:DHCP:EXPires

Supported All Models

`:SYSTem:COMMunicate:LAN:DHCP:EXPires`

This command returns a string indicating the time at which the current DHCP lease expires or an empty string if no DHCP lease was acquired.

Remarks Only relevant when the instrument's LAN configuration type has been set to Auto.

:LAN:DHCP:OBTained

Supported All Models

`:SYSTem:COMMunicate:LAN:DHCP:OBTained`

This command returns a string indicating the time at which the current DHCP lease was obtained or an empty string if no DHCP lease was acquired.

Remarks	Only relevant when the instrument's LAN configuration type has been set to Auto.

:LAN:DHCP:SERVer

Supported	All Models.

`:SYSTem:COMMunicate:LAN:DHCP:SERVer`

This command returns a string containing the IP address of the DHCP server that has provided the current lease or an empty string if no DHCP lease was acquired.

Remarks	Only relevant when the instrument's LAN configuration type has been set to Auto.

:LAN:DNS:DYNamic

Supported	All Models

```
:SYSTem:COMMunicate:LAN:DNS:DYNamic ON|OFF|1|0
:SYSTem:COMMunicate:LAN:DNS:DYNamic?
```

This command turns dynamic Domain Name System (DNS) on/off. The query returns the current setting, not the saved setting.

Default	On
Key Entry	**Dynamic DNS Off On**
Key Path	**Utility > I/O Config > LAN Setup > Advanced Settings > Dynamic Hostname Services > Dynamic DNS Off On**

:LAN:DNS[:SERVer]

Supported	All Models

```
:SYSTem:COMMunicate:LAN:DNS[:SERVer] <ipstring>
:SYSTem:COMMunicate:LAN:DNS[:SERVer]?
```

This command defines the IP address of the signal generator DNS server. This entry defines the DNS server for the signal generator LAN connection. The query returns the current setting, not the saved setting.

Key Entry	**DNS Server**

:LAN:DOMain

Supported	All Models

```
:SYSTem:COMMunicate:LAN:DOMain <string>
:SYSTem:COMMunicate:LAN:DOMain?
```

This command defines the domain name of the signal generator’s DNS server. This entry defines the DNS server for the signal generator LAN connection. The query returns the current setting, not the saved setting.

Key Entry	**Domain Name**

:LAN:GATeway

Supported	All Models

```
:SYSTem:COMMunicate:LAN:GATeway "<ipstring>"
:SYSTem:COMMunicate:LAN:GATeway?
```

This command sets the gateway for local area network (LAN) access to the signal generator from outside the current sub–network. The query returns the current setting, not the saved setting.

Key Entry	**Default Gateway**
Remarks	Using an empty string restricts access to the signal generator to local hosts on the LAN.

:LAN:HOSTname

Supported	All Models

```
:SYSTem:COMMunicate:LAN:HOSTname "<string>"
:SYSTem:COMMunicate:LAN:HOSTname?
```

This command sets the signal generator’s local area network (LAN) connection hostname. The query returns the current setting, not the saved setting.

Key Entry	**Hostname**

:LAN:IDENtify

Supported	All Models

```
:SYSTem:COMMunicate:LAN:IDENtify ON|OFF|1|0
```

This command controls the LAN identify feature.

ON (1)	The command enables device identification by displaying the full–screen message "Identify: <IP Address>" on the signal generator's front panel; the LAN Status indicator will also show "IDENTIFY". For more information, refer to the Programming Guide.

OFF (0)	This command disables device identification by clearing the message on the signal generator's front panel and returning the LAN Status indicator to display the current network state. For more information, refer to the Programming Guide.

:LAN:IP

Supported	All Models

```
:SYSTem:COMMunicate:LAN:IP "<ipstring>"
:SYSTem:COMMunicate:LAN:IP?
```

This command sets the signal generator’s local area network (LAN) internet protocol (IP) address for your IP network connection.

Key Entry	**IP Address**

:LAN:MDNS

Supported	All Models

```
:SYSTem:COMMunicate:LAN:MDNS ON|OFF|1|0
:SYSTem:COMMunicate:LAN:MDNS?
```

This command enables or disables the multicast (mDNS) and DNS service discovery (DNS-SD) services. The query returns the current setting.

Default	On
Key Entry	**mDNS/DNS-SD Off On**
Key Path	**Utility > I/O Config > LAN Setup > Advanced Settings > Dynamic Hostname Services > mDNS/DNS-SD Off On**

:LAN:RESTart

Supported All Models

```
:SYSTem:COMMunicate:LAN:RESTart
```

This command restarts the network to enable changes that have been made to the LAN setup.

Key Entry	**Proceed With Reconfiguration**
Key Path	**Utility** > **I/O Config** > **Lan Setup** > **Proceed With Reconfiguration**

:LAN:SUBNet

Supported All Models

```
:SYSTem:COMMunicate:LAN:SUBNet "<ipstring>"
:SYSTem:COMMunicate:LAN:SUBNet?
```

This command sets the signal generator’s local area network (LAN) subnet mask address for your internet protocol (IP) network connection.

NOTE An error will occur if the IP address, Gateway, and subnet mask have conflicting settings.

Key Entry	**Subnet Mask**
Remarks	The SCPI query returns the current setting, not the saved setting.

Diagnostic Subsystem (:DIAGnostic[:CPU]:INFOrmation)

:CCOunt:ATTenuator

Supported All Models

`:DIAGnostic[:CPU]:INFormation:CCOunt:ATTenuator?`

This query returns the cumulative number of times that the attenuator has been switched.

Key Entry **Diagnostic Info**

:CCOunt:PON

Supported All Models

`:DIAGnostic[:CPU]:INFormation:CCOunt:PON?`

This query returns the cumulative number of times the signal generator has been powered–on.

Key Entry **Diagnostic Info**

:CCOunt:PROTection

Supported All Models

`:DIAGnostic[:CPU]:INFormation:CCOunt:PROTection?`

This query returns the cumulative number of times the reverse power protection has been cycled.

Key Entry **Diagnostic Info**

:DISPlay:OTIMe

Supported All Models

`:DIAGnostic[:CPU]:INFormation:DISPlay:OTIMe?`

This query returns the cumulative number of hours the display has been on.

Key Entry **Diagnostic Info**

:LICense:AUXiliary

Supported All Models

`:DIAGnostic[:CPU]:INFormation:LICense:AUXiliary?`

This query returns a list of licenses for software applications associated with the signal generator that have the software license file installed on the PC, as opposed to a license key installed on the signal generator. This query includes calibration software licenses but does not return demo licenses for Arb–based applications.

Key Entry	**Auxiliary Software Options**
Remarks	If you use the signal generator with a PC that has a copy of a software application for which a license shows with this query, the software automatically accesses and installs the license on the PC. To access Arb–based demo software licenses, see :LICense:WAVeform. To view option numbers for software applications that use license keys, see ":OPTions" on page 146.

:LICense:WAVeform

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:DIAGnostic[:CPU]:INFormation:LICense:WAVeform?
```

This query returns a list of Arb–based licenses (including demo) for software applications associated with the signal generator that have the software license file installed on the PC, as opposed to a license key installed on the signal generator. These waveform licenses are created by the software application in a license file on the PC. Refer to ":WLICence[:VALue]" on page 147 for more information.

The response format is a series of comma separated entries enclosed in quotation marks. The first field is the waveform type number and the second is a text description of the license.

Key Entry	**Waveform Licenses**
Remarks	If a license appears in this list, this means that you can transfer waveform files, created with the associated Arb–based software application to another signal generator if the other signal generator has the same license. For a list of option numbers for software applications that use license keys, see ":OPTions".

:OPTions

Supported All Models

`:DIAGnostic[:CPU]:INFormation:OPTions?`

This query returns a comma separated list of internally installed signal generator options.

Key Entry **Instrument Options**

:OPTions:DETail

Supported All Models

`:DIAgnostic[:CPU]:INFormation:OPTions:DETail?`

This query returns the options that are installed along with the option revision and DSP version if applicable.

Key Entry **Options Info**

:OTIMe

Supported All Models

`:DIAGnostic[:CPU]:INFormation:OTIMe?`

This query returns the cumulative number of hours that the signal generator has been on.

Key Entry **Diagnostic Info**

:REVision

Supported All Models

`:DIAGnostic[:CPU]:INFormation:REVision?`

This query returns the CPU bootstrap read only memory (boot ROM) revision date. In addition, the query returns the revision, creation date, and creation time of the main firmware.

Key Entry **Diagnostic Info**

:SDATe?

Supported All Models

`:DIAGnostic[:CPU]:INFormation:SDATe?`

This query returns the date and time of the firmware revision.

Key Entry **Diagnostic Info**

:WLICence[:VALue]

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:DIAGnostic[:CPU]:INFormation:WLIcense[:VALue]? <type_num>`

This query returns the number of seconds remaining on the waveform license for the type of waveform designated by the <type_num> variable number. The type variable number is obtained using the :LICense:WAVeform command shown on page 145. Zero is returned for non–existent and expired licenses. The value 2^32 –1 (4,294,967,295) is returned for licenses that do not expire.

Display Subsystem (:DISPlay)

:ANNotation:AMPLitude[:STATe]

Supported All Models

```
:DISPlay:ANNotation:AMPLitude[:STATe] ON|OFF|1|0
:DISPlay:ANNotation:AMPLitude[:STATe]?
```

This command enables or disables the amplitude annotation secure display mode. See also, ":ANNotation:FREQuency[:STATe]" on page 148 and ":SECurity:DISPlay:RESTricted" on page 238.

On(1) This selection turns off the displayed amplitude security, and the amplitude annotation is visible.

OFF(0) This selection turns on the displayed amplitude security and the amplitude annotation is blanked on the signal generator's display. Also, the keys that access the amplitude, sweep, and user flatness information are disabled.

For more information about security functions, refer to the **User's Guide**.

:ANNotation:AMPLitude:UNIT

Supported All Models

```
:DISPlay:ANNotation:AMPLitude:UNIT
DBM|DBUV|DBUVEMF|V|VEMF|DB
:DISPlay:ANNotation:AMPLitude:UNIT?
```

This command sets the displayed front-panel amplitude units.

If the amplitude reference state is set to on, the query returns units expressed in dB. Setting any other unit will cause a setting conflict error stating that the amplitude reference state must be set to off. Refer to, ":REFerence:STATe" on page 116 for more information.

***RST** DBM

:ANNotation:FREQuency[:STATe]

Supported All Models

```
:DISPlay:ANNotation:FREQuency[:STATe] ON|OFF|1|0
:DISPlay:ANNotation:FREQuency[:STATe]?
```

This command enables or disables the frequency annotation secure display mode. See also, ":ANNotation:AMPLitude[:STATe]" on page 148 and ":SECurity:DISPlay:RESTricted" on page 238.

ON (1) This selection turns off the displayed frequency security, and the frequency annotation is visible.

OFF (0)	This selection turns on the displayed frequency security and the frequency annotation is blanked on the signal generator's display. Also, the keys that access the frequency, sweep, and user flatness information are disabled.

For more information about security functions, refer to the **User's Guide**.

***RST**	**Activate Restricted Display**

:ANNotation:CLOCk:DATE:FORMat

Supported	All Models

```
:DISPlay:ANNotation:CLOCk:DATE:FORMat MDY|DMY
:DISPlay:ANNotation:CLOCk:DATE:FORMat?
```

This command enables the selection of the date format. The choices are month–day–year (MDY) or day–month–year (DMY) format.

Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:ANNotation:CLOCk[:STATe]

Supported	All Models

```
:DISPlay:ANNotation:CLOCk[:STATe] ON|OFF|1|0
:DISPlay:ANNotation:CLOCk[:STATe]?
```

This command enables or disables the digital clock view in the lower right side of the front-panel display.

Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:BRIGhtness

Supported	All Models

```
:DISPlay:BRIGhtness <value>
:DISPlay:BRIGhtness?
```

This command sets the display brightness (intensity). The brightness can be set to the minimum level (0.02), maximum level (1), or in between by using fractional numeric values (0.03–0.99).

Range	0.02 to 1
Key Entry	**Brightness**
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:CAPTure

Supported All Models

`:DISPlay:CAPTure`

This event command enables the user to capture the current display and store it in the signal generator's memory.

Remarks The display capture is stored as DISPLAY.BMP in the Binary Directory file system. This file is overwritten with each subsequent display capture. The file can be down–loaded in the following manner:

1. Log on to the signal generator using ftp.
2. Change (cd) to the BIN directory.
3. Retrieve the file by using the GET command or by using the :MEM:DATA query on page 165.

:CMAP:DEFault

Supported All Models

`:DISPlay:CMAP:DEFault [<palette:BRIGht|DARK|MONOchrome>]`

This command selects the color palette for the instrument display.

Key Entry	Bright Color	Dark Color	Monochrome

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:REMote

Supported All Models

```
:DISPlay:REMote ON|OFF|1|0
:DISPlay:REMote?
```

This command enables or disables the display updating when the signal generator is remotely controlled.

ON (1) This choice updates the signal generator display (Text Area) so you can see the settings as the commands are executed, however, this will degrade the signal generator speed. Frequency Area, Amplitude Area, and status LEDs continue to update. For more information on the front-panel display description, refer to the **User's Guide**.

OFF (0)	This choice turns off the display (Text Area) updating while further optimizing the signal generator for speed. No Text Area updates occur but the Frequency Area, Amplitude Area, and status LEDs continue to update. For more information on the front-panel display description, refer to the **User's Guide**.
Key Entry	**Update in Remote Off On**
Remarks	The setting enabled by this command is not affected by signal generator preset or `*RST`. However, cycling the signal generator power will reset it to zero.

[:WINDow][:STATe]

Supported All Models

```
:DISPlay[:WINDow][:STATe] ON|OFF|1|0
:DISPlay[:WINDow][:STATe]?
```

This command is used to either blank out (OFF or 0) the display screen or turn it on (ON or 1).

Remarks *RST and presetting the signal generator or cycling the power will turn the display on.

IEEE 488.2 Common Commands

*CLS

Supported All Models

*CLS

The Clear Status (CLS) command clears the status byte by emptying the error queue and clearing all the event registers including the Data Questionable Event Register, the Standard Event Status Register, the Standard Operation Status Register and any other registers that are summarized in the status byte.

*ESE

Supported All Models

*ESE <data>

The Standard Event Status Enable (ESE) command sets the Standard Event Status Enable Register.

The variable <data> represents the sum of the bits that will be enabled.

Range 0 to 255

Remarks The setting enabled by this command is not affected by signal generator preset or *RST. However, cycling the signal generator power will reset this register to zero.

Refer to the **Programming Guide** for more information.

*ESE?

Supported All Models

*ESE?

The Standard Event Status Enable (ESE) query returns the value of the Standard Event Status Enable Register.

Remarks Refer to the **Programming Guide** for more information.

*ESR?

Supported All Models

CAUTION This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

*ESR?

The Standard Event Status Register (ESR) query returns the value of the Standard Event Status Register.

Remarks Refer to the **Programming Guide** for more information.

*IDN?

Supported All Models

`*IDN?`

The Identification (IDN) query outputs an identifying string. The response will show the following information:

`<company name>, <model number>, <serial number>, <firmware revision>`

Key Entry **Diagnostic Info**

Remarks The identification information can be modified. Refer to :SYST:IDN on page 216 for more information.

*OPC

Supported All Models

`*OPC`

The Operation Complete (OPC) command sets bit 0 in the Standard Event Status Register when all pending operations have finished.

*OPC?

Supported All Models

`*OPC?`

The Operation Complete (OPC) query returns the ASCII character 1 in the Standard Event Status register indicating completion of all pending operations.

This query stops any new commands from being processed until the current processing is complete. This command blocks the controller until **all** operations are complete (i.e. the timeout setting should be longer than the longest sweep).

CAUTION The *OPC? query is not recommended for checking if a previous command has been completed by the SCPI parser. (e.g. If the *OPC? query is waiting for a sweep or arb generation that is pending, it could potentially hang the *OPC? query for an undefined extended or even indefinite period of time.)

*OPT?

Supported All Models

`*OPT?`

The options (OPT) query returns a comma separated list of all of the instrument options currently installed on the signal generator.

Key Entry	**Instrument Options**

*PSC

Supported	All Models

`*PSC ON|OFF|1|0`

The Power–On Status Clear (PSC) command controls the automatic power–on clearing of the Service Request Enable Register, the Standard Event Status Enable Register, and device–specific event enable registers.

ON (1)	This choice enables the power–on clearing of the listed registers.
OFF (0)	This choice disables the clearing of the listed registers and they retain their status when a power–on condition occurs.
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

*PSC?

Supported	All Models

`*PSC?`

The Power–On Status Clear (PSC) query returns the flag setting as enabled by the `*PSC` command.

*RCL

Supported	All Models

`*RCL <reg>,<seq>`

The Recall (RCL) command recalls the state from the specified memory register <reg> of the specified sequence <seq>.

Range	Registers: 0 to 99	Sequences: 0 to 9
Key Entry	**RECALL Reg**	**Select Seq:**

*RST

Supported	All Models

`*RST`

The Reset (RST) command resets most signal generator functions to factory–defined conditions.

Remarks Each command shows the *RST value if the setting is affected.

The settings enabled by this command is not affected by a signal generator power–on, preset, or *RST.

*RST uses the factory preset state which is better for automated testing, for example sweep mode is set to single.

For a comparison of the SCPI preset commands, refer to Table , “The defined conditions are either factory– or user-defined.,” on page 231.

*SAV

Supported All Models

`*SAV <reg>,<seq>`

The Save (SAV) command saves signal generator settings to the specified memory register <reg> of the specified sequence <seq>.

Range	**Registers**: 0 to 99	**Sequences**: 0 to 9
Key Entry	**Save Reg**	**Save Seq[n] Reg[nn]**

Remarks The save function does not save all signal generator settings. Refer to the **User’s Guide** for more information on the save function. Refer to “*RCL” on page 154 for information on recalling saved signal generator settings.

*SRE

Supported All Models

`*SRE <data>`

The Service Request Enable (SRE) command sets the value of the Service Request Enable Register.

The variable <data> is the decimal sum of the bits that will be enabled. Bit 6 (value 64) is ignored and cannot be set by this command.

Range 0 to 255

Remarks Refer to the **Programming Guide** for more information.

Entering values from 64 to 127 is equivalent to entering values from 0 to 63.

The setting enabled by this command is not affected by signal generator preset or *RST. However, cycling the signal generator power will reset it to zero.

*SRE?

Supported All Models

*SRE?

The Service Request Enable (SRE) query returns the value of the Service Request Enable Register.

Range 0 to 63 or 128 to 191

Remarks Refer to the **Programming Guide** for more information.

*STB?

Supported All Models

*STB?

The Read Status Byte (STB) query returns the value of the status byte including the master summary status (MSS) bit.

Range 0 to 255

Remarks Refer to the **Programming Guide** for more information.

*TRG

Supported All Models

*TRG

The Trigger (TRG) command triggers the device if BUS is the selected trigger source, otherwise, *TRG is ignored.

*TST?

Supported	All Models

`*TST?`

The Self–Test (TST) query initiates the internal self–test and returns one of the following results:

`0`	This shows that all tests passed.
`1`	This shows that one or more tests failed.
Key Entry	**Run Complete Self Test**

*WAI

Supported	All Models

`*WAI`

The Wait–to–Continue (WAI) command causes the signal generator to wait until all pending commands are completed, before executing any other commands.

Memory Subsystem (:MEMory)

:CATalog:BINary?

Supported All Models

`:MEMory:CATalog:BINary?`

This query outputs a list of the binary files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name>,<file type>,<file size>"`

Example Output

`1818624,519962624,"GEN_FILE11,BIN,5"`

Key Entry **Binary**

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:CATalog:BIT

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:CATalog:BIT?`

This command outputs a list of the bit files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name,file type,file size>"`

Key Entry **Bit**

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:CATalog:DMOD

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:CATalog:DMOD?`

This command outputs a list of the arbitrary waveform digital modulation files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name,file type,file size>"`

Key Entry **DMOD**

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:CATalog:FIR

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:CATalog:FIR?`

This command outputs a list of the finite impulse response filter (FIR) files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name,file type,file size>"`

Key Entry **FIR**

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:CATalog:FSK?

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:CATalog:FSK?`

This command outputs a list of the frequency shift keying (FSK) files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name,file type,file size>"`

Key Entry	**FSK**
Remarks	Refer to "File Name Variables" on page 43 for information on the file name syntax.

:CATalog:IQ?

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:CATalog:IQ?`

This query outputs a list of the Inphase and Quadrature (I/Q) files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name>,<file type>,<file size>"`

Key Entry	**I/Q**
Remarks	Refer to File Name Variables for information on the file name syntax.

:CATalog:LIST?

Supported	All Models

`:MEMory:CATalog:LIST?`

This query outputs a list of the list sweep files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name>,<file type>,<file size>"`

Example Output

`1818624,519962624,"LAST,LIST,122","LIST10,LIST,69"`

Key Entry	**List**

Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:MDMod

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:CATalog:MDMod?`

This command outputs a list of the arbitrary waveform multi carrier digital modulation files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name,file type,file size>"`

Key Entry **MDMOD**

Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:MTONe

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:CATalog:MTONe?`

This command outputs a list of the arbitrary waveform multitone files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name,file type,file size>"`

Key Entry **MTONE**

Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:PTRain?

Supported All with Options UNW and 320

`:MEMory:CATalog:PTRain?`

This command lists all files of the pulse train files stored in the non-volatile storage.

:CATalog:SEQ?

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:CATalog:SEQ?`

This query outputs a list of the arbitrary waveform sequence files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name>,<file type>,<file size>"`

Example Output

`1818624,519962624,"SEQ1_TEST,SEQ,206","SEQ_TEST,SEQ,169"`

Key Entry **SEQ**

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:CATalog:SHAPe

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:CATalog:SHAPe?`

This command outputs a list of the burst shape files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name,file type,file size>"`

Key Entry **SHAPE**

Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:CATalog:STATe?

Supported All Models

`:MEMory:CATalog:STATe?`

This query outputs a list of the state files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name,file type,file size>"`

Example Output

`1818624,519962624,"0_00,STAT,641"`

Key Entry **State**

Remarks Refer to File Name Variables for information on the file name syntax.

The `:MEM:CAT:STAT` command requires the use of registry number and sequence number variables. The ranges are 0 to 99 for <reg_num> and 0 to 9 for <seq_num>.

:CATalog:UFLT?

Supported All Models

`:MEMory:CATalog:UFLT?`

This query outputs a list of the user–flatness correction files. The return data will be in the following form:

`<mem used>,<mem free>,"<file listing>"`

The signal generator will return the two memory usage parameters and as many file listings as there are files in the directory list. Each file listing parameter will be in the following form:

`"<file name,file type,file size>"`

Example Output

`1818624,519962624,"FLAT_1,UFLT,16","LAST,UFLT,16"”`

Key Entry **User Flatness**

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:CATalog[:ALL]?

Supported All Models

```
:MEMory:CATalog[:ALL]?
```

This query outputs a list of all the files in the memory subsystem. However it does not include files stored on the Option 653, 655, 656, or 657 baseband generator. The return data will be in the following form:

```
<mem used>,<mem free>,"<file listing>"
```

The signal generator will return the two memory usage parameters and as many file listings as there are files in the memory subsystem. Each file listing parameter will be in the following form:

```
"<file name,file type,file size>"
```

Example Output

```
1818624,519962624,0_00@STATE,STAT,641","0_01@STATE,STAT,669"
,"A@NVHDR,NVHDR,132","A@NVMKR,NVMKR,0","A@NVWFM,NVWFM,9","CO
PY12@STATE,STAT,669","FLAT_1@USERFLAT,UFLT,16","GEN_FILE11@B
INARY,BIN,5","LAST@LIST,LIST,122","LAST@USERFLAT,UFLT,16","P
ERSISTENT@STATE,STAT,1056",SEQ1_TEST@SEQ,SEQ,206
```

Key Entry **All**

Remarks Refer to the Table 1-3 on page 45 for a listing of the file types and the table on page 46 for information on the "<file name>" syntax.

:COPY[:NAME]

Supported All Models

```
:MEMory:COPY[:NAME] "<file name>","<file name>"
```

This command makes a duplicate of the requested file.

Key Entry **Copy File**

Remarks Refer to File Name Variables for information on the file name syntax.

When copying a waveform file from volatile to non–volatile memory, the marker file and file header, associated with the waveform file, will automatically be copied at the same time.

:DATA

Supported All Models

```
:MEMory:DATA "<file_name>",<data_block>
:MEMory:DATA? "<file_name>"
```

This command loads data into signal generator memory using the <data_block> parameter and saves the data to a file designated by the "<file_name>" variable. The query returns the file contents of the file as a datablock.

A waveform file must be located in volatile waveform memory (WFM1) before it can be played by the signal generator's dual ARB player.

For downloads directly into volatile waveform memory (WFM1) use the path "WFM1:<file_name>". For downloads to non–volatile waveform memory, use the path "NVWFM:<file_name>".

`"<file_name>"` This variable names the destination file, including the directory path.

`<data_block>` This parameter represents the data and file length parameters. The data in the file is represented by the <data_block> variable.

Refer to the **Programming Guide** for more information on programming the status registers.

Example

```
:MEM:DATA "NVWFM:IQ_Data",#210Qaz37pY9oL
```

The preceding example downloads 10 bytes of data to a file, IQ_Data, in the signal generator's non–volatile memory. The table shown below describes the command parameters.

– "NVWFM:IQ_Data"	**IQ_Data is the file name. The directory path is not needed. The path "/USER/WAVEFORM/" is implied.**
– #210Qaz37pY9oL	Data block
#	This character indicates the beginning of the data block
2	Number of digits in the byte count
10	Byte count
Qaz37pY9oL	10 bytes of data

NOTE The data, `Qaz37pY9oL`, in the above command are not valid and are shown for example purposes only. Typically, ASCII characters representing data are unprintable.

Remarks See File Name Variables for information on the file name syntax.

:DATA:APPend

Supported All Models

`:APPend "<file_name>",<data_block>`

This commands appends data to an existing file stored in signal generator memory.

"<file_name>" This variable names the destination file and directory path.

`<data_block>` This parameter represents the data and file length parameters. The data in the file is represented by the <data_block> variable. The file length parameters are used
by the signal generator for allocating memory.

Refer to the **Programming Guide** for more information on downloading and using files.

Example

`:MEM:DATA:APPend "NVWFM:IQ_Data",#14Y9oL`

The preceding example downloads and appends the data, Y9oL, to an existing file named IQ_Data stored in the signal generator's non–volatile memory (NVWFM).

– "NVWFM:IQ_Data"	**IQ_Data the file name. The directory path is not needed. The path "/USER/WAVEFORM/" is implied.**
– #14Y9oL	Data block
`#`	This character indicates the beginning of the data block
`1`	Number of digits in the byte count
`4`	Byte count
`Y9oL`	4 bytes of data

Remarks Refer to File Name Variables for information on the file name syntax.

:DATA:BIT

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:MEMory:DATA:BIT <"filename">,<bit_count>,<datablock>
:MEMory:DATA:BIT? <"filename">
```

This command loads bit data into signal generator memory using the <bit_count> and <datablock> parameters and saves the data to a file designated by the <"filename"> variable. The query returns the bit count, file length information, and the data.

<"filename">	This variable names the destination file and the directory path.
<bit_count>	This number represents the number of bits in the data block.
`<datablock>`	This parameter represents the data and file length parameters. The data in the file is represented by the `<datablock>` variable. The file length parameters are used by the signal generator for allocating memory.

Refer to the **Programming Guide** for more information on downloading and using files.

Example

```
:MEM:DATA:BIT "Test_Data",16,#12Qz
```

The preceding example downloads bit data to the file, Test_Data. The table below describes the command parameters.

– "Test_Data"	Test_Data is the file name. The directory path is not needed. The path "/USER/BIT/" is implied.
– 16	Number of bits in the data block
– #12Qz	Data block
`#`	This character indicates the beginning of the data block
`1`	Number of digits in the byte count
`2`	Byte count
`Qz`	16 bits of data (ascii representation of bit data)

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:DATA:BIT:INSert

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:MEMory:DATA:BIT:INSert
"<filename>",<bitOffset>,<bitCount>,<datablock>
```

This command inserts a specified number of bits at a specified bit offset in a bit file.

"<filename>" This variable names the destination file and the directory path.

<bitOffset> This number represents a value between 0 and a value that will fill all of the available memory. This is where the <bitCount> bits of the data in the <datablock> will be inserted. If the <bitOffset> is greater than the current file length, then zero bits will fill the file from the current length in bits to the <bitOffset>.

<bitCount> This number represents the number of bits in the data block.

`<datablock>` This parameter represents the data to be inserted into the file.

Refer to the **Programming Guide** for more information on downloading and using files.

Example

```
:MEM:DATA:BIT:INS "Test_Data",7,16,#12Qz
```

The preceding example inserts bit data at the 7th bit of the file, Test_Data. The table below describes the command parameters.

– "Test_Data"	Test_Data is the file name. The directory path is not needed. The path "/USER/BIT/" is implied.
– 7	The offset in bits to insert the data in the data block
– 16	Number of bits in the data block
– #12Qz	Data block
#	This character indicates the beginning of the data block
1	Number of digits in the byte count
2	Byte count
Qz	16 bits of data (ascii representation of bit data)

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:DATA:FIR

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:MEMory:DATA:FIR
"<file_name>",[REAL|COMPlex],osr,coefficients
:MEMory:DATA:FIR?"<file_name>"
```

This command loads user–defined finite impulse response (FIR) coefficient data, with a given oversample ratio (OSR), into a file in the signal generator's non–volatile memory. The query returns the oversample ratio and coefficient data.

"<file_name>"	This variable is the file name of the destination file. The directory path, `/USER/FIR` is not required as it is implied by the command.
REAL	Filter with real coefficients which are applied to I and Q equally. These coefficients are in the time domain and are supplied by the user. This type of filter is selectable as either a modulation filter or an equalization filter.
COMPlex	Filter with complex I and Q samples (I + jQ) that are applied to the I/Q signal in a complex manner, as in (I + jQ)*(I + jQ). These coefficients are in the time domain and are supplied by the user. This type of filter is only selectable by the equalization filter feature.
osr	The OSR is the number of filter taps per symbol. For an equalization filter, the OSR must always be 1 and the filter coefficients must be sampled at 200MHz. For a modulation filter, the OSR must be ≥2 and the filter rate must be sampled at 2 times the OSR.
coefficients	This variable is the set of FIR coefficients. The maximum number of taps is 1024. For COMPlex filters, the coefficients alternate between the real and imaginary values. There can be 2048 coefficients for COMPlex filters. The equalization filter is limited to 256 taps.

Refer to the **Programming Guide** for more information on downloading and using files.

Example

```
:MEM:DATA:FIR
"FIR_1",4,0,0,0,0,0,0.000001,0.000012,0.000132,
0.001101,0.006743,0.030588,0.103676,0.265790,0.523849,0.8095
08,1,1,
0.809508,0.523849,0.265790,0.103676,0.030588,0.006743,0.0011
01,0.000132,0.000012,0.000001,0,0,0,0,0
```

The preceding example downloads real FIR coefficients with an oversampling ratio of 4 to the signal generator's non–volatile memory in a file named FIR_1. Notice that the signal generator directory path, `/USER/FIR`, is not needed as it is implied by the command. Refer to File Name Variables for information on the file name syntax.

Example 2

```
:MEM:DATA:FIR "EQ_1",COMP,1,0,0.000001,0.000145,
0.000035,1,0,-0.000256,0.000016,0.000001,0
```

The preceding example downloads complex FIR coefficients with an OSR 1 as file "EQ_1". This file is suitable for use as an equalization filter.

Range	**osr:** 1 to 32
	coefficient: –1000 to 1000

Key Entry Oversample Ratio

:DATA:FSK

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:MEMory:DATA:FSK
"<file_name>",<num_states>,<f0>,<f1>,...<f(n)>
[,<diff_state>,<num_diff_states>,<diff1>,...<diff(n)>]
:MEMory:DATA:FSK? "<file_name>"
```

This command loads custom frequency shift keying (FSK) data into a file in the signal generator's non-volatile memory.

The query returns data in the following form:

```
<num_states>,<f0>,<f1>,...<f(n)>,<diff_state>,<num_diff_stat
es>,<diff1>,...<diff(n)>
```

"<file_name>"	This variable string identifies the name of the FSK file. The filename must be enclosed with quotation marks.
<num_states>	This variable identifies the number of frequency states.
<f0>	This variable identifies the value of the first frequency state.
<f1>,...<f(n)>	This variable identifies the value of the second and subsequent frequency states with a frequency resolution of 0.1Hz.
<diff_state>	This variable enables or disables differential encoding.
<num_diff_states>	This variable identifies the number of differential states.

<diff0> This variable identifies the value of the first differential state.

<diff1>,...<diff(n)> This variable identifies the value of the second and subsequent differential states.

Refer to the **Programming Guide** for more information on downloading and using files.

Example

```
:MEM:DATA:FSK "4FSK",4,–2kHZ,–1kHZ,2kHZ,1kHZ,ON,2,1,0
```

The preceding example downloads a four-level FSK data to a file named `4FSK`. There are four states (frequencies): –2kHZ, –1kHZ, 2kHZ, 1kHZ; differential encoding is toggled ON, and there are two differential states 1 and 0. The table shown below describes the command parameters.

– **"4FSK"**	**4FSK is the FSK file name. The directory path is not needed. The path "/USER/FSK" is implied.**
– 4	Number of states
-2kHz	First frequency state
-1kHz	Second frequency state
2kHz	Third frequency state
1kHz	Fourth frequency state
ON	Differential encoding is on
2	Number of differential states
1	Value of the first differential state.
0	Value of the second differential state.

Range

num_diff_states: 0–256

num_states: 2–16

f0–f(n): –20MHZ to 20MHZ (**For ARB custom modulation, the range values vary with the symbol rate values**.)

diff0–diff(n): –128 to 127

Remarks Refer to File Name Variables for information on the file name syntax.

:DATA:IQ

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

:MEMory:DATA:IQ

```
:MEMory:DATA:IQ
"<file_name>",<offsetQ>,<num_states>,<i0>,<q0>,<i1>,
<q1>,...<i(n)>,<q(n)>[,<diff_state>,<num_diff_states>,<diff0
>,<diff1>,..<diff(n)>]
:MEMory:DATA:IQ? "<file_name>"
```

This command loads custom I/Q data into a file in the signal generator's non-volatile memory.

The query returns data in the following form:

```
<offsetQ>,<num_states>,<i0>,<q0>,<i1>,<q1>,...<i(n)>,<q(n)>,
<diff_state>,<num_diff_states>,<diff0>,<diff1>,...<diff(n)>
```

"<file_name>"	This variable string identifies the name of the I/Q file. The filename must be enclosed with quotation marks.
<offsetQ>	This variable enables (1) or disables (0) the Q output delay by 1/2 symbol from the I output.
<num_states>	This is the number of symbols.
<i0>...<i(n)>	This is the I value of the first and subsequent I symbols.
<q0>...<q(n)>	This is the Q value of the first and subsequent Q symbols.
<diff_state>	This variable enables and disables differential encoding.
<num_diff_states>	This variable identifies the number of differential states.
<diff0>	This variable identifies the value of the first differential state.
<diff1,...diff(n)>	This variable identifies the value of the second and subsequent differential states.

Refer to the **Programming Guide** for more information on downloading and using files.

Example

```
:MEM:DATA:IQ "Test_BPSK",1,2,1,0,0,0
```

The preceding example loads and stores a two-symbol I/Q file named `Test_BPSK` that has a Q offset. The table shown below describes the command parameters.

– "Test_BPSK"	**Test_BPSK is the file name. The directory path is not needed. The path "`/USER/IQ`" is implied.**
– 1	Q Offset. The Q output delay is enabled.
– 2	Number of symbols
– 1	Value of the first I symbol
– 0	Value of the first Q symbol.

– "Test_BPSK"	**Test_BPSK is the file name. The directory path is not needed. The path "/USER/IQ" is implied.**
– 0	Value of the second I symbol
– 0	Value of the second Q symbol

Range	num_states:	2–1024
	i0–i(n):	–1 to 1
	q0–q(n):	–1 to 1
	num_diff_states:	0–256
	diff0–diff(n):	-128 to 127

Remarks Refer to “File Name Variables” on page 43 for information on the file name syntax.

:DATA:PRAM:FILE:BLOCk

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DATA:PRAM:FILE:BLOCk "<file_name>", <data_block>`

This command loads block-formatted data directly into pattern RAM volatile memory (WFM1). Pattern RAM memory describes how memory (WFM1) is used and is not a distinct piece of memory. A PRAM file is specified as an array of bytes.

"<file_name>" This variable names the destination file. No directory path name is needed.

`<data_block>` This parameter represents the data and file length parameters. The data in the file is represented by the `<data_block>` variable. The file length parameters are used
by the signal generator for allocating memory.

Pattern Ram files are binary files downloaded directly into waveform memory as an array of bytes. Each byte specifies a data bit (LSB 0), a burst bit (BIT 2), and an Event 1 output bit (BIT 6). Refer to the **Programming Guide** for more information on pattern RAM downloading.

Example

```
:MEM:DATA:PRAM:FILE:BLOC "PRAM_Data",#14Yq8L
```

The preceding example downloads PRAM data to a file named PRAM_Data into the signal generator's volatile memory (WFM1).

– "PRAM_Data"	**PRAM_Data is the file name. PRAM files are saved to the signal generator's volatile memory (WFM1).**
– #14Yq8L	Data block
#	This character indicates the beginning of the data block
1	Number of digits in the byte count
4	Byte count
Yq8L	4 bytes of data

NOTE The data, `Yq8L`, in the above command is not valid and is used for example purposes only. Typically, ASCII characters representing data are unprintable.

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:DATA:PRAM:FILE:LIST

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
MEMory:DATA:PRAM:FILE:LIST
"<file_name>",<uint8>[,<uint8>,<...>]
```

This command loads list-formatted data directly into pattern RAM volatile memory (WFM1). Pattern RAM memory describes how memory (WFM1) is used and is not a distinct piece of memory. A PRAM file is specified as an array of bytes.

NOTE This command should be preceded by a *WAI (Wait-to-Continue) command to ensure that all pending operations are completed, before loading the list.

"<file_name>"	This variable names the destination file.
<uint8>	This variable is any of the valid 8-bit, unsigned integer values between 0 and 255.
[,<uint8>,<...>]	This variable identifies the value of the second and subsequent 8-bit unsigned integer variables.

Pattern Ram files are binary files downloaded directly into waveform memory as an array of bytes. Each byte specifies a data bit (LSB 0), a burst bit (BIT 2), and an Event 1 output bit (BIT 6). Refer to the **Programming Guide** for more information on pattern RAM downloading.

Example

```
:MEM:DATA:PRAM:FILE:LIST "Pram_Data", 85,21,21,20,20,100
```

The preceding example downloads PRAM data, in list format, to a file named Pram_Data in the signal generator's volatile memory (WFM1).

– "Pram_Data"	**`Pram_Data` is the file name. PRAM files are saved to the signal generator's volatile memory (WFM1).**
– 85	The first 8-bit integer value
– 21,21,20,20,100	Subsequent 8-bit integer values.

Range 0–255

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:DATA:SHAPe

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:MEMory:DATA:SHAPe
"<file_name>",<rise_pnts>,<rp0>,<rp1>,...<fall_points>,<fp0>
,
<fp1>,...<fp(n)>
:MEMory:DATA:SHAPe? "<file_name>"
```

This command loads a burst shape file into the signal generator's non-volatile memory (NVWFM).

"<file_name>"	This variable names the destination file and directory path.
rise_pnts	This variable indicates the number of rise points used to describe the burst shape rising slope.
rp0,...rp(n)	This variable defines each successive rise point, where 0 is no power and 1 is full power.
fall_points	This variable indicates the number of fall points used to describe the burst shape falling slope.
fp0,...fp(n)	This variable defines each successive fall point, where 1 is full power and 0 is no power.

Refer to the **Programming Guide** for more information on downloading and using files.

Example

```
:MEM:DATA:SHAP "Shape_File",6,0,0.2,0.4,0.6,0.8,1.0,2,0.5,0
```

The preceding example loads shape data to a file named Shape_File in the signal generator's non-volatile memory.

– "Shape_File"	**`Shape_File` is the shape data filename. The directory path is not needed. The path `"/USER/SHAPE/"` is implied.**
– 6	Number of rise points describing the burst shape.
– 0,0.2,0.4,0.6,0.8,1.0	Rise point values.
– 2	Number of fall points describing the burst shape.
– 0.5,0	Fall point values.

Range	**num_rise_points:**	2–256
	num_fall_points:	2–256
	rp0–rp(n):	0.0–1.0
	fp0–fp(n):	0.0–1.0

:DELete:ALL

Supported All Models

CAUTION Using this command deletes all non-volatile user files including binary, list, state, and flatness correction files, and any saved setups which use the front-panel table editor. However, this does not include files stored on the Option 653, 655, 656, or 657 ARB generator. You cannot recover the files after executing this command.

`:MEMory:DELete:ALL`

This command clears the file system of all non-volatile user files.

Key Entry **Delete All Files**

:DELete:BINary

Supported All Models

`:MEMory:DELete:BINary`

This command deletes all binary files.

Key Entry **Delete All Binary Files**

:DELete:BIT

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DELete:BIT`

This command deletes all bit files.

Key Entry	**Delete All Bit Files**

:DELete:DMOD

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DELete:DMOD`

This command deletes all arbitrary waveform digital modulation files.

Key Entry	**Delete All ARB DMOD Files**

:DELete:FIR

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DELete:FIR`

This command deletes all finite impulse response filter files.

Key Entry	**Delete All FIR Files**

:DELete:FSK

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DELete:FSK`

This command deletes all FSK files.

Key Entry	**Delete All FSK Files**

:DELete:IQ

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DELete:IQ`

This command deletes all I/Q files.

Key Entry	**Delete All I/Q Files**

:DELete:LIST

Supported	All Models

`:MEMory:DELete:LIST`

This command deletes all List files.

Key Entry	**Delete All List Files**

:DELete:MDMod

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DELete:MDMod`

This command deletes all arbitrary waveform multicarrier digital modulation files.

Key Entry	**Delete All ARB MDMOD Files**

:DELete:MTONe

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DELete:MTONe`

This command deletes all arbitrary waveform multitone files.

Key Entry	**Delete All ARB MTONE Files**

:DELete:PTRain

Supported	All with Options UNW and 320

`:MEMory:DELete:PTRain`

This command deletes all pulse train files.

:DELete:SEQ

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DELete:SEQ`

This command deletes all sequence files.

Key Entry	**Delete All Sequence Files**

:DELete:SHAPe

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MEMory:DELete:SHAPe`

This command deletes all burst shape files.

Key Entry	**Delete All Shape Files**

:DELete:STATe

Supported All Models

`:MEMory:DELete:STATe`

This command deletes all state files.

Key Entry **Delete All State Files**

:DELete:UFLT

Supported All Models

`:MEMory:DELete:UFLT`

This command deletes all user–flatness correction files.

Key Entry **Delete All UFLT Files**

:DELete[:NAME]

Supported All Models

`:MEMory:DELete[:NAME] "<file name>"`

This command clears the user file system of "<file name>".

Key Entry **Delete File**

Remarks Refer to File Name Variables for information on the file name syntax.

When deleting a waveform (WFM1) file from memory, the marker file and file header, associated with the waveform file, will also be deleted.

:EXPort[:ASCii]:PTRain

Supported All with Options UNW and 320

`:MEMory:EXPort[:ASCii]:PTRAin <"filename">`

This command writes out a CSV/ASCII file to the BINARY directory. User may supply their own extender as part of the filename. Refer to :EXPort[:ASCii]:SEParator:COLumn and :EXPort[:ASCii]:SEParator:DECimal.

Example

`:MEM:EXP:PTR "myfile.csv"`

The preceding example saves a power train file to “myfile.csv”.

Key Entry **Export To File**

:EXPort[:ASCii]:SEParator:COLumn

Supported All with Options UNW and 320

```
:MEMory:EXPort[:ASCii]:SEParator:COLumn
TAB|SEMicolon|COMMa|SPACe
:MEMory:EXPort[:ASCii]:SEParator:COLumn?
```

This command selects whether the column separator is a tab, ";", "," or a " " during export of CSV/ASCII files.

This value is persistent across preset/recall and power cycles. (At the factory the MXG is set to COMMa (“,”).) Refer to :EXPort[:ASCii]:SEParator:DECimal.

Key Entry **Export Column Separator**

:EXPort[:ASCii]:SEParator:DECimal

Supported All with Options UNW and 320

```
:MEMory:EXPort[:ASCii]:SEParator:DECimal DOT|COMMa
:MEMory:EXPort[:ASCii]:SEParator:DECimal?
```

This command selects whether the decimal point is a "." or a "," during export of CSV/ASCII files.

This value is persistent across preset/recall and power cycles. (At the factory the MXG is set to DOT (“.”).) Refer to :EXPort[:ASCii]:SEParator:COLumn.

Key Entry **Export Decimal Separator**

:FREE[:ALL]

Supported All Models

```
:MEMory:FREE[:ALL]?
```

This command returns the number of bytes left in the non–volatile user file system.

Key Entry **All**

:IMPort[:ASCii]:PTRain

Supported All with Options UNW and 320

```
:MEMory:IMPort[:ASCii]:PTRain <"filename">
```

This command reads a CSV/ASCII file from the BINARY directory. The user must specify any extender (such as .csv or .txt) used when placing the file into the instrument. Note that the form of these files must be On Time<column separator>Off Time<column separator>Repetitions<newline> or On Time<column separator>Off Time<newline> with repetition count assumed to always be 1 in the second case. Refer to :IMPort[:ASCii]:SEParator:DECimal.

Key Entry	**Import From Selected File**

:IMPort[:ASCii]:SEParator:DECimal

Supported	All with Options UNW and 320

```
:MEMory:IMPort[:ASCii]:SEParator:DECimal DOT|COMMa
:MEMory:IMPort[:ASCii]:SEParator:DECimal?
```

This command selects whether the decimal point is a "." or a "," during import of CSV/ASCII files.

This value is persistent across preset/recall and power cycles. (At the factory the MXG is set to **DOT** (".").) Refer to :IMPort[:ASCii]:PTRain.

Key Entry	**Import Decimal Separator**

:LOAD:LIST

Supported	All Models

```
:MEMory:LOAD:LIST "<file name>"
```

This command loads a list sweep file.

Key Entry	**Load From Selected File**

:LOAD:PTRain

Supported	All with Options UNW and 320

```
:MEMory:LOAD:PTRain <"filename">
```

This command reads the pulse train file specified. Refer to :STORe:PTRain.

Key Entry	**Confirm Load from File**

:MOVE

Supported	All Models

```
:MEMory:MOVE "<src_file>","<dest_file>"
```

This command renames the requested file in the memory catalog.

Key Entry	**Rename File**
Remarks	Refer to File Name Variables for information on the file name syntax.

:SIZE

Supported	All Models

```
:MEMory:SIZE? <"filename">
```

This command returns the size of the file named <"filename"> in bytes or a –1, if the file does not exist. If the MSUS or directory is invalid, an “`ERROR: -257, File name error`” will be reported.

:STATe:COMMent

Supported All Models

```
:MEMory:STATe:COMMent <reg_num>,<seq_num>,"<comment>"
:MEMory:STATe:COMMent? <reg_num>,<seq_num>
```

This command lets you to add a descriptive comment to the saved state <reg_num>,<seq_num>. Comments can be up to 55 characters long.

Key Entry **Add Comment To Seq[n] Reg[nn]**

:STORe:LIST

Supported All Models

```
:MEMory:STORe:LIST "<file name>"
```

This command stores the current list sweep data to a file.

Key Entry **Store To File**

:STORe:PTRain

Supported All with Options UNW and 320

```
:MEMory:STORe:PTRain <"filename">
```

Writes out the current pulse train list to the PTRAIN file specified. This operation will overwrite any existing file of the same name in the PTRAIN directory with a binary file. Refer to :LOAD:PTRain.

Key Entry **Store To File**

:CATalog

Supported All Models

```
:MMEMory:CATalog? "<msus>"
```

This command outputs a list of the files from the specified file system.

The variable "<msus>" (mass storage unit specifier) represents "<file system>". The file systems and types are shown in Table 1-3 on page 45.

The return data will be in the following form:

```
<mem used>,<mem free>,"<file listing>"
```

The signal generator will return the two memory usage parameters and as many file listings as there are files in the specified file system. Each file listing will be in the following format:

```
"<file name,file type,file size>"
```

Key Entry **Binary** **List** **State** **User Flatness**

Seq **BBG Segments** **NVM KR** **NVW FM**

Remarks Refer to MSUS (Mass Storage Unit Specifier) Variable for information on the use of the "<msus>" variable.

:COPY

Supported All Models

```
:MMEMory:COPY "<file name>","<file name>"
```

This command makes a duplicate of the requested file.

Key Entry **Copy File**

Remarks Refer to File Name Variables for information on the file name syntax.

When copying a waveform file from volatile to non–volatile memory, the marker file and file header, associated with the waveform file, will automatically be copied at the same time.

:DATA

Supported All Models

```
:MMEMory:DATA "<file name>",<datablock>
:MMEMory:DATA? "<file name>"
```

This command loads <datablock> into the memory location "<file name>".

The query returns the <datablock> associated with the "<file name>".

Remarks Refer to File Name Variables for information on the file name syntax.

:DELete:NVWFm

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:MMEMory:DELete:NVWFm
```

This command clears the user file system of all non–volatile arbitrary waveform files.

Key Entry **Delete All NVWFM Files**

:DELete:WFM

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MMEMory:DELete:WFM`

This command clears the user file system of all volatile arbitrary waveform files stored on the WFM1.

Key Entry	**Delete All BBG Segments**

:DELete[:NAME]

Supported	All Models On the

`:MMEMory:DELete[:NAME] "<file name>",["<msus>"]`

This command clears the user file system of "<file name>" with the option of specifying the file system separately. For a list of file systems refer to Table on page 45.

The variable "<msus>" (mass storage unit specifier) represents the file system.

Key Entry	**Delete File**
Remarks	If the optional variable "<msus>" is omitted, the file name needs to include the file system extension. Refer to File Name Variables and MSUS (Mass Storage Unit Specifier) Variable for information on the use of the file variables. When deleting a waveform file from memory, the marker file and file header, associated with the waveform file, will also be deleted.

:HEADer:CLEar

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:MMEMory:HEADer:CLEar "<file name>"
```

This command sets the file header field settings to unspecified for the "<file name>" variable.

Key Entry **Clear Header**

Remarks In addition to waveforms currently running in the signal generator, it is possible to change or delete file header information on files that are not currently running but are stored in either the internal storage or USB media non–volatile memory (Example: `:MMEMory:HEADer:CLEar "NVWFM:file_name"`).

Refer to File Name Variables for information on the file name syntax.

:HEADer:DESCription

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:MMEMory:HEADer:DESCription "<file name>","<description>"
:MMEMory:HEADer:DESCription? "<file name>"
```

This command inserts a description for the file header.

Key Entry **Edit Description**

Remarks In addition to waveforms currently running in the signal generator, it is possible to change or delete file header information on files that are not currently running but are stored in either the internal storage or USB media non–volatile memory (Example: `:MMEMory:HEADer:DESCription "NVWFM:file_name",”example_file_name”`).

The header description is limited to 32 characters. Refer to File Name Variables for information on the file name syntax.

:HEADer:ID?

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MMEMory:HEADer:ID? "<file name>"`

This query returns the unique waveform ID of file *"<file name>"*.

The command is ignored if the file name does not exist.

:LOAD:LIST

Supported All Models

`:MMEMory:LOAD:LIST "<file name>"`

This command loads a List sweep file.

Key Entry **Load From Selected File**

:LOAD:PTRain

Supported All with Options UNW and 320

`:MMEMory:LOAD:PTRain <"filename">`

This command reads the pulse train file specified. Refer to :STORe:PTRain.

Key Entry **Confirm Load from File**

:LOAD:WFM:ALL

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MMEMory:LOAD:WFM:ALL`

This command loads all of the waveforms in the active media to the internal BBG memory. The active media is either internal non-volatile memory storage media or an external storage media connected to the front-panel USB port.

Key Entry **Load All From Int Media**

:MOVE

Supported All Models

`:MMEMory:MOVE "<src_file>","<dest_file>"`

This command renames the requested file in the memory catalog.

Key Entry **Rename File**

Remarks Refer to File Name Variables for information on the file name syntax.

:STORe:LIST

Supported All Models

`:MMEMory:STORe:LIST "<file name>"`

This command stores the current list sweep data to a file.

Key Entry **Store To File**

:STORe:PTRain

Supported All with Options UNW and 320

`:MMEMory:STORe:PTRain <"filename">`

Writes out the current pulse train list to the PTRAIN file specified. This operation will overwrite any existing file of the same name in the PTRAIN directory with a binary file. Refer to :LOAD:PTRain.

Key Entry **Store To File**

:STORe:WFM:ALL

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

`:MMEMory:STORe:WFM:ALL`

This command stores from the internal BBG memory to the active media. The active media is either internal non-volatile memory storage media or an external storage media connected to the front-panel USB port.

Key Entry **Store All To Int Media**

Output Subsystem (:OUTPut)

:BLANking:AUTO

Supported All Models

```
:OUTPut:BLANking:AUTO ON|OFF|1|0
:OUTPut:BLANKing:AUTO?
```

This command turns the RF output on or off during frequency band changes. Frequency band changes can cause the signal generator's RF output to fluctuate. The output blanking function, when active, turns off the RF output until the frequency and power settles.

`ON(1)`	The RF output turns off when crossing a frequency band.
`OFF(0)`	The RF output stays on, **if possible**, when crossing a frequency band. Refer to the **Data sheet**.
***RST**	1
Key Entry	**Output Blanking Off On Auto**
Remarks	Refer to the signal generator's data sheet for information on frequency switching speeds, settling times, and frequency band information.

:BLANking:STATe

Supported All Models

```
:OUTPut:BLANking:STATe ON|OFF|1|0
:OUTPut:BLANKing:STATe?
```

This command enables or disables the RF output blanking state.

`ON(1)`	The RF output turns off during frequency changes.
`OFF(0)`	The RF output stays on, **if possible**, during frequency changes. Refer to the **Data sheet**.
***RST**	0
Remarks	Refer to the signal generator's data sheet for information on frequency switching speeds, settling times, and frequency band information.

:MODulation[:STATe]

Supported All Models

```
:OUTPut:MODulation[:STATe] ON|OFF|1|0
:OUTPut:MODulation[:STATe]?
```

This command enables or disables the modulation of the RF output with the currently active modulation type(s).

***RST**	1
Key Entry	**Mod On/Off**
Remarks	Some modulation types can be simultaneously enabled such as pulse and AM. An annunciator on the signal generator is always displayed to indicate whether modulation is switched on or off.

[:STATe]

Supported All Models

```
:OUTPut[:STATe] ON|OFF|1|0
:OUTPut[:STATe]?
```

This command enables or disables the RF output.

***RST**	0
Key Entry	**RF On/Off**
Remarks	Although you can configure and engage various modulations, no signal is available at the RF OUTPUT connector until this command is executed. An annunciator is always displayed on the signal generator to indicate whether the RF output is switched on or off.

Route Subsystem (:ROUTe)

[:CONNectors]:EVENt[:OUTPut]

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe[:CONNectors]:EVENt[:OUTPut] M1|M2|M3|M4|AUX29|NONE

:ROUTe[:CONNectors]:EVENt[:OUTPut]?

This command selects a marker (M1–M4) signal to be routed to the rear panel EVENT 1 connector. AUX29 selects Aux I/O Pin 29. NONE indicates that the BNC connector is, or can be, input.

***RST**	M1
Key Entry	**Route to Event 1 BNC**

HARDware:DGENerator:INPut:BPOLarity

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:INPut:BPOLarity POSitive|NEGative
:ROUTe:HARDware:DGENerator:INPut:BPOLarity?
```

This command configures the polarity of the TTL input signal at the BURST GATE IN connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST**	POS
Key Entry	**Burst Gate In Polarity Neg Pos**
Remarks	This command performs the same function as "HARDware:DGENerator:IPOLarity:BGATe" on page 191.

HARDware:DGENerator:INPut:CPOLarity

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:INPut:CPOLarity POSitive|NEGative
:ROUTe:HARDware:DGENerator:INPut:CPOLarity?
```

This command configures the polarity of the TTL input signal at the DATA CLOCK connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST**	POS
Key Entry	**Data Clock Polarity Neg Pos**

Remarks This command performs the same function as "HARDware:DGENerator:IPOLarity:CLOCk" on page 192.

HARDware:DGENerator:INPut:DPOLarity

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:INPut:DPOLarity POSitive|NEGative
:ROUTe:HARDware:DGENerator:INPut:DPOLarity?
```

This command configures the polarity of the TTL input signal at the DATA connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST** POS

Key Entry **Data Polarity Neg Pos**

Remarks This command performs the same function as "HARDware:DGENerator:IPOLarity:DATA" on page 192.

HARDware:DGENerator:INPut:SPOLarity

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:INPut:SPOLarity POSitive|NEGative
:ROUTe:HARDware:DGENerator:INPut:SPOLarity?
```

This command configures the polarity of the TTL input signal at the SYMBOL SYNC connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST** POS

Key Entry **Symbol Sync Polarity Neg Pos**

Remarks This command performs the same function as "HARDware:DGENerator:IPOLarity:SSYNc" on page 193.

HARDware:DGENerator:IPOLarity:BGATe

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:IPOLarity:BGATe POSitive|NEGative
:ROUTe:HARDware:DGENerator:IPOLarity:BGATe?
```

This command configures the polarity of the input signal at the BURST GATE IN connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST**	POS
Key Entry	**Burst Gate In Polarity Neg Pos**
Remarks	This command performs the same function as "HARDware:DGENerator:INPut:BPOLarity" on page 190.

HARDware:DGENerator:IPOLarity:CLOCk

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:IPOLarity:CLOCk POSitive|NEGative
:ROUTe:HARDware:DGENerator:IPOLarity:CLOCk?
```

This command configures the polarity of the TTL input signal at the DATA CLOCK connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST**	POS
Key Entry	**Data Clock Polarity Neg Pos**
Remarks	This command performs the same function as "HARDware:DGENerator:INPut:CPOLarity" on page 190.

HARDware:DGENerator:IPOLarity:DATA

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:IPOLarity:DATA POSitive|NEGative
:ROUTe:HARDware:DGENerator:IPOLarity:DATA?
```

This command configures the polarity of the TTL input signal at the DATA connector. POSitive refers to normal logic, while NEGative refers the inverted logic.

***RST**	POS
Key Entry	**Data Polarity Neg Pos**
Remarks	This command performs the same function as "HARDware:DGENerator:INPut:DPOLarity" on page 191.

HARDware:DGENerator:IPOLarity:SSYNc

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:IPOLarity:SSYNc POSitive|NEGative
:ROUTe:HARDware:DGENerator:IPOLarity:SSYNc?
```

This command configures the polarity of the TTL input signal at the SYMBOL SYNC connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST** POS

Key Entry **Symbol Sync Polarity Neg Pos**

Remarks This command performs the same function as "HARDware:DGENerator:INPut:SPOLarity" on page 191.

HARDware:DGENerator:OPOLarity:CLOCk

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:OPOLarity:CLOCk POSitive|NEGative
:ROUTe:HARDware:DGENerator:OPOLarity:CLOCk?
```

This command configures the polarity of the TTL output Data Clock Out signal at the DATA CLK OUT pin on the rear panel AUX I/O connector. POSitive refers to normal logic, while the NEGative refers to inverted logic.

***RST** POS

Key Entry **Data Clock Out Neg Pos**

Remarks This command performs the same function as "HARDware:DGENerator:OUTPut:CPOLarity" on page 194.

HARDware:DGENerator:OPOLarity:DATA

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:OPOLarity:DATA POSitive|NEGative
:ROUTe:HARDware:DGENerator:OPOLarity:DATA?
```

This command configures the polarity of the TTL output DATA OUT signal at the DATA OUT pin on the rear panel AUX I/O connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST** POS

Key Entry **Data Out Polarity Neg Pos**

Remarks This command performs the same function as "HARDware:DGENerator:OUTPut:DPOLarity" on page 195.

HARDware:DGENerator:OPOLarity:SSYNc

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:OPOLarity:SSYNc POSitive|NEGative
:ROUTe:HARDware:DGENerator:OPOLarity:SSYNc?
```

This command configures the polarity of the TTL output SYMBOL SYNC signal at the SYM SYNC OUT pin on the rear panel AUX I/O connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST** POS

Key Entry **Symbol Sync Out Polarity Neg Pos**

Remarks This command performs the same function as "HARDware:DGENerator:OUTPut:SPOLarity" on page 195.

HARDware:DGENerator:OUTPut:CPOLarity

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:OUTPut:CPOLarity
POSitive|NEGative
:ROUTe:HARDware:DGENerator:OUTPut:CPOLarity?
```

This command configures the polarity of the TTL output DATA CLOCK OUT signal at the DATA CLK OUT pin on the rear panel AUX I/O connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST** POS

Key Entry **Data Clock Polarity Neg Pos**

Remarks This command performs the same function as "HARDware:DGENerator:OPOLarity:CLOCk" on page 193.

HARDware:DGENerator:OUTPut:DCS[:STATe]

Supported N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:OUTPut:DCS[:STATe] ON|OFF|1|0
:ROUTe:HARDware:DGENerator:OUTPut:DCS[:STATe]?
```

This command is used to enable or disable the output DATA OUT, DATA CLK OUT, and SYM SYNC OUT signals from the rear panel AUX I/O connector. Normally, these output signals should be enabled (On). However, disabling these outputs will decrease the spurs that are sometimes present when operating at high symbol rates.

***RST**	1
Key Entry	**DATA/CLK/SYNC Rear Outputs Off On**

HARDware:DGENerator:OUTPut:DPOLarity

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:OUTPut:DPOLarity
POSitive|NEGative
:ROUTe:HARDware:DGENerator:OUTPut:DPOLarity?
```

This command configures the polarity of the TTL output signal at the DATA OUT connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST**	POS
Key Entry	**Data Out Polarity Neg Pos**
Remarks	This command performs the same function as "HARDware:DGENerator:OPOLarity:DATA" on page 193.

HARDware:DGENerator:OUTPut:SPOLarity

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

```
:ROUTe:HARDware:DGENerator:OUTPut:SPOLarity
POSitive|NEGative
:ROUTe:HARDware:DGENerator:OUTPut:SPOLarity?
```

This command configures the polarity of the TTL input signal at the SYMBOL SYNC connector. POSitive refers to normal logic, while NEGative refers to inverted logic.

***RST**	POS
Key Entry	**Symbol Sync Out Polarity Neg Pos**

LINE:PTRigger[1]|2:BNC:SOURce

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe:LINE:PTRigger[1]|2:BNC:SOURce BBTRigger[1]|BBTRigger2|EVENt[1]|PTRigger|NONE
:ROUTe:LINE:PTRigger[1]|2:BNC:SOURce?

This command selects a BNC connector to use as an input for the Pattern Trigger In source.

BBTRigger1	This choice sets the BB TRIG 1 connector as the Pattern Trigger In source.
BBTRigger2	This choice sets the BB TRIG 2 connector as the Pattern Trigger In source.
EVENT1	This choice sets the EVENT 1 connector as the Pattern Trigger In source.
PTRigger	This choice sets the PAT TRIG connector as the Pattern Trigger In source.
NONE	This choice selects no Pattern Trigger In source.
***RST**	PTR
Key Entry	**Patt Trig Source**

[:CONNectors]:BBTRigger[1]|2[:OUTPut]

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe[:CONNectors]:BBTRigger[1]|2[:OUTPut] M1|M2|M3|M4|AUX29|NONE
:ROUTe[:CONNectors]:BBTRigger[1]|2[:OUTPut]?

This command selects a marker (M1–M4) signal to be routed to the specified rear panel BB TRIG 1 or BB TRIG 2 connector. AUX29 selects Aux I/O Pin 29. NONE indicates that the BNC connector is, or can be, an input.

***RST**	BBTRigger1 - M2 BBTRigger2 - None
Key Entry	**Route to BB TRIG 1, 2 BNC**

[:CONNectors]:PTRig[:OUTPut]

Supported	N5172B with Option 653 or 655, N5182B with Option 656 or 657

:ROUTe[:CONNectors]:PTRig[:OUTPut] M1|M2|M3|M4|AUX29|NONE
:ROUTe[:CONNectors]:PTRig[:OUTPut]?

This command selects a marker (M1–M4) signal to be routed to the rear panel PAT TRIG connector. AUX29 selects Aux I/O Pin 29. NONE indicates that the BNC connector is, or can be, an input.

***RST**	None
Key Entry	**Route to PATT TRIG BNC**

[:CONNectors]:SOUT

Supported	All Models

```
:ROUTe[:CONNectors]:SOUT
SWEep|SETTled|PVIDeo|PSYNc|SW8757|SRUN|SFDone
:ROUTe:CONNectors:SOUT?
```

This command selects a signal to be routed to the rear panel SWEEP OUT connector.

`SWEep`	This choice routes the sweep out signal to the SWEEP OUT connector.
`SETTled`	This choice routes the source settled signal to the SWEEP OUT connector.
`PVIDeo`	This choice routes the pulse video signal to the SWEEP OUT connector.
`PSYNc`	This choice routes the pulse sync signal to the SWEEP OUT connector.
`SW8757`	This choice routes the sweep out signal to the SWEEP OUT connector for compatibility with the 8757D.
`SRUN`	This choice routes the sweep run signal (the pulse at the start of each full sweep) to the SWEEP OUT connector.
`SFDone`	This choice routes the swept function done signal (the pulse at the end of each full swept function) to the SWEEP OUT connector.
***RST**	SWE
Key Entry	**Route to Sweep Out BNC**

[:CONNectors]:TRIGger1:OUTPut

Supported	**As indicated**

```
:ROUTe[:CONNectors]:TRIGger1:OUTPut
SWEep|SRUN|SETTled|PVIDeo|PSYNc|LXI|PULSe|TRIGger2|SFDone|NO
NE
:ROUTe[:CONNectors]:TRIGger1:OUTPut?
```

This command selects a signal to be routed to the rear panel TRIG 1 connector.

`SWEep`	This choice routes the sweep trigger out signal to the TRIG 1 connector.

`SETTled`	This choice routes the source settled signal to the TRIG 1connector.
`PVIDeo`	This choice routes the pulse video signal to the TRIG 1 connector.
`PSYNc`	This choice routes the pulse sync signal to the TRIG 1 connector.
`LXI`	This choice routes the LXI signal to the TRIG 1 connector.
PULSe	This choice routes the pulse sync signal to the TRIG 1 connector.
`TRIGger2`	This choice routes the TRIG 2 BNC signal to the TRIG 1 connector.
`SFDone`	This choice routes the swept function done signal (the pulse at the end of each full swept function) to the TRIG 1 connector.
`NONE`	This choice routes no signal to the <connector> connector, which allows the BNC to be an input.
***RST**	NONE
Key Entry	**Route to Trig 1 BNC**

[:CONNectors]:TRIGger[2]:OUTPut

Supported **As indicated**

```
:ROUTe[:CONNectors]:TRIGger[2]:OUTPut
SWEep|SRUN|SETTled|PVIDeo|PSYNc|LXI|PULSe|TRIGger1|SFDone|NO
NE
:ROUTe[:CONNectors]:TRIGger[2]:OUTPut?
```

This command selects a signal to be routed to the rear panel TRIG 2 connector.

`SWEep`	This choice routes the sweep trigger out signal to the TRIG 2 connector.
`SETTled`	This choice routes the source settled signal to the TRIG 2 connector.
`PVIDeo`	This choice routes the pulse video signal to the TRIG 2 connector.
`PSYNc`	This choice routes the pulse sync signal to the TRIG 2 connector.
`LXI`	This choice routes the LXI signal to the TRIG2 connector.
PULSe	This choice routes the pulse sync signal to the TRIG 2 connector.

`TRIGger1`	This choice routes the TRIG 1 BNC signal to the TRIG 2 connector.
`SFDone`	This choice routes the swept function done signal (the pulse at the end of each full swept function) to the TRIG 2 connector.
`NONE`	This choice routes no signal to the <connector> connector, which allows the BNC to be an input.
***RST**	SWE
Key Entry	**Route to Trig 2 BNC**

Status Subsystem (:STATus)

:OPERation:CONDition?

Supported All Models

`:STATus:OPERation:CONDition?`

This query returns the decimal sum of the bits for the registers that are set to one and are part of the Standard Operation Status Group. For example, if a sweep is in progress (bit 3), the value 8 is returned.

Range	0 to 32767
Remarks	The data in this register is continuously updated and reflects current conditions.
	Refer to the **Programming Guide** for more information.

:OPERation:ENABle

Supported All Models

```
:STATus:OPERation:ENABle <value>
:STATus:OPERation:ENABle?
```

This command determines which bits in the Standard Operation Event Register will set the Standard Operation Status Summary bit (bit 7) in the Status Byte Register.

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range	0 to 32767
Remarks	Refer to the **Programming Guide** for more information.

:OPERation:NTRansition

Supported All Models

```
:STATus:OPERation:NTRansition <value>
:STATus:OPERation:NTRansition?
```

This command determines which bits in the Standard Operation Condition Register will set the corresponding bit in the Standard Operation Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range	0 to 32767
Remarks	Refer to the **Programming Guide** for more information.

:OPERation:PTRansition

Supported All Models

```
:STATus:OPERation:PTRansition <value>
:STATus:OPERation:PTRansition?
```

This command determines which bits in the Standard Operation Condition Register will set the corresponding bit in the Standard Operation Event Register when that bit has a positive transition (0 to 1).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:OPERation:SUPPress

Supported All Models

```
:STATus:OPERation:SUPPress 0|1|ON|OFF
:STATus:OPERation:SUPPress?
```

This command disables the instrument’s management of the Standard Operation Condition Register and saves 50 us of switching time.

***RST** OFF

Remarks Refer to the **Programming Guide** for more information.

:OPERation[:EVENt]

Supported All Models

CAUTION This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

```
:STATus:OPERation[:EVENt]?
```

This query returns the decimal sum of the bits in the Standard Operation Event Register.

Range 0 to 32767

Remarks The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the **Programming Guide** for more information.

:PRESet

Supported All Models

`:STATus:PRESet`

This command presets all transition filters, enable registers, and error/event queue enable registers.

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:BERT:CONDition

Supported N5172B or N5182B with Option UN7

`:STATus:QUEStionable:BERT:CONDition?`

This query returns the decimal sum of the bits in the Data Questionable BERT Condition Register. For example, if no clock signal has been input for more than three seconds during the bit error rate measurement (bit 0), then a value of 1 is returned.

Range 0–32767

Remarks The data in this register is continuously updated and reflects the current conditions.

Refer to the **X-Series Signal Generators Programming Guide** for more information.

:QUEStionable:BERT:ENABle

Supported N5172B or N5182B with Option UN7

```
:STATus:QUEStionable:BERT:ENABle <value>
:STATus:QUEStionable:BERT:ENABle?
```

This command determines which bits in the Data Questionable BERT Event Register will set the Data Questionable BERT Summary bit (bit 12) in the Data Questionable Condition Register.

The variable <value> is the sum of the decimal values of the bits you want to enable.

Range 0–32767

Remarks Refer to the **X-Series Signal Generators Programming Guide** for more information.

:QUEStionable:BERT:NTRansition

Supported N5172B or N5182B with Option UN7

```
:STATus:QUEStionable:BERT:NTRansition <value>
:STATus:QUEStionable:BERT:NTRansition?
```

This command determines which bits in the Data Questionable BERT Condition Register will set the corresponding bit in the Data Questionable BERT Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0–32767

Remarks The data in this register is continuously updated and reflects the current conditions.

Refer to the **X-Series Signal Generators Programming Guide** for more information.

:QUEStionable:BERT:PTRansition

Supported N5172B or N5182B with Option UN7

```
:STATus:QUEStionable:BERT:PTRansition <value>
:STATus:QUEStionable:BERT:PTRansition?
```

This command determines which bits in the Data Questionable BERT Condition Register will set the corresponding bit in the Data Questionable BERT Event Register when that bit has a positive transition (0 to 1).

The variable `<value> is the sum of the decimal values of the bits that you want to enable.`

Range 0–32767

Remarks Refer to the **X-Series Signal Generators Programming Guide** for more information..

:QUEStionable:BERT[:EVENt]

Supported N5172B or N5182B with Option UN7

CAUTION This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

```
:STATus:QUEStionable:BERT[:EVENt]?
```

This command returns the decimal value of the sum of the bits in the Data Questionable BERT Event Register.

Range 0–32767

Remarks Note that the register requires that the equivalent PTR or NTR filters be set before a condition register bit can set a bit in the Event register.

Refer to the **X-Series Signal Generators Programming Guide** for more information.

:QUEStionable:CALibration:CONDition?

Supported All Models

`:STATus:QUEStionable:CALibration:CONDition?`

This query returns the decimal sum of the bits in the Data Questionable Calibration Condition Register.

Range 0 to 32767

Remarks The data in this register is continuously updated and reflects the current conditions.

Refer to the **Programming Guide** for more information.

:QUEStionable:CALibration:ENABle

Supported All Models

```
:STATus:QUEStionable:CALibration:ENABle <value>
:STATus:QUEStionable:CALibration:ENABle?
```

This command determines which bits in the Data Questionable Calibration Event Register will set the calibration summary bit (bit 8) in the Data Questionable Condition Register.

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:CALibration:NTRansition

Supported All Models

```
:STATus:QUEStionable:CALibration:NTRansition <value>
:STATus:QUEStionable:CALibration:NTRansition?
```

This command determines which bits in the Data Questionable Calibration Condition Register will set the corresponding bit in the Data Questionable Calibration Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:CALibration:PTRansition

Supported All Models

```
:STATus:QUEStionable:CALibration:PTRansition <value>
:STATus:QUEStionable:CALibration:PTRansition?
```

This command determines which bits in the Data Questionable Calibration Condition Register will set the corresponding bit in the Data Questionable Calibration Event Register when that bit has a positive transition (0 to 1).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:CALibration[:EVENt]?

Supported All Models

CAUTION **This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.**

```
:STATus:QUEStionable:CALibration[:EVENt]?
```

This command returns the decimal sum of the bits in the Data Questionable Calibration Event Register.

Range 0 to 32767

Remarks The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the **Programming Guide** for more information.

:QUEStionable:CONDition?

Supported All Models

```
:STATus:QUEStionable:CONDition?
```

This query returns the decimal sum of the bits in the Data Questionable Condition Register. For example, if the ALC Heater Detector is cold (bit 4), a value of 16 is returned.

Range 0 to 32767

Remarks The data in this register is continuously updated and reflects current conditions.

Refer to the **Programming Guide** for more information.

:QUEStionable:ENABle

Supported All Models

```
:STATus:QUEStionable:ENABle <value>
:STATus:QUEStionable:ENABle?
```

This command determines which bits in the Data Questionable Event Register will set the Data Questionable Status Group Summary bit (bit 3) in the Status Byte Register.

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:FREQuency:CONDition?

Supported All Models

```
:STATus:QUEStionable:FREQuency:CONDition?
```

This query returns the decimal sum of the bits in the Data Questionable Frequency Condition Register. For example, if the 1 GHz internal reference clock is unlocked (bit 2), a value of 4 is returned.

Range 0 to 32767

Remarks The data in this register is continuously updated and reflects current conditions.

Refer to the **Programming Guide** for more information.

:QUEStionable:FREQuency:ENABle

Supported All Models

```
:STATus:QUEStionable:FREQuency:ENABle <value>
:STATus:QUEStionable:FREQuency:ENABle?
```

This command determines which bits in the Data Questionable Frequency Event Register will set the frequency summary bit (bit 5) in the Data Questionable Condition Register.

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:FREQuency:NTRansition

Supported All Models

```
:STATus:QUEStionable:FREQuency:NTRansition <value>
:STATus:QUEStionable:FREQuency:NTRansition?
```

This command determines which bits in the Data Questionable Frequency Condition Register will set the corresponding bit in the Data Questionable Frequency Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:FREQuency:PTRansition

Supported All Models

```
:STATus:QUEStionable:FREQuency:PTRansition <value>
:STATus:QUEStionable:FREQuency:PTRansition?
```

This command determines which bits in the Data Questionable Frequency Condition Register will set the corresponding bit in the Data Questionable Frequency Event Register when that bit has a positive transition (0 to 1).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:FREQuency[:EVENt]?

Supported All Models

CAUTION **This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.**

```
:STATus:QUEStionable:FREQuency[:EVENt]?
```

This query returns the decimal sum of the bits in the Data Questionable Frequency Event Register.

Range 0 to 32767

Remarks The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the **Programming Guide** for more information.

:QUEStionable:MODulation:CONDition?

Supported All Models

`:STATus:QUEStionable:MODulation:CONDition?`

This command returns the decimal sum of the bits in the Data Questionable Modulation Condition Register. For example, if the modulation is uncalibrated (bit 4), a value of 16 is returned.

Range 0 to 32767

Remarks The data in this register is continuously updated and reflects current conditions.

Refer to the **Programming Guide** for more information.

:QUEStionable:MODulation:ENABle

Supported All Models

```
:STATus:QUEStionable:MODulation:ENABle <val>
:STATus:QUEStionable:MODulation:ENABle?
```

This command determines which bits in the Data Questionable Modulation Event Register will set the modulation summary bit (bit 7) in the Data Questionable Condition Register.

The variable <val> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:MODulation:NTRansition

Supported All Models

```
:STATus:QUEStionable:MODulation:NTRansition <val>
:STATus:QUEStionable:MODulation:NTRansition?
```

This command determines which bits in the Data Questionable Modulation Condition Register will set the corresponding bit in the Data Questionable Modulation Event Register when that bit has a negative transition (1 to 0).

The variable <val> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:MODulation:PTRansition

Supported All Models

```
:STATus:QUEStionable:MODulation:PTRansition <val>
:STATus:QUEStionable:MODulation:PTRansition?
```

This command determines which bits in the Data Questionable Modulation Condition Register will set the corresponding bit in the Data Questionable Modulation Event Register when that bit has a positive transition (0 to 1).

The variable <val> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:MODulation[:EVENt]?

Supported All Models

CAUTION This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.

```
:STATus:QUEStionable:MODulation[:EVENt]?
```

This query returns the decimal sum of the bits in the Data Questionable Modulation Event Register.

Range 0 to 32767

Remarks The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the **Programming Guide** for more information.

:QUEStionable:NTRansition

Supported All Models

```
:STATus:QUEStionable:NTRansition <value>
:STATus:QUEStionable:NTRansition?
```

This command determines which bits in the Data Questionable Condition Register will set the corresponding bit in the Data Questionable Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:POWer:CONDition?

Supported All Models

`:STATus:QUEStionable:POWer:CONDition?`

This query returns the decimal sum of the bits in the Data Questionable Power Condition Register. For example, if the RF output signal is unleveled (bit 1), a value of 2 is returned.

Range 0 to 32767

Remarks The data in this register is continuously updated and reflects current conditions.

Refer to the **Programming Guide** for more information.

:QUEStionable:POWer:ENABle

Supported All Models

```
:STATus:QUEStionable:POWer:ENABle <value>
:STATus:QUEStionable:POWer:ENABle?
```

This command determines which bits in the Data Questionable Power Event Register will set the power summary bit (bit 3) in the Data Questionable Condition Register.

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:POWer:NTRansition

Supported All Models

```
:STATus:QUEStionable:POWer:NTRansition <value>
:STATus:QUEStionable:POWer:NTRansition?
```

This command determines which bits in the Data Questionable Power Condition Register will set the corresponding bit in the Data Questionable Power Event Register when that bit has a negative transition (1 to 0).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:POWer:PTRansition

Supported All Models

```
:STATus:QUEStionable:POWer:PTRansition <value>
:STATus:QUEStionable:POWer:PTRansition?
```

This command determines which bits in the Data Questionable Power Condition Register will set the corresponding bit in the Data Questionable Power Event Register when that bit has a positive transition (0 to 1).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable:POWer[:EVENt]?

Supported All Models

CAUTION **This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.**

```
:STATus:QUEStionable:POWer[:EVENt]?
```

This query returns the decimal sum of the bits in the Data Questionable Power Event Register.

Range 0 to 32767

Remarks The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the **Programming Guide** for more information.

:QUEStionable:PTRansition

Supported All Models

```
:STATus:QUEStionable:PTRansition <value>
:STATus:QUEStionable:PTRansition?
```

This command determines which bits in the Data Questionable Condition Register will set the corresponding bit in the Data Questionable Event Register when that bit has a positive transition (0 to 1).

The variable <value> is the sum of the decimal values of the bits that you want to enable.

Range 0 to 32767

Remarks Refer to the **Programming Guide** for more information.

:QUEStionable[:EVENt]?

Supported All Models

CAUTION **This is a destructive read. The data in the register is latched until it is queried. Once queried, the data is cleared.**

`:STATus:QUEStionable[:EVENt]?`

This query returns the decimal sum of the bits in the Data Questionable Event Register.

Range 0 to 32767

Remarks The equivalent PTR or NTR filters must be set before the condition register can set the corresponding bit in the event register.

Refer to the **Programming Guide** for more information.

System Subsystem (:SYSTem)

:CAPability

Supported All Models

`:SYSTem:CAPability?`

This query returns the signal generator’s capabilities and outputs the appropriate specifiers:

```
(RFSOURCE
WITH((AM|FM|PULM|PM)&(FSSWEEP|FLIST)&(PSSWEEP|PLIST)
&TRIGGER&REFERENCE))
```

This is a list of the SCPI–defined basic functionality of the signal generator and the additional capabilities it has in parallel (a&b) and singularly (a|b).

:DATE

Supported All Models

```
:SYSTem:DATe <year>,<month>,<day>
:SYSTem:DATe?
```

This command sets the date as shown in the lower right area of the signal generator display.

<year> This variable requires a four digit integer.

The query returns the date in the following format:

<+year>, <+month>, <+day>

Range	<month>: 1 to 12	<day>: 1 to 31

Key Entry **Time/Date**

:ERRor:CODE[:NEXt]

Supported All Models

`:SYSTem:ERRor:CODE[:NEXt]?`

This query returns the next error message number from the signal generator SCPI error queue. If there are no error messages, the query returns the following output:

`+0`

When there is more than one error message, the query will need to be sent for each message.

The Keysight MXG deletes the error messages from the front-panel error queue after viewing the last message.

Key Entry	Error Info	View Next Error Message

:ERRor[:NEXt]

Supported All Models

```
:SYSTem:ERRor[:NEXt]?
```

This query returns the next error message from the signal generator SCPI error queue. If there are no error messages, the query returns the following output:

```
+0,"No error"
```

When there is more than one error message, the query will need to be sent for each message.

The Keysight MXG deletes the error messages from the front-panel error queue after viewing the last message.

Key Entry	Error Info	View Next Error Message

:ERRor:SCPI[:SYNTax]

Supported All Models

```
:SYSTem:ERRor:SCPI[:SYNTax] ON|OFF|1|0
:SYSTem:ERRor:SCPI[:SYNTax]?
```

This command enables or disables the reporting of SCPI syntax errors to the error queue.

The setting ON/1 is persistent through Preset and *RST. It is cleared to OFF/0 by sending SYST:PRES:ALL or cycling the power of the signal generator.

:FILesystem:STORage:EXTernal

Supported All Models

```
:SYSTem:FILesystem:STORage:EXTernal?
```

This query checks to see if the external USB port is actively being used for data storage and retrieval on the signal generator. A returned value of 1 means the external USB media is being used for data storage and retrieval. For more information on non–volatile storage media settings, refer to :FILesystem:STORage:EXTernal:PATH, :FILesystem:STORage:TYPE and :FILesystem:STORage:TYPE:AUTO commands.

:FILesystem:STORage:EXTernal:PATH

Supported All Models

```
:SYSTem:FILesystem:STORage:EXTernal:PATH <"USB media root path">
:SYSTem:FILesystem:STORage:EXTernal:PATH?
```

This command selects the directory storage path on the USB media. For more information, refer to the signal generator’s softkey Help. For more information on non–volatile storage media settings, refer to :FILesystem:STORage:EXTernal, :FILesystem:STORage:TYPE and :FILesystem:STORage:TYPE:AUTO commands.

Remarks When reading and writing files from or to the USB media, different memory subsystem file types are marked by having a particular extender on the filename. Refer to Table USB Media Path Options on page 215.

Files with unrecognized extenders are treated as binary (.bin) files.

USB Media Path Options	**Extender**	File Type	**Memory Subsystem**
	.waveform	waveform	NVWFM
	.markers	waveform marker	NVMKR
	.header	waveform header	NVHDR
	.state	instrument state	STATE
	.list	list sweep	LIST
	.userflat	user flatness	USERFLAT
	.seq	waveform sequence	SEQ
	All others	**All others**	BIN

:FILesystem:STORage:TYPE

Supported All Models

```
:SYSTem:FILesystem:STORage:TYPE INTernal|EXTernal
:SYSTem:FILesystem:STORage:TYPE?
```

This command selects the non–volatile storage location on the signal generator. For more information on non–volatile storage media settings, refer to :FILesystem:STORage:EXTernal, :FILesystem:STORage:EXTernal:PATH and :FILesystem:STORage:TYPE:AUTO commands.

Key Entry **Storage Type Int Ext Auto**

Example

```
:SYST:FIL:STOR:TYPE EXT
```

The preceding example selects the external USB port as the location for non-volatile file storage on the signal generator.

:FILesystem:STORage:TYPE:AUTO

Supported All Models

```
:SYSTem:FILesystem:STORage:TYPE:AUTO ON|OFF|1|0
:SYSTem:FILesystem:STORage:TYPE:AUTO?
```

This command enables the signal generator to auto–detect when the USB media is connected. When AUTO (ON|1) is selected, the file system uses the USB media, if available. When the USB media is removed, the file system uses the internal media. For more information, refer to the signal generator's softkey Help. For more information on non–volatile storage media settings, refer to :FILesystem:STORage:EXTernal, :FILesystem:STORage:EXTernal:PATH and :FILesystem:STORage:TYPE commands.

***RST** 1

Key Entry **Storage Type Int Ext Auto**

Example

```
:SYST:FIL:STOR:TYPE:AUTO ON
```

The preceding example selects AUTOmatic as the non–volatile storage setting and the signal generator will detect if the external USB port has a memory storage device connected.

Remarks When the USB media is removed, the USB non–volatile user file system effectively does not exist.

:IDN

Supported All Models

```
:SYSTem:IDN "string"
```

This command modifies the identification string that the `*IDN?` query returns. Sending an empty string sets the query output of `*IDN?` to its factory shipped setting. The maximum string length is 72 characters.

Remarks	Modification of the *IDN? query output enables the signal generator to identify itself as another signal generator when used as a replacement. The display diagnostic information, shown by pressing the **Diagnostic Info** softkey, is not affected by this command.

:LANGuage

Supported	All

```
:SYSTem:LANGuage
"SCPI"|"COMP"|"8648"|"E4428C"|"E4438C"|"E8257D"|"E8267D"|"E8
663B"|"E8247C"|"E8257C"|"E8267C"|"N5181A|"N5182A"|"E442XB"|"
E443XB"|"E8241A"|"E8244A"|"E8251A"|"E8254A"|"SMU200A"|"SMATE
200A"|"SMJ100A"|"SMIQ"|"SML"|"SMV"|"SMR"|"SMF100A"|"MG3691B"
|"MG3692B"|"MG3693B"|"MG3694B"|"3410"|"8360"|"8371"|"83732"|
"83752"|"8340"|"8644"|"8662"|"8663"|"8664"|"8665"
:SYSTem:LANGuage?
```

This command sets the remote language for the signal generator.

SCPI	This choice provides compatibility for SCPI commands.
COMP	This choice provides compatibility for the 8656B, 8657A/B signal generator which is supported only through the GPIB interface.
8648	This choice provides compatibility for the 8648A/B/C/D signal generator which is supported only through a GPIB interface.
E4428C or E4438C	This choice provides compatibility for the E4428C or E4438C signal generators which are supported through a GPIB, LAN, or USB interface.
E8257D, or E8267D, or E8663B	This choice provides compatibility for the E8257D, E8267D, or E8663B signal generators which are supported through a GPIB, LAN, or USB interface.
E8247C, or E8257C, or E8267C	This choice provides compatibility for the E8247C, E8257C, or E8267C signal generators which are supported through a GPIB, LAN, or USB interface.

N5181A or N5182A	This choice provides compatibility for the N5181A or N5182A signal generators which are supported through a GPIB, LAN, or USB interface.
E442XB or E443XB	This choice provides compatibility for the E442XB or E443XB signal generators which are supported through a GPIB, LAN, or USB interface.
E8241A or E8244A	This choice provides compatibility for the 8648A/B/C/D signal generator which is supported through a GPIB, LAN, or USB interface.
E8251A or E8254A	This choice provides compatibility for the E8251A or E8254A signal generators which are supported through a GPIB, LAN or USB interface.
SMU200A, or SMATE200A, or SMJ100A, or SMIQ, or SML, or SMV, or SMR, or SMF100A	This choice provides compatibility for the Rohde and Schwarz SMU200A, SMATE200A, SMJ100A, SMIQ, SML, SMV, SMR, or SMF100A signal generators which are supported through a GPIB, LAN or USB interface.
MG3691B, or MG3692B, or MG3693B, or MG3694B	This choice provides compatibility for the Anritsu MG3691B, MG3692B, MG3693B, or MG3694B signal generators which are supported through a GPIB, LAN or USB interface.
3410	This choice provides compatibility for the Aeroflex 3410 series signal generator, which is supported through a GPIB, LAN, or USB interface.
8360	This choice provides compatibility for 8360 series signal generators.
83712, or 83732, or 83752	This choice provides compatibility for the 83712A/B, 83732A/B, or 83752A/B signal generator.

8340	This choice provides compatibility for the 8340A/B signal generator.
8644	This choice provides compatibility for the 8644A/B signal generator.
8662, or 8663, or 8664, or 8665	This choice provides compatibility for the 8662A, 8663A, 8664A, and 8665A signal generator.
***RST**	"SCPI"

Key Entry	**SCPI**	**SMJ100 A**	**8648A/B/C/D**	**E8257D, E8267D, E8663B**
	SML	**3410 Series**	**8656B, 8657A/B**	**E8241A, E8244A, E8251A, E8264A**
	SMV	**E4428C, E4438C**	**SMU200A, SMATE200A**	**8662A**
	SMIQ	**E442xB, E443xB**	**E8247C, E8257C, E8267C**	**8663A**

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:LICense:AUS[:DATE]?

Supported All Models

`:SYSTem:LICense:AUS[:DATE]?`

This query retrieves the latest expiration date of the Keysight Upgrade Service license.

:LICense:[FPACk]:WAVeform:ADD

`:  SYSTem:LICense:[FPACk:]WAVeform:ADD "filename"`

This command assigns a “filename” to the next available waveform slot. Filename should be just the filename, no path information. The file must reside in a non–volatile waveform memory (NVWFM) before it can be licensed.

Key Entry	**Add Waveform**
Key Path	**Mode > Dual ARB > More 2 of 2 > Waveform Licensing > Add Waveform To Next Available Slot > Add Waveform**

:LICense:[FPACk]:WAVeform:CLEar

Supported All Models

`:SYSTem:LICense[:FPACk]:WAVeform:CLEar <slot_number>`

This command clears the file currently assigned to the license waveform license slot. The specified slot cannot be locked.

Key Entry	**Clear Waveform From Slot**
Key Path	**Mode > Dual ARB > More 2 of 2 > Waveform Licensing > Clear Waveform From Slot >**

:LICense:[FPACk]:WAVeform:FREE?

Supported All Models

`:SYSTem:LICense[:FPACk]:WAVeform:FREE?`

This queries the number of available slots open for waveforms to be licensed.

:LICense:[FPACk]:WAVeform:IDList?

Supported All Models

`:SYSTem:LICense:[FPACk]:WAVeform:IDList?`

This query returns a comma separated list of the licensed waveform IDs. The ID of a waveform in the instrument can be compared to this list to see if it is licensed.

:LICense:[FPACk]:WAVeform:LOCK

Supported All Models

```
:SYSTem:LICense[:FPACk]:WAVeform:LOCK slot_number
```

This command locks the file currently assigned to the waveform license slot specified by slot number. Once the slot is locked it can no longer be modified.

Key Entry	**Lock Waveform In Slot**
Key Path	**Mode > Dual ARB > More 2 of 2 > Waveform Licensing > Lock Waveform In Slot >**

:LICense:[FPACk]:WAVeform:REPLace

Supported All Models

```
:SYSTem:LICense[:FPACk]:WAVeform:REPlace slot_number,
"filename"
```

This command will overwrite the contents of the selected slot with the "filename", providing the slot is in the trial period. If the slot is locked the command returns an error.

Key Entry	**Replace Waveform In Slot**
Key Path	**Mode > Dual ARB > More 2 of 2 > Waveform Licensing > Replace Waveform In Slot >**

:LICense:[FPACk]:WAVeform:STATus?

Supported All Models

```
:SYSTem:LICense[:FPACk]:WAVeform:STATus? slot_number
```

This query returns the same values that are indicated in the Status column display.

:LICense:[FPACk]:WAVEform:USED?

Supported All Models

```
:SYSTem:LICense:FPACk:WAVEform:USED?
```

This query returns the number of slots used by licensed waveforms.

:LICense:INSTall

Supported All Models

```
:SYSTem:LICense:INSTall
<license_line>|<block_of_license_lines>
```

This command installs the licenses into the signal generator.

<license_line>	This choice installs a license line.
<block_of_license_lines>	This choice installs a block of license lines.

Example

```
:SYST:LIC:INST "FEATURE 403 aspk 0 permanent 0
389D66FB107E9B02
    HOSTID=N5182B,US00000068"
```

The preceding example installs license "FEATURE 403 aspk 0 permanent 0 389D66FB107E9B02 HOSTID=N5182B,US00000068", into the signal generator.

Example

```
:SYST:LIC:INST #210Qaz37pY9oL
```

The preceding is an example of the syntax for installing a block of licenses into the signal generator. For more on handling block data, refer to the **Programming Guide**.

NOTE

The data, `Qaz37pY9oL`, in the above command are not valid and are shown for example purposes only. Typically, ASCII characters representing data are unprintable.

For additional information on downloading and installing licenses for applications, refer to the Keysight License Manager at http://www.keysight.com/find/LicenseManager.

:LICense:LIST

Supported All Models

```
:SYSTem:LICense:LIST?
```

This query provides a listing of the current licenses installed on the signal generator.

:LICense:REMove

Supported All Models

```
:SYSTem:LICense:REMove <license_line>
```

This command removes a single license line.

Example

To remove a license line:

```
:SYST:LIC:REM "FEATURE 403 aspk 0 permanent 0
389D66FB107E9B02
```

```
HOSTID=N5182B,US00000068"
```

The preceding example removes a license "FEATURE 403 aspk 0 permanent 0 389D66FB107E9B02 HOSTID=N5182B,US00000068", from the signal generator.

Remarks To remove multiple license lines: Repeat the process for removing a single license for each license line to be removed.

:LOG:SCPI ON/OFF/1/0

Supported All Models

:SYSTem:LOG:SCPI ON|OFF|1|0

This command toggles the state of SCPI logging. When toggled ON, a copy of every subsequent SCPI command executed will be placed in the log.

Toggling the state to OFF suspends the logging, and toggling back to ON resumes the logging. Pressing the front-panel **Clear SCPI Log** softkey will clear the log.

Remarks This log information is stored in a file the BIN directory called SCPI_LOG.TXT. You can use FTP to download the file from the instrument.

:OPT

Supported All Models

```
:SYSTem:OPT "string"
```

This command modifies the option string that the `*OPT?` query returns. Sending an empty string sets the query output of `*OPT?` to its factory shipped setting. The maximum string length is 72 characters.

Remarks Modification of the *OPT? query output enables the signal generator, with a set of options, to **identify** itself as another signal generator when used as a replacement

The display diagnostic information, shown by pressing the
Diagnostic Info softkey, is not affected by this command.

:PDOWn

Supported All Models

`:SYSTem:PDOWn`

This command turns off the instrument.

:PMETer[1]|2:CHANnel

Supported All Models

`:SYSTem:PMETer[1]|2:CHANnel A|B`

`:SYSTem:PMETer[1]|2:CHANnel?`

This command selects the external power meter channel that will be used by each channel’s power meter measurement. The query returns the selected channel.

Key Entry	**External Power Meter Channel A B**
Default	Channel A

:PMETer[1]|2:COMMunicate:LAN:DEVice

Supported All Models

`:SYSTem:PMETer[1]|2:COMMunicate:LAN:DEVice <deviceName>`

`:SYSTem:PMETer[1]|2:COMMunicate:LAN:DEVice?`

This command enters a VXI–11 name for a power meter that is being controlled by the signal generator for power meter measurements. If connecting directly to the power meter enter the name as specified on your power meter documentation. If connecting through a LAN–GPIB gateway, enter the SICL address of the power meter.

Key Entry	**PM VXI–11 Device Name**
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:PMETer[1]|2:COMMunicate:LAN:IP

Supported All Models

`:SYSTem:PMETer[1]|2:COMMunicate:LAN:IP <ipAddress>`

`:SYSTem:PMETer[1]|2:COMMunicate:LAN:IP?`

This command sets the internet protocol (IP) address for a power meter that is controlled by the signal generator for power meter measurements. If connecting to a GPIB power meter through a LAN–GPIB gateway, this command sets the IP address of the gateway.

Key Entry	**Power Meter IP Address**
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST.`
	Ensure that the power meter IP address is different from the signal generator address.

:PMETer[1]|2:COMMunicate:LAN:PORT

Supported All Models

`:SYSTem:PMETer[1]|2:COMMunicate:LAN:PORT <portNumber>`

`:SYSTem:PMETer[1]|2:COMMunicate:LAN:PORT?`

This command sets the IP port on the power meter that is controlled by the signal generator.

Key Entry	**Power Meter IP Port**
`5025`	Standard mode. The command enables standard mode for simple programming.
`5024`	Telnet mode. The command enables the telnet SCPI service for programming.

NOTE **For firmware versions <A.01.51, the default telnet mode is 5023. For firmware versions A.01.51 and greater, telnet port 5023 is still available for backwards compatibility.**

Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.
	For more information on standard mode and telnet SCPI mode, refer to the **Programming Guide**.

:PMETer[1]|2:COMMunicate:TYPE

Supported All Models

`:SYSTem:PMETer[1]|2:COMMunicate:TYPE SOCKets|SOCKETS|VXI11|USB`

`:SYSTem:PMETer[1]|2:COMMunicate:TYPE?`

This command sets the type of control connection for communication with the external power meter for power meter measurements. The query returns the connection type.

Key Entry	**Connection Type**
`SOCK or SOCKETS`	The command enables the power meter for sockets LAN control through the signal generator.

`VXI11`	The command enables the power meter for VXI–11 control through the signal generator. A power meter with GPIB can be controlled through VXI–11 using a LAN–GPIB gateway.
`USB`	The command enables the power meter for USB control through the signal generator.
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:PMETer[1]|2:COMMunicate:USB:DEVice

Supported All Models

`:SYSTem:PMETer[1]|2:COMMunicate:USB:DEVice <device>`

`:SYSTem:PMETer[1]|2:COMMunicate:USB:DEVice?`

This command selects the USB device to be used for power meter measurements for Channel A or B. The query returns the USB device identification.

Key Entry **Connection Type** > **USB Devise**

:PMETer[1]|2:COMMunicate:USB:LIST?

Supported All Models

`:SYSTem:PMETer[1]|2:COMMunicate:USB:LIST?`

This queries for the list of all connected USB devices.

:PMETer[1]|2:MEASure?

Supported All Models

`:SYSTem:PMETer[1]|2:MEASure?`

This query starts the measurement and returns the result for Channel A or B.

:PMETer[1]|2:SENSe:AVERage:COUNt

Supported All Models

`:SYSTEm:PMETer[1]|2:SENSe:AVERage:COUNt <avgCount>`

`:SYSTEm:PMETer[1]|2:SENSe:AVERage:COUNt?`

This command sets the averaging count value for Channel A or B when automatic averaging is disabled (i.e. manual mode.) The query returns an integer.

Range: 1 to 2048

Key Entry **Averaging Count**

Default: 1024

:PMETer[1]|2:SENSe:AVERage:COUNt:AUTO

Supported All Models

```
:SYSTEm:PMETer[1]|2:SENSe:AVERage:COUNt:AUTO ON|OFF|1|0
```

```
:SYSTEm:PMETer[1]|2:SENSe:AVERage:COUNt:AUTO?
```

This command enables or disables the automatic averaging mode for Channel A or B. The query returns the state of the automatic averaging mode.

Key Entry **Averaging Mode**

Default: Auto

:PMETer[1]|2:SENSe:AVERage[:STATe]

Supported All Models

```
:SYSTem:PMETer[1]|2:SENSe:AVERage[:STATe] ON|OFF|1|0
```

```
:SYSTem:PMETer[1]|2:SENSe:AVERage[:STATe]?
```

This command enables or disables averaging for Channel A or B. The query returns the state of averaging.

Key Entry **Averaging Mode**

:PMETer[1]|2:SENSe:FREQuency[:CW|:FIXed]

Supported All Models

```
:SYSTem:PMETer[1]|2:SENSe:FREQuency[:CW|:FIXed] <freq><unit>
```

```
:SYSTem:PMETer[1]|2:SENSe:FREQuency[:CW|:FIXed]?
```

This command sets channel frequency for channel A or B. The query returns the value.

Key Entry **Channel Frequency**

Default 50 MHz

:PMETer[1]|2:UNIT:POWer

Supported All Models

```
:SYSTem:PMETer[1]|2:UNIT:POWer DBM|W
```

```
:SYSTem:PMETer[1]|2:UNIT:POWer?
```

This command selects the power measurement units for Channel A or B. The query returns that value.

Key Entry **Measurement Units dBm W**

:PMETer[1]|2[:STATe]

Supported All Models

```
:SYSTem:PMETer[1]|2[:STATe] ON|OFF|1|0
```

```
:SYSTem:PMETer[1]|2[:STATe]?
```

This command enables or disables the power meter measurements for channel A or B.

Key Entry **Averaging Mode > Off**

:PMETer:PASSthrough

Supported All Models

```
:SYSTem:PMETer[1]|2:PASSthrough <”scpiCommand”>
```

```
:SYSTem:PMETer[1]|2:PASSthrough? <”scpiQuery?”>
```

Provides a SCPI pass-through method of accessing attached power meters. In this mode, the MXG exposes commands that encapsulate power meter commands, allowing commands and query responses to pass through the MXG.

Remarks It is not possible to use the Power Meter Display and pass-through on the same channel at the same time.

:PMETer:PASSthrough:ENABle

Supported All Models

```
:SYSTem:PMETer[1]|2:PASSthrough:ENABle 0|1
```

```
:SYSTem:PMETer[1]|2:PASSthrough:ENABle?
```

This command enables/disables the pass-through feature.

Example

```
SYST:PMET1:PASS:ENAB
```

The preceding example enables the pass-through feature.

Remarks It is not possible to use the Power Meter Display and pass-through on the same channel at the same time.

:PMETer:PASSthrough:TIMeout

Supported All Models

`:SYSTem:PMETer[1]|2:PASSthrough:TIMeout <value>`

`:SYSTem:PMETer[1]|2:PASSthrough:TIMeout?`

This command sets the communication timeout value (seconds = S, mseconds = MS, µseconds = US).

Example

`SYST:PMET1:PASS:TIMEOUT 60S`

The preceding example sets the timeout to 60 seconds.

Remarks It is not possible to use the Power Meter Display and pass-through on the same channel at the same time.

:PMETer:SENSe:CORRection:GAIN2[:INPut][:MAGNitude]

Supported All Models

`:SYSTem:PMETer`:SENSe:CORRection:GAIN2[:INPut][:MAGNitude]

This command sets gain for channel A or B. The query returns the value.

***RST** 0

Range -100 to 100 dB, but ultimately depends the range supported by the power meter/sensor

:PMETer:SENSe:FREQuency[:CW]:COUPling[:STATe]

Supported All Models

`:SYSTem:PMETer`:SENSe:FREQuency[:CW]:COUPling[:STATe]

This command sets the channel frequency for channel A or B.

The channel frequency can be set explicitly (fixed frequency) or coupled to the front panel displayed frequency.

The coupling to the displayed frequency can be expressed as

FreqCh = FreqDisplayed * Multiplier + Offset

***RST** OFF|0

Range ON|1 and OFF|0

:PMETer:SENSe:FREQuency[:CW]:MULTiplier

Supported	All Models

`:SYSTem:PMETer`:SENSe:FREQuency[:CW]:MULTiplier

Sets the channel frequency for channel A or B.

The channel frequency can be set explicitly (fixed frequency) or coupled to the front panel displayed frequency.

The coupling to the displayed frequency can be expressed as

FreqCh = FreqDisplayed * Multiplier + Offset

***RST**	1.0
Range	-1000 to 1000

:PMETer:SENSe:FREQuency[:CW]:OFFSet

Supported	All Models

`:SYSTem:PMETer`:SENSe:FREQuency[:CW]:OFFSet

Sets the channel frequency for channel A or B.

The channel frequency can be set explicitly (fixed frequency) or coupled to the front panel displayed frequency.

The coupling to the displayed frequency can be expressed as

FreqCh = FreqDisplayed * Multiplier + Offset

***RST**	0
Range	-200 GHz to 200 GHz

:PON:TYPE

Supported	All

```
:SYSTem:PON:TYPE PRESet|LAST|USER
:SYSTem:PON:TYPE?
```

This command sets the defined conditions for the signal generator at power on.

PRESet	This choice sets the conditions to factory– or user–defined as determined by the choice for the preset type.
LAST	This choice retains the settings at the time the signal generator was last powered down.
USER	This choice sets the power on state to be the user preset value.
Key Entry	**Power On Last Preset**

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:PRESet

NOTE **If this SCPI command is not responding as expected, use the E4428C/38C compatibility command: `:SYST:PRESet:TYPE:NORMal` to return the front-panel Preset key to its factory default functionality.**

Supported All

`SYSTem:PRESet`

This command returns the signal generator to a set of defined conditions. It is equivalent to pressing the front-panel **Preset** key.

Key Entry **Preset**

Remarks The defined conditions are either factory– or user-defined.

Table 3-1 Preset SCPI Commands Overview

Command	Description	Remarks
*RST	This IEEE 488.2 Common Command uses the factory preset settings for the instrument preset.	Optimized for automated testing
:SYSTem:PRESet:PERSistent	Only the instrument's persistent parameters are returned to factory default value.	
:SYSTem:PON:TYPE PRESet|LAST|USER :SYSTem:PON:TYPE?	Sets the power on state (PON) to be the same as the front-panel green Preset key, or the last state, or to the user state.	
:SYSTem:PRESet	Performs the same preset as currently set for the front-panel green Preset key.	
:SYSTem:PRESet:USER:SAVE	Saves the current instrument state as the user preset state.	
:SYSTem:PRESet:ALL	Sets the instrument to the same default conditions performed by sequentially inputting: `:SYSTem:PRESet` + `:SYSTem:PERSistent:PRESet`	
:SYSTem:PRESet:USER	Executes a user preset.	

:PRESet:ALL

Supported All

`:SYSTem:PRESet:ALL`

This command sets all states of the signal generator back to their factory default settings, including states that are not normally affected by signal generator power–on, preset, or `*RST`.

:PRESet:LANGuage

Supported All

```
:SYSTem:PRESet:LANGuage
"SCPI"|"COMP"|"8648"|"E4428C"|"E4438C"|"E8257D"|"E8267D"|"E8
663B"|"E8247C"|"E8257C"|"E8267C"|"N5181A"|"N5182A"|"E442XB"|
"E443XB"|"E8241A"|"E8244A"|"E8251A"|"E8254A"|"SMU200A"|"SMAT
E200A"|"SMJ100A"|"SMIQ"|"SML"|"SMV"|"SMR"|"SMF100A"|"MG3691B
"|"MG3692B"|"MG3693B"|"MG3694B"|"3410"|"8360"|"8372"|"83732"
|"83752"|"8340"|"8644"|"8662"|"8663"|"8664"|"8665"
:SYSTem:PRESet:LANGuage?
```

This command sets the remote language that is available when the signal generator is preset.

SCPI	This choice provides compatibility for SCPI commands.
COMP	This choice provides compatibility for the 8656B, 8657A/B signal generator which is supported only through the GPIB interface.
8648	This choice provides compatibility for the 8648A/B/C/D signal generator which is supported only through a GPIB interface.
E4428C or E4438C	This choice provides compatibility for the E4428C or E4438C signal generators which are supported through a GPIB, LAN, or USB interface.
E8257D, or E8267D, or E88663B	This choice provides compatibility for the E8257D, or E8267D or E8663B signal generators which are supported through a GPIB, LAN, or USB interface.
E8247C, or E8257C, or E8267C	This choice provides compatibility for the E8247C, E257C, or E8267C signal generators which are supported through a GPIB, LAN, or USB interface.
N5181A or N5182A	This choice provides compatibility for the N5181A or N5182A signal generators which are supported through a GPIB, LAN, or USB interface.

E442XB or E443XB	This choice provides compatibility for the E442XB or E443XB signal generators which are supported through a GPIB, LAN, or USB interface.
E8241A or E8244A	This choice provides compatibility for the 8648A/B/C/D signal generator which is supported through a GPIB, LAN, or USB interface.
E8251A or E8254A	This choice provides compatibility for the E8251A or E8254A signal generators which are supported through a GPIB, LAN, or USB interface.
SMU200A, or SMATE200A, or SMJ100A, or SMIQ, or SML, or SMV, or SMR, or SMF100A	This choice provides compatibility for the Rohde and Schwartz SMU200A, SMATE200A, SMJ100A, SMIQ, SML, SMV, SMR, or SMF100A signal generators which are supported through a GPIB, LAN, or USB interface.
MG3691B, or MG3692B, or MG3693B, or MG3694B	This choice provides compatibility for the Anritsu MG3691B, MG3692B, MG3693B, or MG3694B signal generators which are supported through a GPIB, LAN or USB interface.
3410	This choice provides compatibility for the Aeroflex 3410 signal generator which are supported through a GPIB, LAN, or USB interface.
8360	This choice provides compatibility for 8360 series signal generators.
83712, or 83732, or 83752	This choice provides compatibility for the 83712A/B, 83732A/B, or 83752A/B signal generator.
8340	This choice provides compatibility for the 8340A/B signal generator.
8644	This choice provides compatibility for the 8644A/B signal generator.

8662, or
8663, or
8664, or
8665 — This choice provides compatibility for the 8662A, 8663A, 8664A, or 8665A signal generator.

***RST** "SCPI"

Key Entry	SCPI	SMJ100A	8648A/B/C/D	E8257D, E8267D, E8663B
	SML	3410 Series	8656B, 8657A/B	E8241A, E8244A, E8251A, E8264A
	SMV	E4428C, E4438C	SMU200A, SMATE200A	8662A
	SMIQ	E442xB, E443xB	E8247C, E8257C, E8267C	8663A

Remarks After setting a new preset language and presetting the instrument, some defaults may change to the preset values of the instrument indicated by the remote language.

:PRESet:PERSistent

Supported All

`:SYSTem:PRESet:PERSistent`

This command sets the states that are not affected by signal generator power–on, preset, or *RST to their factory default settings.

Key Entry **Restore System Settings to Default Values**

Remarks For a list of the persistent instrument factory default values refer to the **Programming Guide**.

:PRESet:TYPE

Supported All

`:SYSTem:PRESet:TYPE NORMal|USER`

This command defines the **Preset** key as either factory preset or as the user preset saved in memory.

NORMal — This choice uses the factory–defined defaults when **Preset** is pressed.

COMP	This choice uses the user–defined preset saved in the instrument when **Preset** is pressed. Refer to :PRESet:USER and :PRESet:USER:SAVE commands.

Key Entry **Preset**

Remarks This command will return an error, if the USER parameter is sent without a user preset saved in the instrument.

:PRESet:USER

Supported All

```
:SYSTem:PRESet:USER
```

This command presets the signal generator to the user's saved state.

Key Entry **Execute User Preset**

Remarks This command presets the signal generator to the saved user–defined state.

:PRESet:USER:SAVE

Supported All

```
:SYSTem:PRESet:USER:SAVE
```

This command saves your user–defined preset conditions to a state file.

Key Entry **Save User Preset**

Remarks Only one user–defined preset file can be saved. Subsequent saved user–defined preset files will overwrite the previously saved file.

:SANalyzer:COMMunicate:LAN:DEVice

Supported All Models

```
:SYSTem:SANalyzer:COMMunicate:LAN:DEVice <deviceName>
:SYSTem:SANalyzer:COMMunicate:LAN:DEVice?
```

This command enters a VXI–11 name for a signal analyzer that is being controlled by the signal generator for making spectral measurements. If connecting directly to the signal analyzer, enter the name as specified on your signal analyzer documentation. If connecting through a LAN–GPIB gateway, enter the SICL address of the signal analyzer.

Key Entry **SA VXI–11 Device Name**

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

:SANalyzer:COMMunicate:LAN:IP

Supported All Models

```
:SYSTem:SANalyzer:COMMunicate:LAN:IP <ipAddr>
:SYSTem:SANalyzer:COMMunicate:LAN:IP?
```

This command sets the internet protocol (IP) address for the spectrum analyzer that is controlled by the signal generator for making spectral measurements. If connecting to a GPIB signal analyzer through a LAN–GPIB gateway, this command sets the IP address of the gateway.

Key Entry **Signal Analyzer IP Address**

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

Ensure that the signal analyzer IP address is different from the signal generator address.

:SANalyzer:COMMunicate:LAN:PORT

Supported All Models

```
:SYSTem:SANalyzer:COMMunicate:LAN:PORT <portNum>
:SYSTem:SANalyzer:COMMunicate:LAN:PORT?
```

This command...

This command sets the IP port on the signal analyzer that is controlled by the signal generator.

Key Entry	Signal Analyzer IP Port
`5025`	Standard mode. The command enables standard mode for simple programming.
`5024`	Telnet mode. The command enables the telnet SCPI service for programming.

NOTE

For firmware versions <A.01.51, the default telnet mode is 5023. For firmware versions A.01.51 and greater, telnet port 5023 is still available for backwards compatibility.

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

For more information on standard mode and telnet SCPI mode, refer to the **Programming Guide**.

:SANalyzer:COMMunicate:TYPE

Supported All Models

```
:SYSTem:SANalyzer:COMMunicate:TYPE SOCKets|SOCKETS|VXI11
:SYSTem:SANalyzer:COMMunicate:TYPE?
```

This command sets the type of control connection for communication with the external signal analyzer for spectral measurements. The query returns the connection type.

Key Entry	Connection Type
`SOCK or SOCKETS`	The command enables the signal analyzer for sockets LAN control through the signal generator.
`VXI11`	The command enables the signal analyzer for VXI–11 control through the signal generator. A signal analyzer with GPIB can be controlled through VXI–11 using a LAN–GPIB gateway.
`USB`	The command enables the signal analyzer for USB control through the signal generator.

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:SECurity:DISPlay

Supported All Models with Option 006

```
:SYSTem:SECurity:DISPlay ON|OFF|1|0
:SYSTem:SECurity:DISPlay?
```

This command enables or disables the secure display mode.

ON (1) This selection turns the signal generator display back on, showing the current settings. Cycling the signal generator power also restores the display. Note that the current instrument state may be retained across reboots depending on the power-on configuration choice. See :PON:TYPE command for information on the power–on choices available.

OFF (0) This selection blanks the signal generator's display, hiding the settings and disabling the front-panel keys. While in this mode, the display shows `*** SECURE DISPLAY ACTIVATED ***`.

For more information about security functions, refer to the **User's Guide**.

Example

```
:SYST:SEC:DISP OFF
```

The preceding example enables the secure display mode.

***RST** 1

Range N/A

Key Entry **Activate Security Display**

:SECurity:DISPlay:RESTricted

Supported All Models

```
:SYSTem:SECurity:DISPlay:RESTricted ON|OFF|1|0
:SYSTem:SECurity:DISPlay:RESTricted?
```

This command enables or disables the secure restricted display mode. See also, :ANNotation:AMPLitude[:STATe] and :ANNotation:FREQuency[:STATe] commands.

ON (1) This selection turns on the secure restricted display, blanking the frequency. Also, the keys that access the frequency, sweep, and user flatness information are disabled.

OFF (0)	This selection turns off the secure restricted display mode, allowing the signal generator's display to show the current frequency.

For more information about security functions, refer to the **User's Guide**.

Example

```
:SYST:SEC:DISP:REST ON
```

The preceding example enables the security restricted display mode.

***RST**	0
Key Entry	**Activate Restricted Display**

:SECurity:ERASeall

Supported	All Models with Option 006

```
:SYSTem:SECurity:ERASeall
```

This command removes all user files, flatness correction files, and baseband generator files. In addition, all table editor files are returned to their original factory values.

This command differs from the :DELete:ALL command, which does not reset table editors to factory values. For more information about security functions, refer to the **User's Guide**.

Key Entry	**Erase All**

:SECurity:SANitize

Supported	All Models with Option 006

```
:SYSTem:SECurity:SANitize
```

This command removes all user files, table editor files values, flatness correction files, and baseband generator files. The memory is then overwritten with a sequence of data as described below. For more information about security functions, refer the **User's Guide**.

SRAM	All addressable locations will be overwritten with random characters.
HARD DISK	All addressable locations will be overwritten with a single character and then a random character.
FLASH MEMORY	The flash blocks will be erased.
Key Entry	**Erase and Sanitize All**

:SSAVer:DELay

Supported	All

```
:SYSTem:SSAVer:DELay <value>
:SYSTem:SSAVer:DELay?
```

This command sets the amount of time before the display light or display light and text is switched off. This will occur if there is no input through the front panel during the delay period.

The variable `<value>` is a whole number measured in hours.

Range	1 to 12
Key Entry	**Screen Saver Delay:**
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`. Refer to :SSAVer:MODE command for selecting the screen saver mode.

:SSAVer:MODE

Supported	All

```
:SYSTem:SSAVer:MODE LIGHt|TEXT
:SYSTem:SSAVer:MODE?
```

This command toggles the screen saver mode between light only or light and text.

LIGHt	This choice enables only the light to turn off during the screen saver operation while leaving the text visible on the darkened screen.
TEXT	This choice enables both the display light and text to turn off during the screen saver operation.
Key Entry	**Screen Saver Mode**
Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:SSAVer:STATe

Supported	All

```
:SYSTem:SSAVer:STATe ON|OFF|1|0
:SYSTem:SSAVer:STATe?
```

This command enables or disables the display screen saver.

Key Entry	**Screen Saver Off On**

Remarks	The setting enabled by this command is not affected by signal generator power–on, preset, or `*RST`.

:TIME

Supported All

```
:SYSTem:TIME <hour>,<minute>,<second>
:SYSTem:TIME?
```

This command sets the time displayed in the lower right area of the signal generator's display.

Range	<hour>: 0 to 23	<minute>: 0 to 59	<second>: 0 to 59

Key Entry **Time/Date**

:VERSion

Supported All

```
:SYSTem:VERSion?
```

This command returns the SCPI version number with which the signal generator complies.

Trigger Subsystem

:ABORt

Supported All

`:ABORt`

This command causes the List or Step sweep in progress to abort. If `INIT:CONT[:ALL]` is set to on, the sweep will immediately re-initiate. The pending operation flag affecting `*OPC`, `*OPC?`, and `*WAI` will undergo a transition once the sweep has been reset.

:INITiate:CONTinuous[:ALL]

Supported All

```
:INITiate:CONTinuous[:ALL] ON|OFF|1|0
:INITiate:CONTinuous[:ALL]?
```

This command selects either a continuous or single list or step sweep. Execution of this command does not affect a sweep in progress.

ON (1)	This choice selects continuous sweep where, after the completion of the previous sweep, the current sweep will restart automatically or wait until the appropriate trigger source is received.
OFF (0)	This choice selects a single sweep. Refer to :INITiate[:IMMediate][:ALL] for single sweep triggering information.
***RST**	0
Key Entry	**Sweep Repeat Single Cont**
Remarks	Execution of this command will not affect a sweep in progress.

:INITiate[:IMMediate][:ALL]

Supported All

`:INITiate[:IMMediate][:ALL]`

This command either sets or sets and starts a single List or Step sweep, depending on the trigger type. The command performs the following:

- arms a single sweep when BUS, EXTernal, or KEY is the trigger source selection
- arms and starts a single sweep when IMMediate is the trigger source selection

This command is ignored if a sweep is in progress. See :INITiate:CONTinuous[:ALL] command for setting continuous or single sweep. See :TRIGger[:SEQuence]:SOURce command to select the trigger source.

Key Entry	**Single Sweep**

:TRIGger:EXTernal:SOURce

Supported	All

```
:TRIGger:EXTernal:SOURce TRIGger[1]|TRIGger2|PULSe
:TRIGger:EXTernal:SOURce?
```

This command selects the external trigger source. With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1	This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.
TRIGger2	This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.
PULSe	This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.

Example

```
:TRIG:EXT:SOUR PULS
```

The preceding example sets the external trigger source to the PULSE BNC.

***RST**	TRIGger1

Key Entry	**Trigger 1**	**Trigger 2**	**Pulse**

:TRIGger:INTernal:SOURce

Supported	All

```
:TRIGger:INTernal:SOURce PVIDeo|PSYNc
:TRIGger:INTernal:SOURce?
```

This command selects the internal trigger source.

PVIDeo	This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.
PSYNc	This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.

Example

```
:TRIG:INT:SOUR PVID
```

The preceding example sets the internal trigger source to Pulse Video.

***RST**	PSYN

Key Entry	**Pulse Video**	**Pulse Sync**

:TRIGger:OUTPut[1]|2:POLarity

Supported	All

```
:TRIGger:OUTPut[1]|2:POLarity POSitive|NEGative
:TRIGger:OUTPut[1]|2:POLarity?
```

Sets the polarity of the TTL signal output at the selected (TRIG 1 or TRIG 2) output BNC.

POSitive	TTL high at the start of a dwell sequence, or when waiting for the point trigger in manual sweep mode; TTL low when dwell is over, or when the point trigger is received.
NEGative	TTL polarity is reversed.

Example

```
:TRIG:OUTP2:POL NEG
```

The preceding example sets the signal polarity to be reversed at the TRIG 2 BNC when the trigger is present.

***RST**	POS

Key Entry	**Trigger Out 1 Polarity Neg Pos**	**Trigger Out 2 Polarity Neg Pos**

:TRIGger[:SEQuence]:SLOPe

Supported	All

```
:TRIGger[:SEQuence]:SLOPe POSitive|NEGative
:TRIGger[:SEQuence]:SLOPe?
```

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

POSitive	The signal generator triggers an event when it detects a rising edge on the source signal

NEGative	The signal generator triggers an event when it detects a falling edge on the source signal
***RST**	POS
Key Entry	**Int/Ext Trigger Polarity Neg Pos**

:TRIGger[:SEQuence]:SOURce

Supported	All

```
:TRIGger[:SEQuence]:SOURce
BUS|IMMediate|EXTernal|INTernal|KEY|TIMer|MANual
:TRIGger[:SEQuence]:SOURce?
```

This command sets the sweep trigger source for a list or step sweep.

BUS	This choice enables GPIB triggering using the `*TRG` or `GET` command. The `*TRG` SCPI command can be used with any combination of GPIB, LAN, or USB. The `GET` command requires USB, GPIB, or LAN–VXI–11.
IMMediate	This choice enables immediate triggering of the sweep event.
EXTernal	This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2 or PULSE connector (see :TRIGger:EXTernal:SOURce).
INTernal	This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal (see :TRIGger:INTernal:SOURce).
KEY	This choice enables triggering through front panel interaction by pressing the **Trigger** key.
TIMer	This choice enables the sweep trigger timer.
MANual	This choice enables manual sweep triggering.
***RST**	IMM
Remarks	The wait for the BUS, EXTernal, or KEY trigger can be bypassed by sending the :TRIGger[:SEQuence][:IMMediate] command.

Example

```
:TRIG:SOUR BUS
```

The preceding example sets the sweep trigger source to BUS.

***RST**	IMM

Key Entry	**Bus**	**Free Run**	**EXT**	**INT**	**Trigger Key**	**Timer Trigger**

:TRIGger[:SEQuence]:TIMer

Supported All Models

```
:TRIGger[:SEQuence]:TIMer <period>
:TRIGger[:SEQuence]:TIMer?
```

This command sets the period of the timer trigger.

***RST**	1 ms
Range	.5 ms to 1000 seconds
Key Entry	Trig Timer Period

:TRIGger[:SEQuence][:IMMediate]

Supported All Models

```
:TRIGger[:SEQuence][:IMMediate]
```

This event command causes an armed List or Step sweep to immediately start without the selected trigger occurring.

:TSWeep

Supported All Models

```
[:SOURce]:TSWeep
```

This command aborts the current sweep, then either arms or arms and starts a single list, depending on the trigger type.

The command performs the following:

– arms a single sweep when BUS, EXTernal, or Trigger KEY is the trigger source selection

– arms and starts a single sweep when IMMediate is the trigger source selection

Key Entry **Single Sweep**

Unit Subsystem (:UNIT)

:POWer

Supported All

```
:UNIT:POWer DBM|DBUV|DBUVEMF|V|VEMF|DB
:UNIT:POWer?
```

This command terminates an amplitude value in the selected unit of measure.

If the amplitude reference state is set to on, the query returns units expressed in dB and the dB choice will be displayed. Setting any other unit will cause a setting conflict error stating that the amplitude reference state must be set to off. Refer to, :REFerence:STATe command for more information.

***RST** DBM

Key Entry **dBm** **dBuV** **dBuVemf** **mV** **mVemf**

Key Path AMPTD > keypad entry > Power Units >

Remarks All power values in this chapter are shown with dBm as the unit of measure. If a different unit of measure is selected, replace dBm with the newly selected unit whenever it is indicated for the value.

:VOLT:TYPE

Supported All

```
:UNIT:VOLT:TYPE PD|EMF
:UNIT:VOLT:TYPE?
```

This command scales the voltage values to display potential differences or electromagnetic force.

Potential Difference This choice sets the instrument to PD mode where the output voltage assumes that a 50 ohm load is connected. PD is the default mode of the instrument.

Electro–motive Force This choice sets the instrument to EMF mode where the output voltage assumes no load is connected. the EMF value is twice the PD value.

***RST** PD

4 Analog Modulation Commands

This chapter describes SCPI commands for subsystems dedicated to analog commands common to all Keysight X-Series signal generators.

This chapter contains the following sections:

KEYSIGHT TECHNOLOGIES

Amplitude Modulation Subsystem–Option UNT ([:SOURce])

:AM[1]|2[:DEPTh]:EXPonential

Supported All Models with Option UNT

```
[:SOURce]:AM[1]|2[:DEPTh]:EXPonential <value>
[:SOURce]:AM[1]|2[:DEPTh]:EXPonential?
```

This commands sets the amplitude modulation depth in dB.

***RST**	+4.00000000E+001
Range	0 to 40 dB
Key Entry	**AM Depth**
Remarks	Refer to :AM[:DEPTh]:STEP[:INCRement] command for setting the value associated with UP and DOWN choices.

:AM[1]|2[:DEPTh][:LINear]

Supported All Models with Option UNT

```
[:SOURce]:AM[1]|2[:DEPTh][:LINear] <value><unit>|UP|DOWN
[:SOURce]:AM[1]|2[:DEPTh][:LINear]?
```

This commands sets the amplitude modulation depth in percent.

***RST**	+1.00000000E–001
Range	0.0 to 100%
Key Entry	**AM Depth**
Remarks	Refer to :AM[:DEPTh]:STEP[:INCRement] command for setting the value associated with UP and DOWN choices.

:AM[1]|2[:DEPTh][:LINear]:TRACk

Supported All models with Option UNT

```
[:SOURce]:AM[1]|2[:DEPTh][:LINear]:TRACk ON|OFF|1|0
[:SOURce]:AM[1]|2[:DEPTh][:LINear]:TRACk?
```

This command enables or disables AM depth value coupling between AM paths 1 and 2. When the depth values are coupled, a change made to one path is applied to both. LINear must be the AM type for this command to have any affect. To set the AM measurement type, use the :AM[1]|2:TYPE command.

ON (1) This choice will link the depth value of AM[1] with AM2; AM2 will assume the AM[1] depth value. For example, if AM[1] depth is set to 15% and AM2 is set to 11%,

	enabling the depth tracking will cause the AM2 depth value to change to 15%. This applies regardless of the path (AM[1] or AM2) selected in this command
OFF (0)	This choice disables coupling and both paths will have independent depth values.

Example

`:AM1:TRAC ON`

The preceding example enables AM depth coupling between AM path 1 and AM path 2.

***RST**	0
Key Entry	**AM Depth Couple Off On**

:AM[:DEPTh]:STEP[:INCRement]

Supported	All Models with Option UNT

```
[:SOURce]:AM[:DEPTh]:STEP[:INCRement] <value><unit>
[:SOURce]:AM[:DEPTh]:STEP[:INCRement]?
```

This command sets the AM depth step increment.

Range	0.1–100%
Key Entry	**Incr Set**
Remarks	The value set by this command is used with the UP and DOWN choices for the AM depth setting. Refer to :AM[1]|2[:DEPTh][:LINear] command for more information. The setting enabled by this command is not affected by signal generator power-on, preset, or `*RST`.

:AM[1]|2:EXTernal[1]|2:COUPling

Supported	All Models with Option UNT

```
[:SOURce]:AM[1]|2:EXTernal[1]|2:COUPling AC|DC
[:SOURce]:AM[1]|2:EXTernal[1]|2:COUPling?
```

This command sets the coupling for the amplitude modulation source through the selected external input connector.

AC	This choice will only pass ac signal components.
DC	This choice will pass both ac and dc signal components.
***RST**	DC
Key Entry	**Ext Coupling DC AC**

Remarks The command does not change the currently active source or switch the current modulation on or off. The modulating signal may be the sum of several signals, either internal or external sources.

:AM[1]|2:EXTernal[1]|2:IMPedance

Supported All Models with Option UNT

```
[:SOURce]:AM[1]|2:EXTernal[1]|2:IMPedance 50|600|1000000
[:SOURce]:AM[1]|2:EXTernal[1]|2:IMPedance?
```

This command sets the input impedance for the externally-applied AM input signal.

50	This choice selects 50 Ohm input impedance.
600	This choice selects 600 Ohm input impedance.
1000000	This choice selects 1 MOhm input impedance.
***RST**	50 Ohm

Key Entry	**Ext Impedance**	50 Ohm	600 Ohm	1 MOhm

:AM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent
<value><unit>
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent?
```

This command sets the amplitude of tone 2 of the internal dual function generator source as a percent of the peak analog modulation amplitude. Tone 1 of the internal dual function generator source will make up the remaining amplitude.

***RST** 50.0

Range 0 to 100.0 percent

Key Entry **AM Tone 2 Ampl % of Peak**

:AM[1]|2:INTernal:DUAL:FUNCtion2:POFFset

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion2:POFFset
<value><unit>
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion2:POFFset?
```

This command sets the phase offset in degrees or radians of tone 2 in relation to tone 1 of the internal dual function generator source.

***RST** 0.000 rad

Range -6.290 to 6.290 rad

-360.4 to 360.4 deg

Key Entry **AM Tone 2 Phase Offset**

:AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:FREQuency

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:FREQuency
<value><unit>
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:FREQuency?
```

Sets the frequency of tone 1 (default) or tone 2 of the internal dual function generator source.

***RST** 400.0 Hz

Range 100.0 mHz to 6.25 MHz

Key Entry **AM Tone 1 Freq** **AM Tone 2 Freq**

:AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe
SINE|TRIangle|SQUare|RAMP
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe?
```

This command sets the shape of tone 1 (default) or tone 2 of the internal dual function generator source.

***RST** `SINE`

Key Entry **AM Tone 1 Waveform** **AM Tone 2 Waveform**

:AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe:RAMP

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe:RAMP?
```

This command sets the ramp direction of the selected tone (1 or 2) of the internal dual function generator source when :AM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe is set to RAMP.

***RST**	POS

Key Entry **Pos Ramp** **Neg Ramp**

:AM[1]|2:INTernal:FUNCtion[1]|2:FREQuency

Supported	All Models with Option UNT

```
[:SOURce]:AM[1]|2:INTernal:FUNCtion[1]|2:FREQuency
<value><unit>|UP|DOWN
[:SOURce]:AM[1]|2:INTernal:FUNCtion[1]|2:FREQuency?
```

This command sets the internal amplitude modulation rate for the following applications:

– the start frequency for a swept-sine waveform

– the frequency rate for all other waveforms

***RST**	+4.00000000E+002

Range Swept-Sine & Sine: 0.1 Hz–20 MHz

Key Entry **AM Rate**

:AM[1]|2:INTernal:FUNCtion[1]|2:POFFset

Supported	All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:FUNCtion[1]|2:POFFset
<value><unit>
[:SOURce]:AM[1]|2:INTernal:FUNCtion[1]|2:POFFset?
```

This command sets the phase offset in degrees or radians of internal function generator source.

***RST**	0.000 rad

Range -6.290 to 6.290 rad

-360.4 to 360.4 deg

Key Entry **AM Phase Offset**

:AM[1]|2:INTernal:FUNCtion[1]|2:SHAPe

Supported	All Models with Options UNT

```
[:SOURce]:AM[1]|2:INTernal:FUNCtion[1]|2:SHAPe
SINE|TRIangle|SQUare|RAMP|PULSe
[:SOURce]:AM[1]|2:INTernal:FUNCtion[1]|2:SHAPe?
```

This command sets the AM waveform type.

***RST**	`SINE`
Remarks	SINE is the only shape available without Option 303.

Key Entry	**AM Waveform**

:AM[1]|2:INTernal:FUNCtion[1]|2:SHAPe:RAMP

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:FUNCtion[1]|2:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:AM[1]|2:INTernal:FUNCtion[1]|2:SHAPe:RAMP?
```

This command sets the ramp direction when :AM[1]|2:INTernal:FUNCtion[1]|2:SHAPe is set to RAMP.

***RST** POS

Key Entry	**Pos Ramp**	**Neg Ramp**

:AM[1]|2:INTernal:NOISe[1]|2:TYPe

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:NOISe[1]|2:TYPe UNIForm|GAUSsian
[:SOURce]:AM[1]|2:INTernal:NOISe[1]|2:TYPe?
```

This command sets the noise type when :AM[1]|2:SOURce is set to NOISe[1] or NOISe2.

***RST** POS

Key Entry	**Noise Gen 1**	**Noise Gen 2**

:AM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt
<val><units>
[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt?
```

This command sets the start frequency for the swept function generator.

***RST**	400.0 Hz
Range	100 mHz to 6.250 MHz

Key Entry	**AM Start Freq**

:AM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STOP

Supported	All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STOP
<val><units>
[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STOP?
```

This command sets the stop frequency for the swept function generator.

***RST**	400.0 Hz
Range	100 mHz to 6.250 MHz
Key Entry	**AM Stop Freq**

:AM[1]|2:INTernal:SWEep:FUNCtion:SHAPe

Supported	All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCtion:SHAPe
SINE|TRIangle|SQUare|RAMP
[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCtion:SHAPe?
```

This command sets the AM waveform type for the swept function generator.

***RST**	`SINE`

Key Entry	**AM Sweep Waveform**

:AM[1]|2:INTernal:SWEep:FUNCtion:SHAPe:RAMP

Supported	All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCtion:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:AM[1]|2:INTernal:SWEep:FUNCtion:SHAPe:RAMP?
```

This command sets the ramp direction for the swept function generator when :AM[1]|2:INTernal:SWEep:FUNCtion:SHAPe is set to RAMP.

***RST**	POS

Key Entry	**Pos Ramp**	**Neg Ramp**

:AM[1]|2:INTernal:SWEep:RATE[1]|2

Supported	All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:RATE[1]|2 <val><units>
[:SOURce]:AM[1]|2:INTernal:SWEep:RATE[1]|2?
```

This command sets the sweep rate for the AM swept–sine waveform.

The sweep rate function is only available for internal source 1.

***RST**	+4.00000000E+002
Range	0.5 Hz to 100 kHz
Key Entry	**AM Sweep Rate**

:AM[1]|2:INTernal:SWEep:SHAPe

Supported	All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:SHAPe SAWTooth|TRIangle
[:SOURce]:AM[1]|2:INTernal:SWEep:SHAPe?
```

This command selects the sweep shape.

SAWTooth	A sawtooth sweep shape only sweeps from start freq to stop freq.
TRIangle	A triangle sweep sweeps from start freq to stop freq and back to start freq. With a triangle shape sweep you can choose a different sweep rate for start freq to stop freq and another sweep rate for stop freq to start freq.
***RST**	`SAWTooth`

Key Entry	**AM Sweep Shape**

:AM[1]|2:INTernal:SWEep:TIME:COUPled

Supported	All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:TIME:COUPled ON|OFF|1|0
[:SOURce]:AM[1]|2:INTernal:SWEep:TIME:COUPled?
```

This command sets the couplings between start-to-stop values and stop-to-start values for AM sweep times and rates. The sweep times coupled to on.

Use this command when :AM[1]|2:INTernal:SWEep:SHAPe is set to TRIangle.

ON|1	This choice uses the same sweep time for both start freq to stop freq and stop freq to start freq sweeps of a triangle shape sweep. If sweep times coupled is ON, sweep time and rate is only set by the Start -> Stop softkeys.
OFF|0	This choice disables sweep time couplings.
***RST**	`OFF`

Key Entry	**AM Sweep Times Coupled Off On**

:AM[1]|2:INTernal:SWEep:TIME[1]|2

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:TIME[1]|2 <val><unit>
[:SOURce]:AM[1]|2:INTernal:SWEep:TIME[1]|2?
```

This command sets the sweep rate for the amplitude-modulated, swept-sine waveform.

***RST**	+1.00000000E–001
Range	1mS–65.535S
Key Entry	**AM Sweep Time**

:AM[1]|2:INTernal:SWEep:TRIGger

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger
BUS|IMMediate|EXTernal|INTernal|KEY
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger?
```

This command sets the trigger source for the amplitude modulated swept-sine waveform.

BUS	This choice enables GPIB triggering using the `*TRG` or `GET` command or LAN and RS-232 triggering using the `*TRG` command.
IMMediate	This choice enables immediate triggering of the sweep event.
EXTernal	This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2, or PULSE BNC connector.
INTernal	This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.
KEY	This choice enables triggering through front panel interaction by pressing the **Trigger** key.
***RST**	IMM

Key Entry	**Bus**	**Free Run**	**Ext**	**Int**	**Trigger Key**

:AM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce
TRIGger[1]|TRIGger2|PULSe
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce?
```

This command selects the external trigger source for the AM swept-sine waveform. With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1	This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.
TRIGger2	This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.
PULSe	This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.
***RST**	TRIGger1

Key Entry	**Trigger 1**	**Trigger 2**	**Pulse**

:AM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce

Supported	All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce
PVIDeo|PSYNc
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce?
```

This command selects the internal trigger source for the AM swept-sine waveform.

PVIDeo	This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.
PSYNc	This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.
***RST**	PSYN

Key Entry	**Pulse Video**	**Pulse Sync**

:AM[1]|2:INTernal:SWEep:TRIGger:SLOPe

Supported All Models with Options UNT and 303

```
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger:SLOPe
POSitive|NEGative
[:SOURce]:AM[1]|2:INTernal:SWEep:TRIGger:SLOPe?
```

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :AM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :AM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

POSitive	The signal generator triggers an event when it detects a rising edge on the source signal
NEGative	The signal generator triggers an event when it detects a falling edge on the source signal
***RST**	POS
Key Entry	**Int/Ext Trigger Polarity Neg Pos**

:AM:MODE

Supported All Models with Option UNT

```
[:SOURce]:AM:MODE DEEP|NORMal
```

```
[:SOURce]:AM:MODE?
```

This command sets the amplitude modulation mode. `DEEP` provides an AM depth with greater dynamic range. `NORMal` sets AM to standard operation.

Default	DEEP
Key Entry	**AM Mode Normal Deep**
Remarks	The RF carrier is modulated when you have set the signal generator's modulation state to ON, see :MODulation[:STATe] command for more information. Whenever amplitude modulation is enabled, the `AM` annunciator is turned on in the display.

:AM[1]|2:SOURce

Supported All Models with Option UNT

```
[:SOURce]:AM[1]|2:SOURce
FUNCtion[1]|FUNCtion2|SWEep|DUAL|NOISe[1]|NOISe2|EXT[1]|EXT2
[:SOURce]:AM[1]|2:SOURce?
```

This command sets the source to generate the amplitude modulation.

FUNCtion[1]	Selects function generator 1 as the modulation source.
FUNCtion[2]	Selects function generator 2 as the modulation source.
SWEep	Selects the swept function generator as the modulation source.
DUAL	Selects the dual function generator as the modulation source.
NOISe[1]	Selects noise generator 1 as the modulation source.
NOISe2	Selects noise generator 2 as the modulation source.
EXT[1]	Selects an externally applied signal as the modulation input. Connect the signal to the EXT 1 connector.
EXT2	Selects an externally applied signal as the modulation input. Connect the signal to the EXT 2 connector.
***RST**	FUNCtion[1]

Key Entry				
	Ext1	**Func Gen 1**	**Dual Func Gen**	**Noise Gen 1**
	Ext2	**Func Gen 2**	**Swept Func Gen**	**Noise Gen 2**

Remarks

A 1.0 V_p input is required for calibrated AM depth settings.

The externally applied, ac-coupled input signal is tested for a voltage level and a display annunciator will report a high or low condition if that voltage is > ±3% of 1 V_p.

Only FUNC1, FUNC2, EXT1 and EXT2 are available without Option 303.

:AM[1]|2:STATe

Supported All Models with Option UNT

```
[:SOURce]:AM[1]|2:STATe ON|OFF|1|0
[:SOURce]:AM[1]|2:STATe?
```

This command enables or disables the amplitude modulation for the selected path.

***RST**	0
Key Entry	**AM Off On**
Remarks	The RF carrier is modulated when you have set the signal generator’s modulation state to ON, see :MODulation[:STATe] command for more information.

Whenever amplitude modulation is enabled, the **AM** annunciator is turned on in the display.

:AM[1]|2:TYPE

Supported All models with Option UNT

```
[:SOURce]:AM[1]|2:TYPE LINear|EXPonential
[:SOURce]:AM[1]|2:TYPE?
```

This command sets the AM type to linear or exponential AM.

LINear	This choice selects linear AM type with depth values in units of percent/volt.
EXPonential	This choice selects exponential AM type with depth values in units of dB/volt.

Example

```
:AM2:TYPE EXP
```

The preceding example selects exponential type depth values for AM path 2.

***RST**	LIN
Key Entry	**AM Type LIN EXP**

:AM:WIDeband:STATe

Supported All Models with Option UNT

```
[:SOURce]:AM:WIDeband:STATe ON|OFF|1|0
[:SOURce]:AM:WIDeband:STATe?
```

This command toggles the state of wideband AM, which provides bandwidth beyond that of standard AM by utilizing an external modulating signal connected to the I Input.

***RST** 0

Key Entry **AM Path 1 2 WB** **AM Off On**

Remarks Instruments that have 9kHz as their lowest frequency cannot have wideband AM at frequencies from 9kHz up to 5MHz.

Frequency Modulation Subsystem–Option UNT ([:SOURce])

:FM[1]|2:EXTernal[1]|2:COUPling

Supported All Models with Option UNT

```
[:SOURce]:FM[1]|2:EXTernal[1]|2:COUPling AC|DC
[:SOURce]:FM[1]|2:EXTernal[1]|2:COUPling?
```

This command sets the coupling for the frequency modulation source through the selected external input connector.

Use this command with the EXTernal[1]|2:DC command to remove the effects of DC and optimize the DCFM calibration.

AC	This choice only passes ac signal components.
DC	This choice passes both ac and dc signal components.
***RST**	DC
Key Entry	**Ext Coupling DC AC**
Remarks	The command does not change the currently active source or switch the current modulation on or off. The modulating signal may be the sum of several signals, either internal or external sources.

:FM[1]|2:EXTernal[1]|2:IMPedance

Supported All Models with Option UNT

```
[:SOURce]:FM:EXTernal[1]|2:IMPedance 50|600|1000000
[:SOURce]:FM:EXTernal[1]|2:IMPedance?
```

This command sets the input impedance for the externally-applied FM input signal.

50	This choice selects 50 Ohm input impedance.
600	This choice selects 600 Ohm input impedance.
1000000	This choice selects 1 MOhm input impedance.
***RST**	50 Ohm

Key Entry	**Ext Impedance**	50 Ohm	600 Ohm	1 MOhm

:FM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent
<value><unit>
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent?
```

This command sets the amplitude of tone 2 of the internal dual function generator source as a percent of the peak analog modulation amplitude. Tone 1 of the internal dual function generator source will make up the remaining amplitude.

***RST**	50.0
Range	0 to 100.0%
Key Entry	**FM Tone 2 Ampl % of Peak**

:FM[1]|2:INTernal:DUAL:FUNCtion2:POFFset

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion2:POFFset
<value><unit>
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion2:POFFset?
```

This command sets the phase offset in degrees or radians of tone 2 in relation to tone 1 of the internal dual function generator source.

***RST**	0.000 rad
Range	-6.290 to 6.290 rad -360.4 to 360.4 deg
Key Entry	**FM Tone 2 Phase Offset**

:FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:FREQuency

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:FREQuency
<value><unit>
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:FREQuency?
```

This command sets the frequency of tone 1 (default) or tone 2 of the internal dual function generator source.

***RST**	400.0 Hz	
Range	100.0 mHz to 6.25 MHz	
Key Entry	**FM Tone 1 Freq**	**FM Tone 2 Freq**

:FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe
SINE|TRIangle|SQUare|RAMP
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe?
```

This command sets the shape of tone 1 (default) or tone 2 of the internal dual function generator source.

***RST** `SINE`

Key Entry **FM Tone 1 Waveform** **FM Tone 2 Waveform**

:FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe:RAMP

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe:RAMP?
```

This command sets the ramp direction of the selected tone (1 or 2) of the internal dual function generator source when :FM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe is set to RAMP.

***RST** POS

Key Entry **Pos Ramp** **Neg Ramp**

:FM:INTernal:FREQuency:STEP[:INCRement]

Supported All Models with Option UNT

```
[:SOURce]:FM[1]|2:INTernal[1]|2:FREQuency:STEP[:INCRement]
<num>
[:SOURce]:FM[1]|2:INTernal[1]|2:FREQuency:STEP[:INCRement]?
```

This command sets the step increment for the internal frequency modulation.

The variable <num> sets the entered value in units of Hertz.

***RST** +5.00000000E+002 (persistent value; use :PRESet:PERSistent to restore the factory preset value)

Range 0.1–6.25E6

Key Entry **Incr Set**

Remarks The value set by this command is used with the UP and DOWN choices for the FM frequency setting. Refer to :FM[1]|2:INTernal:FUNCtion[1]|2:FREQuency command for more information.

The setting enabled by this command is not affected by signal generator power-on, preset, or `*RST`.

:FM[1]|2:INTernal:FUNCtion[1]|2:FREQuency

Supported All Models with Option UNT

```
[:SOURce]:FM[1]|2:INTernal:FUNCtion[1]|2:FREQuency
<value><unit>|UP|DOWN
[:SOURce]:FM[1]|2:INTernal:FUNCtion[1]|2:FREQuency?
```

This command sets the internal frequency modulation rate for the following applications:

– the start frequency for a swept-sine waveform

– the frequency rate for all other waveforms

***RST** +4.00000000E+002

Range	All Waveforms: 0.1 Hz–2 MHz
Key Entry	**FM Rate**

:FM[1]|2:INTernal:FUNCtion[1]|2:POFFset

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:FUNCtion[1]|2:POFFset
<value><unit>
[:SOURce]:FM[1]|2:INTernal:FUNCtion[1]|2:POFFset?
```

This command sets the phase offset in degrees or radians of internal function generator source.

***RST** 0.000 rad

Range	-6.290 to 6.290 rad
	-360.4 to 360.4 deg
Key Entry	**FM Phase Offset**

:FM[1]|2:INTernal:FUNCtion[1]|2:SHAPe

Supported All Models with Option UNT

```
[:SOURce]:FM[1]|2:INTernal:FUNCtion[1]|2:SHAPe
SINE|SQUare|RAMP|PULSe
[:SOURce]:FM[1]|2:INTernal:FUNCtion[1]|2:SHAPe?
```

This command sets the FM waveform type.

***RST** `SINE`

Remarks The waveform selection is only valid when INT is the source selection. Refer to ":FM[1]|2:SOURce" on page 272 for source type selection.

SINE is the only shape available without Option 303.

:FM[1]|2:INTernal:FUNCtion[1]|2:SHAPe:RAMP

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:FUNCtion[1]|2:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:FM[1]|2:INTernal:FUNCtion[1]|2:SHAPe:RAMP?
```

This command sets the ramp direction when :FM[1]|2:INTernal:FUNCtion[1]|2:SHAPe is set to RAMP.

***RST** POS

Key Entry	Pos Ramp	Neg Ramp

:FM[1]|2:INTernal:NOISe[1]|2:TYPe

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:NOISe[1]|2:TYPe UNIForm|GAUSsian
[:SOURce]:FM[1]|2:INTernal:NOISe[1]|2:TYPe?
```

This command sets the noise type when ":FM[1]|2:SOURce" on page 272 is set to NOISe[1] or NOISe2.

***RST** POS

Key Entry	Noise Gen 1	Noise Gen 2

:FM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt
<val><units>
[:SOURce]:FM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt?
```

This command sets the start frequency for the swept function generator.

***RST** 400.0 Hz

Range 100 mHz to 6.250 MHz

Key Entry **FM Start Freq**

:FM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STOP

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STOP
<val><units>
[:SOURce]:FM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STOP?
```

This command sets the stop frequency for the swept function generator.

***RST**	400.0 Hz
Range	100 mHz to 6.250 MHz
Key Entry	**FM Stop Freq**

:FM[1]|2:INTernal:SWEep:FUNCtion:SHAPe

Supported	All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:FUNCtion:SHAPe
SINE|TRIangle|SQUare|RAMP
[:SOURce]:FM[1]|2:INTernal:SWEep:FUNCtion:SHAPe?
```

This command sets the FM waveform type for the swept function generator.

***RST**	`SINE`
Key Entry	**FM Sweep Waveform**

:FM[1]|2:INTernal:SWEep:FUNCtion:SHAPe:RAMP

Supported	All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:FUNCtion:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:FM[1]|2:INTernal:SWEep:FUNCtion:SHAPe:RAMP?
```

This command sets the ramp direction for the swept function generator when :FM[1]|2:INTernal:SWEep:FUNCtion:SHAPe is set to RAMP.

***RST**	POS	
Key Entry	**Pos Ramp**	**Neg Ramp**

:FM[1]|2:INTernal:SWEep:RATE[1]|2

Supported	All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:RATE[1]|2 <val><units>
[:SOURce]:FM[1]|2:INTernal:SWEep:RATE[1]|2?
```

This command sets the sweep rate for the FM swept–sine waveform.

The sweep rate function is only available for internal source 1.

***RST**	+4.00000000E+002
Range	0.5 Hz to 100 kHz

Key Entry **FM Sweep Rate**

:FM[1]|2:INTernal:SWEep:SHAPe

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:SHAPe SAWTooth|TRIangle
[:SOURce]:FM[1]|2:INTernal:SWEep:SHAPe?
```

This command selects the sweep shape.

SAWTooth	A sawtooth sweep shape only sweeps from start freq to stop freq.
TRIangle	A triangle sweep sweeps from start freq to stop freq and back to start freq. With a triangle shape sweep you can choose a different sweep rate for start freq to stop freq and another sweep rate for stop freq to start freq.
***RST**	`SAWTooth`

Key Entry **FM Sweep Shape**

:FM[1]|2:INTernal:SWEep:TIME:COUPled

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:TIME:COUPled ON|OFF|1|0
[:SOURce]:FM[1]|2:INTernal:SWEep:TIME:COUPled?
```

This command sets the couplings between start-to-stop values and stop-to-start values for FM sweep times and rates. The sweep times coupled to on.

Use this command when :FM[1]|2:INTernal:SWEep:SHAPe is set to TRIangle.

ON|1	This choice uses the same sweep time for both start freq to stop freq and stop freq to start freq sweeps of a triangle shape sweep. If sweep times coupled is ON, sweep time and rate is only set by the Start -> Stop softkeys.
OFF|0	This choice disables sweep time couplings.
***RST**	`OFF`

Key Entry **FM Sweep Times Coupled Off On**

:FM[1]|2:INTernal:SWEep:TIME[1]|2

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:TIME[1]|2 <val><unit>
[:SOURce]:FM[1]|2:INTernal:SWEep:TIME[1]|2?
```

This command sets the sweep time for the swept-sine waveform.

***RST**	+1.00000000E–001
Range	1.0mS–65.535S
Key Entry	**FM Sweep Time**

:FM[1]|2:INTernal:SWEep:TRIGger

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger
BUS|IMMediate|EXTernal|INTernal|KEY
[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger?
```

This command sets the trigger source for the frequency modulated swept-sine waveform.

BUS	This choice enables GPIB triggering using the `*TRG` or `GET` command or LAN and RS-232 triggering using the `*TRG` command.
IMMediate	This choice enables immediate triggering of the sweep event.
EXTernal	This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2, or PULSE BNC connector.
INTernal	This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.
KEY	This choice enables triggering through front panel interaction by pressing the **Trigger** key.
***RST**	IMM

Key Entry	**Bus**	**Free Run**	**Ext**	**Int**	**Trigger Key**

:FM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce

Supported All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce
TRIGger[1]|TRIGger2|PULSe
[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce?
```

This command selects the external trigger source for the FM swept-sine waveform. With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1	This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

TRIGger2	This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.
PULSe	This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.
***RST**	TRIGger1

Key Entry	**Trigger 1**	**Trigger 2**	**Pulse**

:FM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce

Supported	All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce
PVIDeo|PSYNc
[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce?
```

This command selects the internal trigger source for the FM swept-sine waveform.

PVIDeo	This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.
PSYNc	This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.
***RST**	PSYN

Key Entry	**Pulse Video**	**Pulse Sync**

:FM[1]|2:INTernal:SWEep:TRIGger:SLOPe

Supported	All Models with Options UNT and 303

```
[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger:SLOPe
POSitive|NEGative
[:SOURce]:FM[1]|2:INTernal:SWEep:TRIGger:SLOPe?
```

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :FM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :FM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

POSitive	The signal generator triggers an event when it detects a rising edge on the source signal

NEGative	The signal generator triggers an event when it detects a falling edge on the source signal
***RST**	POS
Key Entry	**Int/Ext Trigger Polarity Neg Pos**

:FM[1]|2:SOURce

Supported All Models with Option UNT

```
[:SOURce]:FM[1]|2:SOURce
FUNCtion[1]|FUNCtion2|SWEep|DUAL|NOISe[1]|NOISe2|EXT[1]|EXT2
[:SOURce]:FM[1]|2:SOURce?
```

This command sets the source to generate the frequency modulation.

FUNCtion[1]	Selects function generator 1 as the modulation source.
FUNCtion[2]	Selects function generator 2 as the modulation source.
SWEep	Selects the swept function generator as the modulation source.
DUAL	Selects the dual function generator as the modulation source.
NOISe[1]	Selects noise generator 1 as the modulation source.
NOISe2	Selects noise generator 2 as the modulation source.
EXT[1]	Selects an externally applied signal as the modulation input. Connect the signal to the EXT 1 connector.
EXT2	Selects an externally applied signal as the modulation input. Connect the signal to the EXT 2 connector.
***RST**	FUNCtion[1]

Key Entry	**Ext1**	**Func Gen 1**	**Dual Func Gen**	**Noise Gen 1**
	Ext2	**Func Gen 2**	**Swept Func Gen**	**Noise Gen 2**

Remarks The externally applied, ac-coupled input signal is tested for a voltage level and a display annunciator will report a high or low condition if that voltage is > ±3% of 1 V_p.

:FM[1]|2:STATe

Supported All Models with Option UNT

```
[:SOURce]:FM[1]|2:STATe ON|OFF|1|0
[:SOURce]:FM[1]|2:STATe?
```

This command enables or disables the frequency modulation for the selected path.

***RST**	0
Key Entry	**FM Off On**
Remarks	The RF carrier is modulated when you set the signal generator’s modulation state to ON, see :MODulation[:STATe] command for more information. Whenever frequency modulation is enabled, the `FM` annunciator is turned on in the display.

:FM[1]|2[:DEViation]

Supported	All Models with Option UNT

```
[:SOURce]:FM[1]|2[:DEViation] <value><unit>
[:SOURce]:FM[1]|2[:DEViation]?
```

This command sets the frequency modulation deviation. Please refer to **Data Sheet** for more information on FM deviation specifications.

***RST**	+1.00000000E+003
Key Entry	**FM DEV**

:FM[:DEViation]:STEP[:INCRement]

Supported	All Models with Option UNT

```
[:SOURce]:FM[:DEViation]:STEP[:INCRement]
<value><unit>|GHz|MHz|kHz|Hz
[:SOURce]:FM[:DEViation]:STEP[:INCRement]?
```

This command sets the step increment for the FM deviation of the signal generator.

***RST**	+5.00000000E+003
Key Entry	**Incr Set**
Remarks	The setting enabled by this command is not affected by signal generator power-on, preset, or `*RST`.

Low Frequency Output Subsystem ([:SOURce]:LFOutput)

:AMPLitude

Supported All Models with Option UNT

```
[:SOURce]:LFOutput:AMPLitude <val><unit>
[:SOURce]:LFOutput:AMPLitude?
```

This command sets the amplitude for the signal at the LF OUTPUT connector.

***RST**	0.00
Range	0.000VP–5.0VP
Key Entry	**LF Out Amplitude**

:DUAL:FUNCtion2:AMPLitude:PERCent

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:DUAL:FUNCtion2:AMPLitude:PERCent
<value><unit>
[:SOURce]:LFOutput:DUAL:FUNCtion2:AMPLitude:PERCent?
```

This command sets the amplitude of tone 2 of the internal dual function generator source as a percent of the peak analog modulation amplitude. Tone 1 of the internal dual function generator source will make up the remaining amplitude.

***RST**	50.0
Range	0 to 100.0%
Key Entry	**LFOut Tone 2 Ampl % of Peak**

:DUAL:FUNCtion2:POFFset

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:DUAL:FUNCtion2:POFFset <value><unit>
[:SOURce]:LFOutput:DUAL:FUNCtion2:POFFset?
```

This command sets the phase offset in degrees or radians of tone 2 in relation to tone 1 of the internal dual function generator source.

***RST**	0.000 rad
Range	-6.290 to 6.290 rad -360.4 to 360.4 deg

Key Entry	**LF Out Tone 2 Phase Offset**

:DUAL:FUNCtion[1]|2:FREQuency

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:DUAL:FUNCtion[1]|2:FREQuency
<value><unit>
[:SOURce]:LFOutput:DUAL:FUNCtion[1]|2:FREQuency?
```

This command sets the frequency of tone 1 (default) or tone 2 of the internal dual function generator source.

***RST** 400.0 Hz

Range	100.0 mHz to 6.25 MHz	
Key Entry	**LF Out Tone 1 Freq**	**LF Out Tone 2 Freq**

:DUAL:FUNCtion[1]|2:SHAPe

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:DUAL:FUNCtion[1]|2:SHAPe
SINE|TRIangle|SQUare|RAMP
[:SOURce]:LFOutput:DUAL:FUNCtion[1]|2:SHAPe?
```

This command sets the shape of tone 1 (default) or tone 2 of the internal dual function generator source.

***RST** SINE

Key Entry	**LF Out Tone 1 Waveform**	**LF Out Tone 2 Waveform**

:DUAL:FUNCtion[1]|2:SHAPe:RAMP

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:DUAL:FUNCtion[1]|2:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:LFOutput:DUAL:FUNCtion[1]|2:SHAPe:RAMP?
```

This command sets the ramp direction of the selected tone (1 or 2) of the internal dual function generator source when :DUAL:FUNCtion[1]|2:SHAPe is set to RAMP.

***RST** POS

Key Entry	**Pos Ramp**	**Neg Ramp**

:FUNCtion[1]|2:FREQuency

Supported All models with Option UNT

```
[:SOURce]:LFOutput:FUNCtion[1]|2:FREQuency <val><units>
[:SOURce]:LFOutput:FUNCtion[1]|2:FREQuency?
```

This command sets the frequency of function generator 1 or 2. The command sets:

– the frequency of the first tone of a dual–sine waveform

– the start frequency for a swept–sine waveform

– the frequency for all other waveform types

For selecting the waveform type, use the :FUNCtion[1]|2:SHAPe command.

***RST** +4.00000000E+002

Range	**Sine and Dual–Sine**: 0.5 Hz to 1 MHz		
Range	**Swept–Sine**: 1 Hz to 1 MHz		
	All Other Waveforms: 0.5 Hz to 100 kHz		
Key Entry	**LF Out Tone 1 Freq**	**LF Out Start Freq**	**LF Out Freq**

:FUNCtion[1]|2:PERiod

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:FUNCtion[1]|2:PERiod <val><unit>
[:SOURce]:LFOutput:FUNCtion[1]|2:PERiod?
```

This command sets the pulse period of the internally generated pulsed low frequency waveform.

***RST** +8.00000000E–005

Range 16uS–30S

Key Entry **LF Out Period**

:FUNCtion[1]|2:POFFset

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:FUNCtion[1]|2:POFFset <value><unit>
[:SOURce]:LFOutput:FUNCtion[1]|2:POFFset?
```

This command sets the phase offset in degrees or radians of internal function generator source.

***RST**	0.000 rad
Range	-6.290 to 6.290 rad -360.4 to 360.4 deg
Key Entry	**LF Out Phase Offset**

:FUNCtion[1]|2:PWIDth

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:FUNCtion[1]|2:PWIDth <val><unit>
[:SOURce]:LFOutput:FUNCtion[1]|2:PWIDth?
```

This command sets the pulse width of the internally-generated pulsed low frequency waveform.

The upper limit range value is restricted by the current value of the pulse period. For example, if the pulse period value is set to 16 μS, the pulse width is limited to a maximum range value of 16 μS.

***RST**	+4.00000000E–005
Range	8uS–30S
Key Entry	**LF Out Width**
Remarks	To change the pulse period value, refer to the :FUNCtion[1]|2:PERiod command.

:FUNCtion[1]|2:SHAPe

Supported All models with Option UNT

```
[:SOURce]:LFOutput:FUNCtion[1]|2:SHAPe
SINE|TRIangle|SQUare|RAMP|PULSe|NOISe|DC
[:SOURce]:LFOutput:FUNCtion[1]|2:SHAPe?
```

This command selects the waveform type. Function Generator 1 must be the source for the dual–sine or the swept–sine waveform. Refer to the :SOURce command for more information.

***RST** SINE

Key Entry	**Sine**	**Triangle**	**Square**	**Ramp**	**Pulse**
	Noise	**DC**			

:FUNCtion[1]|2:SHAPe:RAMP

Supported All models with Option UNT

```
[:SOURce]:LFOutput:FUNCtion[1]|2:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:LFOutput:FUNCtion[1]|2:SHAPe:RAMP?
```

This command selects a positive or negative slope for the ramp modulation on the LF output.

For selecting the waveform type, use the :FUNCtion[1]|2:SHAPe command.

***RST** POS

Key Entry **Positive** **Negative**

:LOAD:IMPedance

Supported All Models with Option UNT

```
[:SOURce]:LFOutput:LOAD:IMPedance 50|1000000
[:SOURce]:LFOutput:LOAD:IMPedance?
```

This command sets the impedance of the load that the LF Output is connected to. This changes the displayed LF Output amplitude based on the load impedance. Max LF Output amplitude is 5V into 50 Ohms and 10V into 1 MOhms.

50	This choice selects 50 Ohm load impedance.
1000000	This choice selects 1 MOhm load impedance.
***RST**	50 Ohm

Key Entry **Load Impedance 50 Ohm 1 MOhm**

:NOISe[1]|2:TYPe

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:NOISe[1]|2:TYPe UNIForm|GAUSsian
[:SOURce]:LFOutput:NOISe[1]|2:TYPe?
```

This command sets the noise type when :SOURce is set to NOISe[1] or NOISe2.

***RST** POS

Key Entry **Uniform** **Gaussian**

:OFFset

Supported All Models with Option UNT

[:SOURce]:LFOutput:OFFset <value><unit>
[:SOURce]:LFOutput:OFFset?

This command sets the DC offset (in volts) of the signal at the LF Output connector.

***RST** 0.000 V

Range	-10.000 to 10.000 V	
Key Entry	**LF Out DC Offset Into 50 Ohms**	**LF Out DC Offset Into 1 MOhms**

:SOURce

Supported All Models with Options UNT and 303

[:SOURce]:LFOutput:SOURce MONitor|FUNCtion[1]|FUNCtion2|SWEep|DUAL|NOISe[1]|NOISe2|DC
[:SOURce]:LFOutput:SOURce?

This command selects the source for the LF output.

MONitor	Selects monitoring on the LF output BNC. Select the monitoring source using the :SOURce:MONitor command.
FUNCtion[1]	Selects function generator 1 as the modulation source.
FUNCtion[2]	Selects function generator 2 as the modulation source.
SWEep	Selects the swept function generator as the LF output BNC source. If AM or FM or PM is modulating the swept function generator then the LF output BNC will have the unmodulated signal if you choose to monitor the swept function generator.
DUAL	Selects the dual function generator as the modulation source.
NOISe[1]	Selects noise generator 1 as the modulation source.
NOISe2	Selects noise generator 2 as the modulation source.
DC	Selects a DC voltage level as the LF output BNC source.
***RST**	MONitor

Key Entry	**Int Monitor**	**Func Gen 1**	**Dual Func Gen**
	DC	**Func Gen 2**	**Swept Func Gen**
	Noise Gen 1	**Noise Gen 1**	

Remarks Only MON, FUNC1 and DC are available without Option 303.

:SOURce:MONitor

Supported All models with Option UNT

```
[:SOURce]:LFOutput:SOURce:MONitor
FUNCtion[1]|FUNCtion2|SWEep|DUAL
[:SOURce]:LFOutput:SOURce:MONitor?
```

This command selects the source for the LF output.

FUNCtion[1]|2 These choices enable you to output a signal where the frequency and shape of the signal is set by internal function generator 1 or 2. For example, if the internal source is currently assigned to an AM path configuration and AM is turned on, the signal output at the LF OUTPUT connector will have the frequency and shape of the amplitude modulating signal.

SWEep Selects the swept function generator as the modulation source to monitor. If AM or FM or PM is modulating the swept function generator then the LF output BNC will have the unmodulated signal if you choose to monitor the swept function generator.

DUAL Selects the dual function generator as the modulation source to monitor. If AM or FM or PM is modulating the dual function generator then the LF output BNC will have the unmodulated signal if you choose to monitor the dual function generator.

***RST** FUNC1

Key Entry	**Func Gen 1**	**Dual Func Gen**
	Func Gen 2	**Swept Func Gen**

Remarks Only FUNC1 is available without Option 303.

:STATe

Supported All Models

```
[:SOURce]:LFOutput:STATe ON|OFF|1|0
[:SOURce]:LFOutput:STATe?
```

This command enables or disables the low frequency output.

***RST** 0

Key Entry **LF Out Off On**

:SWEep:FUNCtion:FREQuency:STARt

Supported	All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:FUNCtion:FREQuency:STARt
<val><units>
[:SOURce]:LFOutput:SWEep:FUNCtion:FREQuency:STARt?
```

This command sets the start frequency for the swept function generator.

***RST**	400.0 Hz
Range	100 mHz to 6.250 MHz
Key Entry	**LF Out Start Freq**

:SWEep:FUNCtion:FREQuency:STOP

Supported	All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:FUNCtion:FREQuency:STOP
<val><units>
[:SOURce]:LFOutput:SWEep:FUNCtion:FREQuency:STOP?
```

This command sets the stop frequency for the swept function generator.

***RST**	400.0 Hz
Range	100 mHz to 6.250 MHz
Key Entry	**LF Out Stop Freq**

:SWEep:FUNCtion:SHAPe

Supported	All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:FUNCtion:SHAPe
SINE|TRIangle|SQUare|RAMP
[:SOURce]:LFOutput:SWEep:FUNCtion:SHAPe?
```

This command sets the waveform type for the swept function generator.

***RST**	`SINE`
Key Entry	**LF Out Sweep Waveform**

:SWEep:FUNCtion:SHAPe:RAMP

Supported	All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:FUNCtion:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:LFOutput:SWEep:FUNCtion:SHAPe:RAMP?
```

This command sets the ramp direction for the swept function generator when :SWEep:FUNCtion:SHAPe is set to RAMP.

***RST** POS

Key Entry **Pos Ramp** **Neg Ramp**

:SWEep:RATE[1]|2

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:RATE[1]|2 <val><units>
[:SOURce]:LFOutput:SWEep:RATE[1]|2?
```

This command sets the sweep rate for the swept–sine waveform.

The sweep rate function is only available for internal source 1.

***RST** +4.00000000E+002

Range 0.5 Hz to 100 kHz

Key Entry **LF Out Sweep Rate**

:SWEep:SHAPe

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:SHAPe SAWTooth|TRIangle
[:SOURce]:LFOutput:SWEep:SHAPe?
```

This command selects the sweep shape.

SAWTooth A sawtooth sweep shape only sweeps from start freq to stop freq.

TRIangle A triangle sweep sweeps from start freq to stop freq and back to start freq. With a triangle shape sweep you can choose a different sweep rate for start freq to stop freq and another sweep rate for stop freq to start freq.

***RST** `SAWTooth`

Key Entry **LF Out Sweep Shape**

:SWEep:TIME:COUPled

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:TIME:COUPled ON|OFF|1|0
[:SOURce]:LFOutput:SWEep:TIME:COUPled?
```

This command sets the couplings between start-to-stop values and stop-to-start values for low-frequency output sweep times and rates. The sweep times coupled to on.

Use this command when :SWEep:SHAPe is set to TRIangle.

ON|1	This choice uses the same sweep time for both start freq to stop freq and stop freq to start freq sweeps of a triangle shape sweep. If sweep times coupled is ON, sweep time and rate is only set by the Start -> Stop softkeys.
OFF|0	This choice disables sweep time couplings.
***RST**	OFF

Key Entry **LF Out Sweep Times Coupled Off On**

:SWEep:TIME[1]|2

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:TIME[1]|2 <val><unit>
[:SOURce]:LFOutput:SWEep:TIME[1]|2?
```

This command sets the sweep time for the swept-sine waveform.

***RST**	+1.00000000E–001
Range	1.0mS–65.535S
Key Entry	**LF Out Sweep Time**

:SWEep:TRIGger

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:TRIGger
IMMediate|KEY|EXTernal|INTernal|BUS
[:SOURce]:LFOutput:SWEep:TRIGger?
```

This command sets the trigger source for the frequency modulated swept-sine waveform.

IMMediate	This choice enables immediate triggering of the sweep event.
KEY	This choice enables triggering through front panel interaction by pressing the **Trigger** key.
EXTernal	This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2, or PULSE BNC connector.
INTernal	This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.
BUS	This choice enables GPIB triggering using the `*TRG` or `GET` command or LAN and RS-232 triggering using the `*TRG` command.

***RST** IMM

Key Entry	Bus	Free Run	Ext	Int	Trigger Key

:SWEep:TRIGger:EXTernal:SOURce

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:TRIGger:EXTernal:SOURce
TRIGger[1]|TRIGger2|PULSe
[:SOURce]:LFOutput:SWEep:TRIGger:EXTernal:SOURce?
```

This command selects the external trigger source for the sweep. With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1 This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

TRIGger2 This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.

PULSe This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.

***RST** TRIGger1

Key Entry	Trigger 1	Trigger 2	Pulse

:SWEep:TRIGger:INTernal:SOURce

Supported All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:TRIGger:INTernal:SOURce
PVIDeo|PSYNc
[:SOURce]:LFOutput:SWEep:TRIGger:INTernal:SOURce?
```

This command selects the internal trigger source for the sweep.

PVIDeo This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.

PSYNc This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.

***RST** PSYN

Key Entry	Pulse Video	Pulse Sync

:SWEep:TRIGger:SLOPe

Supported	All Models with Options UNT and 303

```
[:SOURce]:LFOutput:SWEep:TRIGger:SLOPe POSitive|NEGative
[:SOURce]:LFOutput:SWEep:TRIGger:SLOPe?
```

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :SWEep:TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :SWEep:TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

POSitive	The signal generator triggers an event when it detects a rising edge on the source signal
NEGative	The signal generator triggers an event when it detects a falling edge on the source signal
***RST**	POS
Key Entry	**Int/Ext Trigger Polarity Neg Pos**

Phase Modulation Subsystem–Option UNT ([:SOURce])

:PM[1]|2:BANDwidth|BWIDth

Supported All Models with Option UNT

```
[:SOURce]:PM[1]|2:BANDwidth|BWIDth NORMal|HIGH
[:SOURce]:PM[1]|2:BANDwidth|BWIDth?
```

This command toggles between normal phase modulation and high-bandwidth phase modulation mode.

***RST**	NORM
Key Entry	**FM ΦM Normal High BW**

:PM[1]|2:EXTernal[1]|2:COUPling

Supported All Models with Option UNT

```
[:SOURce]:PM[1]|2:EXTernal[1]|2:COUPling AC|DC
[:SOURce]:PM[1]|2:EXTernal[1]|2:COUPling?
```

This command sets the coupling for the phase modulation source through the selected external input connector.

Use this command with the EXTernal[1]|2:DC command to remove the effects of DC and optimize the DCFM calibration.

AC	This choice will only pass ac signal components.
DC	This choice will pass both ac and dc signal components.
***RST**	DC
Key Entry	**Ext Coupling DC AC**
Remarks	This command does not change the currently active source or switch the current modulation on or off. The modulating signal may be the sum of several signals, either internal or external sources.

:PM[1]|2:EXTernal[1]|2:IMPedance

Supported All Models with Option UNT

```
[:SOURce]:PM[1]|2:EXTernal[1]|2:IMPedance 50|600|1000000
[:SOURce]:PM[1]|2:EXTernal[1]|2:IMPedance?
```

This command sets the input impedance for the externally-applied phase-modulated input signal.

50	This choice selects 50 Ohm input impedance.
600	This choice selects 600 Ohm input impedance.

1000000	This choice selects 1 MOhm input impedance.
***RST**	50 Ohm

Key Entry	**Ext Impedance**	50 Ohm	600 Ohm	1 MOhm

:PM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent
<value><unit>
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion2:AMPLitude:PERCent?
```

This command sets the amplitude of tone 2 of the internal dual function generator source as a percent of the peak analog modulation amplitude. Tone 1 of the internal dual function generator source will make up the remaining amplitude.

***RST**	50.0
Range	0 to 100.0%
Key Entry	**ΦM Tone 2 Ampl % of Peak**

:PM[1]|2:INTernal:DUAL:FUNCtion2:POFFset

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion2:POFFset
<value><unit>
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion2:POFFset?
```

This command sets the phase offset in degrees or radians of tone 2 in relation to tone 1 of the internal dual function generator source.

***RST**	0.000 rad
Range	-6.290 to 6.290 rad -360.4 to 360.4 deg
Key Entry	**ΦM Tone 2 Phase Offset**

:PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:FREQuency

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:FREQuency
<value><unit>
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:FREQuency?
```

This command sets the frequency of tone 1 (default) or tone 2 of the internal dual function generator source.

***RST** 400.0 Hz

Range 100.0 mHz to 6.25 MHz

Key Entry **ΦM Tone 1 Freq** **ΦM Tone 2 Freq**

:PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe

Supported All Models with Option UNTand 303

```
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe
SINE|TRIangle|SQUare|RAMP
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe?
```

This command sets the shape of tone 1 (default) or tone 2 of the internal dual function generator source.

***RST** `SINE`

Key Entry **ΦM Tone 1 Waveform** **ΦM Tone 2 Waveform**

:PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe:RAMP

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe:RAMP?
```

This command sets the ramp direction of the selected tone (1 or 2) of the internal dual function generator source when :PM[1]|2:INTernal:DUAL:FUNCtion[1]|2:SHAPe is set to RAMP.

***RST** POS

Key Entry **Pos Ramp** **Neg Ramp**

:PM:INTernal:FREQuency:STEP[:INCRement]

Supported All Models with Option UNT

```
[:SOURce]:PM:INTernal:FREQuency:STEP[:INCRement] <num>
[:SOURce]:PM:INTernal:FREQuency:STEP[:INCRement]?
```

This command sets the step increment of the phase modulation internal frequency.

The variable <num> sets the entered value in units of Hertz.

***RST**	+5.00000000E+002 (persistent value; use :PRESet:PERSistent to restore the factory preset value)
Range	0.1–6.25E6
Key Entry	**Incr Set**
Remarks	The value set by this command is used with the UP and DOWN choices for the PM frequency command. Refer to :PM[1]|2:INTernal:FUNCtion[1]|2:FREQuency command for more information. The setting enabled by this command is not affected by signal generator power-on, preset, or `*RST`.

:PM[1]|2:INTernal:FUNCtion[1]|2:FREQuency

Supported All Models with Option UNT

```
[:SOURce]:PM[1]|2:INTernal:FUNCtion[1]|2:FREQuency
<value><unit>|UP|DOWN
[:SOURce]:PM[1]|2:INTernal:FUNCtion[1]|2:FREQuency?
```

This command sets the internal modulation frequency rate for the following applications:

– the start frequency for a swept-sine waveform

– the frequency rate for all other waveforms

***RST**	+4.00000000E+002	
Range	All Waveforms: 0.1 Hz–2 MHz (Wideband)	All Waveforms: 0.1 Hz–1 MHz (narrowband)
Key Entry	**ΦM Rate**	

:PM[1]|2:INTernal:FUNCtion[1]|2:POFFset

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:FUNCtion[1]|2:POFFset
<value><unit>
[:SOURce]:PM[1]|2:INTernal:FUNCtion[1]|2:POFFset?
```

This command sets the phase offset in degrees or radians of internal function generator source.

***RST**	0.000 rad
Range	-6.290 to 6.290 rad -360.4 to 360.4 deg

Key Entry	**ΦM Phase Offset**

:PM[1]|2:INTernal:FUNCtion[1]|2:SHAPe

Supported All Models with Option UNT

```
[:SOURce]:PM[1]|2:INTernal:FUNCtion[1]|2:SHAPe
SINE|SQUare|TRIangle|RAMP|PULSe
[:SOURce]:PM[1]|2:INTernal:FUNCtion[1]|2:SHAPe?
```

This command sets the phase modulation waveform type.

***RST** SINE

Remarks The waveform selection is only valid when INT is the source selection. Refer to ":PM[1]|2:SOURce" on page 295 for source type selection.

SINE is the only shape available without Option 303.

:PM[1]|2:INTernal:FUNCtion[1]|2:SHAPe:RAMP

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:FUNCtion[1]|2:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:PM[1]|2:INTernal:FUNCtion[1]|2:SHAPe:RAMP?
```

This command sets the ramp direction when :PM[1]|2:INTernal:FUNCtion[1]|2:SHAPe is set to RAMP.

***RST** POS

Key Entry	**Pos Ramp**	**Neg Ramp**

:PM[1]|2:INTernal:NOISe[1]|2:TYPe

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:NOISe[1]|2:TYPe UNIForm|GAUSsian
[:SOURce]:PM[1]|2:INTernal:NOISe[1]|2:TYPe?
```

This command sets the noise type when ":PM[1]|2:SOURce" on page 295 is set to NOISe[1] or NOISe2.

***RST** POS

Key Entry	**Noise Gen 1**	**Noise Gen 2**

:PM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt

Supported All models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt
<val><units>
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STARt?
```

This command sets the start frequency for the swept function generator.

***RST**	400.0 Hz
Range	100 mHz to 6.250 MHz
Key Entry	**ΦM Start Freq**

:PM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STOP

Supported	All models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STOP
<val><units>
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCtion:FREQuency:STOP?
```

This command sets the stop frequency for the swept function generator.

***RST**	400.0 Hz
Range	100 mHz to 6.250 MHz
Key Entry	**ΦM Stop Freq**

:PM[1]|2:INTernal:SWEep:FUNCtion:SHAPe

Supported	All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCtion:SHAPe
SINE|TRIangle|SQUare|RAMP
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCtion:SHAPe?
```

This command sets the phase modulation waveform type for the swept function generator.

***RST**	SINE
Key Entry	**ΦM Sweep Waveform**

:PM[1]|2:INTernal:SWEep:FUNCtion:SHAPe:RAMP

Supported	All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCtion:SHAPe:RAMP
POSitive|NEGative
[:SOURce]:PM[1]|2:INTernal:SWEep:FUNCtion:SHAPe:RAMP?
```

This command sets the ramp direction for the swept function generator when :PM[1]|2:INTernal:SWEep:FUNCtion:SHAPe is set to RAMP.

***RST** POS

Key Entry **Pos Ramp** **Neg Ramp**

:PM[1]|2:INTernal:SWEep:RATE[1]|2

Supported All models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:RATE[1]|2 <val><units>
[:SOURce]:PM[1]|2:INTernal:SWEep:RATE[1]|2?
```

This command sets the sweep rate for a phase–modulated, swept–sine waveform.

To select the waveform, use the :PM[1]|2:INTernal:SWEep:FUNCtion:SHAPe command.

Example

```
:PM1:INT:SWE:RATE 30KHZ
```

The preceding example sets the sweep rate to 30 kHz.

***RST** +4.00000000E+002

Range 0.5 Hz to 100 kHz

Key Entry **ΦM Sweep Rate**

:PM[1]|2:INTernal:SWEep:SHAPe

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:SHAPe SAWTooth|TRIangle
[:SOURce]:PM[1]|2:INTernal:SWEep:SHAPe?
```

This command selects the sweep shape.

SAWTooth A sawtooth sweep shape only sweeps from start freq to stop freq.

TRIangle A triangle sweep sweeps from start freq to stop freq and back to start freq. With a triangle shape sweep you can choose a different sweep rate for start freq to stop freq and another sweep rate for stop freq to start freq.

***RST** `SAWTooth`

Key Entry **ΦM Sweep Shape**

:PM[1]|2:INTernal:SWEep:TIME:COUPled

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:TIME:COUPled ON|OFF|1|0
[:SOURce]:PM[1]|2:INTernal:SWEep:TIME:COUPled?
```

This command sets the couplings between start-to-stop values and stop-to-start values for phase modulation sweep times and rates. The sweep times coupled to on.

Use this command when :PM[1]|2:INTernal:SWEep:SHAPe is set to TRIangle.

ON|1	This choice uses the same sweep time for both start freq to stop freq and stop freq to start freq sweeps of a triangle shape sweep. If sweep times coupled is ON, sweep time and rate is only set by the Start -> Stop softkeys.
OFF|0	This choice disables sweep time couplings.
***RST**	`OFF`

Key Entry	**ΦM Sweep Times Coupled Off On**

:PM[1]|2:INTernal:SWEep:TIME[1]|2

Supported	All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:TIME[1]|2 <val><unit>
[:SOURce]:PM[1]|2:INTernal:SWEep:TIME[1]|2?
```

This command sets the sweep time for a phase-modulated, swept-sine waveform.

***RST**	+1.00000000E–001
Range	1.0mS–65.535S
Key Entry	**ΦM Sweep Time**

:PM[1]|2:INTernal:SWEep:TRIGger

Supported	All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger
BUS|IMMediate|EXTernal|INTernal|KEY
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger?
```

This command sets the trigger source for the phase-modulated, swept-sine waveform.

BUS	This choice enables GPIB triggering using the `*TRG` or `GET` command or LAN and RS-232 triggering using the `*TRG` command.
IMMediate	This choice enables immediate triggering of the sweep event.

EXTernal	This choice enables the triggering of a sweep event by an externally applied signal at the TRIG 1, TRIG 2, or PULSE BNC connector.
INTernal	This choice enables the triggering of a sweep event by an internal Pulse Video or Pulse Sync signal.
KEY	This choice enables triggering through front panel interaction by pressing the **Trigger** key.
***RST**	IMM

Key Entry **Bus** **Free Run** **Ext** **Trigger Key**

:PM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce
TRIGger[1]|TRIGger2|PULSe
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce?
```

This command selects the external trigger source for the phase-modulated swept-sine waveform. With external triggering, the selected bi-directional BNC is configured as an input.

TRIGger1	This choice selects the TRIG 1 BNC as the external trigger source for triggering sweep, point and function generator sweeps.
TRIGger2	This choice selects the TRIG 2 BNC as the external trigger source for triggering sweep, point and function generator sweeps.
PULSe	This choice selects the PULSE BNC as the external trigger source for triggering sweep, point and function generator sweeps.
***RST**	TRIGger1

Key Entry **Trigger 1** **Trigger 2** **Pulse**

:PM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce
PVIDeo|PSYNc
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce?
```

This command selects the internal trigger source for the phase-modulated swept-sine waveform.

PVIDeo	This choice selects Pulse Video as the internal trigger source for triggering sweep, point and function generator sweeps.
PSYNc	This choice selects Pulse Sync as the internal trigger source for triggering sweep, point and function generator sweeps.
***RST**	PSYN

Key Entry **Pulse Video** **Pulse Sync**

:PM[1]|2:INTernal:SWEep:TRIGger:SLOPe

Supported All Models with Option UNT and 303

```
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger:SLOPe
POSitive|NEGative
[:SOURce]:PM[1]|2:INTernal:SWEep:TRIGger:SLOPe?
```

This command sets the polarity of an external signal at the TRIG 1, TRIG 2, or PULSE BNC (see :PM[1]|2:INTernal:SWEep:TRIGger:EXTernal:SOURce) or internal Pulse Video or Pulse Sync signal (see :PM[1]|2:INTernal:SWEep:TRIGger:INTernal:SOURce) that will trigger a list or step sweep.

POSitive	The signal generator triggers an event when it detects a rising edge on the source signal
NEGative	The signal generator triggers an event when it detects a falling edge on the source signal
***RST**	POS
Key Entry	**Int/Ext Trigger Polarity Neg Pos**

:PM[1]|2:SOURce

Supported All Models with Option UNT

```
[:SOURce]:PM[1]|2:SOURce
FUNCtion[1]|FUNCtion2|SWEep|DUAL|NOISe[1]|NOISe2|EXT[1]|EXT2
[:SOURce]:PM[1]|2:SOURce?
```

This command sets the source to generate the phase modulation.

FUNCtion[1]	Selects function generator 1 as the modulation source.
FUNCtion[2]	Selects function generator 2 as the modulation source.
SWEep	Selects the swept function generator as the modulation source.
DUAL	Selects the dual function generator as the modulation source.

NOISe[1]	Selects noise generator 1 as the modulation source.
NOISe2	Selects noise generator 2 as the modulation source.
EXT[1]	Selects an externally applied signal as the modulation input. Connect the signal to the EXT 1 connector.
EXT2	Selects an externally applied signal as the modulation input. Connect the signal to the EXT 2 connector.
***RST**	FUNCtion[1]

Key Entry	**Ext1**	**Func Gen 1**	**Dual Func Gen**	**Noise Gen 1**
	Ext2	**Func Gen 2**	**Swept Func Gen**	**Noise Gen 2**

Remarks The externally applied, ac-coupled input signal is tested for a voltage level and a display annunciator will report a high or low condition if that voltage is > ±3% of 1 V_p.

:PM[1]|2:STATe

Supported All Models with Option UNT

```
[:SOURce]:PM[1]|2:STATe ON|OFF|1|0
[:SOURce]:PM[1]|2:STATe?
```

This command enables or disables the phase modulation for the selected path.

***RST** 0

Key Entry **ΦM Off On**

Remarks The RF carrier is modulated when you set the signal generator’s modulation state to ON, see :MODulation[:STATe] command for more information.

Whenever phase modulation is enabled, the ΦM annunciator is turned on in the display

:PM[1]|2[:DEViation]

Supported All Models with Option UNT

```
[:SOURce]:PM[1]|2[:DEViation] <value><unit>|UP|DOWN
[:SOURce]:PM[1]|2[:DEViation]?
```

This command sets the deviation of the phase modulation.

The variable <unit> will accept RAD (radians), PIRAD (pi-radians), and DEG (degrees); however, the query will only return values in radians.

***RST**	+0.00000000E+000
Range	See the Data Sheet for range values
Key Entry	**ΦM Dev**
Remarks	Refer to :PM[:DEViation]:STEP[:INCRement] command for setting the value associated with the UP and DOWN choices.

:PM[:DEViation]:STEP[:INCRement]

Supported All Models with Option UNT

```
[:SOURce]:PM[:DEViation]:STEP[:INCRement] <value><unit>
[:SOURce]:PM[:DEViation]:STEP[:INCRement]?
```

This command sets the phase modulation deviation step increment.

Range	0.001–1E3RAD
Key Entry	**Incr Set**
Remarks	The value set by this command is used with the UP and DOWN choices for the FM deviation command. Refer to :PM[1]|2[:DEViation] command for more information. The setting enabled by this command is not affected by signal generator power-on, preset, or `*RST`.

Pulse Modulation Subsystem–Options UNW and 320 ([:SOURce])

:PULM:EXTernal:POLarity

Supported All with Option UNW

```
[:SOURce]:PULM:EXTernal:POLarity NORMal|INVerted
[:SOURce]:PULM:EXTernal:POLarity?
```

This command selects the polarity of the TTL input signal at the TRIG IN rear panel connector. The signal generator can respond to either a normal (a TTL high) or an inverted (TTL low) signal.

Example

```
:PULM:EXT:POL NORM
```

The preceding example selects normal (TTL high) polarity.

***RST** Normal

Key Entry **Ext Polarity Normal Invert**

:PULM:INTernal:DELay:STEP

Supported All with Option UNW

```
[:SOURce]:PULM:INTernal:DELay:STEP <value><unit>
[:SOURce]:PULM:INTernal:DELay:STEP?
```

This command sets the step increment for the pulse delay.

The step value, set by this command, is used with the UP and DOWN choices in the :PULM:INTernal:DELay[1]|2 command.

The step value set with this command is not affected by a signal generator power-on, preset, or `*RST command`.

Example

```
:PULM:INT:DEL:STEP 10NS
```

The preceding example sets the pulse delay step value to 10 nanoseconds.

Range 10nS to (pulse period – 20 nS)

Key Entry **Incr Set**

:PULM:INTernal:DELay[1]|2

Supported All with Option UNW

```
[:SOURce]:PULM:INTernal:DELay[1]|2 <value><unit>|UP|DOWN
[:SOURce]:PULM:INTernal:DELay[1]|2
```

This command sets the pulse delay for the internally-generated pulse modulation using the variable <value><unit>. The command, used with the UP|DOWN parameters, will change the delay by a user-defined step value. Refer to the :PULM:INTernal:DELay:STEP command for setting the value associated with the UP and DOWN choices.

The optional variable <unit> accepts nS (nanoseconds) to S (seconds) with a resolution of 10 nS.

The range value is dependent on the pulse period (refer to the :PULM:INTernal:PERiod command).

Use DELay1 with the DOUBlet parameter and Delay1 and Delay2 with the ADOublet parameter (refer to the :PULM:SOURce:INTernal command).

When "TRIGgered" is the pulse train trigger mode, then this value specifies the time after a trigger is received before the first Pulse Train On Time starts (refer to the :PULM:INTernal:TRAin:TRIGger command).

Example

```
:PULM:INT:DEL 200E-9
```

The preceding example sets the internal pulse delay to 200 nanoseconds.

***RST**	+0.00000000E+000
Range	**Internal Free Run**: depends on pulse period and pulse width settings **Internal Triggered, Adjustable Doublet, & Triggered Doublet**: 70nS to (42 S - 10 nS - pulse width)
Key Entry	**Pulse Delay**

:PULM:INTernal:FREQuency

Supported	All with Option UNW

```
[:SOURce]:PULM:INTernal:FREQuency
<frequency>|MAXimum|MINimum|UP|DOWN
[:SOURce]:PULM:INTernal:FREQuency?
```

This command sets the pulse rate for the internally-generated square wave using the variable *<frequency>*. The command, used with the **UP|DOWN** parameters, will change the frequency by a user-defined step value. Refer to the :PULM:INTernal:FREQuency:STEP command for setting the value associated with the **UP** and **DOWN** choices.

This command is used when `SQUare` is the pulse modulation type. Refer to :PULM:SOURce command for the pulse modulation type selection.

Example

```
:PULM:INT:FREQ 1MHz
```

The preceding example sets the square wave pulse rate to 1 megahertz.

***RST**	+4.00000000E+002
Range	0.1Hz–10MHz
Key Entry	**Pulse Rate**

:PULM:INTernal:FREQuency:STEP

Supported	All with Option UNW

```
[:SOURce]:PULM:INTernal:FREQuency:STEP[:INCRement]
<freq>|MAXimum|MINimum|DEFault
[:SOURce]:PULM:INTernal:FREQuency:STEP[:INCRement]?
```

This command sets the step value for the internally-generated square wave pulse rate.

This command is used when `SQUare` is the pulse modulation type. Refer to :PULM:SOURce command for the pulse modulation type selection. The step value, set with this command, is used with the **UP** and **DOWN** choices in the :PULM:INTernal:FREQuency command.

The step value set with this command is not affected by a power-on, preset, or *RST command.

Example

```
:PULM:INT:FREQ:STEP MIN
```

The preceding example sets the step value for the square wave pulse rate to 0.1 Hz, the minimum rate.

Range	0.1Hz–10MHz
Key Entry	**Incr Set**

:PULM:INTernal:PERiod

Supported	All with Option UNW

```
[:SOURce]:PULM:INTernal:PERiod
<period>|MAXimum|MINimum|UP|DOWN
[:SOURce]:PULM:INTernal:PERiod?
```

This command sets the pulse period for the internally generated pulse modulation using the variables *<value><units>.* The command, used with the **UP|DOWN** parameters, will change the pulse period by a user–defined step value. Refer to the :PULM:INTernal:PERiod:STEP[:INCRement] command for setting the value associated with the **UP** and **DOWN** choices.

If the entered value for the pulse period is equal to or less than the value for the pulse width, the pulse width changes to a value that is less than the pulse period. Refer to :PULM:INTernal:PWIDth[1]|2 command for setting the pulse width.

Example

```
:PULM:INT:PER .5S
```

The preceding example sets the period of the internally generated pulse to 500 milliseconds.

***RST**	+4.00000000E–006
Range	30 nS – 42 S
Key Entry	**Pulse Period**

:PULM:INTernal:PERiod:STEP[:INCRement]

Supported	All with Option UNW

```
[:SOURce]:PULM:INTernal:PERiod:STEP[:INCRement]
<value><unit>|UP|DOWN
[:SOURce]:PULM:INTernal:PERiod:STEP[:INCRement]?
```

This command sets the step value for the internal pulse period using the variable <value><unit>.

The step value, set with this command, is used with the **UP** and **DOWN** choices available in the :PULM:INTernal:PERiod command.

The step value set with this command is not affected by a power-on, preset, or `*RST command.`

Example

```
:PULM:INT:PER:STEP .1S
```

The preceding example sets the square wave pulse period step value to 100 milliseconds.

Range	30 nS – 42S
Key Entry	**Incr Set**

:PULM:INTernal:PWIDth:STEP

Supported	All with Option UNW

```
[:SOURce]:PULM:INTernal:PWIDth:STEP
<value><unit>|MAXimum|MINimum|DEFault
[:SOURce]:PULM:INTernal:PWIDth:STEP?
```

This command sets the step increment for the pulse width using the variables *<value><unit>*.

The step value, set by this command, is used with the **UP** and **DOWN** choices available in the :PULM:INTernal:PWIDth[1]|2 command.

The step value, set with this command, is not affected by a power-on, preset, or *RST command.

Example

```
:PULM:INT:PWID:STEP 100NS
```

The preceding example sets the pulse width step to 100 nanoseconds.

Range	20nS to (pulse period - 10 nS)
Key Entry	**Incr Set**

:PULM:INTernal:PWIDth[1]|2

Supported	All with Option UNW

```
[:SOURce]:PULM:INTernal:PWIDth[1]|2 <value><unit>|UP|DOWN
[:SOURce]:PULM:INTernal:PWIDth[1]|2?
```

This command sets the pulse width for the internally generated pulse signal.

This command sets the pulse width for the internally-generated pulse modulation using the variables <value><unit>. The command, used with the **UP|DOWN** parameters, will change the pulse width by a user-defined step value. Refer to the :PULM:INTernal:PWIDth:STEP command for setting the value associated with the **UP** and **DOWN** choices.

If the entered value for the pulse width is equal to or greater than the value for the pulse period, the pulse width changes to a value that is less than the pulse period. For more information, refer to the :PULM:INTernal:PERiod command.

Use PWIDTH1 with the DOUBlet parameter and PWIDTH1 and PWIDTH2 with the ADOublet parameter (refer to :PULM:SOURce:INTernal command).

NOTE A power search is recommended for signals with pulse widths less than one microsecond. Refer to :ALC:SEARch.

Example

```
:PULM:INT:PWIDth 100MS
```

The preceding example sets the pulse width to 100 milliseconds.

***RST**	+2.00000000E–006
Range	20 nS to (pulse period - 10 nS)
Key Entry	**Pulse Width**

:PULM:INTernal:TRAin:LIST:PRESet

Supported	All with Options UNW and 320

```
[:SOURce]:PULM:INTernal:TRAin:LIST:PRESet
```

This command sets the list to a single row of 2us of On Time, 2us of Off Time, and a Repetition of 1. Refer to :PULM:INTernal:TRAin:ONTime and :PULM:INTernal:TRAin:OFFTime.

:PULM:INTernal:TRAin:OFFTime

Supported All with Options UNW and 320

```
[:SOURce]:PULM:INTernal:TRAin:OFFTime <value>,<value>
[:SOURce]:PULM:INTernal:TRAin:OFFTime?
```

This command sets the pulse off values for the current list of pulse train off times (where the RF will be off). If this list is shorter than the other lists, then the last element will be repeated as necessary to match the length of the On Time or the Repetition list. The query returns the count of pulse cycle elements in the list of off times. Refer to :PULM:INTernal:TRAin:ONTime and :PULM:INTernal:TRAin:REPetition.

The resolution for this setting is 10nS.

Example

```
:PULM:INT:TRA:OFFT 100NS,200NS,400E-9
```

The preceding example sets the pulse train off cycles to 100 nanoseconds, 200 nanoseconds, and 400 nanoseconds.

Range 20nS to 42S

:PULM:INTernal:TRAin:OFFTime:POINts?

Supported All with Options UNW and 320

```
[:SOURce]:PULM:INTernal:TRAin:OFFTime:POINts?
```

This query returns the count of elements in the list of off times.

:PULM:INTernal:TRAin:ONTime

Supported All with Options UNW and 320

```
[:SOURce]:PULM:INTernal:TRAin:ONTime <value>,<value>
[:SOURce]:PULM:INTernal:TRAin:ONTime?
```

This command sets the pulse on values for the current list of pulse train on times. If this list is shorter than the other lists, then the last element will be repeated as necessary to match the length of the Off Time or the Repetition list. The query returns the count of pulse cycle elements in the list of on times. Refer to :PULM:INTernal:TRAin:OFFTime and :PULM:INTernal:TRAin:REPetition.

The resolution for this setting is 10 nS.

Example

```
:PULM:INT:TRA:ONT 100NS,200NS,400E-9
```

The preceding example sets the pulse train on cycles to 100 nanoseconds, 200 nanoseconds, and 400 nanoseconds.

Range	20nS to 42S

:PULM:INTernal:TRAin:ONTime:POINts?

Supported	All with Options UNW and 320

```
[:SOURce]:PULM:INTernal:TRAin:ONTime:POINts?
```

This query returns the count of elements in the list of on times.

:PULM:INTernal:TRAin:REPetition

Supported	All with Options UNW and 320

```
[:SOURce]:PULM:INTernal:TRAin:REPetition <value>,<value>
[:SOURce]:PULM:INTernal:TRAin:REPetition?
```

This command generates a user-defined list of the pulse repetitions. The maximum is a total count of 2047, so a list of "2047,1" would be too long. Lists that are too long will generate an error and only the first 2047 pulses will be played. If this list is shorter than the other lists, then the last element will be repeated as necessary to match the length of the On Time or Off Time list, whichever is longer. Refer to :PULM:INTernal:TRAin:ONTime and :PULM:INTernal:TRAin:OFFTime.

Example

```
:PULM:INT:TRA:REP 100,20,3
```

The preceding example repeats the first pulse cycle 100 times, the second cycle to be repeated 20 times, and the third cycle 3 times.

Range	1 to 2047 total pulse repetitions

:PULM:INTernal:TRAin:REPetition:POINts?

Supported All with Options UNW and 320

```
[:SOURce]:PULM:INTernal:TRAin:REPetition:POINts?
```

This query returns the count of elements in the list of repetitions.

:PULM:INTernal:TRAin:TRIGger

Supported All with Options UNW and 320

```
[:SOURce]:PULM:INTernal:TRAin:TRIGger FRUN|TRIGgered|GATEd
[:SOURce]:PULM:INTernal:TRAin:TRIGger?
```

This command sets the triggering mode for the Pulse Train feature.

FRUN	Free Run triggering continuously plays the pulse train.
TRIGgered	Trigger runs the pulse train (after waiting the Pulse Delay) each time an external trigger is supplied (edge triggered) to the PULSE BNC, the “Trigger Immediately” softkey is pressed, or the [:SOURce]:PULM:INTernal:TRAin:TRIGger:IMMediate SCPI command is sent (when the pulse train playback is idle). Triggers received during playback are lost.
GATEd	Gated triggering runs the pulse train while an external trigger is supplied (level triggered) to the PULSE BNC. The state of the GATEd trigger is detected only when the playback is transitioning to or in idle. This means that, once started, playback is always completed, even if the GATE trigger changes to the inactive state.
***RST**	TRIGgered
Key Entry	**Trigger Mode**

:PULM:INTernal:TRAin:TRIGger:IMMediate

Supported All with Options UNW and 320

```
[:SOURce]:PULM:INTernal:TRAin:TRIGger:IMMediate
[:SOURce]:PULM:INTernal:TRAin:TRIGger:IMMediate?
```

This command will cause the pulse train to run once. If the pulse train is already running or off, then this SCPI command has no effect.

Key Entry **Trigger Immediately**

:PULM:INTernal:VIDeo:POLarity

Supported All with Option UNW

```
[:SOURce]:PULM:INTernal:VIDeo:POLarity NORMal|INVerted
[:SOURce]:PULM:INTernal:VIDeo:POLarity?
```

This command inverts the polarity on the internally generated pulse video signal.

If the entered value for Trig Out BNC Video Polarity is set to Invert, the pulse video signal at the Trig Out BNC is inverted.

Example

```
:PULM:INT:VID INV
```

The preceding example inverts the video signal polarity at the Trig Out BNC.

***RST**	Normal
Key Entry	**Trig Out BNC Video Polarity Normal Invert**

:PULM:SOURce

Supported	All with Option UNW

```
[:SOURce]:PULM:SOURce INTernal|EXTernal
[:SOURce]:PULM:SOURce?
```

This command sets the source of the pulse modulation.

The INTernal selection accesses one of the six internally generated modulation inputs while EXTernal selects an external pulse (rear panel connector) input. To select an internally generated modulation input, refer to :PULM:SOURce:INTernal command.

Key Entry	**Pulse Source**

:PULM:SOURce:INTernal

Supported	All with Option UNW

NOTE The PTRain (Pulse Train) parameter requires Option 320.

```
[:SOURce]:PULM:SOURce:INTernal
SQUare|FRUN|TRIGgered|ADOublet|DOUBlet|GATEd|PTRain
[:SOURce]:PULM:SOURce:INTernal?
```

This command selects one of the seven internally generated modulation inputs. There is one external source: Ext Pulse selected by :PULM:SOURce command.

SQUare	This command sets Square as the pulse modulation source. This is an internal free-run pulse with a 50% duty cycle. The period is determined by the rate.

FRUN	This command sets Free Run as the pulse modulation source. You can define the period, width, and delay.
TRIGgered	This command sets Triggered as the pulse modulation source. This selection produces an RF pulse with a user-defined width and delay at the RF OUTPUT connector when a valid trigger signal occurs at the PULSE connector.
ADOublet	This command sets Adjustable Doublet as the pulse modulation source. This selection produces two pulses at the RF OUTPUT connector for each trigger event at the PULSE connector. The first pulse has a user-defined width and delay (from the rising edge of the Pulse Sync Out signal). The second pulse has a user-defined width and delay (from the rising edge of the first pulse).
DOUBlet	This command sets Trigger Doublet as the pulse modulation source. This produces two pulses at the RF OUTPUT connector for each trigger event at the PULSE connector. The first pulse follows the external trigger signal. The second pulse has user-defined width and delay parameters.
GATEd	This command sets Gated as the pulse modulation source. A pulse train with user-defined period and width parameters occurs at the RF OUTPUT connector when a valid gate signal is applied to the PULSE connector.
PTRain	This selection produces an RF pulse train (up to 2047 distinct cycles) with user-defined widths and delays at the RF OUTPUT connector when a valid trigger signal occurs at the PULSE connector. The Pulse Train Trigger mode selection determines when the pulse train is output.

Example

```
:PULM:SOUR:INT SQU
```

The preceding example selects an internal free-run square wave with a 50% duty cycle, as the pulse modulation source.

***RST**	FRUN (Int Free–Run)

Key Entry	**Square**	**Free-Run**	**Triggered**
	Trigger Doublet	**Gated**	**Pulse Train**
	Adjustable Doublet		

:PULM:STATe

Supported	All with Option UNW

```
[:SOURce]:PULM:STATe ON|OFF|1|0
[:SOURce]:PULM:STATe?
```

This command enables or disables pulse modulation for the selected path.

When pulse modulation is enabled, the PULSE annunciator appears on the signal generator's front-panel display.

Example

```
:PULM:STAT ON
```

The preceding example enables the pulse modulation.

***RST**	0
Key Entry	**Pulse Off On**

5 Arb Commands

This chapter provides arb signal generation SCPI command descriptions for use in either component or receiver test using Keysight X-Series signal generators.

This chapter contains the following sections:

KEYSIGHT TECHNOLOGIES

All Subsystem–N5172B/82B ([:SOURce])

:RADio:ALL:OFF

Supported N5172B/82B

`[:SOURce]:RADio:ALL:OFF`

This command turns off all digital modulation formats.

Remarks This command does not affect analog modulation.

Dmodulation Subsystem–N5172B/82B with Option 431 ([:SOURce]:RADio:DMODulation:ARB)

:BASeband:FREQuency:OFFSet

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:BASeband:FREQuency:OFFSet <v
alue><unit>
[:SOURce]:RADio:DMODulation:ARB:BASeband:FREQuency:OFFSet?
```

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed–through is not in the center.

The X-Series signal generator provides automatic DAC over–range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by *1/square root of 2*.

***RST**	`+0.00000000E+000`
Range	`+5.0E7 to –5.0E7 Hz`

Key Entry **Baseband Frequency Offset**

:BASeband:FREQuency:OFFSet:PHASe:RESet

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:BASeband:FREQuency:OFFSet:PH
ASe:RESet
```

This command clears the phase accumulation and so zero phase shift.

When the Baseband Frequency Offset is non–zero, the hardware rotator accumulates phase–shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non–zero residual phase present in the signal, the DAC Over–Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by 1/square root of 2.

Key Entry **Baseband Frequency Offset Phase Reset**

:FILTer

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:FILTer
RNYQuist|NYQuist|GAUSsian|
RECTangle|IS95|IS95_EQ|IS95_MOD|IS95_MOD_EQ|EDGE|EWIDe|EHSR|
WCDMa|AC4Fm|"<user FIR>"
[:SOURce]:RADio:DMODulation:ARB:FILTer?
```

This command specifies the pre–modulation filter type.

RNYQuist	This choice selects a Root Nyquist (root raised cosine) filter. This filter is adjusted using Alpha.
NYQuist	This choice selects a Nyquist (raised cosine) filter. This filter is adjusted using Alpha.
GAUSsian	This choice selects a Gaussian filter which is adjusted using Bbt values.
RECTangle	This choice selects a one symbol wide rectangular filter.
IS95	This choice selects a filter that meets the criteria of the IS–95 standard.
IS95_EQ	This choice selects a filter which is a combination of the IS–95 filter (above) and the equalizer filter described in the IS–95 standard. This filter is only used for IS–95 baseband filtering.
IS95_MOD	This choice selects a filter that meets the criteria of the IS–95 error function (for improved adjacent channel performance) with lower passband rejection than the filter specified in the IS–95 standard.
IS95_MOD_EQ	This choice selects a filter which is a combination of the equalizer filter described in the IS–95 standard and a filter that meets the criteria of the IS–95 error function (for improved adjacent channel performance), with lower passband rejection.
EDGE	This choice selects a linearized Gaussian filter as defined in GSM 05.04.
EWIDe	This choice selects an EDGE spectrally wide pulse shape filter as per 3GPP TS 45.004.
EDGE EHSR	This choice selects an EDGE high symbol rate spectrally narrow pulse shape filter as per 3GPP TS 45.004.
WCDMa	This choice selects a W-CDMA filter which is the equivalent of a Root Nyquist filter with an alpha of 0.22 optimized for ACP.
AC4Fm	This choice selects a predefined Association of Public Safety Communications Officials (APCO) specified compatible 4–level frequency modulation (C4FM) filter.
"<user FIR>"	This variable is any FIR filter file that you have stored in memory. The variable needs no directory path indicating the location of the file, such as `FIR:` or `/USER/FIR`. The command assumes the FIR directory. For more information on file names, refer to "File Name Variables" on page 43.

***RST** Root Nyquist

Key Entry	Nyquist	IS–95	EDGE
	Gaussian	IS–95 Mod	WCDMA
	User FIR	IS–95 w/EQ	Rectangle
	Root Nyquist	IS–95 Mod w/EQ	EDGE Wide
		APCO 25 C4FM	EDGE EHSR

:FILTer:ALPHa

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:FILTer:ALPHa <val>
[:SOURce]:RADio:DMODulation:ARB:FILTer:ALPHa?
```

This command changes the Nyquist or Root Nyquist filter alpha value.

The filter alpha value can be set to the minimum level (0), the maximum level (1), or in between by using fractional numeric values (0.001 to 0.999).

***RST** +5.0000000E–001

Range 0.000 to 1.000

Key Entry **Filter Alpha**

Remarks To change the current filter type, refer to “:FILTer” on page 311.

:FILTer:BBT

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:FILTer:BBT <val>
[:SOURce]:RADio:DMODulation:ARB:FILTer:BBT?
```

This command changes the bandwidth–multiplied–by–bit–time (BbT) filter parameter.

The filter BbT value can be set to the minimum level (0.1), the maximum level (1), or in between by using fractional numeric values (0.100 to 0.999).

***RST** +5.00000000E–001

Range 0.100 to 1.000

Key Entry **Filter BbT**

Remarks This command is effective only after choosing a Gaussian filter. It does not have an effect on other types of filters.

To change the current filter type, refer to ":FILTer" on page 311.

:FILTer:CHANnel

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:FILTer:CHANnel EVM|ACP
[:SOURce]:RADio:DMODulation:ARB:FILTer:CHANnel?
```

This command optimizes the Nyquist and Root Nyquist filters to minimize error vector magnitude (EVM) or to minimize adjacent channel power (ACP).

EVM	This choice provides the most ideal passband.
ACP	This choice improves stopband rejection.
***RST**	EVM
Key Entry	**Optimize FIR For EVM ACP**
Remarks	To change the current filter type, refer to ":FILTer" on page 311.

:HEADer:CLEar

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:HEADer:CLEar
```

This command clears the header information from the file header used by this modulation format.

Key Entry	**Clear Header**
Remarks	The **Digital Modulation Off On** softkey must be set to On for this command to function.

:HEADer:SAVE

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:HEADer:SAVE
```

This command saves the header information to the file header used by this modulation format.

Key Entry	**Save Setup To Header**
Remarks	The **Digital Modulation Off On** softkey must be set to On for this command to function.

:IQ:MODulation:ATTen

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:IQ:MODulation:ATTen <val>
[:SOURce]:RADio:DMODulation:ARB:IQ:MODulation:ATTen?
```

This command sets the attenuation level of the I/Q signals being modulated through the signal generator RF path.

The variable <val> is expressed in units of decibels (dB).

***RST**	+6.00000000E+000
Range	0 to 50
Key Entry	**I/Q Modulator Atten Manual Auto**

:IQ:MODulation:ATTen:AUTO

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:IQ:MODulation:ATTen:AUTO
ON|OFF|1|0
[:SOURce]:RADio:DMODulation:ARB:IQ:MODulation:ATTen:AUTO?
```

This command enables or disables the I/Q attenuation auto mode.

ON (1)	This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.
OFF (0)	This choice holds the attenuator at its current setting or at a selected value. Refer to the :IQ:MODulation:ATTen command for setting the attenuation value.
***RST**	1
Key Entry	**I/Q Modulator Atten Manual Auto**

:MDEStination:AAMPlitude

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:MDEStination:AAMPlitude
NONE|M1|M2|M3|M4
[:SOURce]:RADio:DMODulation:ARB:MDEStination:AAMPlitude?
```

This command routes the selected marker to the Alternate Amplitude function. The `NONE` parameter clears the marker for the Alternate Amplitude function.

***RST**	NONE

Key Entry	**None**	**Marker 1**	**Marker 2**	**Marker 3**	**Marker 4**

:MDEStination:ALCHold

Supported	N5172B/82B with Option 431

CAUTION **Incorrect automatic level control (ALC) sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.**

```
[:SOURce]:RADio:DMODulation:ARB:MDEStination:ALCHold
NONE|M1|M2|M3|M4
[:SOURce]:RADio:DMODulation:ARB:MDEStination:ALCHold?
```

This command enables the marker ALC hold function for the selected marker.

Use the ALC hold function when you have a waveform signal that incorporates idle periods, or when the increased dynamic range encountered with RF blanking is not desired. The ALC leveling circuitry responds to the marker signal during the marker pulse (marker signal high), averaging the modulated signal level during this period.

The ALC hold function operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker's polarity, see :MPOLarity:MARKer1|2|3|4.

NOTE **Do not use the ALC hold for more than 100 ms, because it can affect the waveform's output amplitude.**

The marker signal has a minimum of a two–sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the ALC sampling to begin.

The ALC hold setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

NOTE **A waveform file that has unspecified settings in the file header uses the previous waveform's routing settings.**

For more information on the marker ALC hold function, see the *User's Guide*.

NONE	This terminates the marker ALC hold function.
M1–M4	These are the marker choices. The ALC hold feature uses only one marker at a time.

Example

```
:RAD:DMOD:ARB:MDES:ALCH M1
```

The preceding example routes marker 1 to the ALC Hold function.

***RST** NONE

Key Entry	None	Marker 1	Marker 2	Marker 3	Marker 4

:MDEStination:PULSe

Supported N5172B/82B with Option 431

CAUTION

The pulse function incorporates ALC hold. Incorrect automatic level control (ALC) sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

```
[:SOURce]:RADio:DMODulation:ARB:MDEStination:PULSe
NONE|M1|M2|M3|M4
[:SOURce]:RADio:DMODulation:ARB:MDEStination:PULSe?
```

This command enables the marker pulse/RF blanking function for the selected marker.

This function automatically uses the ALC hold function, so there is no need to select both the ALC hold and pulse/RF blanking functions for the same marker.

NOTE

Do not use ALC hold for more than 100 ms, because it can affect the waveform's output amplitude.

The signal generator blanks the RF output when the marker signal goes low. The marker polarity determines when the marker signal is low. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker's polarity, see :MPOLarity:MARKer1|2|3|4.

NOTE

Set marker points prior to using this function. Enabling this function without setting marker points may create a continuous low or high marker signal, depending on the marker polarity. This causes either no RF output or a continuous RF output.

The marker signal has a minimum of a two-sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the RF blanking to begin. The RF blanking setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

NOTE **A waveform that has unspecified settings in the file header uses the previous waveform's routing settings. This could create the situation where there is no RF output signal, because the previous waveform used RF blanking.**

For more information on the marker RF blanking function, see the *User's Guide*.

NONE	This terminates the marker RF blanking/pulse function.
M1–M4	These are the marker choices. The RF blanking/pulse feature uses only one marker at a time.

Example

```
:RAD:DMOD:ARB:MDES:PULS M2
```

The preceding example routes marker 2 to Pulse/RF Blanking.

***RST**	NONE

Key Entry	**None**	**Marker 1**	**Marker 2**	**Marker 3**	**Marker 4**

:MODulation:ASK[:DEPTh]

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:MODulation:ASK[:DEPTh] <0% - 100%>
[:SOURce]:RADio:DMODulation:ARB:MODulation:ASK[:DEPTh]?
```

This command changes the depth for the amplitude shift keying (ASK) modulation. Depth is set as a percentage of the full power on level.

***RST**	+1.00000000E+002
Range	0 to 100
Key Entry	**ASK Depth 100%**
Remarks	The modulation is applied to the I signal, the Q value is always kept at zero.

:MODulation:FSK[:DEViation]

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:MODulation:FSK[:DEViation]
<val>
[:SOURce]:RADio:DMODulation:ARB:MODulation:FSK[:DEViation]?
```

This command sets the symmetric FSK frequency deviation value.

The variable <val> is expressed in units of Hertz and the maximum range value equals the current symbol rate value multiplied by ten, limited to 20 MHz.

***RST**	+4.00000000E+002
Range	0 to 10 times the current symbol rate but never more than the lesser of maxSymbolRate*0.8 or 40 MHz.
Key Entry	**Freq Dev**
Remarks	To change the modulation type, refer to ":MODulation[:TYPE]" on page 319. Refer to the :SRATe command for a list of the minimum and maximum symbol rate values. To set an asymmetric FSK deviation value, refer to the **User's Guide** for more information.

:MODulation[:TYPE]

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:MODulation[:TYPE]
ASK|BPSK|QPSK|UQPSk|IS95QPSK|
GRAYQPSK|OQPSK|IS95OQPSK|P4DQPSK|PSK8|PSK16|D8PSK|EDGE|MSK|F
SK2|FSK4|FSK8|FSK16|
C4FM|QAM4|QAM16|QAM32|QAM64|QAM128|QAM256|QAM1024|UIQ|UFSK|V
SAQAM16|VSAQAM32|
VSAQAM64|VSAQAM128|VSAQAM256|VSAQAM512|VSAQAM1024
[:SOURce]:RADio:DMODulation:ARB:MODulation[:TYPE]?
```

This command sets the modulation type for the digital modulation personality.

***RST**	QPSK

Key Entry	**AS K**	**BPS K**	**QPS K**	**Unbalanced QPSK**	**IS-95 QPSK**	
	OQPS K	**IS-95 OQPSK**	**π/4 DQPSK**	**8PS K**	**16PS K**	**D8PS K**
	2-Lvl FSK	**4-Lvl FSK**	**8-Lvl FSK**	**16-Lvl FSK**	**C4F M**	

32QAM	**64QAM**	**128QAM**	**256QAM**	**1024QAM**	**Select User IQ**

Select User FSK	**VSA 16QAM**	**VSA 32QAM**	**VSA 64QAM**
VSA 256QAM	**VSA 512QAM**	**VSA 1024QAM**	**4QAM**

Gray Coded QPSK	**EDGE**	**MSK**	**16QAM**	**Select User IQ**

VSA 128QAM

:MODulation:UFSK

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:MODulation:UFSK <“filename”>
[:SOURce]:RADio:DMODulation:ARB:MODulation:UFSK?
```

This command selects the user FSK file to use when the :MODulation[:TYPE] is set to UFSK.

For more information on the file name syntax, see “File Name Variables” on page 43.

Key Entry **Select User FSK**

:MODulation:UIQ

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:MODulation:UIQ <“filename”>
[:SOURce]:RADio:DMODulation:ARB:MODulation:UIQ?
```

This command selects the user FSK file to use when the :MODulation[:TYPE] is set to UIQ.

For more information on the file name syntax, see “File Name Variables” on page 43.

Key Entry **Select User I/Q**

:MODulation:UQPSk[:GAIN]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:MODulation:UQPSk[:GAIN]
<val>
[:SOURce]:RADio:DMODulation:ARB:MODulation:UQPSk[:GAIN]?
```

This command sets the Unbalanced QPSK modulation I versus Q gain, which is the difference in amplitude between I and Q. UQPSK is a 2 bits per symbol modulation where the I constellation values are typically set to be larger or smaller than the Q constellation values. This factor is known as the I Gain. Use this command when the :MODulation[:TYPE] is set to UQPSk.

The variable <val> is expressed in units of dB and the resolution is 0.01 dB.

***RST**	0 dB
Range	-50 to 50 dB
Key Entry	**I Gain**

:MPOLarity:MARKer1|2|3|4

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:MPOLarity:MARKer1|2|3|4
NEGative|POSitive
[:SOURce]:RADio:DMODulation:ARB:MPOLarity:MARKer1|2|3|4?
```

This command sets the polarity for the selected marker. For a positive marker polarity, the marker signal is high during the marker points. For a negative marker polarity, the marker signal is high during the period of no marker points.

***RST**	POS

Key Entry	**Marker 1 Polarity Neg Pos**	**Marker 2 Polarity Neg Pos**
	Marker 3 Polarity Neg Pos	**Marker 4 Polarity Neg Pos**

:NOISe:BANDwidth

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe:BANDwidth
<value><unit>
[:SOURce]:RADio:DMODulation:ARB:NOISe:BANDwidth?
```

This command selects the flat noise bandwidth value of the real–time noise for an ARB waveform.

Typically, this value is set slightly wider than the carrier bandwidth.

***RST**	+1.00000000E+000

Range	Option 653	1 sa to 75 Msa

Option 655	1 sa to 150 Msa
Option 656	1 sa to 100 Msa
Option 657	1 sa to 200 Msa

Key Entry **Noise Bandwidth**

:NOISe:CBRate

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe:CBRate <1bps -
999Mbps> [:SOURce]:RADio:DMODulation:ARB:NOISe:CBRate?
```

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. For DMODulation (ARB Custom) the carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

Example

```
:RAD:DMOD:ARB:NOIS:CBR 5
```

The preceding example sets the carrier bit rate to 5 Mbps.

Default	2.000000000 Mbps
Range	1 bps to 999 Mbps
Key Entry	**Carrier Bit Rate**

:NOISe:CBWidth

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe:CBWidth <1Hz-125MHz>
[:SOURce]:RADio:DMODulation:ARB:NOISe:CBWidth?
```

This command selects the carrier bandwidth over which the AWGN (additive white gaussian noise) is applied. The noise power will be integrated over the selected bandwidth for the purposes of calculating C/N (carrier to noise ratio). The carrier bandwidth is typically the symbol rate. For more information refer to ":NOISe[:STATe]" on page 326.

***RST**	1.000000000 MHz
Range	1 Hz to 125 MHz
Key Entry	**Carrier Bandwidth**

:NOISe:CN

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe:CN <-100dB - 100dB>
[:SOURce]:RADio:DMODulation:ARB:NOISe:CN?
```

This command sets the carrier to noise ratio in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to the ":NOISe:CBWidth" command.

Example

```
:RAD:ARB:NOIS:CN 50DB
```

The preceding example sets the carrier to noise ratio to 50 dB.

***RST** +0.00000000E+000

Key Entry **Carrier to Noise Ratio**

:NOISe:CNFormat

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe:CNFormat CN|EBNO
[:SOURce]:RADio:DMODulation:ARB:NOISe:CNFormat?
```

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example

```
:RAD:DMOD:ARB:NOIS:CNF EBNO
```

The preceding example sets the carrier to noise ratio format to EbNo.

Default Carrier to Noise Ratio Format C/N

Key Entry **Carrier to Noise Ratio Format C/N Eb/No**

:NOISe:EBNO

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe:EBNO <ebno in dB>
[:SOURce]:RADio:DMODulation:ARB:NOISe:EBNO?
```

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:NOISe:CBRate) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :NOISe:CNFormat command.

The query returns the value of Eb/N0.

Default	0 dB
Range	–100 to 100 dB
Key Entry	**Carrier to Noise Ratio Format Eb/No**

:NOISe:MUX

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio[1]:DMODulation:ARB:NOISe:MUX
SUM|CARRier|NOISe
```

```
[:SOURce]:RADio[1]:DMODulation:ARB:NOISe:MUX?
```

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

```
:RAD:DMOD:ARB:NOIS:MUX CARR
```

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default	Carrier+Noise
Key Entry	**Carrier+Noise** | **Carrier** | **Noise**

:NOISe:POWer:CARRier

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:CARRier
<carrierPower>
[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:CARRier?
```

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] and :NOISe:POWer:NOISe:TOTal commands.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Carrier Power**

:NOISe:POWer:CONTrol[:MODE]

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:CONTrol[:MODE]TO
Tal|CARRier|NOISe
[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:CONTrol[:MODE]?
```

This command sets the power control to one of the three following modes:

Total	This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.
Carrier	In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.
Total Noise	In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.
Default	TOTal
Key Entry	**Total Carrier Total Noise**

:NOISe:POWer:NOISe:CHANnel?

Supported	N5172B/82B with Option 431 and 403

`[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:NOISe:CHANnel?`

The query returns the current noise power across the carrier bandwidth in dBm.

:NOISe:POWer:NOISe:TOTal

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:NOISe:TOTal
<totalNoisePowerInDbm>
[:SOURce]:RADio:DMODulation:ARB:NOISe:POWer:NOISe:TOTal?
```

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] command.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Total Noise Power**

:NOISe[:STATe]

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:DMODulation:ARB:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:DMODulation:ARB:NOISe[:STATe]?
```

This command enables or disables adding real–time, non–repeating additive white gaussian noise (AWGN) to the carrier modulated by the waveform being played by the Dual ARB waveform player.

For more information on AWGN, see the **User’s Guide**.

Example

```
:RAD:ARB:NOIS ON
```

The preceding example applies real–time AWGN to the carrier.

***RST**	0
Key Entry	**Real-Time AWGN Off On**

:PHASe:NOISe:F1

Supported	N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F1 <value><unit>
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F1?
```

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see :PHASe:NOISe:F2). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the *User's Guide*.

***RST**	+1.00000000E+003
Range	0 Hz to 77.50052449 MHz
Key Entry	**Desired Start Freq (f1)**

:PHASe:NOISe:F1:ACTual?

Supported	N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F1:ACTual?
```

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2

Supported	N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F2?
```

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see :PHASe:NOISe:F1). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the *User's Guide*.

***RST**	+3.00000000E+004

Range	1 Hz to 77.50052449 MHz
Key Entry	**Desired Stop Freq (f2)**

:PHASe:NOISe:F2:ACTual?

Supported	N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:F2:ACTual?
```

This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHASe:NOISe:LMID

Supported	N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:LMID?
```

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the *User's Guide*.

NOTE The amplitude range varies depending on the f2 value (":PHASe:NOISe:F2" on page 327). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The range values are expressed in units of dBc/Hz.

***RST**	–7.00000000E+001
Range	–300 to 100 dBc/Hz
Key Entry	**Desired Flat Amplitude (Lmid)**

:PHASe:NOISe:LMID:ACTual?

Supported	N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:LMID:ACTual?
```

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

:PHASe:NOISe[:STATe]

Supported N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe[:STATe]
ON|OFF|1|0
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe[:STATe]?
```

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the *User's Guide*.

***RST** 0

Key Entry **Phase Noise Off On**

:PHASe:NOISe:TRACe?

Supported N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:DMODulation:ARB:PHASe:NOISe:TRACe?
<startFreq>,<stopFreq>,<numSamples>
```

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range	<startFreq>	1 Hz to 100 MHz
	<stopFreq>	1 Hz to 100 MHz
	<numSamples>	1 to 8192

:PLAY:COMPleted?

Supported N5172B/82B with Option 431

`[:SOURce]:RADio:DMODulation:ARB:PLAY:COMPleted?`

This SCPI command returns whether the ARB waveform has completed since the last query or the last time the waveform was set up to play. The waveform is setup to play when various waveform parameters are adjusted, such as turning the mode off and on or changing the triggering mode. It returns a 0 if the waveform has not completed and a 1 if the waveform has completed at least one time. After this query, the value will be reset to 0 until another completion occurs.

:PLAY:WCOMpleted?

Supported N5172B/82B with Option 431

`[:SOURce]:RADio:DMODulation:ARB:PLAY:WCOMpleted?`

This SCPI command returns whether the ARB waveform has completed since the last query or the last time the waveform was setup up to play. This SCPI command will wait until the ARB waveform has completed. The completion is after repeat counts for single trigger. The waveform is set up to play when various waveform parameters are adjusted, such as turning the mode off and on or changing the triggering mode. It returns a 0 if the waveform has not completed and a DCAS has been sent to the instrument or the mode is not on, otherwise a 1 will be returned when the waveform has completed at least one time. After this query, the value will be reset to 0 until another completion occurs.

:RETRigger

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:RETRigger ON|OFF|IMMediate
[:SOURce]:RADio:DMODulation:ARB:RETRigger?
```

This command enables or disables the ARB retriggering mode; the retrigger mode controls how the retriggering function performs while a waveform is playing.

ON (1)	This choice specifies that if a trigger occurs while a waveform is playing, the waveform will retrigger at the end of the current waveform sequence and play once more.
OFF (0)	This choice specifies that if a trigger occurs while a waveform is playing, the trigger will be ignored.

IMMediate	This choice specifies that if a trigger occurs while a waveform is playing, the waveform will reset and replay from the start immediately upon receiving a trigger.
***RST**	ON

Key Entry	On	Off	Immediate

:SCLock:RATE

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:SCLock:RATE <val>
[:SOURce]:RADio:DMODulation:ARB:SCLock:RATE?
```

This command sets the sample clock rate.

The variable <val> is expressed in units of Hertz (kHz – MHz)

***RST**	+4.00000000E+006
Range	1E3 to 2E8
Key Entry	**ARB Sample Clock**
Remarks	The modulation format should be active before executing this command. If this command is executed before the modulation format is active, the entered value will be overridden by a calculated factory default value. Refer to the [:STATe] command to activate the modulation format.

:SETup

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:SETup
GSM|NADC|PDC|PHS|DECT|AC4Fm|
ACQPsk|CDPD|PWT|EDGE|TETRa|BLUetooth|DEFault|MCARrier|"<file
name>"
[:SOURce]:RADio:DMODulation:ARB:SETup?
```

This command selects the digital modulation format type or multicarrier, and turns multicarrier off or on (see the MCARrier choice description).

The *MCARrier* choice selects multicarrier and turns it on. Selecting any other setup such as GSM or CDPD turns multicarrier off. To select the multicarrier setup, see the “:SETup:MCARrier” on page 332.

***RST**	NADC

Key Entry	GSM	NADC	PDC	PHS	DECT	APCO 25 w/C4FM

CDPD **PWT** **EDGE** **TETRA** **BLUetooth** **DEFault**

Multicarrier Off On **Select File** **APCO w/CQPSK**

Remarks	For information on the file name syntax, refer to "File Name Variables" on page 43.

:SETup:MCARrier

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier
GSM|NADC|PDC|PHS|DECT|
AC4Fm|ACQPsk|CDPD|PWT|EDGE|TETRa,<num carriers>,<freq
spacing>)|
"<file name>"
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier?
```

This command builds a table with the specified number of carriers and frequency spacing or retrieves the setup stored in the specified user file.

The carrier type, number of carriers, and frequency spacing value are returned when a query is initiated. The output format is as follows:

```
<carrier type>,<num carriers>,<freq spacing>
```

If a specific file is loaded and then queried, only the file name is returned.

The variable <freq spacing> is expressed in units of Hertz (kHz–MHz).

***RST**	**Carrier**: NADC	**<num carriers>**: 2
	<freq spacing>: +1.0000000000000E+06	
Range	**<num carriers>**: 2–100	
	<freq spacing>: 2 ÷ (<num carriers> – 1) × 80 MHz	

Key Entry **GSM** **NADC** **PDC** **PHS** **DECT**

CDPD **PWT** **EDGE** **TETRA** **# of Carriers**

Custom Digital Mod State	**APCO w/CQPSK**
APCO 25 w/C4FM	**Freq Spacing**

Remarks For information on the file name syntax, refer to "File Name Variables" on page 43.

:SETup:MCARrier:PHASe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:PHASe
FIXed|RANDom
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:PHASe?
```

This command toggles the phase settings for multicarrier digital modulation.

FIXed This choice sets the phase of all carriers to 0.

RANDom This choice sets random phase values for all of the carriers.

***RST** FIX

Key Entry **Carrier Phases Fixed Random**

:SETup:MCARrier:STORe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:STORe "<file
name>"
```

This command stores the current multicarrier setup information.

The stored file contains information that includes the digital modulation format, number of carriers, frequency spacing, and power settings for the multicarrier setup.

Key Entry **Load/Store**

Remarks The setting enabled by this command is not affected by signal generator power–on, preset, or *RST.

For information on the file name syntax, refer to "File Name Variables" on page 43.

:SETup:MCARrier:TABLe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:TABLe
INIT|APPend|
<carrier_num>,GSM|NADC|PDC|PHS|DECT|AC4Fm|ACQPsk|CDPD|PWT|ED
```

GE|TETRa|
"<file name>",<freq_offset>,<power>
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:TABLe?
<carrier_num>

This command modifies the parameters of one of the available multicarrier digital modulation formats.

The variable <freq_offset> is expressed in units of Hertz (kHz–MHz).

The variable <power> is expressed in units of decibels (dB).

INIT	This choice clears the current information and creates a new one–row table, allowing for further definition using additional parameters.
APPend	This choice adds rows to an existing table.
<carrier_num>	This variable specifies the number of the carriers in the multicarrier table that will be modified. The value of the variable <carrier_num> must be specified prior to selecting the digital modulation format.

Carrier type, frequency offset, and power level are returned when a query is initiated. The output format is as follows:

`<carrier type>,<freq_offset>,<power>`

***RST**	**carrier type**: NADC	**<freq_offset>**: –5.00000000E+004		
	<power>: +0.00000000E+000			
Range	**<freq_offset>**: –8E7 to 8E7	**<power>**: –40 to 0		
Key Entry	**Initialize Table**	**Insert Row**	**GSM**	
	NADC	**PDC**	**PHS**	**DECT**
	APCO 25 w/C4FM	**APCO w/CQPSK**	**TETRA**	
	CDPD	PWT	**EDGE**	**Custom Digital Mod State**

Remarks For information on the file name syntax, refer to "File Name Variables" on page 43.

To store a multicarrier setup refer to
":SETup:MCARrier:STORe" on page 333.

:SETup:MCARrier:TABLe:NCARriers

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:SETup:MCARrier:TABLe:NCARrie
rs?
```

This query returns the number of carriers in the current multicarrier setup.

***RST**	+2
Range	1 to 100
Key Entry	**# of Carriers**

:SETup:STORe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:SETup:STORe "<file name>"
```

This command stores the current custom digital modulation state.

The saved file contains information that includes the modulation type, filter and symbol rate for the custom modulation setup.

Key Entry	**Store Custom Dig Mod State**
Remarks	For information on the file name syntax, refer to "File Name Variables" on page 43.

:SRATe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:SRATe <val>
[:SOURce]:RADio:DMODulation:ARB:SRATe?
```

This command sets the transmission symbol rate.

The variable `<val>` is expressed in units of symbols per second (sps–Msps) and the maximum range value is dependent upon the modulation type and filter.

***RST** +1.00000000E+006

Range	Option 653	50 sps to 37.5 Msps
	Option 655	50 sps to 75 Msps
	Option 656	50 sps to 50 Msps
	Option 657	50 sps to 100 Msps

Key Entry **Symbol Rate**

:TRIGger:TYPE

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE
CONTinuous|SINGle|GATE
[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE?
```

This command sets the trigger mode (type) that controls the waveform's playback.

Triggers control the playback by telling the X-Series signal generator when to play the modulating signal (waveform). Depending on the trigger settings, the waveform playback can occur once, continuously, or the X-Series signal generator may start and stop playing the waveform repeatedly (GATE mode).

A trigger signal comprises both positive and negative signal transitions (states), which are also called high and low periods. You can configure the X-Series signal generator to trigger on either state of the trigger signal. It is common to have multiple triggers, also referred to as trigger occurrences or events, occur when the X-Series signal generator requires only a single trigger. In this situation, the X-Series signal generator recognizes the first trigger and ignores the rest.

When you select a trigger mode, you may lose the signal (carrier plus modulating) from the RF output until you trigger the waveform. This is because the X-Series signal generator sets the I and Q signals to zero volts prior to the first trigger event, which suppresses the carrier. After the first trigger event, the waveform's final I and Q levels determine whether you will see the carrier signal or not (zero = no carrier, other values = carrier visible). At the end of most files, the final I and Q points are set to a value other than zero.

There are four parts to configuring the trigger:

- Choosing the trigger type, which controls the waveform's transmission.
- Setting the waveform's response to triggers:
  - CONTinuous, see ":TRIGger:TYPE:CONTinuous[:TYPE]" on page 338
  - SINGle, see ":RETRigger" on page 330
  - GATE, selecting the mode also sets the response
- Selecting the trigger source (see ":TRIGger[:SOURce]" on page 339), which determines how the X-Series signal generator receives its trigger signal, internally or externally. The GATE choice requires an external trigger.
- Setting the trigger polarity when using an external source:
  - CONTinuous and SINGle see ":TRIGger[:SOURce]:EXTernal:SLOPe" on page 341
  - GATE, see ":TRIGger:TYPE:GATE" on page 338

For more information on triggering, see the *User's Guide*.

The following list describes the trigger type command choices:

CONTinuous	Upon triggering, the waveform repeats continuously.
SINGle	Upon triggering, the waveform segment or sequence plays once.
GATE	An external trigger signal repeatedly starts and stops the waveform's playback (transmission). The time duration for playback depends on the duty period of the trigger signal and the gate polarity selection (see ":TRIGger:TYPE:GATE" on page 338). The waveform plays during the inactive state and stops during the active polarity selection state. The active state can be set high or low. The gate mode works only with an external trigger source.

NOTE The ARB gating behavior described above is opposite to the gating behavior for real–time custom mode.

***RST** CONT

Key Entry **Continuous** **Single** **Gated**

:TRIGger:TYPE:CONTinuous[:TYPE]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE:CONTinuous[:TYPE] FREE|
TRIGger|RESet
[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE:CONTinuous[:TYPE]?
```

This commands selects the waveform's response to a trigger signal while using the continuous trigger mode.

For more information on triggering and to select the continuous trigger mode, see ":TRIGger:TYPE" on page 336.

The following list describes the waveform's response to each of the command choices:

FREE	Turning the ARB format on immediately triggers the waveform. The waveform repeats until you turn the format off, select another trigger, or choose another waveform file.
TRIGger	The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously until you turn the format off, select another trigger, or choose another waveform file.
RESet	The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously. Subsequent triggers reset the waveform to the beginning. For a waveform sequence, this means to the beginning of the first segment in the sequence.
***RST**	FREE

Key Entry	**Free Run**	**Trigger & Run**	**Reset & Run**

:TRIGger:TYPE:GATE

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE:GATE LOW|HIGH
[:SOURce]:RADio:DMODulation:ARB:TRIGger:TYPE:GATE?
```

This command selects the active state (gate polarity) of the gate while using the gating trigger mode.

The LOW and HIGH selections correspond to the low and high states of an external trigger signal. For example, when you select HIGH, the active state occurs during the high of the trigger signal. When the active state occurs, the X-Series signal generator starts the waveform playback at the last played sample point, then stops the playback at the next sample point when the inactive state occurs. For more information on triggering and to select gating as the trigger mode, see ":TRIGger:TYPE" on page 336.

The following list describes the X-Series signal generator's gating behavior for the polarity selections:

LOW	The waveform playback starts when the trigger signal goes low (active state) and stops when the trigger signal goes high (inactive state).
HIGH	The waveform playback starts when the trigger signal goes high (active state) and stops when the trigger signal goes low (inactive state).
***RST**	HIGH
Key Entry	**Gate Active Low High**

:TRIGger[:SOURce]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce] KEY|EXT|BUS
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]?
```

This command sets the trigger source.

For more information on triggering, see ":TRIGger:TYPE" on page 336. The following list describes the command choices:

KEY — This choice enables manual triggering by pressing the front panel **Trigger**.

EXT — An externally applied signal triggers the waveform. This is the only choice that works with gating. The following conditions affect an external trigger:

- The input connector selected for the trigger signal. You have a choice between the rear panel PATTERN TRIG IN connector or the PATT TRIG IN 2 pin on the rear panel AUXILIARY I/O connector. To make the connector selection, see ":TRIGger[:SOURce]:EXTernal[:SOURce]" on page 341.

  For more information on the connectors and on connecting the cables, see the *User's Guide*.
- The trigger signal polarity:
  - gating mode, see ":TRIGger:TYPE:GATE" on page 338

– continuous and single modes, see ":TRIGger[:SOURce]:EXTernal:SLOPe" on page 341

– The time delay between when the X-Series signal generator receives a trigger and when the waveform responds to the trigger. There are two parts to setting the delay:

– setting the amount of delay, see ":TRIGger[:SOURce]:EXTernal:DELay" on page 340

– turning the delay on, see ":TRIGger[:SOURce]:EXTernal:DELay:STATe" on page 341

BUS This choice enables triggering over the GPIB or LAN using the `*TRG` or `GET` commands or the AUXILIARY INTERFACE (RS–232) using the `*TRG` command.

***RST** EXT

Key Entry	**Trigger Key**	**Ext**	**Bus**

:TRIGger[:SOURce]:EXTernal:DELay

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:DE
Lay <val>
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:DE
Lay?
```

This command sets the amount of time to delay the X-Series signal generator's response to an external trigger.

The delay is a path (time) delay between when the X-Series signal generator receives the trigger and when it responds to the trigger. For example, configuring a trigger delay of two seconds, causes the X-Series signal generator to wait two seconds after receipt of the trigger before the X-Series signal generator plays the waveform.

The delay does not occur until you turn it on (see ":TRIGger[:SOURce]:EXTernal:DELay:STATe" on page 341). You can set the delay value either before or after turning it on.

For more information on configuring an external trigger source and to select external as the trigger source, see ":TRIGger[:SOURce]" on page 339.

The unit of measurement for the variable <val> is in seconds (nsec–sec).

***RST** +1.00000000E–003

Range 1E–8 to 4E1

Key Entry **Ext Delay Time**

:TRIGger[:SOURce]:EXTernal:DELay:STATe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe ON|OFF|1|0
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe?
```

This command enables or disables the external trigger delay function.

For setting the delay time, see ":TRIGger[:SOURce]:EXTernal:DELay" on page 340, and for more information on configuring an external source, see ":TRIGger[:SOURce]" on page 339.

***RST** 0

Key Entry **Ext Delay Off On**

:TRIGger[:SOURce]:EXTernal:SLOPe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:SLOPe POSitive|NEGative
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal:SLOPe?
```

This command sets the polarity for an external trigger signal while using the continuous, single triggering mode. To set the polarity for gating, see ":TRIGger:TYPE:GATE" on page 338.

The POSitive and NEGative selections correspond to the high (positive) and low (negative) states of the external trigger signal. For example, when you select POSitive, the waveform responds (plays) during the high state of the trigger signal. When the X-Series signal generator receives multiple trigger occurrences when only one is required, the signal generator uses the first trigger and ignores the rest.

For more information on configuring an external trigger source and to select external as the trigger source, see ":TRIGger[:SOURce]" on page 339.

***RST** NEG

Key Entry **Ext Polarity Neg Pos**

:TRIGger[:SOURce]:EXTernal[:SOURce]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal[:S
OURce] EPT1|EPT2|EPTRIGGER1|EPTRIGGER2
[:SOURce]:RADio:DMODulation:ARB:TRIGger[:SOURce]:EXTernal[:S
OURce]?
```

This command selects which PATTERN TRIG IN connection the X-Series signal generator uses to accept an externally applied trigger signal when external is the trigger source selection.

For more information on configuring an external trigger source and to select external as the trigger source, see ":TRIGger[:SOURce]" on page 339. For more information on the rear panel connectors, see the *User's Guide*.

The following list describes the command choices:

EPT1	This choice is synonymous with EPTRIGGER1 and selects the PATTERN TRIG IN rear panel connector.
EPT2	This choice is synonymous with EPTRIGGER2 and selects the PATT TRIG IN 2 pin on the rear panel AUXILIARY I/O connector.
EPTRIGGER1	This choice is synonymous with EPT1 and selects the PATTERN TRIG IN rear panel connector.
EPTRIGGER2	This choice is synonymous with EPT2 and selects the PATT TRIG IN 2 pin on the rear panel AUXILIARY I/O connector.
***RST**	EPT1

Key Entry	**Patt Trig In 1**	**Patt Trig In 2**

[:STATe]

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:DMODulation:ARB[:STATe] ON|OFF|1|0
[:SOURce]:RADio:DMODulation:ARB[:STATe]?
```

This command enables or disables the digital modulation capability.

ON (1)	This choice sets up the internal hardware to generate the currently selected digital modulation format signal selection.
OFF (0)	This choice disables the digital modulation capability.
***RST**	0
Key Entry	**Digital Modulation Off On**
Key Path	**Mode > ARB Custom Modulation > Digital Modulation Off On**
Remarks	When On is selected, the I/Q state is activated and the I/Q source is set to internal.

Dual ARB Subsystem–N5172B/82B ([:SOURce]:RADio:ARB)

:BASeband:FREQuency:OFFSet

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:BASeband:FREQuency:OFFSet <value><unit>
[:SOURce]:RADio:ARB:BASeband:FREQuency:OFFSet?
```

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed–through is not in the center.

The X-Series signal generator provides an automatic DAC over–range protection feature, which can be turned off (factory default has it set to on). When turned on, the protection is active when the offset value is something other than 0 Hz. It scales down the playing I/Q data by *1/square root of 2*. To turn the protection off, see ":DOPRotection" on page 344.

***RST**	0 Hz
Range	–5.0E7 to +5.0E7 Hz
Key Entry	**Baseband Frequency Offset**

:BASeband:FREQuency:OFFSet:PHASe:RESet

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:BASeband:FREQuency:OFFSet:PHASe:RESet
```

This command clears the phase accumulation and so zero phase shift.

When the Baseband Frequency Offset is non–zero, the hardware rotator accumulates phase–shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non–zero residual phase present in the signal, the DAC Over–Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by **1/square root of 2**.

Key Entry	**Baseband Frequency Offset Phase Reset**

:CLIPping

Supported	N5172B/82B

NOTE Clipping cannot be undone (i.e. restoring clipping value to 100% will have no effect on a previously clipped waveform.)

```
[:SOURce]:RADio:ARB:CLIPping "<file
name>",IJQ|IORQ,<value>[,<value>]
```

This command sets the clipping level of the selected waveform segment to a percentage of its highest peak.

The variable <value> is expressed in units of percent.

IJQ	This choice clips the composite I/Q waveform.
IORQ	This choice clips I and Q separately. When this choice is enabled, percentage values for both I and Q must be specified.

***RST** IJQ **<value>**: +100

Range **<value>**: 10–100 (0.1% resolution)

Key Entry **Clipping Type |I+jQ| |I|,|Q|**

Remarks A value of 100 percent equates to no clipping.

For information on the file name syntax, refer to "File Name Variables" on page 43.

:DOPRotection

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:DOPRotection ON|OFF|1|0
[:SOURce]:RADio:ARB:DOPRotection?
```

This commands turns the DAC over–range protection feature off or on.

The over–range protection feature works only with the Baseband Frequency Offset feature and the Option 432 Phase Noise Impairment.

On	Minimizes the occurrence of a DAC over–range condition. In doing so, it can also decrease the dynamic range of the waveform by scaling the data more than what is actually needed. For the Baseband Frequency Offset feature, this protection is active only when the offset parameter is a value other than 0 Hz.
Off	The automatic protection feature is not enabled. To correct a DAC over–range condition, reduce the waveform runtime scaling value (see ":RSCaling" on page 375).

***RST** ON

Key Entry **DAC Over–range Protection Off On**

:FILTer:ALPHa

Supported N5172B/82B

[:SOURce]:RADio[1]:ARB:FILTer:ALPHa <value>

[:SOURce]:RADio[1]:ARB:FILTer:ALPHa?

This command changes the Nyquist or Root Nyquist Real-Time Modulation filter alpha value.

The filter alpha value can be set to the minimum level (0), the maximum level (1), or in between by using fractional numeric values (0.001 to 0.999).

***RST**	+3.50000000E–001
Range	0.000 to 1.000
Key Entry	**Filter Alpha**
Remarks	To change the current filter type, refer to :FILTer:TYPE.

:FILTer:BBT

Supported	N5172B/82B

[:SOURce]:RADio[1]:ARB:FILTer:BBT <value>

[:SOURce]:RADio[1]:ARB:FILTer:BBT?

This command changes the bandwidth–multiplied–by–bit–time (BbT) Real-Time Modulation filter parameter.

The filter BbT value can be set to the minimum level (0.1), the maximum level (1), or in between by using fractional numeric values (0.100 to 0.999).

***RST**	+5.00000000E–001
Range	0.100 to 1.000
Key Entry	**Filter BbT**
Remarks	This command is effective only after choosing a Gaussian filter. It does not have an effect on other types of filters. To change the current filter type, refer to :FILTer:TYPE.

:FILTer:CHANnel

Supported	N5172B/82B

[:SOURce]:RADio[1]:ARB:FILTer:CHANnel EVM|ACP

[:SOURce]:RADio[1]:ARB:FILTer:CHANnel?

This command optimizes the Nyquist and Root Nyquist Real-Time Modulation filters to minimize error vector magnitude (EVM) or to minimize adjacent channel power (ACP).

EVM	This choice provides the most ideal passband.
ACP	This choice improves stopband rejection.

***RST**	EVM
Key Entry	**Optimize FIR For EVM ACP**
Remarks	To change the current filter type, refer to :FILTer:TYPE.

:FILTer:TYPE

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:FILTer:TYPE RNYQuist|NYQuist|GAUSsian|
RECTangle|IS95|IS95_EQ|IS95_MOD|IS95_MOD_EQ|EDGE|EWIDe|EHSR|
WCDMa|AC4Fm|"<user FIR>"
[:SOURce]:RADio:ARB:FILTer:TYPE?
```

This command specifies the Real-Time Modulation filter type.

RNYQuist	This choice selects a Root Nyquist (root raised cosine) filter. This filter is adjusted using Alpha.
NYQuist	This choice selects a Nyquist (raised cosine) filter. This filter is adjusted using Alpha.
GAUSsian	This choice selects a Gaussian filter which is adjusted using Bbt values.
RECTangle	This choice selects a one symbol wide rectangular filter.
IS95	This choice selects a filter that meets the criteria of the IS–95 standard.
IS95_EQ	This choice selects a filter which is a combination of the IS–95 filter (above) and the equalizer filter described in the IS–95 standard. This filter is only used for IS–95 baseband filtering.
IS95_MOD	This choice selects a filter that meets the criteria of the IS–95 error function (for improved adjacent channel performance) with lower passband rejection than the filter specified in the IS–95 standard.
IS95_MOD_EQ	This choice selects a filter which is a combination of the equalizer filter described in the IS–95 standard and a filter that meets the criteria of the IS–95 error function (for improved adjacent channel performance), with lower passband rejection.
EDGE	This choice selects a linearized Gaussian filter as defined in GSM 05.04.
EWIDe	This choice selects an EDGE spectrally wide pulse shape filter as per 3GPP TS 45.004.
EDGE EHSR	This choice selects an EDGE high symbol rate spectrally narrow pulse shape filter as per 3GPP TS 45.004.

WCDMa	This choice selects a W-CDMA filter which is the equivalent of a Root Nyquist filter with an alpha of 0.22 optimized for ACP.
AC4Fm	This choice selects a predefined Association of Public Safety Communications Officials (APCO) specified compatible 4–level frequency modulation (C4FM) filter.
"<user FIR>"	This variable is any FIR filter file that you have stored in memory. The variable needs no directory path indicating the location of the file, such as `FIR:` or `/USER/FIR`. The command assumes the FIR directory. For more information on file names, refer to “File Name Variables” on page 43.
***RST**	Root Nyquist

Key Entry	**Nyquist**	**IS–95**	**EDGE**
	Gaussian	**IS–95 Mod**	**WCDMA**
	User FIR	**IS–95 w/EQ**	**Rectangle**
	Root Nyquist	**IS–95 Mod w/EQ**	**EDGE Wide**
		APCO 25 C4FM	**EDGE EHSR**

:FILTer[:STATe]

Supported N5172B/82B

```
[:SOURce]:RADio[1]:ARB:FILTer[:STATe]ON|OFF}|1|0
```

```
[:SOURce]:RADio[1]:ARB:FILTer[:STATe]?
```

This command enables or disables the **Real-Time Modulation Filter**. This filter is typically applied to an Arb waveform containing just the I/Q symbol decision points. The filter then defines the transitions between the symbol decision points. This means that the filter must have an oversample ratio of two or more. When this feature is active, the Sample Clock Rate is actually the Symbol Rate.

Default Off

Key Entry **Modulation Filter Off On**

:GENerate:SINE

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:GENerate:SINE
["<file_name>"][,<osr>],[<scale>],
[I|Q|IQ][<phasedeg>]
```

This command creates a sine wave waveform file and saves it in the signal generator's volatile waveform memory (WFM1).

"<file_name>"	This variable names the file used to save the generated sine wave data.
<osr>	This variable sets the oversample ratio, which must be an even number and ≥ 4. The <osr> variable is expressed in samples. If the oversample ratio is < 60 (the minimum number of samples or I/Q points required for a waveform), multiple waveform periods are generated to create a waveform file with ≥ 60 samples. The number of periods created is 60 ÷ <osr> (quotient will round up to an integer value). A waveform with an oversample ratio ≥ 60 has one period.
<scale>	This variable sets the scale factor for the waveform. The scale factor is a real number from zero to one.
I|Q|IQ	Selects I, Q, or I and Q paths for the waveform data. Sine wave data is generated and applied to the I path if the I path is selected; Q data are set to zeros. Sine data is generated and applied to the Q path if the Q path is selected; I data are set to zeros. If the I and Q paths are selected, sine wave data are applied to the I and Q paths.
<phasedeg>	Selects the phase angle of the waveform data. Sine wave data is generated and the phase angle in degrees is applied to the sine wave.

Example

```
:RAD:ARB:GEN:SINE "Sine_Wave",60,.5,IQ
```

The preceding example generates an I/Q sine wave and saves the data to a file named Sine_Wave. The oversampling ratio is 60, the scaling is set for 50%, and the data is applied to both the I and Q paths.

The signal generator's baseband option and available baseband memory determine the maximum number of samples for the waveform.

Range **OSR Option 65x:** 4E0 to 32E6

OSR Option 021: 4E0 to 256E6

OSR Option 022: 4E0 to 512E6

OSR Option 023: 4E0 to 1E9

Scale: 0 to 1

:GENerate:TEST:WAVeforms

Supported N5172B/82B

`[:SOURce]:RADio:ARB:GENerate:TEST:WAVeforms`

This command recreates the arb waveform test files into BBG (waveform) memory (WFM1). When this command is sent to the instrument, the SINE_TEST_WFM and RAMP_TEST_WFM files are regenerated.

Example

`:RAD:ARB:GEN:TEST:WAV`

:HEADer:CLEar

Supported	N5172B/82B

`[:SOURce]:RADio:ARB:HEADer:CLEar`

This command clears the header information from the file header used by this modulation format (i.e. all file header fields are set to unspecified).

Key Entry	**Clear Header**
Remarks	A waveform must be selected for this command to function.

:HEADER:NOISe:RMS[:OVERride]

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:HEADER:NOISe:RMS:OVERride
"<file_name>",<value>|UNSPecified
[:SOURce]:RADio:ARB:HEADER:NOISe:RMS:OVERride? "<file_name>"
```

This command sets the value of the waveform's I and Q RMS (root mean square) for noise.

The RMS is used strictly for calculating the relative power of the noise in the specified header. The RMS is specified in normalized linear units with |+1| or |–1| as full scale on I or Q, therefore the largest RMS that can be specified is the square root of 2 (1.414213562). If the value is unspecified, then the waveform file header's RMS is used.

This value is useful if you wish to have the noise be relative to only a portion of the waveform, such as a pilot channel, or be relative to only a single carrier that is mixed with other carriers.

For setting the header's RMS value, see ":HEADer:RMS" on page 350.

"<file_name>"	This variable names the waveform file to which the RMS value will be applied. The file name variable can designate a file in the WFM1, NVWFM, or SEQ directories. For information on the file name syntax, refer to "File Name Variables" on page 43.
<value>	This variable is the user–measured RMS noise value for the specified carrier.

`UNSPecified` Sets RMS as unspecified, which causes the general RMS value to be used for calculating the relative noise power.

Example

```
:RAD:ARB:HEADER:NOISe:RMS:OVER "WFM1:Sine_Wave",.835
```

The preceding example sets the file header RMS noise override value for a file type WFM1, named Sine_Wave, to .835.

```
:RAD:ARB:HEADER:NOISe:RMS:OVER "WFM1:Sine_Wave",UNSP
```

In the second example, the signal generator calculates the RMS, using the waveform file header's RMS value. For setting the header's RMS value, see ":HEADer:RMS" on page 350.

The RMS value is expressed in volts.

Key Entry	Edit Noise RMS Override	Unspecified	Enter

:HEADer:RMS

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:HEADER:RMS
"<file_name>",<value>|UNSPecified
[:SOURce]:RADio:ARB:HEADER:RMS? "<file_name>"
```

This command sets the file header RMS value for the selected waveform file. The X-Series signal generator uses the RMS value with the dual ARB's real–time noise function and to optimize the modulator drive level.

The signal generator reads the RMS value from the file header when a waveform is selected to play. If the value is unspecified, then it is calculated and stored in the header automatically.

When the waveform file is saved from volatile waveform memory (WFM1) to non–volatile waveform memory (NVWFM), the RMS value, auto–calculated or user–defined, is also saved.

For setting the header noise carrier RMS override value, see ":HEADER:NOISe:RMS[:OVERride]" on page 349.

"<file_name>" This variable names the waveform file to which the RMS value will be applied. The file name variable can designate a file in the WFM1, NVWFM, or SEQ directories. For information on the file name syntax, refer to "File Name Variables" on page 43.

<value> This variable is the user–measured RMS value for the specified waveform. The following figure shows the RMS calculation.

$$\sqrt{\sum_{n=1}^{N} \left(i_n^2 + q_n^2 \right) \times \frac{1}{N}}$$

N = # of Samples

`UNSPecified` Using this variable in the command clears the RMS value and sets it to unspecified. An unspecified RMS value causes the signal generator to calculate the value when the ARB personality is turned on. The RMS calculation includes rise/fall times and does not include consecutive zero level samples. DC offsets and noise are also included in the RMS measurement. But, the Marker values are **not** included in these calculations. Because the signal generator calculation uses so many factors, you may achieve better results calculating your own RMS value.

Examples

`[:SOURce]:RADio:ARB:HEADER:RMS "WFM1:Sine_Wave",.835`

The first example shows a user–measured RMS value for the Sine_Wave waveform file in the waveform's file header.

`:RAD:ARB:HEADER:RMS "WFM1:Sine_Wave",UNSP`

In the second example, the signal generator calculates the RMS value when the ARB is turned on with this file selected or a sequence which contains the file selected.

The RMS value is expressed in volts.

Range 0 to 1.414213562373095

Key Entry	Edit RMS	Enter	Unspecified	Calculate

:HEADer:SAVE

Supported N5172B/82B

`[:SOURce]:RADio:ARB:HEADer:SAVE`

This command saves the Dual ARB state information to the header of the currently selected waveform.

Key Entry **Save Setup To Header**

Remarks A waveform must be selected for this command to function.

:IQ:MODulation:ATTen

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:IQ:MODulation:ATTen <value>
[:SOURce]:RADio:ARB:IQ:MODulation:ATTen?
```

This command sets the attenuation level of the I/Q signals being modulated through the signal generator RF path.

The variable <value> is expressed in units of decibels (dB).

***RST**	Varies (instrument dependent)
Range	0 to 50
Key Entry	**Modulator Atten Manual Auto**

:IQ:MODulation:ATTen:AUTO

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:IQ:MODulation:ATTen:AUTO ON|OFF|1|0
[:SOURce]:RADio:ARB:IQ:MODulation:ATTen:AUTO?
```

This command enables or disables the I/Q attenuation auto mode.

ON (1)	This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.
OFF (0)	This choice holds the attenuator at its current setting or at a selected value. Refer to the :IQ:MODulation:ATTen command for setting the attenuation value.
***RST**	1
Key Entry	**Modulator Atten Manual Auto**

:MARKer:CLEar

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:MARKer:CLEar
"<file_name>",<marker>,<first_point>,<last_point>
```

This command clears a single marker point or a range of marker points on a waveform segment for the selected marker (1–4). The dual ARB player and all of the ARB modulation formats use this command.

"<file_name>"	This variable specifies the name of the waveform file in volatile waveform memory (WFM1). For information on the file name syntax, see “File Name Variables” on page 43.
<marker>	This variable selects the marker number; an integer value from one to four.

<first_point>	This variable defines the first point in a range of points. The number must be greater than or equal to one, and less than or equal to the total number of waveform points. If you enter a value for either the first marker point or the last marker point that would make the first marker point occur after the last, the last marker point automatically adjusts to match the first marker point.
<last_point>	This variable defines the last point in a range of points. The number must be greater than or equal to the first point, and less than or equal to the total number of waveform points.

To clear a single marker point, use the same marker point for the first and last point variables. For more information on markers and ARB files, refer to the *User's Guide*.

Example

```
:RAD:ARB:MARK:CLE "Test_Data",1,1,300
```

The preceding example clears marker 1 from the first point through the 300th point in the Test_Data file.

Range	**<marker>**: 1–4	
	<first_Point>: 1–number of waveform points	
	<last_point>: <first_Point>–number of waveform points	
Key Entry	**Set Marker Off Range Of Points**	**Marker 1 2 3 4**
Key Entry	**First Mkr Point**	**Last Mkr Point**

:MARKer:CLEar:ALL

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:MARKer:CLEar:ALL "<file_name>",<marker>
```

This command clears all marker points on a waveform segment for the selected marker (1–4). The dual ARB player and all of the ARB formats use this command. With all marker points cleared, the event output signal level is set low.

"<file_name>"	This variable specifies the name of the waveform file in volatile waveform memory (WFM1). For information on the file name syntax, see “File Name Variables” on page 43.
<marker>	This variable selects the marker number; an integer value from one to four.

Example

```
:RAD:ARB:MARK:CLE:ALL "Test_Data",1
```

The preceding example clears marker 1 from the all waveform points in the Test_Data file.

Range	1 to 4

Key Entry	**Marker 1 2 3 4**	**Set Marker Off All Points**

:MARKer:ROTate

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:MARKer:ROTate
"<file_name>",<rotate_count>
```

This command shifts the marker points for all markers in a waveform segment earlier or later by the value of the <rotate_count> variable. The dual ARB player and all of the ARB formats use this command.

You can use a positive or negative value. When a marker point is close to the end of the waveform and the <rotate_count> value is greater than the number of remaining marker points, but less than the total number of marker points, the marker points that would move beyond the end of the waveform wrap to the beginning of the waveform. For example, if a marker point resides at sample point 195 out of 200, and the <rotate_count> value is twenty–five, the marker point wraps to the beginning of the waveform and continues out to the twentieth waveform point.

To set the marker points in a waveform, refer to “:MARKer[:SET]” on page 355.

"<file_name>"	This variable specifies the name of the waveform file in volatile waveform memory (WFM1). For information on the file name syntax, see "File Name Variables" on page 43.

Example

```
:RAD:ARB:MARK:ROT "Test_Data",100
```

The preceding example shifts all markers set in the Test_Data file 100 points later. If the first set point in the file is at 50, then after sending this command, the first set point will be 150 (assuming the Test_Data file has at least 150 points and no later set points wrapped around to the beginning of the file).

Range	– (n – 1) to (n – 1)
	n = number of points in the waveform

:MARKer[:SET]

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:MARKer[:SET]
"<file_name>",<marker>,<first_point>,<last_point>,
<skip_count>
```

This command sets a single marker point or a range of marker points on a waveform segment for the selected marker (1–4). The dual ARB player and all of the ARB formats use this command.

The Keysight X-Series signal generator provides four independent markers. Two of the markers route output signals to rear panel event connectors, Marker–1 to Event1 BNC and Marker–2 to Aux I/O. A marker consists of marker points placed at defined sample points in a waveform segment. This means that a marker point cannot be less than one or greater than the last sample point in the waveform. Marker points are cumulative, so multiple command executions with different range values, without first clearing the existing points, places additional marker points on the waveform. Because of this cumulative behavior, it is a good practice to clear existing marker points prior to setting new points. This will eliminate unexpected marker pulses. Refer to ":MARKer:CLEar" on page 352 and ":MARKer:CLEar:ALL" on page 354 for information on clearing marker points.

For waveforms generated on the signal generator (baseband generator), the Keysight X-Series signal generator automatically places a marker point at the first waveform sample for markers one and two.

NOTE

You can set markers for either positive or negative polarity. The following discussions for this command assume positive marker polarity. When using negative marker polarity, the marker pulses occur during the periods of no marker points.

There are three ways to place marker points using this command:

– consecutive marker points over a range that collectively create a single marker pulse that spans the range
– equally spaced marker points over a range, so that a marker pulse occurs at each sample point that coincides with a marker point (Using this method, you can configure a clock signal by setting the <skip_count> variable to one.)
– a single marker point placed at a specific sample point in the waveform, which outputs a single pulse relative to the marker point location (To configure a single marker point, set the first and last points to the same number.)

For more information on markers, refer to the *User's Guide*.

The following list describes the command variables:

"<file_name>"	This variable specifies the name of the waveform file in volatile waveform memory (WFM1). For information on the file name syntax, see "File Name Variables" on page 43.
<marker>	This variable selects the marker number; an integer value from one to four.
<first_point>	This variable defines the first point in the range over which the marker is placed. This number must be greater than or equal to one, and less than or equal to the total number of waveform points. If you enter a value for either the first marker point or the last marker point that would make the first marker point occur after the last, the last marker point is automatically adjusted to match the first marker point.
<last_point>	This variable defines the last point in the range over which the marker will be placed. This value must be greater than or equal to the first point, and less than or equal to the total number of waveform points.
<skip_count>	This variable defines the marker point pattern across the range. A zero value means the marker points occur consecutively across the range. A value greater than zero creates a repeating marker point pattern across the range, where the gap between the marker points is equal to the <skip_count> value. The gaps begin after the first marker point. Each marker point in the pattern, which is only one point wide, produces a marker pulse.

Example

`:RAD:ARB:MARK "Test_Data",1,40,100,2`

The preceding example sets marker 1 on the first point, 40, the last point, 100, and every third point (skip 2) between 40 and 100 (assuming the Test_Data file has at least 100 points).

Range	**<marker>**: 1–4
	<first_Point>: 1–number of waveform points
	<last_point>: <first_Point>–number of waveform points
	<skip_count>: 0–number of points in the range
Key Entry	**Set Marker on Range Of Points** **Marker 1 2 3 4**
	First Mkr Point **Last Mkr Point**
	# Skipped Points **Apply to Waveform**

:MBSync

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:MBSync OFF|MASTer|SLAVe
[:SOURce]:RADio:ARB:MBSync?
```

This command disables or enables the multiple BBG synchronization setup for the current signal generator. Ensure that the Dual ARB play is off prior to executing this command.

OFF — Turns off multiple baseband synchronization for the signal generator.

MASTer — Sets the signal generator as the master for the setup. When selected, the following trigger features are unavailable:

Trigger Type

– Free Run, see page 380
– Gated, see page 379

Prior to selecting MASTer, ensure that the trigger type is something other than shown above. If not, the X-Series signal generator generates a settings conflict error and changes the trigger type to TRIGger (continuous play once triggered).

SLAVe — Sets the signal generator as a slave in the setup. When selected, the following trigger features are unavailable:

Trigger Type	Trigger Source
– Free Run, see page 380 – Gated, see page 379	– All selections, see page 383

Prior to selecting SLAVe, ensure that the trigger type is something other than shown above and that the trigger source is set according to the following list:

- EXT (external trigger signal, see page 383)
- EPT1 (PAT TRIG connector, see page 386)
- SLOPe POSitive (see page 385)
- EXT DELay to OFF (see page 385)

If not, the X-Series signal generator generates a settings conflict error and changes the trigger type to TRIGger (continuous play once triggered) and the trigger source to the above listed selections.

To set the slave position, see ":MBSync:SREFerence" on page 360.

For more information on the multiple BBG synchronization feature, see the *User's Guide*.

Example

```
:RAD:ARB:MBS MAST
```

The preceding example sets the signal generator as the master in the master/slave setup.

***RST** OFF

Key Entry	Off	Master	Slave

:MBSync:NASLaves

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:MBSync:NASLaves <value>
[:SOURce]:RADio:ARB:MBSync:NASLaves?
```

This command enters the number of first-generation MXG (N51xxA) signal generators that are designated as slaves in a multiple BBG synchronization setup. This value is required for both the master and slave signal generators and is used to calculate the internal compensation values to minimize synchronization delay.

NOTE: All first-generation MXG slaves must be at the end of the synchronization chain.

The NASLaves value is a persistent setting that survives both preset and power cycling.

Example

`:RAD:ARB:MBS:NASL 3`

The preceding example enters three as the number of first-generation MXG slaves the current signal generator master/slave setup.

Range	0 to 15 (depends on the NSLaves setting)
Key Entry	**Number of MXG-A Slaves**

:MBSync:NSLaves

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:MBSync:NSLaves <value>
[:SOURce]:RADio:ARB:MBSync:NSLaves?
```

This command enters the number of signal generators designated as slaves in a multiple BBG synchronization setup. This value is required for both the master and slave signal generators.

This command does *not* designate which slave position a signal generator occupies. To set the slave position, see ":MBSync:SREFerence" on page 360.

The NASLaves value is a persistent setting that survives both preset and power cycling.

Example

`:RAD:ARB:MBS:NSL 7`

The preceding example enters seven as the number of slaves the current signal generator master/slave setup.

Range	1 to 15
Key Entry	**Number of Slaves**

:MBSync:SLISten

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:MBSync:SLISten
```

For signal generators designated as slaves in the multiple BBG synchronization setup, this command enables them to receive a one–time baseband synchronization event trigger initiated by the master. The signal generator receives the trigger signal through the **PAT TRIG** connector.

Prior to executing this command, ensure that the Dual ARB player and the trigger source for the master is off.

Since this command is for a one–time event, you must send this command each time there is a need to synchronize the master/slave setup and prior to initiating the synchronization trigger from the master signal generator. After executing this command, each signal generator should show a status register weighting of 256 (waiting for sync). To check the status, see “:REGister[:STATus]” on page 373. To initiate the synchronization signal, see “:MBSync:SSLaves” on page 360.

Example

```
:RAD:ARB:MBS:SLIS
```

The preceding example enables a slave signal generator to receive the synchronization trigger.

Key Entry	**Listen for Sync**

:MBSync:SREFerence

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:MBSync:SREFerence <value>
[:SOURce]:RADio:ARB:MBSync:SREFerence?
```

For signal generators designated as slaves in the multiple BBG synchronization setup, this command sets the slave position of the signal generator.

The SREFerence value is a persistent settings that survives both preset and power cycling.

Example

```
:RAD:ARB:MBS:SREF 13
```

The preceding example sets the signal generator to slave number 13.

Range	1 to 15
Key Entry	**Slave Position**

:MBSync:SSLaves

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:MBSync:SSLaves
```

For the signal generator designated as the master in the multiple BBG synchronization setup, this command initiates the trigger to synchronize the baseband generators. The trigger signal is output through the **EVENT 1** connector.

As each slave receives the synchronization signal, it automatically sends a synchronization signal to the next slave in the chain. Prior to executing this command, all of the slaves must be set to listen for the trigger. For more information, see ":MBSync:SLISten" on page 359. After executing this command, each signal generator should show a status register weighting of 512 (in sync). To check the status, see ":REGister[:STATus]" on page 373.

NOTE If any changes are made to the synchronization parameters after executing this command, the master/slave system must be resynchronized. See the *User's Guide* for more information and the process for resynchronizing a system.

Example

`:RAD:ARB:MBS:SSL`

The preceding example initiates the synchronization trigger signal.

Key Entry	**Sync Slaves**

:MDEStination:AAMPlitude

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:MDEStination:AAMPlitude NONE|M1|M2|M3|M4
[:SOURce]:RADio:ARB:MDEStination:AAMPlitude?
```

This command routes the selected marker to the Alternate Amplitude function. The `NONE` parameter clears the marker for the Alternate Amplitude function.

***RST**	NONE

Key Entry	None	Marker 1	Marker 2	Marker 3	Marker 4

:MDEStination:ALCHold

Supported	N5172B/82B

CAUTION Incorrect automatic level control (ALC) sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

```
[:SOURce]:RADio:ARB:MDEStination:ALCHold NONE|M1|M2|M3|M4
[:SOURce]:RADio:ARB:MDEStination:ALCHold?
```

This command enables the marker ALC hold function for the selected marker. For setting markers, see ":MARKer[:SET]" on page 355.

Use the ALC hold function when you have a waveform signal that incorporates idle periods, or when the increased dynamic range encountered with RF blanking is not desired. The ALC leveling circuitry responds to the marker signal during the marker pulse (marker signal high), averaging the modulated signal level during this period.

The ALC hold function operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker's polarity, see ":MPOLarity:MARKer1|2|3|4" on page 364.

NOTE **Do not use the ALC hold for more than 100 ms, because it can affect the waveform's output amplitude.**

The marker signal has a minimum of a two-sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the ALC sampling to begin.

The ALC hold setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

NOTE **A waveform file that has unspecified settings in the file header uses the previous waveform's routing settings.**

For more information on the marker ALC hold function, see the *User's Guide*. For setting the marker points, see ":MARKer[:SET]" on page 355.

NONE	This terminates the marker ALC hold function.
M1–M4	These are the marker choices. The ALC hold feature uses only one marker at a time.

Example

```
:RAD:ARB:MDES:ALCH M1
```

The preceding example routes marker 1 to the ALC Hold function.

***RST**	NONE

Key Entry	**None**	**Marker 1**	**Marker 2**	**Marker 3**	**Marker 4**

:MDEStination:PULSe

Supported N5172B/82B

CAUTION **The pulse function incorporates ALC hold. Incorrect automatic level control (ALC) sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.**

```
[:SOURce]:RADio:ARB:MDEStination:PULSe NONE|M1|M2|M3|M4
[:SOURce]:RADio:ARB:MDEStination:PULSe?
```

This command enables the marker pulse/RF blanking function for the selected marker.

This function automatically uses the ALC hold function, so there is no need to select both the ALC hold and pulse/RF blanking functions for the same marker.

NOTE Do not use ALC hold for more than 100 ms, because it can affect the waveform's output amplitude.

The signal generator blanks the RF output when the marker signal goes low. The marker polarity determines when the marker signal is low. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker's polarity, see ":MPOLarity:MARKer1|2|3|4" on page 364.

NOTE Set marker points prior to using this function. Enabling this function without setting marker points may create a continuous low or high marker signal, depending on the marker polarity. This causes either no RF output or a continuous RF output. For setting the marker points, see ":MARKer[:SET]" on page 355.

The marker signal has a minimum of a two–sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the RF blanking to begin. The RF blanking setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

NOTE A waveform that has unspecified settings in the file header uses the previous waveform's routing settings. This could create the situation where there is no RF output signal, because the previous waveform used RF blanking.

For more information on the marker RF blanking function, see the *User's Guide*.

NONE	This terminates the marker RF blanking/pulse function.

M1–M4	These are the marker choices. The RF blanking/pulse feature uses only one marker at a time.

Example

```
:RAD:ARB:MDES:PULS M2
```

The preceding example routes marker 2 to Pulse/RF Blanking.

***RST**	NONE

Key Entry	**None**	**Marker 1**	**Marker 2**	**Marker 3**	**Marker 4**

:MPOLarity:MARKer1|2|3|4

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:MPOLarity:MARKer1|2|3|4
NEGative|POSitive
[:SOURce]:RADio:ARB:MPOLarity:MARKer1|2|3|4?
```

This command sets the polarity for the selected marker. For a positive marker polarity, the marker signal is high during the marker points. For a negative marker polarity, the marker signal is high during the period of no marker points.

Example

```
:RAD:ARB:MPOL:MARK3 NEG
```

The preceding example sets the polarity for marker 3 to negative.

***RST**	POS

Key Entry	**Marker 1 Polarity Neg Pos**	**Marker 2 Polarity Neg Pos**
	Marker 3 Polarity Neg Pos	**Marker 4 Polarity Neg Pos**

:NOISe:BANDwidth

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:BANDwidth <value><unit>
[:SOURce]:RADio:ARB:NOISe:BANDwidth?
```

This command selects the flat noise bandwidth value of the real–time noise for an ARB waveform. Typically, this value is set slightly wider than the signal bandwidth. The minimum increment value is 0.001 Hz.

***RST**	+1.00000000E+000

Range	Option 653	1 sa to 75 Msa

Option 655	1 sa to 150 Msa
Option 656	1 sa to 100 Msa
Option 657	1 sa to 200 Msa

Key Entry **Noise Bandwidth**

:NOISe:CBRate

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:CBRate <1bps - 999Mbps>
[:SOURce]:RADio:ARB:NOISe:CBRate?
```

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. The carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

Example

```
:RAD:ARB:NOIS:CBR 5
```

The preceding example sets the carrier bit rate to 5 bps.

Default	1.000 bps
Range	1 bps to 999 Mbps
Key Entry	**Carrier Bit Rate**

:NOISe:CBWidth

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:CBWidth <value><unit>
[:SOURce]:RADio:ARB:NOISe:CBWidth?
```

This command selects the carrier bandwidth over which the additive white gaussian noise (AWGN) is applied. The carrier RMS power and the noise power will be integrated over the selected carrier–bandwidth for the purposes of calculating carrier to noise ratio (C/N). The minimum increment value is 0.001 Hz. For more information, refer to the ":NOISe[:STATe]" command and the ":NOISe:BANDwidth"command.

***RST**	+1.00000000E+000
Range	1 Hz to 200 MHz

Key Entry	**Carrier Bandwidth**

:NOISe:CN

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:CN <value><unit>
[:SOURce]:RADio:ARB:NOISe:CN?
```

This command sets the carrier to noise ratio (C/N) in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to ":NOISe:CBWidth" on page 365.

Example

```
:RAD:ARB:NOIS:CN 50DB
```

The preceding example sets the carrier to noise ratio to 50 dB.

***RST**	+0.00000000E+000
Range	–100 to 100 dB
Key Entry	**Carrier to Noise Ratio**

:NOISe:CNFormat

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:CNFormat CN|EBNO
[:SOURce]:RADio:ARB:NOISe:CNFormat?
```

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example

```
:RAD:ARB:NOIS:CNF EBNO
```

The preceding example sets the carrier to noise ratio format to EbNo.

Default	Carrier to Noise Ratio Format C/N
Key Entry	**Carrier to Noise Ratio Format C/N Eb/No**

:NOISe:EBNO

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:EBNO <ebno in dB>

[:SOURce]:RADio:ARB:NOISe:EBNO?
```

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:NOISe:CBRate on page 365) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :NOISe:CNFormat command.

The query returns the value of EBNO.

Default	0 dB
Range	–100 to 100 dB
Key Entry	**Carrier to Noise Ratio Format Eb/No**

:NOISe:MUX

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio[1]:ARB:NOISe:MUX SUM|CARRier|NOISe
[:SOURce]:RADio[1]:ARB:NOISe:MUX?
```

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

```
:RAD:ARB:NOIS:MUX CARR
```

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default	Carrier+Noise
Key Entry	**Carrier+Noise** | **Carrier** | **Noise**

:NOISe:POWer:CARRier

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:POWer:CARRier <carrierPower>
[:SOURce]:RADio:ARB:NOISe:POWer:CARRier?
```

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] and :NOISe:POWer:NOISe:TOTal commands.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Carrier Power**

:NOISe:POWer:CONTrol[:MODE]

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:POWer:CONTrol[:MODE]TOTal|CARRier|
NOISe [:SOURce]:RADio:ARB:NOISe:POWer:CONTrol[:MODE]?
```

This command sets the power control to one of the three following modes:

Total	This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.
Carrier	In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.
Total Noise	In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.
Default	Total
Key Entry	**Total Carrier Total Noise**

:NOISe:POWer:NOISe:CHANnel?

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:POWer:NOISe:CHANnel?
```

The query returns the current noise power across the carrier bandwidth in dBm.

:NOISe:POWer:NOISe:TOTal

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe:POWer:NOISe:TOTal
<totalNoisePowerInDbm>
[:SOURce]:RADio:ARB:NOISe:POWer:NOISe:TOTal?
```

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] command.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Total Noise Power**

:NOISe[:STATe]

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:ARB:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:ARB:NOISe[:STATe]?
```

This command enables or disables adding real-time additive white gaussian noise (AWGN) to the carrier modulated by the waveform being played by the dual ARB waveform player.

Example

```
:RAD:ARB:NOIS ON
```

The preceding example applies real-time AWGN to the carrier.

***RST**	0
Key Entry	**Real-Time AWGN Off On**

:PHASe:NOISe:F1

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:ARB:PHASe:NOISe:F1 <value><unit>
[:SOURce]:RADio:ARB:PHASe:NOISe:F1?
```

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F2 command). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the *User's Guide*.

***RST**	+1.00000000E+003
Range	0 Hz to 77.50052449 MHz
Key Entry	**Desired Start Freq (f1)**

:PHASe:NOISe:F1:ACTual?

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:ARB:PHASe:NOISe:F1:ACTual?
```

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:ARB:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:ARB:PHASe:NOISe:F2?
```

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the *User's Guide*.

***RST**	+3.00000000E+004
Range	1 Hz to 77.50052449 MHz
Key Entry	**Desired Stop Freq (f2)**

:PHASe:NOISe:F2:ACTual?

Supported	N5172B/82B with Option 432

`[:SOURce]:RADio:ARB:PHASe:NOISe:F2:ACTual?`

This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHASe:NOISe:LMID

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:ARB:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:ARB:PHASe:NOISe:LMID?
```

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the *User's Guide*.

NOTE The amplitude range varies depending on the f2 value (see the ":PHASe:NOISe:F2" on page 370). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The range values are expressed in units of dBc/Hz.

***RST**	–
	7.00000000E+001
Range	–
	300 to 100
Key Entry	**Desired Flat Amplitude (Lmid)**

:PHASe:NOISe:LMID:ACTual?

Supported	N5172B/82B with Option 432

`[:SOURce]:RADio:ARB:PHASe:NOISe:LMID:ACTual?`

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

:PHASe:NOISe[:STATe]

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:ARB:PHASe:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:ARB:PHASe:NOISe[:STATe]?
```

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the *User's Guide*.

***RST** 0

Key Entry **Phase Noise Off On**

:PHASe:NOISe:TRACe?

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:ARB:PHASe:NOISe:TRACe?
<startFreq>,<stopFreq>,<numSamples>
```

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range	<startFreq>	1 Hz to 100 MHz
	<stopFreq>	1 Hz to 100 MHz
	<numSamples>	1 to 8192

:PLAY:COMPleted?

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:PLAY:COMPleted?
```

This SCPI command returns whether the ARB waveform has completed since the last query or the last time the waveform was setup up to play. The completion is after repeat counts for single trigger. The waveform is setup to play when various waveform parameters are adjusted, such as turning the mode off and on or changing the triggering mode. It returns a 0 if the waveform has not completed and a 1 if the waveform has completed at least one time. After this query, the value will be reset to 0 until another completion occurs.

:PLAY:WCOMpleted?

Supported N5172B/82B

`[:SOURce]:RADio:ARB:PLAY:WCOMpleted?`

This SCPI command returns whether the ARB waveform has completed since the last query or the last time the waveform was setup up to play. This SCPI command will wait until the ARB waveform has completed. The completion is after repeat counts for single trigger. The waveform is setup to play when various waveform parameters are adjusted, such as turning the mode off and on or changing the triggering mode. It returns a 0 if the waveform has not completed and a DCAS has been sent to the instrument or the mode is not on, otherwise a 1 will be returned when the waveform has completed at least one time. After this query, the value will be reset to 0 until another completion occurs.

:REGister[:STATus]

Supported N5172B/82B

`[:SOURce]:RADio:ARB:REGister[:STATus]?`

This query returns a weighted decimal value to indicate the status of the following Dual ARB settings:

- Dual ARB state (ARB)
- Triggering modes (ARM and Run)
- Multiple BBG synchronization (MBS1 and MBS2)

Weighting	0	0	0	0	0	0	512	256	0	0	0	0	0	4	2	1
Bit Position	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Status Item	–	–	–	–	–	–	MBS2	MBS1	–	–	–	–	–	Run	ARM	ARB

When the bit position is set high, the weighted position value equals 2^n where n = bit position. When the bit position is set low, the weighting equals zero. The sum of the weighted values indicates the status of all monitored items.

Table 5-1 Low and High Bit Position Description

ARB	
0	Dual ARB is off
1	Dual ARB is on
ARM[a]	
0	Trigger is not armed
1	Trigger is armed and the Dual ARB is waiting for a trigger to start the play-back of the waveform

Table 5-1 **Low and High Bit Position Description**

RUN[b]	
0	The Dual ARB waveform is not playing
1	The Dual ARB waveform is playing
MBS1	
0	Multiple BBG synchronization is *not* waiting for a sync signal from the master
1	Multiple BBG synchronization is waiting for a sync signal from the master
MBS2	
0	Multiple BBG synchronization is out of sync
1	Multiple BBG synchronization is in sync

a. The ARM bit remains 0 for the following trigger type selections:

FREE (Free Run) see page 380
RESet (Reset and Run) see page 380
IMMediate (Restart on Trigger) see page 374
GATE see page 379

b. For GATE triggering, the bit remains high for both states of the trigger signal.

***RST** 0

:RETRigger

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:RETRigger ON|OFF|1|0|IMMediate
[:SOURce]:RADio:ARB:RETRigger?
```

This command enables or disables the ARB retriggering mode. The retrigger mode controls how the retriggering function performs while a waveform is playing.

ON (1) This choice (Buffered Trigger) specifies that if a trigger occurs while a waveform is playing, the waveform will retrigger at the end of the current waveform sequence and play once more.

OFF (0) This choice (No Retrigger) specifies that if a trigger occurs while a waveform is playing, the trigger will be ignored.

IMMediate This choice (Restart on Trigger) specifies that if a trigger occurs while a waveform is playing, the waveform will reset and replay from the start immediately upon receiving a trigger.

***RST**	ON

Key Entry	No Retrigger	Buffered Trigger	Restart on Trigger

Remarks	This command applies to the single trigger type only.

:RSCaling

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:RSCaling <value>
[:SOURce]:RADio:ARB:RSCaling?
```

This command adjusts the scaling value in percent that is applied to a waveform while it is playing. The variable `<value>` is expressed as a percentage. Runtime scaling does not alter the waveform data file. This feature is used to avoid DAC overflow. The scaling is compensated for at the modulator (i.e. when the modulator is the optimized path). For more information about runtime scaling, refer to the **User's Guide**.

Example

```
:RAD:ARB:RSC 50
```

The preceding example applies a 50% scaling factor to the selected waveform. Runtime scaling does not alter the waveform data file.

***RST**	+7.00000000E+001
Range	1 to 100 percent
Key Entry	**Runtime Scaling**
Remarks	Saving the instrument state saves the currently-set Runtime Scaling in the instrument state file.

:SCALing

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:SCALing "<file_name>",<value>
```

This command scales the designated `"<file_name>"` waveform file while it is being played by the dual ARB player. The variable `<value>` is expressed as a percentage, 1–100%. The peak value of the waveform is disconnected and the whole waveform is scaled such that the peak value is at the specified percentage of full scale.

Unlike runtime scaling (:RSCaling), Scaling (:SCALing) has a permanent effect on the waveform data. Scaling up, after scaling down, typically results in a slightly different waveform from the original, as some data is lost in the scale–down process. For more information about waveform file scaling, refer to the **User's Guide**.

Example

```
:RAD:ARB:SCAL "Test_Data", 50
```

The preceding example applies a 50% scaling factor to the Test_Data waveform file.

Range 1 to 100 percent

Key Entry **Scaling** **Scale Waveform Data**

Remarks For information on file name syntax, see "File Name Variables" on page 43.

:SCLock:RATE

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:SCLock:RATE <value>
[:SOURce]:RADio:ARB:SCLock:RATE?
```

This command sets the sample clock rate for the dual ARB format. When the Modulation Filter is active, the Sample Clock Rate is actually the Symbol Rate and is limited from 100 Hz to half of the maximum sample rate as shown in the range table below.

The variable <value> is expressed in units of hertz.

***RST** `+75.000000E+006` (with Option 653)

`+150.000000E+006` (with Option 655)

`+100.000000E+006` (with Option 656)

`+200.000000E+006` (with Option 657)

Range *Option 653*: 1 Hz to 75MHz

Option 655: 1 Hz to 150MHz

Option 656: 1 Hz to 100 MHz

Option 657: 1 Hz to 200 MHz

Key Entry **ARB Sample Clock**

:SEQuence[:MWAVeform]

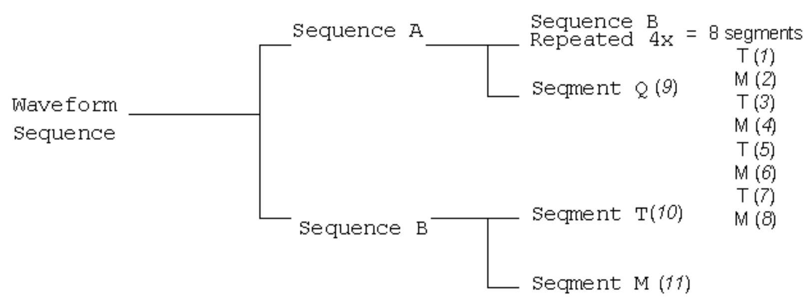
Supported N5172B/82B

```
[:SOURce]:RADio:ARB:SEQuence[:MWAVeform]
<filename>,<waveform1>,<reps>,NONE|M1|M2|
M3|M4|M1M2|M1M3|M1M4|M2M3|M2M4|M3M4|M1M2M3|M1M2M4|M1M3M4|M2M
3M4|M1M2M3M4|
ALL,,<waveform2>,<reps>,NONE|M1|M2|M3|M4|M1M2|M1M3|M1M4|M2M3
```

```
|M2M4|M3M4|M1M2M3|
M1M2M4|M1M3M4|M2M3M4|M1M2M3M4|ALL,}
[:SOURce]:RADio:ARB:SEQuence[:MWAVeform]? <filename>
```

This command creates a waveform sequence. A waveform sequence is made up of segments and other sequences. Any number of segments, up to a segment count limit of 1024, can be used to create a sequence. The count limit is determined by the number of segments in the waveform sequence. Repeated segments are included in the count limit.

For example, using the figure below, suppose a waveform is created using two sequences: Sequence_A and Sequence_B. Sequence_A consists of Sequence_B and Segment_Q with Sequence_B repeated four times. The total segment count for this waveform sequence would be eleven.



The query returns the contents and segment settings of the waveform sequence file

The segments and sequences play in the same order as placed into the waveform sequence by the command. Once you create the file, you cannot edit the segment settings or add further waveform segments unless you use the signal generator’s front panel. Using the same waveform sequence name overwrites the existing file with that name. To use a segment’s marker settings, you must enable the segment’s markers within the segment or within the waveform sequence. A sequence is stored in the catalog of SEQ files USER/SEQ or SEQ: directory.

When you create a waveform sequence, the Keysight X-Series signal generator also creates a file header for the sequence. This file header takes priority over segment or nested sequence file headers. Refer to the *User’s Guide* for more information on file headers. To save the file header, see “:HEADer:SAVE” on page 351.

<file_name>"	This variable names the waveform *sequence* file. For information on the file name syntax, see “File Name Variables” on page 43.

"<waveform1>"	This variable specifies the name of an existing waveform *segment* or sequence file. A waveform segment or the waveform segments in a specified sequence must reside in volatile memory, WFM1, before it can be played by the dual ARB player. For information on the file name syntax, see "File Name Variables" on page 43, and for more information on waveform segments, see the *User's Guide*.
"<waveform2>"	This variable specifies the name of a second existing waveform *segment* or sequence file. The same conditions required for waveform1 apply for this segment or sequence. Additional segments and other sequences can be inserted into the file.
<reps>	This variable sets the number of times a segment or sequence plays (repeats) before the next segment or sequence plays.
NONE	This choice disables all four markers for the waveform. Disabling markers means that the waveform sequence ignores the segment's or sequence's marker settings.
M1, M2, M3, M4	These choices, either individually or a combination of them, enable the markers for the waveform segment or sequence. Markers not specified are ignored for that segment or sequence.
ALL	This choice enables all four markers in the waveform segment or sequence.

Example

```
:RAD:ARB:SEQ "SEQ:Test_Data","WFM1:ramp_test_wfm",25,M1M4,
"WFM1:sine_test_wfm",100,ALL
```

NOTE

A carriage return or line feed is never included in a SCPI command. The example above contains a carriage return so that the text will fit on the page.

The preceding example creates a waveform sequence file named **`Test_Data`**. This file consists of the factory–supplied waveform segments, **`ramp_test_wfm`** and **`sine_test_wfm`**. The waveform is stored in the signal generator's **`SEQ:`** directory.

– The first segment, **`ramp_test_wfm`**, has 25 repetitions with markers 1 and 4 enabled.
– The second segment, **`sine_test_wfm`**, has 100 repetitions with all four markers enabled.

Range <reps>: 1 to 65535

Key Entry	**Build New Waveform Sequence**	**Name and Store**	**Insert Waveform**
	Edit Repetitions	**Toggle Marker 1**	
	Toggle Marker 2	**Toggle Marker 3**	**Toggle Marker 4**

:TRIGger:TYPE

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger:TYPE
CONTinuous|SINGle|GATE|SADVance
[:SOURce]:RADio:ARB:TRIGger:TYPE?
```

This command sets the trigger mode (type) that controls the waveform's playback.

Triggers control the playback by telling the Keysight X-Series signal generator when to play the modulating signal (waveform). Depending on the trigger settings for the Keysight X-Series signal generator, the waveform playback can occur once, continuously, or the Keysight X-Series signal generator may start and stop playing the waveform repeatedly (GATE mode).

A trigger signal comprises both positive and negative signal transitions (states), which are also called high and low periods. You can configure the Keysight X-Series signal generator to trigger on either state of the trigger signal. It is common to have multiple triggers, also referred to as trigger occurrences or events, occur when the signal generator requires only a single trigger. In this situation, the Keysight X-Series signal generator recognizes the first trigger and ignores the rest.

When you select a trigger mode, you may lose the signal (carrier plus modulating) from the RF output until you trigger the waveform. This is because the Keysight X-Series signal generator sets the I and Q signals to zero volts prior to the first trigger event, which suppresses the carrier. After the first trigger event, the waveform's final I and Q levels determine whether you will see the carrier signal or not (zero = no carrier, other values = carrier visible). At the end of most files, the final I and Q points are set to a value other than zero.

There are four parts to configuring the trigger:

– Choosing the trigger type, which controls the waveform's transmission.
– Setting the waveform's response to triggers:
    – CONTinuous, see ":TRIGger:TYPE:CONTinuous[:TYPE]" on page 380
    – SINGle, see ":RETRigger" on page 374

  – SADVance, see ":TRIGger:TYPE:SADVance[:TYPE]" on page 382
  – GATE, selecting the mode also sets the response

– Selecting the trigger source (see ":TRIGger[:SOURce]" on page 383), which determines how the Keysight X-Series signal generator receives its trigger signal, internally or externally. The GATE choice requires an external trigger.

– Setting the trigger polarity when using an external source:

  – CONTinuous, SINGle, and SADVance see ":TRIGger[:SOURce]:EXTernal:SLOPe" on page 385
  – GATE, see ":TRIGger:TYPE:GATE" on page 381

To check the trigger status, see ":REGister[:STATus]" on page 373. For more information on triggering, see the *User's Guide*.

The following list describes the trigger type command choices:

CONTinuous	Upon triggering, the waveform repeats continuously.
SINGle	Upon triggering, the waveform segment or sequence plays once.
SADVance	The trigger controls the segment advance within a waveform sequence. To use this choice, a waveform sequence must be the active waveform. Ensure that all segments in the sequence reside in volatile memory.
GATE	An external trigger signal repeatedly starts and stops the waveform's playback (transmission). The time duration for playback depends on the duty period of the trigger signal and the gate polarity selection (see ":TRIGger:TYPE:GATE" on page 381). The waveform plays during the inactive state and stops during the active polarity selection state. The active state can be set high or low. The gate mode works only with an external trigger source. With the multiple baseband generator synchronization feature active, GATE is unavailable (see page 357 for more information).
***RST**	CONT

Key Entry	**Continuous**	**Single**	**Gate**	**Segment Advance**

:TRIGger:TYPE:CONTinuous[:TYPE]

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger:TYPE:CONTinuous[:TYPE]
FREE|TRIGger|RESet
[:SOURce]:RADio:ARB:TRIGger:TYPE:CONTinuous[:TYPE]?
```

This command selects the waveform’s response to a trigger signal while using the continuous trigger mode.

For more information on triggering and to select the continuous trigger mode, see “:TRIGger:TYPE” on page 379.

The following list describes the waveform’s response to each of the command choices:

FREE	Turning the ARB format on immediately triggers the waveform. The waveform repeats until you turn the format off, select another trigger, or choose another waveform file. With the multiple baseband generator synchronization feature active, this selection is unavailable (see page 357 for more information).
TRIGger	The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously until you turn the format off, select another trigger, or choose another waveform file.
RESet	The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously. Subsequent triggers reset the waveform to the beginning. For a waveform sequence, this means to the beginning of the first segment in the sequence.
***RST**	FREE

Key Entry	**Free Run**	**Trigger & Run**	**Reset & Run**

:TRIGger:TYPE:GATE

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger:TYPE:GATE LOW|HIGH
[:SOURce]:RADio:ARB:TRIGger:TYPE:GATE?
```

This command selects the active state (gate polarity) of the gate while using the gating trigger mode.

The LOW and HIGH selections correspond to the low and high states of an external trigger signal. For example, when you select HIGH, the active state occurs during the high of the trigger signal. When the inactive state occurs, the Keysight X-Series signal generator stops the waveform playback at the last played sample point, then restarts the playback at the next sample point when the active state occurs. For more information on triggering and to select gating as the trigger mode, see “:TRIGger:TYPE” on page 379.

The following list describes the Keysight X-Series signal generator’s gating behavior for the polarity selections:

LOW	The waveform playback stops when the trigger signal goes high and restarts when the trigger signal goes low.
HIGH	The waveform playback stops when the trigger signal goes low and restarts when the trigger signal goes high.
***RST**	HIGH

Key Entry	Active Low	Active High

:TRIGger:TYPE:SADVance[:TYPE]

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]
SINGle|CONTinuous
[:SOURce]:RADio:ARB:TRIGger:TYPE:SADVance[:TYPE]?
```

This commands selects the waveform's response to a trigger signal while using the segment advance (SADVance) trigger mode.

When the Keysight X-Series signal generator receives multiple trigger occurrences when only one is required, the signal generator uses the first trigger and ignores the rest. For more information on triggering and to select segment advance as the trigger mode, see ":TRIGger:TYPE" on page 379.

The following list describes the waveform's response to each of the command choices:

SINGle — Each segment in the sequence requires a trigger to play, and a segment plays only once, ignoring a segment's repetition value (see ":SEQuence[:MWAVeform]" on page 376 for repetition information). The following list describes a sequence's playback behavior with this choice:

- After receiving the first trigger, the first segment plays to completion.
- When the waveform receives a trigger after a segment completes, the sequence advances to the next segment and plays that segment to completion.
- When the waveform receives a trigger during play, the current segment plays to completion. Then the sequence advances to the next segment, and it plays to completion.
- When the waveform receives a trigger either during or after the last segment in a sequence plays, the sequence resets and the first segment plays to completion.

CONTinuous — Each segment in the sequence requires a trigger to play. After receiving a trigger, a segment plays continuously until the waveform receives another trigger. The following list describes a sequence's playback behavior with this choice:

- After receiving the first trigger, the first segment plays continuously.
- A trigger during the current segment play causes the segment to play to the end of the segment file, then the sequence advances to the next segment, which plays continuously.
- When last segment in the sequence receives a trigger, the sequence resets and the first segment plays continuously.

Example

```
:RAD:ARB:TRIG:TYPE:SADV CONT
```

The preceding example selects the continuous segment advance mode.

***RST** `CONT`

Key Entry	Single	Continuous

:TRIGger:TYPE:SINGle:REPeat

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger:TYPE:SINGle:REPeat <count>
```

<count> is the number of times to repeat the waveform when a single trigger is received.

***RST** 1

Range 1 to 65535

:TRIGger[:SOURce]

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger[:SOURce] KEY|EXT|BUS
[:SOURce]:RADio:ARB:TRIGger[:SOURce]?
```

This command sets the trigger source.With the multi–baseband generator synchronization slave selection, this command is unavailable (see page 357 for more information).

For more information on triggering, see ":TRIGger:TYPE" on page 379. The following list describes the command choices:

KEY	This choice enables manual triggering by pressing the front-panel **Trigger** key.
EXT	An externally applied signal triggers the waveform. This is the only choice that works with gating. The following conditions affect an external trigger: – The input connector selected for the trigger signal. You have a choice between the rear panel PATTERN TRIG IN connector or the PATT TRIG IN 2 pin on the rear panel AUXILIARY I/O connector. To make the connector selection, see ":TRIGger[:SOURce]:EXTernal[:SOURce]" on page 386. For more information on the connectors and on connecting the cables, see the *User's Guide*. – The trigger signal polarity: – gating mode, see ":TRIGger:TYPE:GATE" on page 381 – continuous and single modes, see ":TRIGger[:SOURce]:EXTernal:SLOPe" on page 385 – The time delay between when the Keysight X-Series signal generator receives a trigger and when the waveform responds to the trigger. There are two parts to setting the delay: – setting the amount of delay, see ":TRIGger[SOURce]:EXTernal:DELay" on page 384 – turning the delay on, see ":TRIGger[:SOURce]:EXTernal:DELay:STATe" on page 385
BUS	This choice enables triggering over the GPIB or LAN using the `*TRG` or `GET` commands or the AUXILIARY INTERFACE (USB) using the `*TRG` command.
***RST**	EXT

Key Entry **Trigger Key** **Ext** **Bus**

:TRIGger[SOURce]:EXTernal:DELay

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay <value>
[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay?
```

This command sets the amount of time to delay the Keysight X-Series signal generator's response to an external trigger.

The delay is a path (time) delay between when the Keysight X-Series signal generator receives the trigger and when it responds to the trigger. For example, configuring a trigger delay of two seconds, causes the Keysight X-Series signal generator to wait two seconds after receipt of the trigger before the Keysight X-Series signal generator plays the waveform.

The delay does not occur until you turn it on (see ":TRIGger[:SOURce]:EXTernal:DELay:STATe" on page 385). You can set the delay value either before or after turning it on.

For more information on configuring an external trigger source and to select external as the trigger source, see ":TRIGger[:SOURce]" on page 383.

The unit of measurement for the variable <value> is in seconds (nsec–sec).

***RST**	+1.00000000E–003
Range	1E–8 to 3E1
Key Entry	**Ext Delay Time**

:TRIGger[:SOURce]:EXTernal:DELay:STATe

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe
ON|OFF|1|0
[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:DELay:STATe?
```

This command enables or disables the operating state of the external trigger delay function.

For setting the delay time, see ":TRIGger[SOURce]:EXTernal:DELay" on page 384, and for more information on configuring an external source, see ":TRIGger[:SOURce]" on page 383.

***RST**	0
Key Entry	**Ext Delay Off On**

:TRIGger[:SOURce]:EXTernal:SLOPe

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe
POSitive|NEGative
[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal:SLOPe?
```

This command sets the polarity for an external trigger signal while using the continuous, single triggering mode. To set the polarity for gating, see ":TRIGger:TYPE:GATE" on page 381.

The POSitive and NEGative selections correspond to the high (positive) and low (negative) states of the external trigger signal. For example, when you select POSitive, the waveform responds (plays) during the high state of the trigger signal. When the Keysight X-Series signal generator receives multiple trigger occurrences when only one is required, the signal generator uses the first trigger and ignores the rest.

For more information on configuring an external trigger source and to select external as the trigger source, see ":TRIGger[:SOURce]" on page 383.

***RST**	NEG
Key Entry	**Ext Polarity Neg Pos**

:TRIGger[:SOURce]:EXTernal[:SOURce]

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal[:SOURce]
EPT1|EPT2|
EPTRIGGER1|EPTRIGGER2
[:SOURce]:RADio:ARB:TRIGger[:SOURce]:EXTernal[:SOURce]?
```

This command selects which PATTERN TRIG IN connection the Keysight X-Series signal generator uses to accept an externally applied trigger signal when external is the trigger source selection.

For more information on configuring an external trigger source and to select external as the trigger source, see ":TRIGger[:SOURce]" on page 383. For more information on the rear panel connectors, see the *User's Guide*.

The following list describes the command choices:

EPT1	This choice is synonymous with EPTRIGGER1 and selects the PAT TRIG rear panel connector.
EPT2	This choice is synonymous with EPTRIGGER2 and selects the PATT TRIG IN 2 pin on the rear panel AUX I/O connector.
EPTRIGGER1	This choice is synonymous with EPT1 and selects the PAT TRIG rear panel connector.
EPTRIGGER2	This choice is synonymous with EPT2 and selects the PATT TRIG IN 2 pin on the rear panel AUXILIARY I/O connector.
***RST**	EPT1

Key Entry	**Patt Trig In 1**	**Patt Trig In 2**

:WAVeform

Supported	N5172B/82B

```
[:SOURce]:RADio:ARB:WAVeform
"WFM1:file_name"|"SEQ:file_name"
[:SOURce]:RADio:ARB:WAVeform?
```

This command selects a waveform file or sequence, for the dual ARB player to play. The file must be present in volatile memory, WFM1, or in the SEQ directory. If a file is in non–volatile memory (NVWFM), use the command ":COPY[:NAME]" on page 164 to copy the file to WFM1. Any specified values in the header are applied to the ABR upon selection. Unspecified fields in the header cause no change in the ARB state.

"WFM1:file_name" This variable names a waveform file residing in volatile memory (WFM1:). For information on the file name syntax, see "File Name Variables" on page 43.

"SEQ:file_name" This variable names a sequence file residing in the catalog of sequence files. For more information on the file name syntax, see "File Name Variables" on page 43.

Example

```
:RAD:ARB:WAV "WFM1:Test_Data"
```

The preceding example selects the file Test_Data from the list of files in volatile waveform memory, WFM1, and applies its file header settings.

Key Entry **Select Waveform**

:WAVeform:NHEAders

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:WAVeform:NHEaders
"WFM1:file_name"|"SEQ:filename"
[:SOURce]:RADio:ARB:WAVeform:NHEaders?
```

This command, for the dual ARB mode, allows for a fast selection of a segment or sequence waveform file. No header information or settings are applied to the segment or sequence waveform file when this command is used. This will improve the access or loading speed of the waveform file. The file must be in volatile waveform memory (WFM1), or in the SEQ directory. If a file is in non–volatile waveform memory (NVWFM), use the command ":COPY[:NAME]" on page 164 to copy files to WFM1.

"WFM1:file_name" This variable names a waveform file residing in volatile memory:WFM1. For information on the file name syntax, see "File Name Variables" on page 43.

"SEQ:filename" This variable names a sequence file residing in the catalog of sequence files. For more information on the file name syntax, see "File Name Variables" on page 43.

Example

```
:RAD:ARB:WAV:NHE "Test_Data"
```

The preceding example selects the file Test_Data, without applying header settings.

:WAVeform:SEGMents

Supported N5172B/82B

```
[:SOURce]:RADio:ARB:WAVeform:SEGMents?
```

This command returns the segment count in the currently selected waveform sequence for Dual Arb.

[:STATe]

Supported N5172B/82B

```
[:SOURce]:RADio:ARB[:STATe] ON|OFF|1|0
[:SOURce]:RADio:ARB[:STATe]?
```

This command enables or disables the arbitrary waveform generator function.

The Dual ARB Player provides a status register to show the status of the following items:

– Dual ARB state (off or on)
– Trigger arming
– Waveform play-back
– Multiple BBG synchronization

To use the register, see ":REGister[:STATus]" on page 373.

***RST** 0

Key Entry **ARB Off On**

LARB Subsystem–N5172B/82B ([:SOURce]:RADio:LARB)

[:STATe]

Supported N5172B/82B

```
[:SOURce]:RADio:LARB[:STATe] ON|OFF|1|0
[:SOURce]:RADio:LARB[:STATe]?
```

This command enables or disables the waveform sweep function, when the signal generator is in list sweep mode.

NOTE Except for the sample clock rate, unspecified fields in the header result in the default settings of the dual arb's settings being used (i.e. not the current arb's settings). The sample clock rate must be specified for the file header of the waveform file being played. If the sample clock rate is unspecified in the file header, the instrument generates a header error.

***RST**	0
Key Entry	**Waveform Off On**
Remarks	The **Sweep Type** softkey must be set to **List** for this command to function.

Multitone Subsystem–N5172B/82B ([:SOURce]:RADio:MTONe:ARB)

Creating a Multitone Waveform

Use the following steps to create a multitone waveform:

1. Initialize the phase for the multitone waveform. Refer to “:SETup:TABLe:PHASe:INITialize” on page 407.
2. Assign the frequency spacing between the tones. Refer to “:SETup:TABLe:FSPacing” on page 406.
3. Define the number of tones within the waveform. Refer to “:SETup:TABLe:NTONes” on page 406.
4. Modify the power level, phase, and state of any individual tones. Refer to “:SETup:TABLe:ROW” on page 408.

:ALIGnment

Supported	N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:ALIGnment LEFT|CENTer|RIGHt
[:SOURce]:RADio:MTONe:ARB:ALIGnment?
```

This command will align the multitones either left, center or right of the carrier frequency.

Example

```
:RAD:MTON:ARB:ALIG CENT
```

The preceding example aligns each of the multitones equidistant from the carrier frequency.

Key Entry	**Alignment Left Cent Right**

:BASEband:FREQuency:OFFSet

Supported	N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:BASeband:FREQuency:OFFSet
<val><unit>
[:SOURce]:RADio:MTONe:ARB:BASeband:FREQuency:OFFSet?
```

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed–through is not in the center.

The X-Series signal generator provides automatic DAC over–range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by *1/square root of 2*.

***RST**	0.000

Range	+5.0E7 to –5.0E7 Hz
Key Entry	**Baseband Frequency Offset**

:BASeband:FREQuency:OFFSet:PHASe:RESet

Supported	N5172B/82B

`[:SOURce]:RADio:MTONe:ARB:BASeband:FREQuency:OFFSet:PHASe:RESet`

This command clears the phase accumulation and so zero phase shift.

When the Baseband Frequency Offset is non–zero, the hardware rotator accumulates phase–shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non–zero residual phase present in the signal, the DAC Over–Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by **1/square root of 2**.

Key Entry	**Baseband Frequency Offset Phase Reset**

:HEADer:CLEar

Supported	N5172B/82B

`[:SOURce]:RADio:MTONe:ARB:HEADer:CLEar`

This command clears the header information from the file header used by this modulation format.

Key Entry	**Clear Header**
Remarks	The **Multitone Off On** softkey must be set to On for this command to function.

:HEADer:SAVE

Supported	N5172B/82B

`[:SOURce]:RADio:MTONe:ARB:HEADer:SAVE`

This command saves the header information to the file header used by this modulation format.

Key Entry	**Save Setup To Header**
Remarks	The **Multitone Off On** softkey must be set to On for this command to function.

:IQ:MODulation:ATTen

Supported	N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:IQ:MODulation:ATTen <val>
[:SOURce]:RADio:MTONe:ARB:IQ:MODulation:ATTen?
```

This command attenuates the I/Q signals being modulated through the signal generator RF path.

The variable <val> is expressed in units of decibels (dB).

***RST**	+2.00000000E+000
Range	0 to 50
Key Entry	**Modulator Atten Manual Auto**

:IQ:MODulation:ATTen:AUTO

Supported	N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:IQ:MODulation:ATTen:AUTO
ON|OFF|1|0
[:SOURce]:RADio:MTONe:ARB:IQ:MODulation:ATTen:AUTO?
```

This command enables or disables the I/Q attenuation auto mode.

ON (1)	This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.
OFF (0)	This choice holds the attenuator at its current setting or at a selected value. Refer to the :IQ:MODulation:ATTen command for setting the attenuation value.
***RST**	1
Key Entry	**Modulator Atten Manual Auto**

:MDEStination:AAMPlitude

Supported	N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:MDEStination:AAMPlitude
NONE|M1|M2|M3|M4
[:SOURce]:RADio:MTONe:ARB:MDEStination:AAMPlitude?
```

This command routes the selected marker to the Alternate Amplitude function. The `NONE` parameter clears the marker for the Alternate Amplitude function.

***RST**	NONE

Key Entry	**None**	**Marker 1**	**Marker 2**	**Marker 3**	**Marker 4**

:MDEStination:ALCHold

Supported N5172B/82B

CAUTION **Incorrect automatic level control (ALC) sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.**

```
[:SOURce]:RADio:MTONe:ARB:MDEStination:ALCHold
NONE|M1|M2|M3|M4
[:SOURce]:RADio:MTONe:ARB:MDEStination:ALCHold?
```

This command enables the marker ALC hold function for the selected marker. For setting markers, see ":MARKer[:SET]" on page 355.

Use the ALC hold function when you have a waveform signal that incorporates idle periods, or when the increased dynamic range encountered with RF blanking is not desired. The ALC leveling circuitry responds to the marker signal during the marker pulse (marker signal high), averaging the modulated signal level during this period.

The ALC hold function operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker's polarity, see :MPOLarity:MARKer1|2|3|4.

NOTE **Do not use the ALC hold for more than 100 ms, because it can affect the waveform's output amplitude.**

The marker signal has a minimum of a two-sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the ALC sampling to begin.

The ALC hold setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

NOTE **A waveform file that has unspecified settings in the file header uses the previous waveform's routing settings.**

For more information on the marker ALC hold function, see the *User's Guide*.

NONE	This terminates the marker ALC hold function.
M1–M4	These are the marker choices. The ALC hold feature uses only one marker at a time.

***RST**	NONE

Key Entry	**None**	**Marker 1**	**Marker 2**
	Marker 3		**Marker 4**

:MDEStination:PULSe

Supported	N5172B/82B

CAUTION The pulse function incorporates ALC hold. Incorrect automatic level control (ALC) sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

```
[:SOURce]:RADio:MTONe:ARB:MDEStination:PULSe
NONE|M1|M2|M3|M4
[:SOURce]:RADio:MTONe:ARB:MDEStination:PULSe?
```

This command enables the marker pulse/RF blanking function for the selected marker.

This function automatically incorporates the ALC hold function, so there is no need to select both the ALC hold and pulse/RF blanking functions for the same marker.

NOTE Do not use ALC hold for more than 100 ms, because it can affect the waveform's output amplitude.

The signal generator blanks the RF output when the marker signal goes low. The marker polarity determines when the marker signal is low. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. For setting a marker's polarity, see ":MPOLarity:MARKer1|2|3|4" on page 395.

NOTE Set marker points prior to using this function. Enabling this function without setting marker points may create a continuous low or high marker signal, depending on the marker polarity. This causes either no RF output or a continuous RF output. For setting the marker points, see ":MARKer[:SET]" on page 355.

The marker signal has a minimum of a two-sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the RF blanking to begin. The RF blanking setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

NOTE A waveform file that has unspecified settings in the file header uses the previous waveform's routing settings. This could create the situation where there is no RF output signal, because the previous waveform used RF blanking.

For more information on the marker RF blanking function, see the *User's Guide*.

NONE	This terminates the marker RF blanking/pulse function.
M1–M4	These are the marker choices. The RF blanking/pulse feature uses only one marker at a time.
***RST**	NONE

Key Entry	**None**	**Marker 1**	**Marker 2**
	Marker 3		**Marker 4**

:MPOLarity:MARKer1|2|3|4

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:MPOLarity:MARKer1|2|3|4
NEGative|POSitive
[:SOURce]:RADio:MTONe:ARB:MPOLarity:MARKer1|2|3|4?
```

This command sets the polarity for the selected marker. For a positive marker polarity, the marker signal is high during the marker points. For a negative marker polarity, the marker signal is high during the period of no marker points.

***RST** POS

Key Entry	**Marker 1 Polarity Neg Pos**	**Marker 2 Polarity Neg Pos**
	Marker 3 Polarity Neg Pos	**Marker 4 Polarity Neg Pos**

:NOISe:BANDwidth

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:MTONe:ARB:NOISe:BANDwidth <val><unit>
[:SOURce]:RADio:MTONe:ARB:NOISe:BANDwidth?
```

This command sets the flat noise bandwidth value for the multitone waveform. This value is typically set wider than the carrier bandwidth.

To configure the AWGN, refer to the following sections located in the multitone subsystem:

- To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to":NOISe:CBWidth" on page 396.
- To set the carrier to noise ratio as the active function, refer to ":NOISe:CN" on page 397.
- To enable the AWGN, refer to ":NOISe[:STATe]" on page 400.

Range	Option 653	1 sa to 75 Msa
	Option 655	1 sa to 150 Msa
	Option 656	1 sa to 100 Msa
	Option 657	1 sa to 200 Msa

***RST** +1.00000000E+000

Key Entry Noise Bandwidth

:NOISe:CBRate

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:MTONe:ARB:NOISe:CBRate <1bps - 999Mbps>
[:SOURce]:RADio:MTONe:ARB:NOISe:CBRate?
```

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. The carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

Default 1.000 bps

Range 1 bps to 999 Mbps

Key Entry **Carrier Bit Rate**

:NOISe:CBWidth

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:MTONe:ARB:NOISe:CBWidth <1Hz-80MHz>
[:SOURce]:RADio:MTONe:ARB:NOISe:CBWidth?
```

This command selects the carrier bandwidth over which the AWGN (additive white gaussian noise) is applied. The noise power will be integrated over the selected bandwidth for the purposes of calculating C/N (carrier to noise ratio). For more information refer to ":NOISe[:STATe]" on page 400.

***RST**	+1.00000000E+000
	1.0 Hz
Range	1 Hz – 125 MHz (Minimum increment is .001 Hz)
Key Entry	**Carrier Bandwidth**

:NOISe:CN

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:MTONe:ARB:NOISe:CN <-100dB - 100dB>
[:SOURce]:RADio:MTONe:ARB:NOISe:CN?
```

This command sets the carrier to noise ratio in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to :NOISe:CBWidth.

Example

```
:RAD:ARB:NOIS:CN 50DB
```

The preceding example sets the carrier to noise ratio to 50 dB.

***RST**	+0.00000000E+000
Key Entry	**Carrier to Noise Ratio**

:NOISe:CNFormat

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:MTONe:ARB:NOISe:CNFormat CN|EBNO
[:SOURce]:RADio:MTONe:ARB:NOISe:CNFormat?
```

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example

```
:RAD:MTON:ARB:NOIS:CNF EBNO
```

The preceding example sets the carrier to noise ratio format to EbNo.

Default	Carrier to Noise Ratio Format C/N
Key Entry	**Carrier to Noise Ratio Format C/N Eb/No**

:NOISe:EBNO

Supported N5172B/82B with Option 403

`[:SOURce]:RADio:MTONE:ARB:NOISe:EBNO <ebno in dB>`

`[:SOURce]:RADio:MTONE:ARB:NOISe:EBNO?`

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:NOISe:CBRate on page 396) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :NOISe:CNFormat command.

The query returns the value of Eb/N0.

Default 0 dB

Range –100 to 100 dB

Key Entry **Carrier to Noise Ratio Format Eb/No**

:NOISe:MUX

Supported N5172B/82B with Option 403

`[:SOURce]:RADio[1]:MTONe:ARB:NOISe:MUX SUM|CARRier|NOISe`

`[:SOURce]:RADio[1]:MTONe:ARB:NOISe:MUX?`

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

```
:RAD:MTON:ARB:NOIS:MUX CARR
```

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default Carrier+Noise

Key Entry **Carrier+Noise** | **Carrier** | **Noise**

:NOISe:POWer:CARRier

Supported N5172B/82B with Option 403

`[:SOURce]:RADio:MTONe:ARB:NOISe:POWer:CARRier <carrierPower>`
`[:SOURce]:RADio:MTONe:ARB:NOISe:POWer:CARRier?`

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] and :NOISe:POWer:NOISe:TOTal commands.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Carrier Power**

:NOISe:POWer:CONTrol[:MODE]

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:MTONe:ARB:NOISe:POWer:CONTrol[:MODE]
TOTal|CARRier|NOISe
[:SOURce]:RADio:MTONe:ARB:NOISe:POWer:CONTrol[:MODE]?
```

This command sets the power control to one of the three following modes:

Total	This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.
Carrier	In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.
Total Noise	In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total

power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

Default Total

Key Entry **Total Carrier Total Noise**

:NOISe:POWer:NOISe:CHANnel?

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:MTONe:ARB:NOISe:POWer:NOISe:CHANnel?
```

The query returns the current noise power across the carrier bandwidth in dBm.

:NOISe:POWer:NOISe:TOTal

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:MTONe:ARB:NOISe:POWer:NOISe:TOTal
<totalNoisePowerInDbm>
[:SOURce]:RADio:MTONe:ARB:NOISe:POWer:NOISe:TOTal?
```

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] command.

Range The range varies based on the bounds of the total power that results from the noise settings.

Default The appropriate value given the current total power and the current Carrier to Noise (C/N).

Key Entry **Total Noise Power**

:NOISe[:STATe]

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:MTONe:ARB:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:MTONe:ARB:NOISe[:STATe]?
```

This command enables the Multi-Tone modulation mode.

To configure the AWGN, refer to the following sections located in the multitone subsystem:

– To set the AWGN noise bandwidth, refer to ":NOISe:BANDwidth" on page 395.

– To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to":NOISe:CBWidth" on page 396.

– To set the carrier to noise ratio as the active function, refer to ":NOISe:CN" on page 397.

***RST**	Off
Key Entry	Real-Time AWGN Off On

:PHASe:NOISe:F1

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F1 <value><unit>
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F1?
```

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see :PHASe:NOISe:F2). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the *User's Guide*.

***RST**	+1.00000000E+003
Range	0 Hz to 77.50052449 MHz
Key Entry	**Desired Start Freq (f1)**

:PHASe:NOISe:F1:ACTual?

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F1:ACTual?
```

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F2?
```

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the *User's Guide*.

***RST**	+3.00000000E+004
Range	1 Hz to 77.50052449 MHz
Key Entry	**Desired Stop Freq (f2)**

:PHASe:NOISe:F2:ACTual?

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:F2:ACTual?
```

This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHASe:NOISe:LMID

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:LMID?
```

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the *User's Guide*.

NOTE The amplitude range varies depending on the f2 value (":PHASe:NOISe:F2" on page 402). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The range values are expressed in units of dBc/Hz.

***RST**	–
	7.00000000E+001
Range	–
	300 to 100
Key Entry	**Desired Flat Amplitude (Lmid)**

:PHASe:NOISe:LMID:ACTual?

Supported N5172B/82B with Option 432

`[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:LMID:ACTual?`

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

:PHASe:NOISe[:STATe]

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe[:STATe]?
```

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the *User's Guide*.

***RST**	0
Key Entry	**Phase Noise Off On**

:PHASe:NOISe:TRACe?

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:MTONe:ARB:PHASe:NOISe:TRACe?
<startFreq>,<stopFreq>,<numSamples>
```

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range	<startFreq>	1 Hz to 100 MHz
	<stopFreq>	1 Hz to 100 MHz
	<numSamples>	1 to 8192

:SCLock:RATE

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:SCLock:RATE <val>
[:SOURce]:RADio:MTONe:ARB:SCLock:RATE?
```

This command sets the sample clock rate for the multitone modulation format.

The variable <val> is expressed in units of hertz.

***RST** `+60.000000E+006` (with Option 653)

`+120.000000E+006` (with Option 655)

`+80.000000E+006` (with Option 656)

`+160.000000E+006` (with Option 657)

Range *Option 653*: 1 Hz to 60 MHz

Option 655: 1 Hz to 120 MHz

Option 656: 1 Hz to 80 MHz

Option 657: 1 Hz to 160 MHz

Key Entry **ARB Sample Clock**

Remarks The modulation format should be active before executing this command. If this command is executed before the modulation format is active, the entered value will be overridden by a calculated factory default value. To activate the modulation format, refer to "[:STATe]" on page 409.

:SETup

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:SETup "<file name>"
[:SOURce]:RADio:MTONe:ARB:SETup?
```

This command retrieves a multitone waveform file.

Key Entry **Load From Selected File**

Remarks The name of a multitone waveform file is stored in the signal generator file system of MTONE files. This information is held in memory until you send the command that turns the waveform on.

For information on the file name syntax, refer to "File Name Variables" on page 43.

:SETup:STORe

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:SETup:STORe "<file name>"
```

This command stores the current multitone waveform setup in the signal generator file system of MTONE files.

Key Entry **Store To File**

:SETup:TABLe

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe <freq_spacing>,
<num_tones>,<phase>,<state>
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe?
```

This command creates and configures a multitone waveform.

The frequency offset, power, phase, and state value are returned when a query is initiated. The output format is as follows:

```
<frequency offset>,<power>,<phase>,<state>
```

The variable <freq_spacing> is expressed in units of Hertz (Hz–MHz).

The variable <power> is expressed in units of decibels (dB).

*RST	Tone	<frequency offset>	<power>	<phase>	<state>
	Tone 1	-35000	+0.00000000E+000	+0	+1
	Tone 2	-25000	+0.00000000E+000	+0	+1
	Tone 3	-15000	+0.00000000E+000	+0	+1
	Tone 4	-5000	+0.00000000E+000	+0	+1
	Tone 5	+5000	+0.00000000E+000	+0	+1
	Tone 6	+15000	+0.00000000E+000	+0	+1
	Tone 7	+25000	+0.00000000E+000	+0	+1
	Tone 8	+35000	+0.00000000E+000	+0	+1

Range **<freq_spacing>** (2 tones): 1E1 to Option 65x bandwidth

<num_tones>: 2–64

<freq_spacing> (>2 tones): 1E1 to (Option 65x bandwidth ÷ (num_tones – 1))

<phase>: 0–359

BBG_max_bandwidth:

653: 60 MHz
655: 120 MHz
656: 80 MHz
657: 160 MHz

Key Entry	**Freq Spacing**	**Number Of Tones**	**Toggle State**

NOTE The **Toggle State** softkey has a different softkey path but the same SCPI command when initializing the Multitone table (For the softkey path, refer to ":SETup:TABLe:ROW" on page 408).

Remarks To set the frequency spacing, refer to ":SETup:TABLe:FSPacing" on page 406.

:SETup:TABLe:FSPacing

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:FSPacing
<freq_spacing>
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:FSPacing?
```

This command sets the frequency spacing between the tones.

The variable <freq_spacing> is expressed in units of Hertz (Hz–MHz).

***RST** +1.00000000E+004

Range **<freq_spacing>** (2 tones): 1E1–Option 65x bandwidth

<freq_spacing> (>2 tones): 1E1 to (Option 65x bandwidth ÷ (num_tones – 1))

Key Entry **Freq Spacing**

Remarks To set frequency spacing and additional parameters required to create or configure a multitone waveform, refer to ":SETup:TABLe" on page 405.

This command is the second step in creating a multitone waveform. Refer to "Creating a Multitone Waveform" on page 390 for all four steps.

:SETup:TABLe:NTONes

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:NTONes <num_tones>
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:NTONes?
```

This command defines the number of tones in the multitone waveform.

***RST**	+8
Range	2 to 64
Key Entry	**Number Of Tones**
Remarks	To specify the number of tones and additional parameters required to create or configure a multitone waveform, refer to “:SETup:TABLe” on page 405.
	This command is the third step in creating a multitone waveform. Refer to “Creating a Multitone Waveform” on page 390 for all four steps.

:SETup:TABLe:PHASe:INITialize

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:PHASe:INITialize
FIXed|RANDom
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:PHASe:INITialize?
```

This command initializes the phase in the multitone waveform table.

FIXed	This choice sets the phase of all tones to the fixed value of 0 degrees.
RANDom	This choice sets the phase of all tones to random values based on the setting on the random seed generator.
***RST**	FIX
Key Entry	**Initialize Phase Fixed Random**
Remarks	To change the random number generator seed value, refer to “:SETup:TABLe:PHASe:INITialize:SEED” on page 408.
	This command is the first step in creating a multitone waveform. Refer to “Creating a Multitone Waveform” on page 390 for all four steps.

:SETup:TABLe:PHASe:INITialize:SEED

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:PHASe:INITialize:SEED
FIXed|RANDom
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:PHASe:INITialize:SEED?
```

This command initializes the random number generator seed that is used to generate the random phase values for the multitone waveform.

FIXed	This choice sets the random number generator seed to a fixed value.
RANDom	This choice sets the random number generator seed to a random value. This changes the phase value after each initialization of the phase.
***RST**	FIX
Key Entry	**Random Seed Fixed Random**

:SETup:TABLe:ROW

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:ROW
<row_number>,<power>,
<phase>,<state>
[:SOURce]:RADio:MTONe:ARB:SETup:TABLe:ROW? <row_number>
```

This command modifies the indicated tone (row) of the multitone waveform.

<row_number>	The number of rows for this variable is determined by the :SETup:TABLe command.
<power>	The power level of the tone defined in the row number. Power levels for all tones must not exceed the power level of the signal generator. The power variable is expressed in decibels (dB)
<phase>	The phase of the tone relative to the carrier. The phase variable is expressed in degrees.
<state>	The state of the tone in this row can be enabled or disabled.

Frequency offset, power, phase, and state value are returned when a query is initiated. The output format is as follows:
`<frequency_offset>,<power>,<phase>,<state>`

Refer to ":SETup:TABLe" on page 405 for information on how to change the number of rows.
This command is the final step in creating a multitone waveform. Refer to "Creating a Multitone Waveform" on page 390 for all four steps.

Example

```
:RAD:MTON:ARB:SET:TABL:ROW 2,-10,40,0
```

The preceding example modifies row number two in the currently selected multitone table. The power is set to –10 dB, the phase is set to 40 degrees, and the state is off.

***RST**	**frequency offset**: –3.50000000E+004		**<power>**: +0.00000000E+000	
	<phase>: +0.00000000E+000		**<state>**: 1	
Range	**frequency offset**:: 653: +/-30 MHz 655: +/-60 MHz 656: +/-40 MHz 657: +/-80 MHz	**<power>**: –80 to 0	**<phase>**: 0–359	**<state>**: 1
Key Entry	**Goto Row**	**Edit Item**	**Toggle State**	

[:STATe]

Supported N5172B/82B

```
[:SOURce]:RADio:MTONe:ARB[:STATe] ON|OFF|1|0
[:SOURce]:RADio:MTONe:ARB[:STATe]?
```

This command enables or disables the multitone waveform generator function.

***RST** 0

Key Entry **Multitone Off On**

Two Tone Subsystem–N5172B/82B ([:SOURce]:RADio:TTONe:ARB)

:ALIGnment

Supported N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB:ALIGnment LEFT|CENTer|RIGHt
[:SOURce]:RADio:TTONe:ARB:ALIGnment?
```

This command will align the two tones either left, center or right of the carrier frequency.

Example

```
:RAD:TTON:ARB:ALIG CENT
```

The preceding example aligns each of the two tones equidistant from the carrier frequency.

Key Entry **Alignment Left Cent Right**

:APPly

Supported N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB:APPLy
```

This command will cause the two–tone waveform to be regenerated using the current settings.

This command has no effect unless the two–tone waveform generator is enabled and a change has been made to the frequency spacing setting.

Key Entry **Apply Settings**

:BASEband:FREQuency:OFFSet

Supported N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB:BASeband:FREQuency:OFFSet
<val><unit>
[:SOURce]:RADio:TTONe:ARB:BASeband:FREQuency:OFFSet?
```

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed–through is not in the center.

The X-Series signal generator provides automatic DAC over–range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by *1/square root of 2*.

***RST** 0 Hz

Range +5.0E7 to –5.0E7 MHz

Key Entry **Baseband Frequency Offset**

:BASeband:FREQuency:OFFSet:PHASe:RESet

Supported N5172B/82B

`[:SOURce]:RADio:TTONe:ARB:BASeband:FREQuency:OFFSet:PHASe:RESet`

This command clears the phase accumulation and so zero phase shift.

When the Baseband Frequency Offset is non–zero, the hardware rotator accumulates phase–shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non–zero residual phase present in the signal, the DAC Over–Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by **1/square root of 2**.

Key Entry **Baseband Frequency Offset Phase Reset**

:FSPacing

Supported N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB:FSPacing <freq_spacing>
[:SOURce]:RADio:TTONe:ARB:FSPacing?
```

This command sets the frequency spacing between the tones.

The variable <freq_spacing> is expressed in hertz (Hz–MHz).

Example

```
:RAD:TTON:ARB:FSP 10MHZ
```

The preceding example sets a 10 megahertz frequency spacing for the two tones.

***RST** +1.00000000E+004

Range 1E1 to 1E8

Key Entry **Freq Separation**

:HEADer:CLEar

Supported N5172B/82B

`[:SOURce]:RADio:TTONe:ARB:HEADer:CLEar`

This command clears the header information from the header file used for the two–tone waveform format. Header information consists of signal generator settings and marker routings associated with the waveform file. Refer to the **User's Guide** for information on file headers.

For this command to function, two tone must be on. To turn two tone on, see "[:STATe]" on page 426.

Key Entry	**Clear Header**

:HEADer:SAVE

Supported	N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB:HEADer:SAVE
```

This command saves the header information to the header file used for the two–tone waveform format. Header information consists of signal generator settings and marker routings associated with the waveform file. Refer to the **User's Guide** for information on header files.

For this command to function, two tone must be on. To turn two tone on, see "[:STATe]" on page 426.

Key Entry	**Save Setup To Header**

:IQ:MODulation:ATTen

Supported	N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB:IQ:MODulation:ATTen <val><unit>
[:SOURce]:RADio:TTONe:ARB:IQ:MODulation:ATTen?
```

This command sets the attenuation level of the I/Q signals being modulated through the signal generator RF path. The variable <val> is expressed in decibels (dB).

Example

```
:RAD:TTON:ARB:IQ:MOD:ATT 20
```

The preceding example sets the modulator attenuator to 20 dB.

***RST**	+2.00000000E+000
Range	0 to 50 dB
Key Entry	**Modulator Atten Manual Auto**

:IQ:MODulation:ATTen:AUTO

Supported	N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB:IQ:MODulation:ATTen:AUTO
ON|OFF|1|0
[:SOURce]:RADio:TTONe:ARB:IQ:MODulation:ATTen:AUTO?
```

This command enables or disables the modulator attenuator auto mode. The auto mode will be switched to manual if the signal generator receives an AUTO OFF or AUTO ON command.

ON (1)	This choice enables the attenuation auto mode which allows the signal generator to select the attenuation level that optimizes performance based on the current conditions.
OFF (0)	This choice holds the attenuator at its current setting or at a selected value. For setting the attenuation value, refer to ":IQ:MODulation:ATTen" on page 391.

Example

```
:RAD:TTON:ARB:IQ:MOD:ATT:AUTO ON
```

The preceding example enables the attenuator automatic mode.

***RST**	1
Key Entry	**Modulator Atten Manual Auto**

:MDEStination:ALCHold

Supported	N5172B/82B

CAUTION

Incorrect ALC sampling can create a sudden unleveled condition that may create a spike in the RF output potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.

```
[:SOURce]:RADio:TTONe:ARB:MDEStination:ALCHold
NONE|M1|M2|M3|M4
[:SOURce]:RADio:TTONe:ARB:MDEStination:ALCHold?
```

This command disables the marker ALC hold function, or it enables the marker hold function for the selected marker.

Use the ALC hold function when you have a waveform signal that incorporates idle periods, or when the increased dynamic range encountered with RF blanking is not desired. The ALC circuitry responds to the marker signal during the marker pulse (marker signal high), averaging the modulated signal level during this period.

The ALC hold function operates during the low periods of the marker signal. The marker polarity determines when the marker signal is high. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. To set a marker's polarity, see ":MPOLarity:MARKer1|2|3|4" on page 416. For more information on markers, see ":MARKer[:SET]" on page 355.

NOTE

Do not use the ALC hold for more than 100 ms, because it can affect the waveform's output amplitude.

The marker signal has a minimum of a two–sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the ALC sampling to begin.

The ALC hold setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

NOTE

A waveform file that has unspecified settings in the file header uses the previous waveform's routing settings.

For more information on the marker ALC hold function, see the *User's Guide*. To configure marker points, refer to the following sections located in the Dual ARB subsystem:

— For clearing a single marker point or a range of marker points, see":MARKer:CLEar" on page 352.
— For clearing all marker points, see ":MARKer:CLEar:ALL" on page 354.
— For shifting marker points, see ":MARKer:ROTate" on page 354.
— For setting marker points, see ":MARKer[:SET]" on page 355.

NONE	This terminates the marker ALC hold function.
M1–M4	These are the marker choices. The ALC hold feature uses only one marker at a time.

Example

```
:RAD:TTON:ARB:MDES:ALCH M2
```

The preceding example routes marker two to the ALC hold function.

***RST**	NONE

Key Entry	**None**	**Marker 1**	**Marker 2**	**Marker 3**	**Marker 4**

:MDEStination:PULSe

Supported N5172B/82B

CAUTION **The pulse function incorporates ALC hold. Incorrect ALC sampling can create a sudden unleveled condition that may create a spike in the RF output, potentially damaging a DUT or connected instrument. Ensure that you set markers to let the ALC sample over an amplitude that accounts for the high power levels within the signal.**

```
[:SOURce]:RADio:TTONe:ARB:MDEStination:PULSe
NONE|M1|M2|M3|M4
[:SOURce]:RADio:TTONe:ARB:MDEStination:PULSe?
```

This command disables the marker RF blanking/pulse function, or it enables the marker RF blanking/pulse function for the selected marker.

This function automatically incorporates the ALC hold function, so there is no need to select both functions for the same marker.

NOTE **Do not use ALC hold for more than 100 ms, because it can affect the waveform's output amplitude.**

The signal generator blanks the RF output when the marker signal goes low. The marker polarity determines when the marker signal is low. For a positive polarity, this is during the marker points. For a negative polarity, this is when there are no marker points. To set a marker's polarity, see ":MPOLarity:MARKer1|2|3|4" on page 416. For more information on markers, see ":MARKer[:SET]" on page 355.

NOTE **Set marker points prior to using this function. Enabling this function without setting marker points may create a continuous low or high marker signal, depending on the marker polarity. This creates the condition where there is either no RF output or a continuous RF output.**

To configure marker points, refer to the following sections located in the Dual ARB subsystem:

– For clearing a single marker point or a range of marker points, see":MARKer:CLEar" on page 352.

– For clearing all marker points, see ":MARKer:CLEar:ALL" on page 354.

– For shifting marker points, see ":MARKer:ROTate" on page 354.

– For setting marker points, see ":MARKer[:SET]" on page 355.

The marker signal has a minimum of a two–sample delay in its response relative to the waveform signal response. To compensate for the marker signal delay, offset marker points from the waveform sample point at which you want the RF blanking to begin.

The RF blanking setting is part of the file header information, so saving the setting to the file header saves the current marker routing for the waveform file.

NOTE A waveform file that has unspecified settings in the file header uses the previous waveform's routing settings. This could create the situation where there is no RF output signal, because the previous waveform used RF blanking.

For more information on the marker RF blanking function, see the *User's Guide*.

NONE	This terminates the marker RF blanking/pulse function.
M1–M4	These are the marker choices. The RF blanking/pulse feature uses only one marker at a time.
***RST**	NONE

Key Entry	None	Marker 1	Marker 2	Marker 3	Marker 4

:MPOLarity:MARKer1|2|3|4

Supported N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB:MPOLarity:MARKer1|2|3|4
NEGative|POSitive
[:SOURce]:RADio:TTONe:ARB:MPOLarity:MARKer1|2|3|4?
```

This command sets the polarity for the selected marker.

For a positive marker polarity, the marker signal is high during the marker points. For a negative marker polarity, the marker signal is high during the period of no marker points. To configure marker points, refer to the following sections located in the Dual ARB subsystem:

– For clearing a single marker point or a range of marker points, see":MARKer:CLEar" on page 352.
– For clearing all marker points, see ":MARKer:CLEar:ALL" on page 354.
– For shifting marker points, see ":MARKer:ROTate" on page 354.
– For information on markers and setting marker points, see ":MARKer[:SET]" on page 355.

Example

```
:RAD:TTON:ARB:MPOL:MARK1 POS
```

The preceding example sets the polarity for marker one to positive.

***RST**	POS	
Key Entry	**Marker 1 Polarity Neg Pos**	**Marker 2 Polarity Neg Pos**
	Marker 3 Polarity Neg Pos	**Marker 4 Polarity Neg Pos**

:NOISe:BANDwidth

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:TTONe:ARB:NOISe:BANDwidth <val><unit>
[:SOURce]:RADio:TTONe:ARB:NOISe:BANDwidth?
```

This command sets the flat noise bandwidth value for the two-tone waveform. This value is typically set wider than the carrier bandwidth.

To configure the AWGN, refer to the following sections located in the Two Tone subsystem:

– To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to":NOISe:CBWidth" on page 418.

– To set the carrier to noise ratio as the active function, refer to ":NOISe:CN" on page 418.

– To enable the AWGN, refer to ":NOISe[:STATe]" on page 422.

Range	Option 653	1 sa to 75 Msa
	Option 655	1 sa to 150 Msa
	Option 656	1 sa to 100 Msa
	Option 657	1 sa to 200 Msa

***RST** +1.00000000E+000

Key Entry **Noise Bandwidth**

:NOISe:CBRate

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:TTONe:ARB:NOISe:CBRate <1bps - 999Mbps>
[:SOURce]:RADio:TTONe:ARB:NOISe:CBRate?
```

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. The carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

Example

`:RAD:TTON:ARB:NOIS:CBR 5`

The preceding example sets the carrier bit rate to 5 bps.

Default	1.000 bps
Range	1 bps to 999 Mbps
Key Entry	**Carrier Bit Rate**

:NOISe:CBWidth

Supported	N5172B/82B with Option 403

`[:SOURce]:RADio:TTONe:ARB:NOISe:CBWidth <val><unit>`

`[:SOURce]:RADio:TTONe:ARB:NOISe:CBWidth?`

This command selects the carrier bandwidth over which the AWGN (additive white gaussian noise) is applied. The noise power will be integrated over the selected bandwidth for the purposes of calculating C/N (carrier to noise ratio). The carrier bandwidth is limited to the ARB sample rate but cannot exceed 125 MHz. For more information refer to ":NOISe[:STATe]" on page 422.

To configure the AWGN, refer to the following sections located in the Two Tone subsystem:

- To set the AWGN noise bandwidth, refer to ":NOISe:BANDwidth" on page 417.
- To set the carrier to noise ratio as the active function, refer to ":NOISe:CN" on page 418.
- To enable the AWGN, refer to ":NOISe[:STATe]" on page 422.

Range	1 Hz to 125 MHz (Minimum increment is .001 MHz)
***RST**	+1.00000000E+000
Key Entry	**Carrier Bandwidth**

:NOISe:CN

Supported	N5172B/82B with Option 403

`[:SOURce]:RADio:TTONe:ARB:NOISe:CN <val><unit>`

`[:SOURce]:RADio:TTONe:ARB:NOISe:CN?`

This command makes Carrier to Noise Ratio the active function. The value you enter sets noise power as a ratio of carrier power to noise power (C/N). Carrier power equals the total modulated signal power before noise is added. When you add noise, the power output from the signal generator does not change; it is the sum of carrier power and the added noise power. You can apply noise in real time while the waveform is playing.

To configure the AWGN, refer to the following sections located in the Two Tone subsystem:

– To set the AWGN noise bandwidth, refer to ":NOISe:BANDwidth" on page 417.
– To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to":NOISe:CBWidth" on page 418.
– To enable the AWGN, refer to ":NOISe[:STATe]" on page 422.

***RST**	+0.00000000E+000
Key Entry	**Carrier to Noise Ratio**

:NOISe:CNFormat

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:TTONe:ARB:NOISe:CNFormat CN|EBNO
[:SOURce]:RADio:TTONe:ARB:NOISe:CNFormat?
```

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example

```
:RAD:TTON:ARB:NOIS:CNF EBNO
```

The preceding example sets the carrier to noise ratio format to EbNo.

Default	Carrier to Noise Ratio Format C/N
Key Entry	**Carrier to Noise Ratio Format C/N Eb/No**

:NOISe:EBNO

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:TTONE:ARB:NOISe:EBNO <ebno in dB>
[:SOURce]:RADio:TTONE:ARB:NOISe:EBNO?
```

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:NOISe:CBRate on page 417) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :NOISe:CNFormat command.

The query returns the value of EBNO.

Default	0 dB
Range	–100 to 100 dB
Key Entry	**Carrier to Noise Ratio Format Eb/No**

:NOISe:MUX

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio[1]:TTONe:ARB:NOISe:MUX SUM|CARRier|NOISe
[:SOURce]:RADio[1]:TTONe:ARB:NOISe:MUX?
```

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

```
:RAD:TTON:ARB:NOIS:MUX CARR
```

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default	Carrier+Noise
Key Entry	**Carrier+Noise** | **Carrier** | **Noise**

:NOISe:POWer:CARRier

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:CARRier <carrierPower>
[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:CARRier?
```

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] and :NOISe:POWer:NOISe:TOTal commands.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Carrier Power**

:NOISe:POWer:CONTrol[:MODE]

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:CONTrol[:MODE]
TOTal|CARRier|NOISe
[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:CONTrol[:MODE]?
```

This command sets the power control to one of the three following modes:

Total	This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.
Carrier	In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.
Total Noise	In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.
Default	Total
Key Entry	**Total Carrier Total Noise**

:NOISe:POWer:NOISe:CHANnel?

Supported N5172B/82B with Option 403

`[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:NOISe:CHANnel?`

The query returns the current noise power across the carrier bandwidth in dBm.

:NOISe:POWer:NOISe:TOTal

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:NOISe:TOTal
<totalNoisePowerInDbm>
[:SOURce]:RADio:TTONe:ARB:NOISe:POWer:NOISe:TOTal?
```

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] command.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Total Noise Power**

:NOISe[:STATe]

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:TTONe:ARB:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:TTONe:ARB:NOISe[:STATe]?
```

This command enables the Two-Tone modulation mode.

To configure the AWGN, refer to the following sections located in the Two Tone subsystem:

– To set the AWGN noise bandwidth, refer to “:NOISe:BANDwidth” on page 417.

– To set the bandwidth over which the noise power is integrated for calculating the carrier to noise ratio, refer to":NOISe:CBWidth" on page 418.

– To set the carrier to noise ratio as the active function, refer to ":NOISe:CN" on page 418.

***RST**	Off
Key Entry	**Real-Time AWGN Off On**

:PHASe:NOISe:F1

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:F1 <value><unit>
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:F1?
```

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F2 command). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the *User's Guide*.

***RST**	+1.00000000E+003
Range	0 Hz to 77.50052449 MHz
Key Entry	**Desired Start Freq (f1)**

:PHASe:NOISe:F1:ACTual?

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:F1:ACTual?
```

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:F2?
```

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the *User's Guide*.

***RST**	+3.00000000E+004
Range	1 Hz to 77.50052449 MHz
Key Entry	**Desired Stop Freq (f2)**

:PHASe:NOISe:F2:ACTual?

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:F2:ACTual?
```

This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHASe:NOISe:LMID

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:LMID?
```

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the *User's Guide*.

NOTE The amplitude range varies depending on the f2 value (":PHASe:NOISe:F2" on page 423). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

The range values are expressed in units of dBc/Hz.

***RST**	–7.00000000E+001
Range	–300 to 100
Key Entry	**Desired Flat Amplitude (Lmid)**

:PHASe:NOISe:LMID:ACTual?

Supported	N5172B/82B with Option 432

`[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:LMID:ACTual?`

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

:PHASe:NOISe[:STATe]

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe[:STATe]?
```

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the *User's Guide*.

***RST** 0

Key Entry **Phase Noise Off On**

:PHASe:NOISe:TRACe?

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:TTONe:ARB:PHASe:NOISe:TRACe?
<startFreq>,<stopFreq>,<numSamples>
```

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range	<startFreq>	1 Hz to 100 MHz
	<stopFreq>	1 Hz to 100 MHz
	<numSamples>	1 to 8192

:SCLock:RATE

Supported N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB:SCLock:RATE <sample_clock_rate>
[:SOURce]:RADio:TTONE:ARB:SCLock:RATE?
```

This command sets the ARB sample clock rate.

The two tone generator should be on before executing this command. If this command is executed before the two tone generator is active, the entered value will be overridden by a calculated factory default value.

Example

```
:RAD:TTON:ARB:SCL:RATE 1MHZ
```

The preceding example sets the ARB sample clock to 1 MHz.

***RST**	+1.00000000E+008
Range	1E3 to 1E8
Key Entry	**ARB Sample Clock**

[:STATe]

Supported	N5172B/82B

```
[:SOURce]:RADio:TTONe:ARB[:STATe] ON|OFF|1|0
[:SOURce]:RADio:TTONe:ARB[:STATe]?
```

This command enables or disables the on/off operational state of the two–tone waveform generator function.

Example

```
:RAD:TTON:ARB ON
```

The preceding example turns on the two–tone generator.

***RST**	0
Key Entry	**Two Tone Off On**

6 Avionics VOR/ILS Commands

This chapter describes SCPI commands used by Keysight X-Series signal generators with Option 302 during either VOR [VHF Omnidirectional Ranging] or ILS [Instrument Landing System] aircraft navigation receiver test. Avionics is a term used to describe the electronic instrumentation on aircraft.

This chapter contains the following sections:

Avionics Subsystem VOR—Option 302 [:SOURce]:AVIonics:VOR

:BEARing:ANGLe

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:VOR:BEARing:ANGLe <value>
[:SOURce]:AVIonics:VOR:BEARing:ANGLe?
```

This command sets the VOR Bearing Angle between the Variable Phase (VAR) and the Reference (REF) tones.

***RST**	0 deg
Range	0 deg—360 deg
Key Entry	**Aux Fctn > Avionics > VOR > Bearing > Angle > <value> deg**

:BEARing:DIRection

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:VOR:BEARing:DIRection FROM|TO
[:SOURce]:AVIonics:VOR:BEARing:DIRection?
```

This command sets the `FROM` or `TO` direction, effectively inverting the VOR Bearing Angle.

A VOR instrument in the aircraft can be set to either a FROM or a TO convention.

FROM - In the FROM convention, the VOR transmitter beacon is made the reference point and the Bearing Angle is between magnetic-North and the beacon-to-aircraft radial line (RL).

TO - In the TO convention, the aircraft is made the reference point and the Bearing Angle is between magnetic-North and the aircraft-to-beacon radial line (RL).

RL(TO) = 180° – RL(`FROM`)

***RST**	FROM
Choices	FROM | TO
Key Entry	**Aux Fctn > Avionics > VOR > Bearing > Direction From | To**

:DEPTh:SUBCarrier

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:VOR:DEPTh:SUBCarrier <value>
[:SOURce]:AVIonics:VOR:DEPTh:SUBCarrier?
```

This command sets the sub-carrier AM depth as it modulates the main carrier of a VOR signal.

***RST** 30 PCT

Range 0 PCT–49.9 PCT

Key Entry **Aux Fctn > Avionics > VOR > REF/VAR > SubCarrier Depth > <value>%**

:DEPTh:VAR

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:VOR:DEPTh:VAR <value>
[:SOURce]:AVIonics:VOR:DEPTh:VAR?
```

This command sets the AM depth of the 30 Hz variable phase tone for a VOR signal.

***RST** 30 PCT

Range 0 PCT–49.9 PCT

Key Entry **Aux Fctn > Avionics > VOR > REF/VAR > VAR Depth > <value>%**

:DEViation:REF

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:VOR:DEViation:REF <value>
[:SOURce]:AVIonics:VOR:DEViation:REF?
```

This command sets the amount of FM Deviation that the 30 Hz Reference (REF) tone causes on the sub-carrier for a VOR signal.

***RST** 480 Hz

Range 0 Hz–1 kHz

Key Entry **Aux Fctn > Avionics > VOR > REF/VAR > REF Deviation > <value> Hz | kHz | MHz | GHz**

:FREQuency:REFVar

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:VOR:FREQuency:REFVar <value>
[:SOURce]:AVIonics:VOR:FREQuency:REFVar?
```

This command sets the frequency of the 30 Hz Reference (REF) tone and the Variable Phase (VAR) tone for a VOR signal.

***RST** 30 Hz

Range 10 Hz–60 Hz

Key Entry **Aux Fctn > Avionics > VOR > REF/VAR > REF/VAR Freq > <value> Hz | kHz | MHz | GHz**

:FREQuency:SUBCarrier

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:VOR:FREQuency:SUBCarrier <value>
[:SOURce]:AVIonics:VOR:FREQuency:SUBCarrier?
```

This command sets the frequency of the SUBCarrier for a VOR signal.

***RST** 9960 Hz

Range 0 Hz–20 kHz

Key Entry **Aux Fctn > Avionics > VOR > REF/VAR > SubCarrier Freq > <value> Hz | kHz | MHz | GHz**

:FREQuency[:CARRier]:INDex

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:VOR:FREQuency[:CARRier]:INDex <value>
[:SOURce]:AVIonics:VOR:FREQuency[:CARRier]:INDex?
```

This command selects one of the standard VOR carrier frequencies.

The index you enter sets the VOR carrier frequency to one of the standard defined corresponding values and produces a VOR carrier from 108.00 to 117.95 MHz.

***RST** 1 (108.00 MHz)

Range 1–160

Because ILS Localizer systems overlap with the VOR carrier frequency range (there are forty channels allocated to the ILS Localizer in the range from 108.10 to 111.95 MHz), only frequencies where tenths of a megacycle count is even are used as VOR Carrier Frequencies (MHz).

VOR Carrier Frequencies (MHz)	Carrier Freq Index = 1 to 160			
1 to 32	33 to 64	65 to 96	97 to 128	129 to 160
108.00	111.20	113.20	114.80	116.40
108.05	111.25	113.25	114.85	116.45
108.20	111.40	113.30	114.90	116.50
108.25	111.45	113.35	114.95	116.55
108.40	111.60	113.40	115.00	116.60
108.45	111.65	113.45	115.05	116.65
108.60	111.80	113.50	115.10	116.70
108.65	111.85	113.55	115.15	116.75
108.80	112.00	113.60	115.20	116.80
108.85	112.05	113.65	115.25	116.85
109.00	112.10	113.70	115.30	116.90
109.05	112.15	113.75	115.35	116.95
109.20	112.20	113.80	115.40	117.00
109.25	112.25	113.85	115.45	117.05
109.40	112.30	113.90	115.50	117.10
109.45	112.35	113.95	115.55	117.15
109.60	112.40	114.00	115.60	117.20
109.65	112.45	114.05	115.65	117.25
109.80	112.50	114.10	115.70	117.30
109.85	112.55	114.15	115.75	117.35
110.00	112.60	114.20	115.80	117.40
110.05	112.65	114.25	115.85	117.45
110.20	112.70	114.30	115.90	117.50
110.25	112.75	114.35	115.95	117.55
110.40	112.80	114.40	116.00	117.60
110.45	112.85	114.45	116.05	117.65
110.60	112.90	114.50	116.10	117.70
110.65	112.95	114.55	116.15	117.75

110.80	113.00	114.60	116.20	117.80
110.85	113.05	114.65	116.25	117.85
111.00	113.10	114.70	116.30	117.90
111.05	113.15	114.75	116.35	117.95

Key Entry **Aux Fctn > Avionics > VOR > Carrier Freq Index > <value> Enter**

:MODE

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:VOR:MODE OFF|NORMal|VAR|SUBCarrier|SCFM
[:SOURce]:AVIonics:VOR:MODE?
```

This command allows selection of a complete or partial VOR signal and can set the VOR Mode to one of the following:
OFF | NORMal | VAR | SUBCarrier | SCFM

- Selecting **OFF** turns off all VOR signals. When set to OFF, all VOR mode parameter settings are turned off.
- Selecting **NORMal** turns on all VOR signals so that a standard VOR signal is generated with a default VOR Bearing of zero degrees.
- Selecting **VAR** turns on the main VOR carrier and the variable phase 30 Hz tone (VAR signal); suppressed the SUBCarrier.
- Selecting **SUBCarrier** turns on the SUBCarrier without the 30 Hz reference tone; suppresses the main VOR carrier.
- Selecting **SCFM** turns on the SUBCarrier and the 30 Hz reference tone; suppresses the main VOR carrier.

***RST** OFF

Choices OFF | NORMal | VAR | SUBCarrier | SCFM

Key Entry **Aux Fctn > Avionics > VOR > VOR Mode > OFF | NORM | VAR | Sub-carrier | Sub-carrier+FM**

:PRESet

Supported N5171B/81B & N5172B/82B with Option 302

`[:SOURce]:AVIonics:VOR:PRESet`

This command returns the VOR [VHF Omnidirectional Range] system parameters to their *RST (factory-defined) values.

***RST** N/A

Key Entry **Aux Fctn > Avionics > VOR > More 1 of 2 > Recall Default Settings**

Avionics Subsystem COM/ID—Option 302 [:SOURce]:AVIonics:CID

:CODE

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:CID:CODE "<value>"
[:SOURce]:AVIonics:CID:CODE?
```

When entering <value>, enter a valid COM/ID code (airport identification code) by typing a 3-character code enclosed in single-quotes or double-quotes (for example, ‘STS’ or “STS”).

This command sets the airport communication identification code to be played by the COM/ID generator. (This code may also be referred to as an, “airport call-sign”.)

The COM/ID code is transmitted as a three letter-code signal of 1.02000 kHz and is placed on the VOR carrier; this COM/ID code is used to identify the VOR ground-based transmitting station.

Each COM/ID code (airport identification code) must correspond to one of the International Air Transport Association (IATA) codes.

IATA owns, controls, and has a copyright to the complete list of airport identification codes; STS is the airport identification code that refers to the Sonoma County Airport in Santa Rosa, CA, USA.

***RST** STS

Range To find a valid COM/ID code (airport communication identification code) for a particular area, refer to the following websites:

Airline Coding Directory (http://www.iata.org)

AirNav (http://www.airnav.com)

Key Entry **Aux Fctn > Avionics > VOR > COM/ID > COM/ID Code <value> Enter**

:DEPTh

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:CID:DEPTh <value>
[:SOURce]:AVIonics:CID:DEPTh?
```

This command sets the COM/ID tone AM depth.

***RST** 10PCT

Range 0PCT–49.9PCT

Key Entry **Aux Fctn > Avionics > VOR > COM/ID > Depth > <value>%**

:FREQuency

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:CID:FREQuency <value>
[:SOURce]:AVIonics:CID:FREQuency?
```

This command sets the COM/ID tone or code modulating frequency.

***RST**	1.02000 kHz
Range	0 Hz–20 kHz
Key Entry	**Aux Fctn > Avionics > VOR > COM/ID > Frequency > <value> Hz | kHz | MHz | GHz**

:PRESet

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:CID:PRESet
```

This command returns the COM/ID parameters to their *RST values.

***RST**	N/A
Key Entry	**Aux Fctn > Avionics > VOR > COM/ID > More 1 of 2 > Recall Default Settings**

:TYPE

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:CID:TYPE CODE|TONE
[:SOURce]:AVIonics:CID:TYPE?
```

This command toggles the COM/ID Type.

Code – When set to `CODE`, the signal generator plays the code associated with the COM/ID Code.

Tone – When set to `TONE`, the COM/ID Code setting is disabled and the signal generator plays a continuous tone based on the COM/ID Frequency setting;

Obtain this setting with:

```
[:SOURce]:AVIonics:CID:FREQuency?
```

***RST**	Code
Choices	Code | Tone
Key Entry	**Aux Fctn > Avionics > VOR > COM/ID > COM/ID Type Code | Tone**

[:STATe]

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:CID[:STATe] OFF|ON|0|1
[:SOURce]:AVIonics:CID[:STATe]?
```

This command toggles COM/ID OFF (0) or ON (1).
OFF (0)—all COM/ID functions are turned off

***RST** OFF

Choices OFF|ON|0|1

Key Entry **Aux Fctn > Avionics > VOR > COM/ID > COM/ID Off | On**

Avionics Subsystem ILS Localizer—Option 302 [:SOURce]:AVIonics:ILSLocalizer

:DDM:DDM

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:DDM:DDM <value>
[:SOURce]:AVIonics:ILSLocalizer:DDM:DDM?
```

This command sets a value for the “Difference in Depth of Modulation” (DDM).

DDM is defined to be the “percentage modulation depth of the larger signal” minus the “percentage modulation depth of the smaller signal”, divided by 100.

DDM = [AM(90 Hz)% – AM(150 Hz)%] / 100

***RST** 0.0000

Range –0.99 to 0.99

Use a value that is within the range of the current SDM value.

Key Entry **Aux Fctn > Avionics > ILS Localizer > DDM/SDM > DDM <value> Enter**

Remarks Typically the SDM default value provides sufficient range (–0.40 to 0.40) for most applications.

If SDM is set to 99%, then the full range of DDM is available. The following demonstrates the limits of DDM’s range:

(–SDM/100) to (SDM/100)

As SDM’s value increases or decrease, so does DDM’s range.

:DDM:UAMPs

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:DDM:UAMPs <value>
[:SOURce]:AVIonics:ILSLocalizer:DDM:UAMPs?
```

This command sets a value for the difference in depth of modulation (DDM) in uA.

***RST** 0.0 µA

Range –958.1 to 958.1 µA

Use a value that is within the range of the current SDM value.

Key Entry **Aux Fctn > Avionics > ILS Localizer > DDM/SDM > DDM uA <value> Enter**

Remarks Typically the SDM default value provides sufficient range for most applications.

If SDM is set to 99%, then the full range of DDM uA is available. The following demonstrates the limits of DDM uA's range:

((–SDM/100)*(150/.155)) to ((SDM/100)*(150/.155))

As SDM's value increases or decrease, so does the range.

:DDM[:PERCent]

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:DDM[:PERCent] <value>
[:SOURce]:AVIonics:ILSLocalizer:DDM[:PERCent]?
```

This command sets a value for the difference in depth of modulation (DDM) in percent (%).

***RST** 0.00%

Range –99% to 99%

Use a value that is within the range of the current SDM value.

Key Entry **Aux Fctn > Avionics > ILS Localizer > DDM/SDM > DDM% <value> Enter**

Remarks Typically the SDM default value provides sufficient range (–40% to 40%) for most applications.

If SDM is set to 99%, then the full range of DDM is available. The following demonstrates the limits of DDM's range:

(-SDM) to (SDM)

As SDM's value increases or decrease, so does DDM's range.

:FLY:DIRection

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:FLY:DIRection LEFT|RIGHt
[:SOURce]:AVIonics:ILSLocalizer:FLY:DIRection?
```

This command sets the "Difference in Depth of Modulation" (DDM) polarity of the ILS Localizer signal to either:

– LEFT—positive

– RIGHt—negative

The ILS Localizer provides signals that indicate whether an aircraft is Left or Right of the glide path to the runway and enables a pilot to adjust the aircraft Left or Right correctly during landing. This lateral/horizontal correction is performed using two AM carriers with an AM depth of 20%, operating at a carrier frequency range from 108.10 to 111.95 MHz.

For an aircraft on approach, the left tone is modulated at a frequency of 90 Hz by default, and the right tone is modulated at a frequency of 150 Hz by default.

The primary mechanism which makes it possible for a pilot to obtain guidance to a runway is the aircraft receiver's ability to detect the "Difference in Depth of Modulation (DDM)" between the 90 Hz modulation and the 150 Hz modulation.

DDM is defined to be the "percentage modulation depth of the larger signal" minus the "percentage modulation depth of the smaller signal" divided by 100:

DDM = [AM(90 Hz)% – AM(150 Hz)%] / 100

When this formula yields a positive DDM value, the left tone at 90 Hz is stronger; this is indicating that the aircraft is to the Left of the ILS Localizer centerline signal and would have to Fly "Right" to bring the DDM value back to zero so that the aircraft is back in-line with the centerline of the runway.

When this formula yields a negative DDM value, the right tone at 150 Hz is stronger; this is indicating that the aircraft is to the Right of the ILS Localizer centerline signal and would have to Fly "Left" to bring the DDM value back to zero so that the aircraft is back in-line with the centerline of the runway.

Example:

To correct if the left tone at 90 Hz is stronger at 0.2 DDM, the aircraft would have to be pointed Right

```
:AVIonics:ILSLocalizer:FLY:DIRection RIGHt
```

with a DDM of 0.2.

```
AVIonics:ILSLocalizer:DDM 0.2
```

Example:

To correct if the right tone at 150 Hz is stronger at –0.2 DDM,

the aircraft would have to be pointed Left

```
:AVIonics:ILSLocalizer:FLY:DIRection LEFT
```

with a DDM of –0.2.

```
:AVIonics:ILSLocalizer:DDM –0.2
```

***RST**	LEFT
Choices	LEFT | RIGHt
Key Entry	**Aux Fctn > Avionics > ILS Localizer > DDM/SDM > Fly Left | Right**

:FLY:PHASe

Supported	N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:FLY:PHASe <value>
[:SOURce]:AVIonics:ILSLocalizer:FLY:PHASe?
```

This command sets the phase of the right (150 Hz) ILS Localizer signal relative to the left (90 Hz) ILS Localizer signal.

***RST**	0.00 deg
Range	0.00 deg–360 deg
Key Entry	**Aux Fctn > Avionics > ILS Localizer > Left/Right Phase <value> deg**

:FREQuency:LEFT

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:FREQuency:LEFT <value>
[:SOURce]:AVIonics:ILSLocalizer:FREQuency:LEFT?
```

This command sets the frequency of the LEFT ILS Localizer signal.

***RST**	90 Hz
Range	0 Hz–6 MHz
Key Entry	**Aux Fctn > Avionics > ILS Localizer > Left/Right > Left Frequency <value> Hz**

:FREQuency:RIGHt

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:FREQuency:RIGHt <value>
[:SOURce]:AVIonics:ILSLocalizer:FREQuency:RIGHt?
```

This command sets the frequency of the RIGHt ILS Localizer signal.

***RST**	150 Hz
Range	0 Hz–10 MHz
Key Entry	**Aux Fctn > Avionics > ILS Localizer > Left/Right > Right Frequency <value> Hz**

:FREQuency[:CARRier]:INDex

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:FREQuency[:CARRier]:INDex
<value>
[:SOURce]:AVIonics:ILSLocalizer:FREQuency[:CARRier]:INDex?
```

This command sets a carrier index between 1 and 40.
Each index corresponds to a standard defined ILS Localizer carrier channel.

***RST**	1 (108.10 MHz)
Range	1–40 (See table for index versus frequency.)
Key Entry	**Aux Fctn > Avionics > ILS Localizer > Carrier Freq Index > <value> Enter**
Remarks	There are forty channels that are allocated to the ILS Localizer in the range from 108.10 to 111.95 MHz; each ILS Localizer carrier has a corresponding ILS Glide

Slope carrier frequency in the range from 329.15 to 335.00 MHz.

ILS Localizer and Corresponding ILS Glide Slope Carrier Frequencies (MHz)			
ILS Localizer (MHz) Index 1-20	ILS Glide Slope (MHz) Index 1-20	ILS Localizer (MHz) Index 21-40	ILS Glide Slope (MHz) Index 21-40
1=108.10	1=334.70	21=110.10	21=334.40
2=108.15	2=334.55	22=110.15	22=334.25
3=108.30	3=334.10	23=110.30	23=335.00
4=108.35	4=333.95	24=110.35	24=334.85
5=108.50	5=329.90	25=110.50	25=329.60
6=108.55	6=329.75	26=110.55	26=329.45
7=108.70	7=330.50	27=110.70	27=330.20
8=108.75	8=330.35	28=110.75	28=330.05
9=108.90	9=329.30	29=110.90	29=330.80
10=108.95	10=329.15	30=110.95	30=330.65
11=109.10	11=331.40	31=111.10	31=331.70
12=109.15	12=331.25	32=111.15	32=331.55
13=109.30	13=332.00	33=111.30	33=332.30
14=109.35	14=331.85	34=111.35	34=332.15
15=109.50	15=332.60	35=111.50	35=332.90
16=109.55	16=332.45	36=111.55	36=332.75
17=109.70	17=333.20	37=111.70	37=333.50
18=109.75	18=333.05	38=111.75	38=333.35
19=109.90	19=333.80	39=111.90	39=331.10
20=109.95	20=333.65	40=111.95	40=330.95

:MODE

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:MODE OFF|NORMal|SLEFt|SRIGht
[:SOURce]:AVIonics:ILSLocalizer:MODE?
```

This command allows selection of a complete or partial ILS Localizer signal and can set the ILS Localizer Mode to one of the following:
OFF | NORM | SLEFt (Suppress Left) | SRIGht (Suppress Right)

***RST** OFF
Turns off all ILS Localizer signals.
When set to OFF, all ILS Localizer mode parameter settings are turned off.

Choices OFF|NORMal| SLEFt|SRIGht

Key Entry **Aux Fctn > Avionics > ILS Localizer > ILS LOC Mode > OFF | NORM | Suppress Left | Suppress Right**

:PRESet

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:PRESet
```

This command returns the ILS Localizer parameters to their *RST values.

***RST** N/A

Key Entry **Aux Fctn > Avionics > ILS Localizer > More 1 of 2 > Recall Default Settings**

:SDM

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSLocalizer:SDM <value>
[:SOURce]:AVIonics:ILSLocalizer:SDM?
```

This command sets the sum of depth of modulation (SDM):
SDM = [AM(90 Hz) + AM(150 Hz)] / 100

***RST** 40PCT

Range 0PCT–99PCT

Key Entry **Aux Fctn > Avionics > ILS Localizer > DDM/SDM > SDM <value>%**

Avionics Subsystem ILS Glide Slope—Option 302 [:SOURce]:AVIonics:ILSGslope

:DDM:DDM

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:DDM:DDM <value>
[:SOURce]:AVIonics:ILSGslope:DDM:DDM?
```

This command sets a value for the “Difference in Depth of Modulation” (DDM).

DDM is defined to be the “percentage modulation depth of the larger signal” minus the “percentage modulation depth of the smaller signal”, divided by 100.

DDM = [AM(90 Hz)% - AM(150 Hz)%] / 100

***RST** 0.0000

Range –0.99 to 0.99

Use a value that is within the range of the current SDM value.

Key Entry **Aux Fctn > Avionics > ILS Glide Slope > DDM/SDM > DDM <value> Enter**

Remarks Typically the SDM default value provides sufficient range (–0.80 to 0.80) for most applications.

If SDM is set to 99%, then the full range of DDM is available. The following demonstrates the limits of DDM’s range:

(–SDM/100) to (SDM/100)

As SDM’s value increases or decrease, so does DDM’s range.

:DDM:UAMPs

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:DDM:UAMPs <value>
[:SOURce]:AVIonics:ILSGslope:DDM:UAMPs?
```

This command sets a value for the difference in depth of modulation (DDM) in µA.

***RST** 0.0 µA

Range –848.6 to 848.6 µA

Use a value that is within the range of the current SDM value.

Key Entry **Aux Fctn > Avionics > ILS Glide Slope > DDM/SDM > DDM uA <value> Enter**

Remarks Typically the SDM default value provides sufficient range for most applications.

If SDM is set to 99%, then the full range of DDM uA is available. The following demonstrates the limits of DDM uA's range:

((–SDM/100)*(150/.175)) to ((SDM/100)*(150/.175))

As SDM's value increases or decrease, so does the range.

:DDM[:PERCent]

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:DDM[:PERCent] <value>
[:SOURce]:AVIonics:ILSGslope:DDM[:PERCent]?
```

This command sets a value for the difference in depth of modulation (DDM) in %.

***RST** 0.00%

Range –99% to 99%

Use a value that is within the range of the current SDM value.

Key Entry **Aux Fctn > Avionics > ILS Glide Slope > DDM/SDM > DDM % <value> Enter**

Remarks Typically the SDM default value provides sufficient range (–80% to 80%) for most applications.

If SDM is set to 99%, then the full range of DDM is available. The following demonstrates the limits of DDM's range:

(-SDM) to (SDM)

As SDM's value increases or decrease, so does DDM's range.

:FLY:DIRection

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:FLY:DIRection UP|DOWN
[:SOURce]:AVIonics:ILSGslope:FLY:DIRection?
```

The ILS Glide Slope enables a pilot to adjust the aircraft up or down correctly during landing.

The ILS Glide Slope provides signals that indicate whether an aircraft is above, below, or in-line with the glide path to the runway and enables a pilot to adjust the aircraft Up or Down correctly during landing.

This is the same type of information as provided by the ILS Localizer, but for the vertical reference rather than the lateral/horizontal reference; the same modulation and antenna techniques are used.

This vertical adjustment is performed using two AM tones with an AM depth of 40% operating at a carrier frequency range from 329.15 to 335.00 MHz.

For aircraft approach, the upper tone is modulated at a frequency of 90 Hz AM by default, and the lower tone is modulated at a frequency of 150 Hz AM by default.

The primary mechanism which makes it possible for a pilot to obtain guidance to a runway is the aircraft receiver's ability to detect the "Difference in Depth of Modulation (DDM)" between the 90 Hz and the 150 Hz amplitude modulation.

DDM is defined to be the "percentage modulation depth of the larger signal" minus the "percentage modulation depth of the smaller signal", divided by 100:

DDM = [AM(90 Hz)% - AM(150 Hz)%] / 100

When this formula yields a positive DDM value, the upper tone at 90 Hz is stronger; this is indicating that the aircraft is Above the ILS Glide Slope

centerline signal and would have to Fly "Down" to bring the DDM value back to zero so that the aircraft is back in-line with centerline of the runway.

When this formula yields a negative DDM value, the tone at 150 Hz is stronger; this is indicating that the aircraft is Below the ILS Glide Slope centerline signal and would have to Fly "Up" to bring the DDM value back to zero so that the aircraft is back in-line with centerline of the runway

Example:

To correct if the upper tone at 90 Hz is stronger at 0.4 DDM,

the aircraft would have to be pointed Down

```
:AVIonics:ILSGslope:FLY:DIRection DOWN
```

with a DDM of 0.4

```
:AVIonics:ILSGslope:DDM 0.4
```

Example:

To correct if the lower tone at 150 Hz is stronger at –0.4 DDM,

the aircraft would have to be pointed Up

```
:AVIonics:ILSGslope:FLY:DIRection UP
```

with a DDM of –0.4.

```
:AVIonics:ILSGslope:DDM –0.4
```

***RST**	UP
Choices	UP | DOWN
Key Entry	**Aux Fctn > Avionics > ILS Glide Slope > DDM/SDM > Fly Up | Down**

:FLY:PHASe

Supported	N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:FLY:PHASe <value>
[:SOURce]:AVIonics:ILSGslope:FLY:PHASe?
```

This command sets the phase of the Down (150 Hz) ILS Glide Slope signal relative to the Up (90 Hz) ILS Glide Slope signal.

***RST**	0.00 deg
Range	0.00 deg–360 deg
Key Entry	**Aux Fctn > Avionics > ILS Glide Slope > Up/Down Phase <value> deg**

:FREQuency:DOWN

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:FREQuency:DOWN <value>
[:SOURce]:AVIonics:ILSGslope:FREQuency:DOWN?
```

This command sets the frequency of the Down ILS Glide Slope signal.

***RST**	150 Hz
Range	0 Hz–10 MHz
Key Entry	**Aux Fctn > Avionics > ILS Glide Slope > Up/Down > Down Frequency <value> Hz | kHz | MHz | GHz**

:FREQuency:UP

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:FREQuency:UP <value>
[:SOURce]:AVIonics:ILSGslope:FREQuency:UP?
```

This command sets the frequency of the Up ILS Glide Slope signal.

***RST**	90 Hz
Range	0 Hz–6 MHz
Key Entry	**Aux Fctn > Avionics > ILS Glide Slope > Up/Down > Up Frequency <value> Hz | kHz | MHz | GHz**

:FREQuency[:CARRier]:INDex

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:FREQuency[:CARRier]:INDex <val>
[:SOURce]:AVIonics:ILSGslope:FREQuency[:CARRier]:INDex?
```

This command sets a carrier index.

***RST**	1 (334.70 MHz)
Range	1–40 (See table for index versus frequency.)
Key Entry	**Aux Fctn > Avionics > ILS Glide Slope > Carrier Freq Index > <value> Enter**
Remarks	There are forty channels that are allocated to the ILS Localizer in the range from 108.10 to 111.95 MHz; each ILS Localizer carrier has a corresponding ILS Glide

Slope carrier frequency in the range from 329.15 to 335.00 MHz.

ILS Localizer and Corresponding ILS Glide Slope Carrier Frequencies (MHz)			
ILS Localizer Index 1-20	ILS Glide Slope Index 1-20	ILS Localizer Index 21-40	ILS Glide Slope Index 21-40
1=108.10	1=334.70	21=110.10	21=334.40
2=108.15	2=334.55	22=110.15	22=334.25
3=108.30	3=334.10	23=110.30	23=335.00
4=108.35	4=333.95	24=110.35	24=334.85
5=108.50	5=329.90	25=110.50	25=329.60
6=108.55	6=329.75	26=110.55	26=329.45
7=108.70	7=330.50	27=110.70	27=330.20
8=108.75	8=330.35	28=110.75	28=330.05
9=108.90	9=329.30	29=110.90	29=330.80
10=108.95	10=329.15	30=110.95	30=330.65
11=109.10	11=331.40	31=111.10	31=331.70
12=109.15	12=331.25	32=111.15	32=331.55
13=109.30	13=332.00	33=111.30	33=332.30
14=109.35	14=331.85	34=111.35	34=332.15
15=109.50	15=332.60	35=111.50	35=332.90
16=109.55	16=332.45	36=111.55	36=332.75
17=109.70	17=333.20	37=111.70	37=333.50
18=109.75	18=333.05	38=111.75	38=333.35
19=109.90	19=333.80	39=111.90	39=331.10
20=109.95	20=333.65	40=111.95	40=330.95

:MODE

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:MODE OFF|NORMal|SUP|SDOWn
[:SOURce]:AVIonics:ILSGslope:MODE?
```

This command allows selection of a complete or partial ILS Glide Slope signal and can set the ILS Glide Slope Mode to one of the following:

OFF | NORM | SUP (Suppress Up) | SDOWn (Suppress Down).

***RST**	OFF (Default) Turns off all ILS Glide Slope signals that includes all ILS Glide Slope mode parameter settings being turned off.
Choices	OFF|NORMal|SUP|SDOWn
Key Entry	**Aux Fctn > Avionics > ILS Glide Slope > ILS GS Mode > OFF | NORM | Suppress Up | Suppress Down**

:PRESet

Supported	N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:PRESet
```

This command returns the ILS Glide Slope parameters to their *RST values.

***RST**	N/A
Key Entry	**Aux Fctn > Avionics > ILS Glide Slope > More 1 of 2 > Recall Default Settings**

:SDM

Supported	N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:ILSGslope:SDM <value>
[:SOURce]:AVIonics:ILSGslope:SDM?
```

This command sets the sum of depth of modulation (SDM):
SDM = [AM(90 Hz) + AM(150 Hz)] / 100

***RST**	80PCT
Range	0–99PCT
Key Entry	**Aux Fctn > Avionics > ILS Glide Slope > DDM/SDM > SDM <value>%**

Avioncs Subsystem Marker Beacon—Option 302 [:SOURce]:AVIonics:MBEacon

:DEPTh

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:MBEacon:DEPTh <value>
[:SOURce]:AVIonics:MBEacon:DEPTh?
```

This command sets the AM depth on the Marker Beacon carrier.

***RST** 95PCT

Range 0PCT–99.9PCT

Key Entry **Aux Fctn > Avionics > Marker Beacon > Marker Depth <value>%**

:FREQuency:INNer

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:MBEacon:FREQuency:INNer <value>
[:SOURce]:AVIonics:MBEacon:FREQuency:INNer?
```

This command sets the frequency for the Inner Marker Beacon.

***RST** 3000 Hz

Range 0 Hz–10 MHz

Key Entry **Aux Fctn > Avionics > Marker Beacon > Marker Beacon > Inner > Marker Freq > <value> Hz | kHz | MHz | GHz**

:FREQuency:MIDDle

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:MBEacon:FREQuency:MIDDle <value>
[:SOURce]:AVIonics:MBEacon:FREQuency:MIDDle?
```

This command sets the frequency for the Middle Marker Beacon.

***RST** 1300 Hz

Range 0 Hz–10 MHz

Key Entry **Aux Fctn > Avionics > Marker Beacon > Marker Beacon > Middle > Marker Freq > <value> Hz | kHz | MHz | GHz**

:FREQuency:OUTer

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:MBEacon:FREQuency:OUTer <value>
[:SOURce]:AVIonics:MBEacon:FREQuency:OUTer?
```

This command sets the frequency for the Outer Marker Beacon.

***RST** 400 Hz

Range 0 Hz–10 MHz

Key Entry **Aux Fctn > Avionics > Marker Beacon > Marker Beacon > Outer > Marker Freq > <val> Hz | kHz | MHz | GHz**

:FREQuency[:CARRier]:INDex

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:MBEacon:FREQuency[:CARRier]:INDex <val>
[:SOURce]:AVIonics:MBEacon:FREQuency[:CARRier]:INDex?
```

This command sets the carrier frequency for the three Marker Beacons: Inner, Middle, and Outer.

***RST** 17 (75.000 MHz)

Range 1–33

ILS Marker Beacon Carrier Frequencies in MHz (Index = 1 to 33)		
1=74.600	12=74.875	23=75.150
2=74.625	13=74.900	24=75.175
3=74.650	14=74.925	25=75.200
4=74.675	15=74.950	26=75.225
5=74.700	16=74.975	27=75.250
6=74.725	17=75.000	28=75.275
7=74.750	18=75.025	29=75.300
8=74.775	19=75.050	30=75.325
9=74.800	20=75.075	31=75.350
10=74.825	21=75.100	32=75.375
11=74.850	22=75.125	33=75.400

Key Entry **Aux Fctn > Avionics > Marker Beacon > Carrier Freq Index > <value> Enter**

:MODE

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:MBEacon:MODE OFF|INNer|MIDDle|OUTer
[:SOURce]:AVIonics:MBEacon:MODE?
```

This command selects a Marker Beacon Mode and can be one of the following:
OFF | INNer | MIDDle | OUTer

***RST** OFF

Range OFF | INNer | MIDDle | OUTer

Key Entry **Aux Fctn > Avionics > Marker Beacon > Marker Beacon > Off | Inner | Middle | Outer**

:PRESet

Supported N5171B/81B & N5172B/82B with Option 302

```
[:SOURce]:AVIonics:MBEacon:PRESet
```

This command returns the ILS Marker Beacon parameters to their *RST values.

***RST** N/A

Key Entry **Aux Fctn > Avionics > Marker Beacon > More 1 of 2 > Recall Default Settings**

7 Bit Error Rate Test (BERT) Commands

NOTE

For Keysight N5172B/82B X-Series signal generators with firmware version B.01.70 or later installed, before using BERT commands, ensure that the proper baseband operating mode choice is selected. For more information see ":OPERating:MODE" on page 120

This chapter describes SCPI commands used by Keysight X-Series signal generators with Option UN7.

This chapter contains the following sections:

Calculate Subsystem (:CALCulate:BERT[:BASeband])

:COMParator:MODE

Supported N5172B or N5182B with Option UN7

```
:CALCulate:BERT[:BASeband]:COMParator:MODE CEND|FHOLd
:CALCulate:BERT[:BASeband]:COMParator:MODE?
```

This command selects the pass/fail judgment mode of the comparator function.

CEND This choice selects the cycle end mode and each BER measurement result is compared with the limit value to make a pass/fail assessment at the end of a cycle.

FHOLd This choice selects the fail hold mode and only one fail judgment is allowed during that BER measurement loop. Any failed judgment after the first failure is ignored.

***RST** CEND

Key Entry	Cycle End	Fail Hold

Remarks For automated tests, the results of this command can be accessed from the rear panel BER TEST OUT pin on the AUX I/O connector. For more information about the rear panel AUX I/O connector pin configuration, refer to the **X-Series Signal Generators User's Guide**.

:COMParator:THReshold

Supported N5172B or N5182B with Option UN7

```
:CALCulate:BERT[:BASeband]:COMParator:THReshold <value>
:CALCulate:BERT[:BASeband]:COMParator:THReshold?
```

This command specifies the threshold value for the pass/fail judgment function.

The variable <value> is a decimal notation representing a percentage value.

***RST** +1.00000000E-002

Range 0.0000001–1.00

Key Entry **Pass/Fail Limits**

Remarks This command is valid only while the BER pass/fail command is active. Refer to ":COMParator[:STATe]" on page 457.

:COMParator[:STATe]

Supported N5172B or N5182B with Option UN7

```
:CALCulate:BERT[:BASeband]:COMParator[:STATe] ON|OFF|1|0
:CALCulate:BERT[:BASeband]:COMParator[:STATe]?
```

This command enables or disables the pass/fail judgment function.

***RST**	0
Key Entry	**Pass/Fail Off On**

:DISPlay:MODE:

Supported N5172B or N5182B with Option UN7

```
:CALCulate:BERT[:BASeband]:DISPlay:MODE PERCent|SCIentific
:CALCulate:BERT[:BASeband]:DISPlay:MODE?
```

This command selects the display mode for the bit error rate (BER) measurement.

PERCent	This choice reports measurement results as a percentage.
SCIentific	This choice reports measurement results in scientific notation.
***RST**	PERC
Key Entry	**BER Display % Exp**

:DISPlay:UPDate:

Supported N5172B or N5182B with Option UN7

```
:CALCulate:BERT[:BASeband]:DISPlay:UPDate CEND|CONT
:CALCulate:BERT[:BASeband]:DISPlay:UPDate?
```

This command selects the display update mode during bit error rate (BER) measurements.

CEND	This choice selects the cycle end mode and the previous BER measurement result is displayed during the current measurement cycle.
CONT	This choice selects the continuous mode and the display shows the real-time intermediate results during that BER measurement cycle.
***RST**	CONT
Key Entry	**Update Display Cycle End Cont**

Data Subsystem (:DATA)

:BERT:AUXout

Supported N5172B or N5182B with Option UN7

```
:DATA:BERT[:BASeband]:AUXout ERRor|REFerence|PN9
:DATA:BERT[:BASeband]:AUXout?
```

This command selects a pre-defined output signal configuration for pins on the AUX I/O rear panel connector. Refer to Table 7-1 for the output pin configuration and signal type.

ERRor This choice selects the bit error rate (BER) information output.

REFerence This choice selects the reference information output.

PN9 This choice selects a pseudo-random data output.

Table 7-1 AUX I/O pin configurations

Pin#	ERRor	REFerence	PN9
15	BER Meas End	BER Data Out	PN9 Data Out
16	BER Sync Loss	Sync Start	No signal
17	BER Test Out	BER Clock Out	PN9 Clock Out
18	BER Error Out	BER Error Out	BER Error Out
19	BER No Data	Reference Data	No signal

BER Meas End A signal at this pin indicates the status of the bit error rate (BER) measurements. BER measurements are being executed when the signal is high.

BER Sync loss A low signal at this pin indicates that the synchronization is lost. This signal is valid only when the signal at the BER Meas End pin is high.

BER Test Out A signal at this pin indicates the test result of the bit error rate measurements. The result is guaranteed at the falling edge of the BER Meas End signal. The result is pass when the signal is low; the result is fail when the signal is high. The signal is also high when the pass/fail judgment is set to off.

BER Error Out A signal at this pin indicates the number of the error bits. The output is normally low. One pulse signal (pulse width matches the input clock) indicates one error bit. Pulses for the error bits of one measurement cycle are

	not synchronized with the rear panel connector BER CLK IN signal and are output when the BER Meas End signal is high.
BER No Data	A low signal at this pin indicates the no data status. The no data status is reported when there has been no clock inputs for more than 3 seconds or there has been no data change for more than 200 bits. This signal is valid only when the signal of the BER Meas End output signal is high.
BER Clock Out	The BER Clock Out signal monitors the rear panel BER CLK IN signal after polarity control, delay control, and gate control (if applicable) have taken place.
BER Data Out	This is a data stream for the bit error rate measurements. The clock signal is used to trigger the reading of the data.
Sync Start	This signal indicates the timing when the PN generator starts to generate a PN sequence. This signal can also indicate if the hardware is triggering a PN synchronization or making a measurement when the signal is high.
PN9 Clock Out	This signal is the clock signal for the PN9 Data. The falling edge of the PN9 Clock indicates the center of PN9 Data. The PN9 Clock rate is 37.5Mbits per second.
PN9 Data Out	This signal is PN9 data for the self-loopback test.
Reference Data	This signal uses the pseudo-random bit stream as the reference signal.
***RST**	ERRor

Key Entry	**Error Out**	**Reference Out**	**PN9 Out**

:BERT[:BASeband][:DATA]

Supported N5172B or N5182B with Option UN7

```
:DATA:BERT[:BASeband][:DATA]?
BEC|BITC|BER|ALL|TBEC|TBIT|TBER|JUDGe
```

This query returns the data measurement for the selected variable.

BEC	This choice provides the intermediate bit error count result.
BITC	This choice provides the intermediate bit count result.
BER	This choice provides the intermediate bit error rate result.

ALL	This choice provides the values of the bit error count, bit error rate, and bit count in the following format: <bit count>, <error count>, <bit error rate>
TBEC	This choice provides the total bit error count at the end of each cycle.
TBIT	This choice provides the total bit count at the end of each cycle.
TBER	This choice provides the total bit error rate at the end of each cycle.
JUDGe	This choice provides the pass or fail string.

Input Subsystem (:INPut:BERT[: BASeband])

:CGATe:DELay:CLOCk

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CGATe:DELay:CLOCk <value>
:INPut:BERT[:BASeband]:CGATe:DELay:CLOCk?
```

This command sets the number of delay bits for the signal applied to the BER GATE IN rear panel connector.

One bit corresponds with one bit of delay for the input clock.

***RST**	1
Range	1–16384
Key Entry	**Gate Clk Delay**
Remarks	The gate delay mode must be set to CLOCk for this command to work. Refer to ":CGATe:DELay:MODE". Also, the gate and gate delay must be enabled for this command to work. Refer to ":CGATe[:STATe]" on page 463 and ":CGATe:DELay[:STATe]" on page 462.

:CGATe:DELay:MODE

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CGATe:DELay:MODE TIME|CLOCk
:INPut:BERT[:BASeband]:CGATe:DELay:MODE:?
```

This command selects the operating mode of the gate delay.

TIME	This choice selects the time mode which makes it possible to set the gate time delay in absolute time and the resolution.
CLOCk	This choice selects the clock mode which enables you to set the gate delay by a set number of bits.
***RST**	TIME
Key Entry	**Gate Mode Time Clk**
Remarks	The gate state and gate delay state must be enabled for this command to work. Refer to ":CGATe[:STATe]" on page 463 and ":CGATe:DELay[:STATe]" on page 462.

:CGATe:DELay:TIME

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CGATe:DELay:TIME <value><unit>
:INPut:BERT[:BASeband]:CGATe:DELay:TIME?
```

This command sets the delay time of the gate signal. The gate delay time must be the multiple of the minimum resolution value and if not, the delay resolution is automatically rounded to the nearest multiplied value of the gate time delay value.

The variable <value> is expressed in units of seconds (s), milliseconds (ms), microseconds (μs), and nanoseconds (ns).

***RST**	+2.67000000E–008
Range	2.67 ns–1.0 s
Key Entry	**Gate Time Delay**
Remarks	**Gate Delay Off On** must be set to **On** and **Gate Mode Time Clk** set to **Time** for this command to work. Refer to ":CGATe:DELay[:STATe]" on page 462 and ":CGATe:DELay:MODE" on page 461.
	To set the resolution, refer to ":CLOCk:DELAy:RESolution" on page 463.

:CGATe:DELay[:STATe]

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CGATe:DELay[:STATe] ON|OFF|1|0
:INPut:BERT[:BASeband]:CGATe:DELay[:STATe]?
```

This command enables or disables the operating state of the gate delay.

ON	This choice enables the gate delay adjustment function.
OFF	This choice disables the gate delay adjustment function.
***RST**	0
Key Entry	**Gate Delay Off On**
Remarks	The gate must be enabled for this command to work. To enable the gate, refer to ":CGATe[:STATe]" on page 463.

:CGATe:POLarity

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CGATe:POLarity POSitive|NEGative
:INPut:BERT[:BASeband]:CGATe:POLarity?
```

This command sets the input polarity of the gate signal supplied to the BER GATE IN rear panel connector.

POS	With this choice, the signal is valid when the gate signal is high.
NEG	With this choice, the signal is valid when the gate signal is low.
***RST**	POS
Key Entry	**Gate Polarity Neg Pos**

:CGATe[:STATe]

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CGATe[:STATe] ON|OFF|1|0
:INPut:BERT[:BASeband]:CGATe[:STATe]?
```

This command sets the operating state of the clock gate function.

ON	This choice enables the clock gate function.
OFF	This choice disables the clock gate function.
***RST**	0
Key Entry	**Gate Off On**

:CLOCk:DELAy:RESolution

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CLOCk:DELay:RESolution <value><unit>
:INPut:BERT[:BASeband]:CLOCk:DELay:RESolution?
```

This command sets the resolution of the clock delay. The minimum resolution is 5 ns and it corresponds to 1/200 MHz. The 200 MHz is the DAC clock for the C2 board. The input value must be a multiple of the minimum resolution. If the set value is not a multiple value, the delay resolution is automatically rounded to the nearest multiple value with reference to the set value.

***RST**	+1.00000000E–008
Range	5ns–80µs
Key Entry	**Resolution**
Remarks	The clock delay or the gate delay must be enabled for this command to work. Refer to ":CLOCk:DELAy[:STATe]" on page 464 and ":CGATe:DELay[:STATe]" on page 462. A change in the resolution value can affect both the clock and the gate delay time automatically.

:CLOCk:DELAy:TIME

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CLOCk:DELay:TIME <value><unit>
:INPut:BERT[:BASeband]:CLOCk:DELay:TIME?
```

This command sets the clock signal delay time.

The variable <value> is expressed in units of seconds (s), milliseconds (ms), microseconds (μs), and nanoseconds (ns).

***RST**	+2.67000000E–008
Range	26.7ns–999.9967600ms
Key Entry	**Clock Time Delay**
Remarks	The clock delay must be enabled for this command to work. Refer to ":CLOCk:DELAy[:STATe]" on page 464.

:CLOCk:DELAy[:STATe]

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CLOCk:DELay[:STATe] ON|OFF|1|0
:INPut:BERT[:BASeband]:CLOCk:DELay[:STATe]?
```

This command sets the operating state of the clock delay function.

ON	This choice enables the clock delay adjustment.
OFF	This choice disables the clock delay adjustment.
***RST**	0
Key Entry	**Clock Delay Off On**

:CLOCk:POLarity

Supported N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:CLOCk:POLarity POSitive|NEGative
:INPut:BERT[:BASeband]:CLOCk:POLarity?
```

This command sets the input polarity of the clock signal supplied to the BER CLK IN rear panel connector.

POS	With this choice, the signal is valid when the clock signal is high.
NEG	With this choice, the signal is valid when the clock signal is low.
***RST**	POS
Key Entry	**Clock Polarity Neg Pos**

:DATA:POLarity

Supported	N5172B or N5182B with Option UN7

```
:INPut:BERT[:BASeband]:DATA:POLarity POSitive|NEGative
:INPut:BERT[:BASeband]:DATA:POLarity?
```

This command sets the input polarity of the data signal supplied to the BER DATA IN rear panel connector.

POS	With this choice, the signal is valid when the data signal is high.
NEG	With this choice, the signal is valid when the data signal is low.
***RST**	POS
Key Entry	**Data Polarity Neg Pos**

Route Subsystem (:ROUTe:LINE:BERT)

:CLOCk:BNC:SOURce

Supported N5172B or N5182B with Option UN7

```
:ROUTe:LINE:BERT:CLOCk:BNC:SOURce BBTRigger[1]|NONE
:ROUTe:LINE:BERT:CLOCk:BNC:SOURce?
```

This command sets the BERT clock source to the BBTRIG 1 rear panel BNC or None.

***RST** None

Key Entry **Clock BNC None BBTrig 1**

Remarks When BERT is enabled (On), the clock source is automatically set to BBTRIG 1. Routing the BNC connectors in other modes can change this setting. (For example, routing a Marker to BBTRIG 1 will turn off the BERT functionality for this connector.) Use this command to re-enable the BERT clock source. Refer to the **X-Series Signal Generators User's Guide** for rear panel connector configurations.

:DATA:BNC:SOURce

Supported N5172B or N5182B with Option UN7

```
:ROUTe:LINE:BERT:DATA:BNC:SOURce EVENt[1]|NONE
:ROUTe:LINE:BERT:DATA:BNC:SOURce?
```

This command sets the BERT data source to the EVENT 1 rear panel BNC or None.

***RST** None

Key Entry **Data BNC None Event 1**

Remarks When BERT is enabled (On), the data source is automatically set to EVENT 1. Routing the BNC connectors in other modes can change this setting. (For example, routing a Marker to EVENT 1 will turn off the BERT functionality for this connector.) Use this command to re-enable the BERT data source. Refer to the **X-Series Signal Generators User's Guide** for rear panel connector configurations.

:GATE:BNC:SOURce

Supported N5172B or N5182B with Option UN7

```
:ROUTe:LINE:BERT:GATE:BNC:SOURce BBTRigger[2]|NONE
:ROUTe:LINE:BERT:GATE:BNC:SOURce?
```

This command sets the BERT gate source to the BBTRIG 2 rear panel BNC or NONE.

***RST**	None
Key Entry	**Gate BNC None BBTrig 2**
Remarks	When BERT Gate Control is enabled (On), the gate source is automatically set to BBTRIG 2. Routing the BNC connectors in other modes can change this setting. (For example, routing a Marker to BBTRIG 2 will turn off the BERT functionality for this connector.) Use this command to re-enable the BERT gate source. Refer to the **X-Series Signal Generators User's Guide** for rear panel connector configurations.

Sense Subsystem (:SENSe:BERT[:BASeband])

:PRBS:FUNCtion:SPIGnore:DATA

Supported	N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:PRBS:FUNCtion:SPIGnore:DATA
ALL_0|ALL_1
:SENSe:BERT[:BASeband]:PRBS:FUNCtion:SPIGnore:DATA?
```

This command selects the bit parameter of the special pattern ignore function.

ALL_0	This choice ignores a bit pattern of 160 or more consecutive 0’s.
ALL_1	This choice ignores a bit pattern of 160 or more consecutive 1’s.
***RST**	ALL_0
Key Entry	**Spcl Pattern 0’s 1’s**
Remarks	This command is valid only when the special pattern ignore function is enabled (On). Refer to “:PRBS:FUNCtion:SPIGnore[:STATe]”. The special pattern of 160 or more 1’s or 0’s can appear at any position in the bit stream.

:PRBS:FUNCtion:SPIGnore[:STATe]

Supported	N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:PRBS:FUNCtion:SPIGnore[:STATe]
ON|OFF|1|0
:SENSe:BERT[:BASeband]:PRBS:FUNCtion:SPIGnore[:STATe]?
```

This command enables (1) or disables (0) the special pattern ignore function. The special pattern ignore function enables the BER to neglect the consecutive 0's or 1's pattern data.

ON	This choice detects 160 or more consecutive bits of 0’s or 1’s in the incoming bit stream and ignores these bits when making BER measurements. To select 0’s or 1’s refer to “:PRBS:FUNCtion:SPIGnore:DATA”
OFF	This choice disables the special pattern ignore mode for the BER measurement.
***RST**	0
Key Entry	**Spcl Pattern Ignore Off On**
Remarks	This command is valid only when 2 Mbps mode is selected for the maximum data rate, and when the special pattern ignore function is enabled (On). Refer to

“:PRBS:FUNCtion:SPIGnore[:STATe]”. The special pattern of 160 or more 1’s or 0’s can appear at any position in the bit stream.

:PRBS[:DATA]

Supported N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:PRBS[:DATA] PN9|PN11|PN15|PN20|PN23
:SENSe:BERT[:BASeband]:PRBS[:DATA]?
```

This command selects the incoming data pattern for making BER measurements.

PN9–PN23	These choices select an internally generated pseudo-random pattern for BER measurements.
***RST**	PN9

Key Entry	PN9	PN11	PN15	PN20	PN23

:RSYNc:THReshold

Supported N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:RSYNc:THReshold <value>
:SENSe:BERT[:BASeband]:RSYNc:THReshold?
```

This command specifies the threshold level for the resynchronizing function.

***RST**	0.40
Range	0.05–0.40
Key Entry	**Resync Limits**
Remarks	This command is valid only when the BERT resynchronizing function is on. Refer to “:RSYNc[:STATe]” on page 469.

:RSYNc[:STATe]

Supported N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:RSYNc[:STATe] ON|OFF|1|0
:SENSe:BERT[:BASeband]:RSYNc[:STATe]?
```

This command sets the operating state of the resynchronization function.

ON	This choice enables the resynchronization function.
OFF	This choice disables the resynchronization function.
***RST**	1
Key Entry	**BERT Resync Off On**

:STATe

Supported	N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:STATe ON|OFF|1|0
:SENSe:BERT[:BASeband]:STATe?
```

This command sets the operating state of the bit error rate test (BERT) measurement.

ON	This choice enables the BERT measurement.
OFF	This choice disables the BERT measurement.
***RST**	0
Key Entry	**BERT Off On**

:STOP:CRITeria:EBIT

Supported	N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:STOP:CRITeria:EBIT <value>
:SENSe:BERT[:BASeband]:STOP:CRITeria:EBIT?
```

This command specifies the threshold limit to stop the measurement.

***RST**	100
Range	0–1000000000
Key Entry	**Error Count**
Remarks	When the stop mode criteria is set to EBIT, the signal generator monitors the error bits and when it exceeds the set value, the signal generator stops the current BER measurement and waits for the next trigger. EBIT must be the selection for this command to work. To select EBIT refer to ":STOP:CRITeria[:SELect]".

:STOP:CRITeria[:SELect]

Supported	N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:STOP:CRITeria[:SELect] EBIT|NONE
:SENSe:BERT[:BASeband]:STOP:CRITeria[:SELect]?
```

This command determines which threshold criteria is used to prematurely stop the measurement.

EBIT	This choice enables a specified number of bit errors to prematurely stop the measurement.
NONE	This choice disables the stop measurement threshold criteria function.

***RST**	NONE

Key Entry **Error Count** **No Thresholds**

Remarks	The measurement will terminate no later than 200 ms after the threshold is exceeded.

:TBITs

Supported	N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:TBITs <value>
:SENSe:BERT[:BASeband]:TBITs?
```

This command specifies the total bit count to be measured in one measurement cycle.

***RST**	+10000
Range	100–4294967295
Key Entry	**Total Bits**

:TRIGger:BDELay

Supported	N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:TRIGger:BDELay <value>
:SENSe:BERT[:BASeband]:TRIGger:BDELay?
```

This command specifies the number of bits to delay the trigger signal.

***RST**	0
Range	0–65535
Key Entry	**Delay Bits**
Remarks	This command is valid only when the trigger bit delay function is on. Refer to ":TRIGger:BDELay:STATe".

:TRIGger:BDELay:STATe

Supported	N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:TRIGger:BDELay:STATe ON|OFF|1|0
:SENSe:BERT[:BASeband]:TRIGger:BDELay:STATe?
```

This command sets the operating state of the trigger delay function.

ON	This choice enables the trigger delay function.
OFF	This choice disables the trigger delay function.
***RST**	0
Key Entry	**Bit Delay Off On**

Remarks This command needs to be set to ON before the number of bits for the trigger delay can be set. Refer to “:TRIGger:BDELay”.

:TRIGger:COUNt

Supported N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:TRIGger:COUNt <value>
:SENSe:BERT[:BASeband]:TRIGger:COUNt?
```

This command sets the number of times the bit error rate test (BERT) measurements will repeat.

***RST**	1
Range	0–65535
Key Entry	**Cycle Count**
Remarks	With 0 set, the BER measurements are repeated until you set the BERT operating state is set to off. Refer to “:STATe” on page 470.

:TRIGger:EXTernal[:SOURce]

Supported N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:TRIGger:EXTernal[:SOURce]
TRIGger[1]|TRIGger[2]|PULSe
:SENSe:BERT[:BASeband]:TRIGger:EXTernal[:SOURce]?
```

This command selects the external trigger source.

Trigger 1	This choice allows you to trigger the BER measurement with the rear panel TRIG 1 connector.
Trigger 2	This choice allows you to trigger the BER measurement with the rear panel TRIG 2 connector.
Pulse	This choice allows you to trigger the BER measurement with the rear panel PULSE connector.
***RST**	Trigger 1
Key Entry	**BERT Trigger EXT Trigger 1 Trigger 2 Pulse**

:TRIGger:POLarity

Supported N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:TRIGger:POLarity POSitive|NEGative
:SENSe:BERT[:BASeband]:TRIGger:POLarity?
```

This command selects the polarity of the trigger signal.

POSitive	This choice triggers on the rising edge of the input data signal.
NEGative	This choice triggers on the falling edge of the input data signal.
***RST**	POS
Key Entry	**Aux I/O Trigger Polarity Pos Neg**
Key Entry	**Aux I/O Trigger Polarity Pos Neg**

:TRIGger[:SOURce]

Supported N5172B or N5182B with Option UN7

```
:SENSe:BERT[:BASeband]:TRIGger[:SOURce]
IMMediate|KEY|EXT|BUS|AUX
:SENSe:BERT[:BASeband]:TRIGger[:SOURce]?
```

This command selects the triggering type for starting the bit error rate test (BERT) measurements.

IMMediate	This choice begins the measurement directly after synchronization has been achieved.
KEY	This choice begins the measurement when the front panel **Trigger** key is pressed, provided that synchronization has been achieved. If synchronization has not occurred, the trigger is ignored.
EXT	This choice begins the measurement as soon as a trigger signal is applied to the rear panel connector provided that synchronization has been achieved. If synchronization has not occurred, the trigger is ignored.
BUS	This choice enables GPIB triggering using the `*TRG` or `GET` command or LAN and RS-232 triggering using the `*TRG` command.
AUX	This choice triggers an event using the rear panel AUX I/O connector pin #19. Refer to the **X-Series Signal Generators User's Guide**.
***RST**	KEY

Key Entry	**Immediate**	**Trigger Key**	**Ext**	**Bus**	**Aux I/O**

8 Digital Signal Interface Module Commands

NOTE

For Keysight N5172B/82B X-Series signal generators with firmware version B.01.70 or later installed, before using the Keysight N5102A Digital Signal Interface Module commands, ensure that the proper baseband operating mode choice is selected. For more information see ":OPERating:MODE" on page 120

This chapter describes SCPI commands used by Keysight X-Series signal generators with Option 003, or 004, or both along with the N5102A module.

This chapter contains the following sections:

KEYSIGHT TECHNOLOGIES

Digital Subsystem—Option 003 and 004 ([:SOURce])

:DIGital:CLOCk:CPS 1|2|4

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:CLOCk:CPS 1|2|4
:DIGital:CLOCk:CPS?
```

This command selects the number of clock cycles per sample. The command is used with parallel or parallel interleaved port configurations. If this command is executed with a serial port configuration or an IF signal type, the parameter value is changed, but it is not used by the interface module until the port configuration is changed to parallel or parallel interleaved, **and** the signal type is changed to IQ.

The query returns the currently set value. Regardless of the port configuration, you must query all four states (clocks per sample, port configuration, data direction, and signal type) to know the interface module's current setup.

Example

:DIG:CLOC:CPS 2

The preceding example sets two clock cycles for each sample.

***RST**	1
Range	1, 2, or 4
Key Entry	**Clocks Per Sample**

:DIGital:CLOCk:PHASe

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:CLOCk:PHASe <value>
:DIGital:CLOCk:PHASe?
```

This command sets the phase for the clock relative to the leading edge transition of the data. At 0 degrees the clock and leading edge of the data signal are aligned. Any phase value between 0 and 360 degrees can be used in the command, however, the signal generator rounds up or down to get 90, 180, 270 and 0 degree settings. For example, entering 140 degrees will cause the signal generator to use the 180 degree setting.

If this command is executed when the clock rate is less than 10 MHz or greater than 200 MHz, the resolution changes to 180 degrees, and the maximum phase defaults to 180 degrees.

Example

:DIG:CLOC:PHAS 90DEG

The preceding example sets the clock phase to 90 degrees. The clock signal leading edge transition will be delayed by 1/4 of a clock period relative to the leading edge data transition.

***RST**	+0.00000000E+000
Range	0 – 360 deg
Key Entry	**Clock Phase**

:DIGital:CLOCk:POLarity

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:CLOCk:POLarity POSitive|NEGative
:DIGital:CLOCk:POLarity?
```

This command sets the alignment for the clock signal to positive or negative. Positive selects the leading edge transition of the clock signal to align with the leading edge data transition and negative selects the falling edge transition of the clock signal to align with the leading edge of the data.

Example

:DIG:CLOC:POL NEG

The preceding example sets the clock falling edge transition to align with the leading edge data transition.

***RST**	POS
Key Entry	**Clock Polarity**

:DIGital:CLOCk:RATE

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:CLOCk:RATE <value>
:DIGital:CLOCk:RATE?
```

This command sets the clock rate. If an external clock is used, the rate set with this command must match the external clock rate. Only clock phase settings of 0 or 180 degrees are valid for a clock rate setting below 10 MHz. The variable <value> is a expressed in hertz.

Example

:DIG:CLOC:RATE 100MHZ

The preceding example sets the clock rate to 100 megahertz.

***RST**	+1.00000000E+008
Range	1 kHz–200 MHz
Key Entry	**Clock Rate**

:DIGital:CLOCk:REFerence:FREQuency

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:CLOCk:REFerence:FREQuency <freq>
:DIGital:CLOCk:REFerence:FREQuency?
```

This command allows you to specify the frequency of the external reference supplied to the Freq Ref connector. This command is valid only when the clock source is set to internal.

If this command is executed when the clock source is not set to internal, the parameter value is changed, but it is not used by the signal generator until the clock source is changed to internal.

Because a query returns the currently set value, regardless of the clock source, you must query both states (reference frequency and clock source) to know the signal generator's current setup.

Example

:DIG:CLOC:REF:FREQ 50MHZ

The preceding example specifies a 50 megahertz external reference frequency.

***RST**	+1.00000000E+007
Range	1 MHz–100 MHz
Key Entry	**Reference Frequency**

:DIGital:CLOCk:SKEW

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:CLOCk:SKEW <value>
:DIGital:CLOCk:SKEW?
```

This command sets the clock signal skew value. The skew is a fine-tune adjustment for the course tune clock phase function and helps to align the clock with valid data states. This is useful at high clock rates and available only for clock frequencies above 10 megahertz. The variable <value> is a expressed in nanoseconds.

Example

:DIG:CLOC:SKEW 2NS

The preceding example sets the clock skew to 2 nanoseconds.

***RST**	+0.00000000E+000
Range	–5ns to 5ns
Key Entry	**Clock Skew**

:DIGital:CLOCk:SOURce

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:CLOCk:SOURCe INTernal|EXTernal|DEVice
:DIG:CLOC:SOURCe?
```

This command selects one of three possible clock sources.

Example

:DIG:CLOC:SOUR DEV

The preceding example uses the “Device Interface Connector” input clock.

***RST** INT

Key Entry **Clock Source**

:DIGital:DATA:ALIGnment

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:ALIGnment MSB|LSB
:DIGital:DATA:ALIGment?
```

This command selects the bit alignment for a word less than 16 bits in length. The MSB (most significant bit) selection maintains the MSB of the word on the same data line while the LSB (least significant bit) will move depending on the word size. The opposite effect occurs when the alignment is set to LSB.

Example

:DIG:DATA:ALIG MSB

The preceding example sets the MSB word format.

***RST** LSB

Key Entry **Word Alignment**

:DIGital:DATA:BORDer

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:BORDer MSB|LSB
:DIGital:DATA:BORDer?
```

This command selects the bit order for data transmitted through the N5102A module. Data can be in least significant (LSB) bit first or most significant (MSB) bit first.

Example

:DIG:DATA:BORD MSB

The preceding example specifies data in MSB first format.

***RST**	LSB
Key Entry	**Bit Order**

:DIGital:DATA:DIRection

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:DIRection OUTPut|INPut
:DIGital:DATA:DIRection?
```

This command selects an input or output direction for data flow through the N5102A module.

Example

:DIG:DATA:DIR INP

The preceding example selects input as the direction of data flow.

***RST**	OUTP (unless only Option 004 is installed)
Key Entry	**Direction**

:DIGital:DATA:INEGate

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:INEGate OFF|ON|0|1
:DIGital:DATA:INEGate?
```

This command enables or disables the negation of the I data sample. Negation changes the sample by expressing it in two's complement form, multiplying by negative one, and converting back to the selected numeric format. This can be done for I samples, Q samples, or both.

The sample or word represents a quantized analog voltage level. This analog voltage can be added or multiplied. For a 16-bit sample, the range is from 0 to 65535 in offset binary or -32768 to +32767 in 2’s complement mode.

Example

:DIG:DATA:INEG ON

The preceding example enables negation of the I data.

***RST**	0
Key Entry	**Negate I** Data

:DIGital:DATA:INPut:ATTen:AUTO

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:ATTen:AUTO ON|OFF|1|0
:DIGital:DATA:INPut:ATTen:AUTO?
:DIGital:DATA:INPut:ATTen <value><unit>
:DIGital:DATA:INPut:ATTen?
```

This command selects Manual mode or Auto mode for the DSIM input attenuation.

When Auto mode is selected, the signal generator automatically optimizes the attenuation for the current conditions. When the Manual mode is selected, attenuation is the active function. The value entered sets the attenuation.

Example

:DIG:DATA:INP:ATT: 20

The preceding example sets the DSIM input attenuation to 20 dB.

***RST**	Auto
Range	0.00 to 50.00
Key Entry	Input Atten

:DIGital:DATA:INPut:ATTen:LEVel

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:ATTen:MODE DEFault|MANual
:DIGital:DATA:INPut:ATTen:MODE?
:DIGital:DATA:INPut:ATTen:LEVel <unit>
:DIGital:DATA:INPut:ATTen:LEVel?
```

This command specifies the expected value of the IQ input signal.

Example

:DIG:DATA:INP:ATT:LEV 100MV

The preceding example sets the input attenuation to 100 mV.

***RST**	Default
Range	50.0 to 1.000 V
Key Entry	Input Atten Level

:DIGital:DATA:INPut:BASeband:FREQuency:OFFSet

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:BASeband:FREQuency:OFFSet <value><unit>
:DIGital:DATA:INPut:BASeband:FREQuency:OFFSet?
```

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed–through is not in the center.

Keysight X-Series vector signal generators provide automatic DAC over–range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by 1/square root of 2.

NOTE

When setting Baseband Frequency Offset to a non-zero value and then back to a 0 value, the waveform will be at a random phase (and scaled down to avoid DAC over range). The Baseband Frequency Offset Phase Reset must be used to truly restore to a pre-frequency offset setup.

Also note that when using Baseband Frequency Offset to shift part of a signal outside of the flat bandwidth, DAC overrange errors may occur.

Example

:DIG:DATA:INP:BAS:FREQ:OFFS 10HZ

The preceding example sets the baseband frequency offset to 10 Hz.

***RST**	+0.00000000E+000
Range	+8.0E7 to –8.0E7 Hz
Key Entry	Baseband Frequency Offset

:DIGital:DATA:INPut:BASeband:FREQuency:OFFSet:PHASe:RESet

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:BASeband:FREQuency:OFFSet:PHASe:RESet
```

This command clears the phase accumulation resulting in a phase shift of zero.

When the Baseband Frequency Offset is non–zero, the hardware rotator accumulates phase–shift of the baseband signal. This residual phase remains even after the offset value is returned to zero.
While there is a non–zero residual phase present in the signal, the DAC Over–Range Protection feature will automatically prevent DAC overrange errors from occurring by scaling the signal down by 1/square root of 2.

Key Entry	Baseband Frequency Offset Phase Reset

:DIGital:DATA:INPut:FILTer:ALPHa

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:FILTer:ALPHa <value>
:DIGital:DATA:INPut:FILTer:ALPHa?
```

This command changes the Nyquist or root Nyquist filter’s alpha value.

The filter alpha value can be set to a minimum level (0), a maximum level (1), or in between by using fractional numeric values (0.001–0.999).

Example

:DIG:DATA:INP:FILT:ALPH 1

The preceding example sets the filter alpha value to the maximum value of 1.

***RST**	0.500
Range	0.000 to 1.000
Key Entry	Filter Alpha

:DIGital:DATA:INPut:FILTer:BBT

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:FILTer:BBT <value>
:DIGital:DATA:INPut:FILTer:BBT?
```

This command changes the bandwidth-multiplied-by-bit-time (BbT) filter parameter of the selected Gaussian filter.

The filter BbT value can be set to the maximum level (1) or in between the minimum level (0.100) and maximum level by using fractional numeric values (0.101–0.999).

Example

:DIG:DATA:INP:INP:FILT:BBT 1

The preceding example sets the filter BbT value to the maximum value of 1.

***RST**	0.500
Range	0.000 to 1.000
Key Entry	Filter Alpha

:DIGital:DATA:INPut:FILTer

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:FILTer
RNYQuist|NYQuist|GAUSsian|IS95|IS95_EQ|IS95_MOD|IS95_MOD_EQ|
"<User
FIR>"|WCDMA|RECTangle|EDGE|EDGE_Wide|EDGE_HSR|APCO_25_C4FM
:DIGital:DATA:INPut:FILTer?
```

This command selects the pre-modulation filter type.

RNYQuist	This choice selects a Root Nyquist (root raised cosine) filter. This filter is adjusted using Alpha.
NYQuist	This choice selects a Nyquist (raised cosine) filter. This filter is adjusted using Alpha.
GAUSsian	This choice selects a Gaussian filter which is adjusted using Bbt values.
IS95	This choice selects a filter that meets the criteria of the IS-95 standard.
IS95_EQ	This choice selects a filter which is a combination of the IS-95 filter (above) and the equalizer filter described in the IS-95 standard. This filter is only used for IS-95 baseband filtering.
IS95_MOD	This choice selects a filter that meets the criteria of the IS-95 error function (for improved adjacent channel performance) with lower passband rejection than the filter specified in the IS-95 standard.
IS95_MOD_EQ	This choice selects a filter which is a combination of the equalizer filter described in the IS-95 standard and a filter that meets the criteria of the IS-95 error function (for improved adjacent channel performance), with lower passband rejection.
"<user FIR>"	This variable is any filter file that you have stored into memory. Refer to “File Name Variables” on page 43 for information on the file name syntax.
WCDMA	This choice selects the W-CDMA filter, which is the equivalent of a root Nyquist filter with an Alpha value of 0.22.
Rectangle	This choice selects a one-symbol-wide rectangular filter.
EDGE	This choice selects a linearized Gaussian filter as defined in GSM 05.04.
EDGE_Wide	This choice selects an EDGE spectrally wide pulse shape filter as per 3GPP TS 45.004.

EDGE_HSR	This choice selects an EDGE high symbol rate spectrally narrow pulse shape filter as per 3GPP TS 45.004
APCO_25_C4FM	This choice selects a predefined Nyquist filter with alpha of 0.2 combined with a shaping filter. This satisfies the requirements of ITIA/EIA 102.BAAA Sec-9 for the APCO-25 Common Air Interface.

Example

:DIG:DATA:INP:FILT Nyquist

The preceding example selects the Nyquist filter.

***RST** RNYQ

Key Entry **Root Nyquist** **Nyquist** **Gaussian** **IS-95**

IS-95 w/EQ **IS-95 Mod** IS-95 Mod w/EQ

User FIR **WCDMA** **Rectangle** **EDGE**

EDGE Wide **EDGE HSR** **APCO 25 C4FM**

:DIGital:DATA:INPut:FILTer:CHANnel

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:FILTer:CHANnel EVM|ACP
:DIGital:DATA:INPut:FILTer:CHANnel?
```

This command optimizes the Nyquist and root Nyquist filters to minimize error vector magnitude (EVM) or to minimize adjacent channel power (ACP).

EVM This choice provides the most ideal passband.

ACP This choice improves stopband rejection.

Example

:DIG:DATA:INP:FILT:CHAN EVM

The preceding example selects error vector magnitude.

***RST** EVM

Key Entry Optimize FIR for EVM

:DIGital:DATA:INPut:IQ:SCALe

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:IQ:SCALe <value>
:DIGital:DATA:INPut:IQ:SCALe?
```

This command sets the amplitude of the I/Q outputs for better adjacent channel power (ACP); lower scaling values equate to better ACP.

The variable <value> is expressed in units of percent.

Example

:DIG:DATA:INP:IQ:SCAL 30

The preceding example sets the amplitude of the I/Q outputs to 30%.

***RST**	100
Range	1 to 100
Key Entry	I/Q Scaling

:DIGital:DATA:INPut:MDEStination:AAMPlitude

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:MDEStination:AAMPlitude NONE|M1
:DIGital:DATA:INPut:MDEStination:AAMPlitude?
```

This command opens a menu in which you can select a marker to select the alternate amplitude functionality.

Further setups need to be done in the Amplitude > Alternate Amplitude menu to use the functionality.

Example

:DIGital:DATA:INPut:MDES:AAMP M1

The preceding example routes marker 1 to Alternate Amplitude.

***RST**	None
Key Entry	Alternate Amplitude

:DIGital:DATA:INPut:MDEStination:ALCHold

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:MDEStination:ALCHold NONE|M1
:DIGital:DATA:INPut:MDEStination:ALCHold?
```

Opens a menu in which you can select a marker to enable the automatic leveling control (ALC) hold function (or select None to disable the hold feature). The hold selection remains until you reconfigure it, press the Preset key, or cycle the signal generator power.

CAUTION Incorrect ALC settings can cause a sudden unleveled condition to occur. An unleveled RF output can damage a DUT or connected instrument. Ensure that you set markers such that the ALC obtains a sample that accounts for the high power levels within the signal.

Example

:DIGital:DATA:INPut:MDES:ALCH M1

The preceding example routes marker 1 to ALC Hold.

***RST**	None
Key Entry	ALC Hold

:DIGital:DATA:INPut:MDEStination:PULSe

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:MDEStination:PULSe NONE|M1
:DIGital:DATA:INPut:MDEStination:PULSe?
```

Opens a menu in which you can select a marker for the Pulse/RF blanking function.

ALC Hold is automatically enabled during RF output blanking.

Example

:DIGital:DATA:INPut:MDES:PULS M1

The preceding example routes marker 1 to Pulse.

***RST**	None
Key Entry	Pulse/RF Blank

:DIGital:DATA:INPut:MPOLarity:MARKer1

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:MPOLarity:MARKer1 NORMal|INVerted
:DIGital:DATA:INPut:MPOLarity:MARKer1?
```

Selects whether marker 1 polarity is inverted or not.

Example

:DIG:DATA:INP:MPOL:MARK NORM

The preceding example sets the marker 1 polarity as not inverted.

***RST**	Normal
Key Entry	Marker 1 Polarity Normal/Invert

:DIGital:DATA:INPut:NOISe:BANDwidth

Supported N5172B/82B with option 004

`:DIGital:DATA:INPut:NOISe:BANDwidth <value><unit>`
`:DIGital:DATA:INPut:NOISe:BANDwidth?`

This command selects the flat noise bandwidth value of the real–time noise for an ARB waveform. Typically, this value is set slightly wider than the signal bandwidth. The minimum increment value is 0.001 Hz.

Example

:DIG:DATA:INP:NOIS:BAND 8MHZ

The preceding example sets the flat noise bandwidth to 8 MHz.

***RST**	+1.00000000E+000
Range	1 Hz to 160 MHz (depends on the installed baseband generator option)
Key Entry	**Flat Noise Bandwidth**

:DIGital:DATA:INPut:NOISe:CBRate

Supported N5172B/82B with option 004

`:DIGital:DATA:INPut:NOISe:CBRate <1bps - 999Mbps>`
`:DIGital:DATA:INPut:NOISe:CBRate?`

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :DIGital:DATA:INPut:NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. The carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

Example

`:DIG:DATA:INP:NOIS:CBR 5`

The preceding example sets the carrier bit rate to 5 bps.

Default	1.000 bps
Range	1 bps to 999 Mbps
Key Entry	**Carrier Bit Rate**

:DIGital:DATA:INPut:NOISe:CBWidth

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:CBWidth <value><unit>
:DIGital:DATA:?
```

This command selects the carrier bandwidth over which the additive white gaussian noise (AWGN) is applied. The carrier RMS power and the noise power will be integrated over the selected carrier–bandwidth for the purposes of calculating carrier to noise ratio (C/N). The minimum increment value is 0.001 Hz. For more information, refer to the “:DIGital:DATA:INPut:NOISe[:STATe]” command and the “:DIGital:DATA:INPut:NOISe:BANDwidth”command.

***RST**	+1.00000000E+000
Range	1 Hz to 200 MHz
Key Entry	**Carrier Bandwidth**

:DIGital:DATA:INPut:NOISe:CN

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:CN <value><unit>
:DIGital:DATA:INPut:NOISe:CN?
```

This command sets the carrier to noise ratio (C/N) in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to :DIGital:DATA:INPut:NOISe:CBWidth.

Example

```
:DIG:DATA:INP:NOIS:CN 50DB
```

The preceding example sets the carrier to noise ratio to 50 dB.

***RST**	+0.00000000E+000
Range	–100 to 100 dB
Key Entry	**Carrier to Noise Ratio**

:DIGital:DATA:INPut:NOISe:CNFormat

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:CNFormat CN|EBNO
:DIGital:DATA:INPut:NOISe:CNFormat?
```

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example

```
:DIG:DATA:INP:NOIS:CNF EBNO
```

The preceding example sets the carrier to noise ratio format to EbNo. Set the EbNo value with the :DIGital:DATA:INPut:NOISe:EBNO command.

Default	Carrier to Noise Ratio Format C/N
Key Entry	**Carrier to Noise Ratio Format C/N Eb/No**

:DIGital:DATA:INPut:NOISe:EBNO

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:EBNO <ebno in dB>
:DIGital:DATA:INPut:NOISe:EBNO?
```

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:DIGital:DATA:INPut:NOISe:CBRate) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :DIGital:DATA:INPut:NOISe:CNFormat command.

The query returns the value of EBNO.

Example

```
:DIG:DATA:INP:NOIS:EBNO
```

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default	0 dB
Range	–100 to 100 dB
Key Entry	Eb/No

:DIGital:DATA:INPut:NOISe:MUX

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:MUX SUM|CARRier|NOISe
:DIGital:DATA:INPut:NOISe:MUX?
```

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

```
:DIG:DATA:INP:NOIS:MUX CARR
```

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default	Carrier+Noise
Key Entry	**Carrier+Noise** | **Carrier** | **Noise**

:DIGital:DATA:INPut:NOISe:POWer:CARRier

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:POWer:CARRier <value>
:DIGital:DATA:INPut:NOISe:POWer:NOISe:CARRier?
```

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :DIGital:DATA:INPut:NOISe:POWer:CONTrol[:MODE] and :DIGital:DATA:INPut:NOISe:POWer:NOISe:TOTal commands.

In the other control modes, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Carrier Power**

:DIGital:DATA:INPut:NOISe:POWer:CONTrol[:MODE]

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:POWer:NOISe:CONTrol[:MODE]TOTal|CA
RRier|
NOISe|NCHannel
```
:DIGital:DATA:INPut:NOISe:POWer:NOISe:CONTrol[:MODE]?

This command sets the power control to one of the three following modes:

Total	This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.
Carrier	In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.
Total Noise	In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.
N Channel	In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.
Default	Total
Key Entry	**Total Carrier Total Noise**

:DIGital:DATA:INPut:NOISe:POWer:NOISe:CHANnel

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:POWer:NOISe:CHANnel <value>
:DIGital:DATA:INPut:NOISe:POWer:NOISe:CHANnel?
```

This command sets the power within the channel bandwidth. The instrument power is changed in relation to this setting if AWGN is turned on. The channel noise power is only settable from the front panel when the Power Control mode is set to channel noise power.

The variable <value> is expressed in units of dBm.

The query returns the current noise power across the carrier bandwidth in dBm.

Example

:DIG:DATA:INP:NOIS:POW:NOIS:CHAN 10DBM

The preceding example sets the power in the channel bandwidth to 10 dBm.

***RST**	Depends on model and options.
Key Entry	Channel Noise Power

:DIGital:DATA:INPut:NOISe:POWer:NOISe:TOTal

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:POWer:NOISe:TOTal (value)
:DIGital:DATA:INPut:NOISe:POWer:NOISe:TOTal?
```

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted. See also :DIGital:DATA:INPut:NOISe:POWer:CONTrol[:MODE] command.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Total Noise Power**

:DIGital:DATA:INPut:PHASe:NOISe:F1

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:PHASe:NOISe:F1 <value><unit>
:DIGital:DATA:INPut:PHASe:NOISe:F1?
```

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :DIGital:DATA:INPut:PHASe:NOISe:F2 command). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the *User's Guide*.

NOTE The phase noise is added to the base phase noise of the instrument.

***RST**	+1.00000000E+003
Range	0 Hz to 77.500524490 MHz
Key Entry	**Desired Start Freq (f1)**

:DIGital:DATA:INPut:PHASe:NOISe:F1:ACTual?

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:PHASe:NOISe:F1:ACTual?
```

This SCPI command returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

***RST**	+1.00000000E+003
Range	0 Hz to 77.500524490 MHz
Key Entry	**Desired Start Freq (f1)**

:DIGital:DATA:INPut:PHASe:NOISe:F2

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:PHASe:NOISe:F2 <value><unit>
:DIGital:DATA:INPut:PHASe:NOISe:F2?
```

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :DIGital:DATA:INPut:PHASe:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the *User's Guide*.

NOTE The phase noise is added to the base phase noise of the instrument.

***RST**	+3.00000000E+004
Range	1 Hz to 77.500524490 MHz

Key Entry	**Desired Stop Freq (f2)**

:DIGital:DATA:INPut:PHASe:NOISe:F2:ACTual?

Supported	N5172B/82B with option 004

`:DIGital:DATA:INPut:PHASe:NOISe:F2:ACTual?`

This SCPI command returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

NOTE **The phase noise is added to the base phase noise of the instrument.**

***RST**	+3.00000000E+004
Range	1 Hz to 77.500524490 MHz
Key Entry	**Desired Start Freq (f2)**

:DIGital:DATA:INPut:PHASe:NOISe:LMID

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:PHASe:NOISe:LMID <value>
:DIGital:DATA:INPut:PHASe:NOISe:LMID?
```

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator. The actual value can vary by approximately 0.28 dBc/Hz. The effect of this value can be determined by examining the graphic on the front panel or the actual output.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

NOTE **The amplitude range varies depending on the f2 value (see the ":DIGital:DATA:INPut:PHASe:NOISe:F2" on page 495). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.**

NOTE **The phase noise is added to the base phase noise of the instrument.**

The range values are expressed in units of dBc/Hz.

***RST**	-
	7.00000000E+001

Range	–
	300 to 100
Key Entry	**Desired Flat Amplitude (Lmid)**

:DIGital:DATA:INPut:PHASe:NOISe:LMID:ACTual?

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:PHASe:NOISe:LMID:ACTual?
```

This SCPI command returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

NOTE The amplitude range varies depending on the f2 value (see the ":DIGital:DATA:INPut:PHASe:NOISe:F2" on page 495). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.

NOTE The phase noise is added to the base phase noise of the instrument.

The range values are expressed in units of dBc/Hz.

***RST**	–
	7.00000000E+001
Range	–
	300 to 100
Key Entry	**Desired Flat Amplitude (Lmid)**

::DIGital:DATA:INPut:PHASe:NOISe:TRACe? <startFreq:1 - 100MHz>,<stopFreq:1 - 100MHz>,<numSamples:1 - 8192>

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:PHASe:NOISe:TRACe? <startFreq:1 -
100MHz>,<stopFreq:1 - 100MHz>,<numSamples:1 - 8192>
```

This SCPI query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range	<startFreq>	1 Hz to 100 MHz
	<stopFreq>	1 Hz to 100 MHz
	<numSamples>	1 to 8192

:DIGital:DATA:INPut:PHASe:NOISe[:STATe]

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:PHASe:NOISe[:STATe] ON|OFF|1|0
:DIGital:DATA:INPut:PHASe:NOISe[:STATe]?
```

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the *User's Guide*.

The actual performance of the added phase noise can only be determined by examining the graphic on the front panel or the actual output, as the parameters simply guide the phase noise response.

NOTE The phase noise is added to the base phase noise of the instrument.

***RST**	Off
Key Entry	**Phase Noise Off On**

:DIGital:DATA:INPut:NOISe:POWer:NOISe:CHANnel

Supported N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe:POWer:NOISe:CHANnel <value>
:DIGital:DATA:INPut:NOISe:POWer:NOISe:CHANnel?
```

This command sets the current channel noise power level if noise is on. In the "Channel Noise" control mode, the total power will be adjusted to achieve the specified channel noise power and the channel noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the channel noise power setting appropriately to maintain the C/N ratio.

In the other control modes, this will adjust the total power once for the specified channel noise power level, after which the channel noise power could change if any noise parameters are adjusted.

The range varies based on the bounds of the total power that results from the noise settings.

The query returns the current noise power across the carrier bandwidth in dBm.

The variable <value> is expressed in units of dBm.

Example

:DIG:DATA:INP:NOIS:POW:NOIS:CHAN 0

The preceding example sets the channel noise power level to 0 dBm.

***RST**	–144
Range	–144 to 30
Key Entry	Channel Noise Power

:DIGital:DATA:INPut:NOISe[:STATe]

Supported	N5172B/82B with option 004

```
:DIGital:DATA:INPut:NOISe[:STATe] ON|OFF|1|0
:DIGital:DATA:INPut:NOISe[:STATe]?
```

This command enables or disables the real-time noise generator.

Example

:DIG:DATA:INP:NOIS[:STAT] ON

The preceding example enables the real-time noise generator.

***RST**	Off
Key Entry	Real-Time AWGN Off On

:DIGital:DATA:IQSWap

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:IQSWap OFF|ON|0|1
:DIGital:DATA:IQSWap?
```

This command enables or disables swapping of the I and Q data. When enabled, the I data is sent to the N5102A’s Q bus and the Q data is sent to the I bus.

Example

:DIG:DATA:IQSW ON

The preceding example enables swapping of I and Q data.

***RST**	0
Key Entry	**Swap IQ**

:DIGital:DATA:NFORmat

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:NFORMat TCOMplement|OBINary
:DIGital:DATA:NFORMat?
```

This command selects the binary format used to represent the transmitted data values. The selections are offset binary or 2's complement.

Example

:DIG:DATA:NFOR OBIN

The preceding example selects the offset binary format to represent data values.

***RST** TCOM

Key Entry **Numeric Format**

:DIGital:DATA:OUTPut:IGain

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:OUTPut:IGain <value>
:DIGital:DATA:OUTPut:IGain?
```

This command adjusts the gain of the I data in the N5102A module. The adjustment does not affect the Q data.

The variable <value> is expressed as a percentage based on 100% being equivalent to a gain of 1. The offset is an adjustment to the analog level that is represented by the digital sample. The analog voltage is limited to a 16-bit data sample.

Example

:DIG:DATA:OUTP:IG 90

The preceding example sets the I data gain to 90%.

***RST** +0.00000000E+000

Range 87.5 to 112.5%

Key Entry **I Gain**

:DIGital:DATA:OUTPut:IOFFset

Supported N5172B/82B with option 003

```
:DIGital:DATA:OUTPut:IOFFset <value>
:DIGital:DATA:OUTPut:IOFFset?
```

This command adjusts the DC offset for I data. The command is available for the N5102A module output mode. The variable <value> is expressed as a +/– 100% of the full scale value.

Example

:DIG:DATA:OUTP:IOFF 40

The preceding example sets the I offset to 40% of full scale.

***RST**	+0.00000000E+000
Range	–100 to 100
Key Entry	**I Offset**

:DIGital:DATA:OUTPut:POLarity:FRAMe

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:OUTPut:POLarity:FRAMe POSitive|NEGative
:DIGital:DATA:OUTPut:POLarity:FRAMe?
```

This command selects the polarity of the frame marker for serial transmission. The frame marker indicates the beginning of each sample or byte of data. The command is valid for serial transmission only.

POS	This choice selects a positive polarity. The frame marker is high for the first data sample.
NEG	This choice selects a negative polarity. The frame marker is low for the first data sample.

Example

:DIG:DATA:OUTP:POL:FRAM NEG

The preceding example selects a negative polarity for the frame marker.

***RST**	POS
Key Entry	**Frame Polarity**

:DIGital:DATA:OUTPut:QGain

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:OUTPut:QGain <value>
:DIGital:DATA:OUTPut:QGain?
```

This command adjusts the gain for Q data in the N5102A module. The adjustment does not affect the I data.

The variable <value> is expressed as a percentage based on 100% being equivalent to a gain of 1. The offset is an adjustment to the analog level that is represented by the digital sample. The analog voltage is limited to a 16-bit data sample.

Example

:DIG:DATA:OUTP:QG 90

The preceding example sets the gain for Q data to 90%.

***RST**	+0.00000000E+000
Range	87.5 to 112.5%
Key Entry	**Q Gain**

:DIGital:DATA:OUTPut:QOFFset

Supported	N5172B/82B with option 003

```
:DIGital:DATA:OUTPut:QOFFset <value>
:DIGital:DATA:OUTPut:QOFFset?
```

This command adjusts the DC offset for Q data. The command is available for the N5102A module output mode. The variable <value> is expressed as a +/– 100% of the full scale value.

Example

:DIG:DATA:OUTP:QOFF 40

The preceding example sets the Q offset to 40% of full scale.

***RST**	+0.00000000E+000
Range	–100 to 100
Key Entry	**Q Offset**

:DIGital:DATA:OUTPut:ROTation

Supported	N5172B/82B with option 003

```
:DIGital:DATA:OUTPut:ROTation <value>
:DIGital:DATA:OUTPut:ROTation?
```

This command rotates the IQ data in the IQ plane. This command is valid for the N5102A output mode. The variable <value> is expressed in degrees with a range from 0 to 360.

Example

:DIG:DATA:OUTP:ROT 45

The preceding example rotates the IQ constellation 45 degrees.

***RST**	+0.00000000E+000
Range	0 to 360
Key Entry	**Rotation**

:DIGital:DATA:OUTPut:SCALing

Supported N5172B/82B with option 003

```
:DIGital:DATA:OUTPut:SCALing <value>
:DIGital:DATA:OUTPut:SCALing?
```

This command enables scaling of the I and Q data to the level indicated by the <value> variable. This command is valid for the N5102A output mode. The variable <value> is expressed as a percentage.

Example

:DIG:DATA:OUTP:SCAL 50

The preceding example scales the I and Q data amplitude to 50%.

***RST**	+0.700000000E+002
Range	0 to 100
Key Entry	**Scaling**

:DIGital:DATA:OUTPut:SSI:BPFRam

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:OUTPut:SSI:BPFRam <value>
:DIGital:DATA:OUTPut:SSI:BPFRam?
```

This command sets how many bits of data are output between TXFS inputs for SSI output.

Example

:DIG:DATA:OUTP:SSI:BPRF 40

The preceding example sets the number of bits per frame to 40.

Range	1–64
Key Entry	**SSI Output Bits Per Frame**

:DIGital:DATA:OUTPut:SSI:SDELay

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:OUTPut:SSI:SDELay
:DIGital:DATA:OUTPut:SSI:SDELay?
```

This command sets the expected time between the DMCS output being asserted and the first TXFS input (during which time the TXFS signal is ignored) for SSI output.

Example

:DIG:DATA:OUTP:SSI:SDEL 250

The preceding example sets the delay to 250 µs.

Range	0s–648µs
Key Entry	**SSI Output Sync Delay**

:DIGital:DATA:OUTPut:STYPe

Supported	N5172B/82B with option 003

```
:DIGital:DATA:OUTPut:STYPe IQ|IF
:DIGital:DATA:OUTPut:STYPe?
```

This command selects the output format for the IQ data. The IQ selection outputs digital I and Q data. Whereas the IF (intermediate frequency) selection modulates the I and Q data onto the IF frequency. The IF is calculated as 1/4 the clock sample rate. This command is valid only for the N5102A output mode.

IQ	This choice outputs I and Q digital data.
IF	This choice outputs a modulated signal.

Example

:DIG:DATA:STYP IF

The preceding example sets the I and Q output data to modulate the intermediate frequency.

***RST**	IQ
Key Entry	**Signal Type**

:DIGital:DATA:POLarity:IQ

Supported	N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:POLarity:IQ POSitive|NEGative
:DIGital:DATA:POLarity:IQ?
```

This command selects the logic level for I and Q data. Positive selects a high logic level at the output as a digital one and negative selects a low logic level at the output as a digital one.

POS	This choice selects a logic high level as digital one.
NEG	This choice selects a logic low level as a digital one.

Example

:DIG:DATA:POL:IQ NEG

The preceding example sets low level logic.

***RST**	POS
Key Entry	**IQ Polarity**

:DIGital:DATA:QNEGate

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:QNEGate OFF|ON|0|1
:DIGital:DATA:QNEGate?
```

This command enables or disables the negation of the Q data sample. Negation changes the sample by expressing it in two's complement form, multiplying by negative one, and converting back to the selected numeric format.

The sample or word represents a quantized analog voltage level. This analog voltage can be added or multiplied. For a 16-bit sample, the range is from 0 to 65535 in offset binary or -32768 to +32767 in 2’s complement mode.

Example

:DIG:DATA:QNEG ON

The preceding example enables negation of the Q data.

***RST** 0

Key Entry **Negate Q** Data

:DIGital:DATA:SIZE

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:SIZE <value>
:DIGital:DATA:SIZE?
```

This command selects the number of bits in each sample. A sample can have a maximum word length of 16 bits.

Example

:DIG:DATA:SIZE 8

The preceding example sets the sample word size to eight bits.

***RST** +1.600000000E+001

Range 4–16

Key Entry **Word Size**

:DIGital:DATA:TYPE

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:DATA:TYPE SAMPles|PFSamples
:DIGital:DATA:TYPE?
```

This command selects filtered baseband data or unfiltered baseband data as the transmitted data type.

If this command is executed while an ARB modulation format is active, the parameter choice is changed, but it is not **used** by the interface module until a real-time modulation format is turned on.

Because a query returns the current choice, regardless of whether or not an ARB format is active, you must query both states (data type and the modulation format) to know the signal generator's current setup.

SAMPles	This choice selects DAC samples as the data transmitted.
PFSamples	This choice selects pre-filtered samples which are unfiltered I and Q data.

Example

:DIG:DATA:OUTP:TYPE PFS

The preceding example sets the data type to pre-filtered I and Q data.

***RST**	SAMP
Key Entry	**Data Type**

:DIGital:DIAGnostic:LOOPback

Supported	N5172B/82B with Option 003 or 004 or both

`:DIGital:DIAGnostic:LOOPback? DIGBus|CABLe|N5102A|DEVice`

This command selects and executes a loop back test that validates the integrity of digital data.

DIGBus	This choice selects a loop back test on the Digital Bus connector at the signal generator side.
CABLe	This choice selects a loop back test using the Digital Bus Loop Back Fixture test board.
N5102A	This choice selects a loop back test for the N5102A module.
DEVice	This choice selects a loop back test using the LOOP BACK TEST SINGLE ENDED IO DUAL 40 PIN board.

Example

:DIG:DIAG:LOOP? DEV

The preceding example runs the diagnostic test on the Single Ended IO Dual 40 Pin device and returns a pass or fail condition.

***RST**	Device Intfc
Key Entry	**Loop Back Test Type**

:DIGital:LOGic[:TYPE]

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:LOGic[:TYPE]
LVDS|LVTT1|CMOS15|CMOS18|CMOS25|CMOS33|SSI
:DIGital:LOGic[:TYPE]?
```

This command selects the logic data type used by the device being tested.

LVDS	This choice selects low voltage differential signaling as the logic data type.
LVTT1	This choice selects a low voltage TTL signal as the logic data type.
CMOS15	This choice selects a 1.5 volt CMOS signal as the logic data type.
CMOS18	This choice selects a 1.8 volt CMOS signal as the logic data type.
CMOS25	This choice selects a 2.5 volt CMOS signal as the logic data type.
CMOS33	This choice selects a 3.3 volt CMOS signal as the logic data type.
SSI	This key sets the logic type of the device interface to SSI (simple serial interface). This logic type uses single ended I/O and a 3.3 V supply.

Example

:DIG:LOG CMOS15

The preceding example selects 1.5 volt CMOS as the logic data type.

***RST** CMOS33

Key Entry **Logic Type**

:DIGital:PCONfig

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:PCONfig PARallel|SERial|PINTIQ|PINTQI
:DIGital:PCONfig?
```

This command selects the data transmission type used for communication between the N5102A module and the device under test.

PARallel	This choice selects parallel data transmission.
SERial	This choice selects serial data transmission.

PINTIQ	This choice selects parallel interleaving data transmission. The I data is transmitted on the rising clock edge and the Q data on the falling edge.
PINTQI	This choice selects parallel interleaving data transmission. The Q data is transmitted on the rising clock edge and the I data on the falling edge.

Example

:DIG:PCON PINTQI

The preceding example selects parallel interleaving format

***RST** PAR

Key Entry **Port Config**

:DIGital:PRESet:PTHRough

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital:PRESet:PTHRough
```

This command sets up the preset condition for the N5102A module and allows transmission of data through the module with no modifications. The command is valid only when a modulation format is active.

Example

:DIG:PRES:PTHR

The preceding example sets the N5102A module to a preset condition and allows data to pass through unmodified.

Key Entry **Pass Through Preset**

:DIGital[:STATe]

Supported N5172B/82B with Option 003 or 004 or both

```
:DIGital[:STATe] 0|1|OFF|ON
:DIGital[:STATe]?
```

This command enables or disables the operating state of the N5102A module.

Example

:DIG ON

The preceding example turns on the N5102A module.

***RST** OFF

Key Entry **N5102A Off On**

9 Real-Time Commands

This chapter describes SCPI commands used by Keysight X-Series signal generators for real–time signal generation during either component or receiver test.

This chapter contains the following sections:

All Subsystem ([:SOURce]:RADio)

:ALL:OFF

Supported N5172B/82B

`[:SOURce]:RADio:ALL:OFF`

This command turns off all digital modulation formats.

Remarks This command does not affect analog modulation.

AWGN Real–Time Subsystem–Option 403 ([:SOURce]:RADio:AWGN:RT)

:BWIDth

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:AWGN:RT:BANDwidth|BWIDth <value>
[:SOURce]:RADio:AWGN:RT:BANDwidth|BWIDth?
```

This command adjusts the flat bandwidth of the real–time AWGN waveform.

The variable <value> is expressed in units of Hertz (Hz–MHz).

***RST** +1.00000000E+006

Range	Option 653	1 Hz to 60 MHz
	Option 655	1 Hz to 120 MHz
	Option 656	1 Hz to 80 MHz
	Option 657	1 Hz to 160 MHz

Key Entry **Bandwidth**

:CBWidth

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:AWGN:RT:CBWidth <value>
[:SOURce]:RADio:AWGN:RT:CBWidth?
```

This command sets the channel bandwidth, or the portion of the bandwidth specified by the bandwidth ratio.

The variable <value> is expressed in units of Hertz (Hz–MHz).

***RST** +1.00000000E+006

Range 1 to the Option 65x maximum bandwidth, not to exceed the flat noise bandwidth

Key Entry **Bandwidth**

:IQ:MODulation:ATTen

Supported N5172B/82B with Option 403

```
[:SOURce]:RADio:AWGN:RT:IQ:MODulation:ATTen <value>
[:SOURce]:RADio:AWGN:RT:IQ:MODulation:ATTen?
```

This command attenuates the I/Q signals being modulated through the signal generator's RF path.

The variable <value> is expressed in units of decibels (dB).

***RST**	Varies (instrument dependent)
Range	0 to 50
Key Entry	**Modulator Atten Manual Auto**

:IQ:MODulation:ATTen:AUTO

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:AWGN:RT:IQ:MODulation:ATTen:AUTO ON|OFF|1|0
[:SOURce]:RADio:AWGN:RT:IQ:MODulation:ATTen:AUTO?
```

This command enables or disables the I/Q attenuation auto mode.

ON (1)	This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.
OFF (0)	This choice holds the attenuator at its current setting or at a selected value. Refer to ":IQ:MODulation:ATTen" on page 511 for setting the attenuation value.
***RST**	1
Key Entry	**Modulator Atten Manual Auto**

:POWer:CONTrol

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:AWGN:RT:POWer:CONTrol[:MODE] TOTal|NCHannel
[:SOURce]:RADio:AWGN:RT:POWer:CONTrol[:MODE]?
```

This command selects whether the instrument power is set by the displayed instrument power or the channel noise power when the AWGN is turned on.

TOTal	This choice selects the displayed instrument power for control.
NCHannel	This choice selects the channel noise power for control. The channel noise power is only settable from the front panel when the Power Control mode is set to channel noise power.
***RST**	TOTal
Key Entry	**Power Control Mode** Total Nchannel

:POWer:NOISe:CHANnel

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:AWGN:RT:POWer:NOISe:CHANnel <value>
[:SOURce]:RADio:AWGN:RT:POWer:NOISe:CHANnel?
```

This command sets the power within the channel bandwidth. The instrument power is changed in relation to this setting if AWGN is turned on. The channel noise power is only settable from the front panel when the Power Control mode is set to channel noise power.

The variable <value> is expressed in units of dBm.

***RST**	Depends on model and options.
Key Entry	Channel Noise Power

:RATio

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:AWGN:RT:RATio <value>
[:SOURce]:RADio:AWGN:RT:RATio?
```

This command sets the amount of channel bandwidth compared to the amount of flat bandwidth.

The variable <value> is expressed in units of Hertz (Hz–MHz).

***RST**	1.0
Key Entry	**Bandwidth Ratio**

[:STATe]

Supported	N5172B/82B with Option 403

```
[:SOURce]:RADio:AWGN:RT[:STATe] ON|OFF|1|0
[:SOURce]:RADio:AWGN:RT[:STATe]?
```

This command enables or disables the operating state of real–time AWGN.

***RST**	0
Key Entry	**Real-Time AWGN Off On**

Custom Subsystem–Option 431 ([:SOURce]:RADio:CUSTom)

:ALPha

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:ALPHa <val>
[:SOURce]:RADio:CUSTom:ALPHa?
```

This command changes the Nyquist or root Nyquist filter's alpha value.

The filter alpha value can be set to a minimum level (0), a maximum level (1), or in between by using fractional numeric values (0.001–0.999).

***RST**	+3.50000000E–001
Range	0.000–1.000
Key Entry	**Filter Alpha**
Remarks	To change the current filter type, refer to ":FILTer" on page 524.

:BASeband:FREQuency:OFFSet

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BASeband:FREQuency:OFFSet <value><uni
t> [:SOURce]:RADio:CUSTom:BASeband:FREQuency:OFFSet?
```

This command offsets the baseband frequency relative to the carrier. The feature is useful for moving the signal such that the carrier feed–through is not in the center.

Keysight X-Series signal generator provide automatic DAC over–range protection when the offset value is something other than 0 Hz. It scales down the playing I/Q data by *1/square root of 2*.

***RST**	+0.00000000E+000
Range	+8.0E7 to –8.0E7 Hz
Key Entry	**Baseband Frequency Offset**

:BASeband:FREQuency:OFFSet:PHASe:RESet

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BASeband:FREQuency:OFFSet:PHASe:RESet
```

This command clears the phase accumulation resulting in a phase shift of zero.

When the Baseband Frequency Offset is non–zero, the hardware rotator accumulates phase–shift of the baseband signal. This residual phase remains even after the offset value is returned to zero. While there is a non–zero residual phase present in the signal, the DAC Over–Range Protection feature will automatically prevent DAC over-range errors from occurring by scaling the signal down by 1/square root of 2.

Key Entry	**Baseband Frequency Offset Phase Reset**

:BBT

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BBT <val>
[:SOURce]:RADio:CUSTom:BBT?
```

This command changes the bandwidth-multiplied-by-bit-time (BbT) filter parameter.

The filter BbT value can be set to the maximum level (1) or in between the minimum level (0.100) and maximum level by using fractional numeric values (0.101–0.999).

***RST**	+5.00000000E–001
Range	0.100–1.000
Key Entry	**Filter BbT**
Remarks	This command is effective only after choosing a Gaussian filter. It does not have an effect on other types of filters. To change the current filter type, refer to “:FILTer” on page 524.

:BRATe

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BRATe <val>
[:SOURce]:RADio:CUSTom:BRATe?
```

This command sets the bit rate in bits per second (bps–Mbps). The maximum bit rate depends on the modulation type as shown in the following tables.

The IQ digital data stream is shaped by a FIR filter.

To change the modulation type, refer to “:MODulation[:TYPE]” on page 528.

When the bit rate is changed, the signal generator reconfigures the baseband generator. The time required to reconfigure the baseband generator is inversely proportional to the bit rate: lower bit rates require more time.

***RST**	+2.00000000E+006

The following table lists the range for PRAM or external serial data in the Custom format.

Range

Bits/Symbol	Min Bit Rate	N5172B Opt 653 Max Bit Rate	N5172B Opt 655 Max Bit Rate	N5182B Opt 656 Max Bit Rate	N5182B Opt 657 Max Bit Rate
1	1 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps
2	2 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps
3	3 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps
4	4 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps
5	5 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps
6	6 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps
7	7 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps
8	8 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps
9	9 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps
10	10 bps	37.5 Mbps	50 Mbps	50 Mbps	50 Mbps

The following table shows the various data rates by modulation type when the internal data generator is used.

Range

Bits/Symbol	Min Bit Rate	N5172B Opt 653 Max Bit Rate	N5172B Opt 655 Max Bit Rate	N5182B Opt 656 Max Bit Rate	N5182B Opt 657 Max Bit Rate
1	1 bps	37.5 Mbps	75 Mbps	50 Mbps	100 Mbps
2	2 bps	75 Mbps	150 Mbps	100 Mbps	200 Mbps
3	3 bps	112 Mbps	225 Mbps	150 Mbps	300 Mbps
4	4 bps	150 Mbps	300 Mbps	200 Mbps	400 Mbps
5	5 bps	187 Mbps	375 Mbps	250 Mbps	500 Mbps
6	6 bps	225 Mbps	450 Mbps	300 Mbps	600 Mbps
7	7 bps	262 Mbps	525 Mbps	350 Mbps	700 Mbps
8	8 bps	300 Mbps	600 Mbps	400 Mbps	800 Mbps
9	9 bps	337 Mbps	675 Mbps	450 Mbps	900 Mbps
10	10 bps	375 Mbps	750 Mbps	500 Mbps	1000 Mbps

The bits per symbol are determined by the modulation type:

Bits/Symbol	Modulation Type
1	2-Lvl FSK, ASK, BPSK, MSK

2	4-Lvl FSK, 4QAM, C4FM, Gray Coded QPSK, IS95 OQPSK, IS95 QPSK, OQPSK, QPSK, pi/4 DQPSK, Unbalanced QPSK
3	8-Lvl FSK, 8PSK, D8PSK, EDGE
4	16-Lvl FSK, 16PSK, 16QAM, VSA 16QAM
5	32QAM, VSA 32QAM
6	64QAM, VSA 64QAM
7	128QAM, VSA 128QAM
8	256QAM, VSA 256QAM
9	VSA 512QAM
10	1024QAM, VSA 1024QAM

Key Entry **Symbol Rate**

:BURSt:SHAPe:FALL:DELay

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FALL:DELay <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FALL:DELay?
```

This command sets the burst shape fall delay.

The variable <val> is expressed in bits.

***RST** +0.00000000E+000

Range (depends on modulation type and symbol rate)

Key Entry **Fall Delay**

Remarks To change the modulation type, refer to ":MODulation[:TYPE]" on page 528. Refer to ":SRATe" on page 538 for a list of the minimum and maximum symbol rate values.

":BURSt:SHAPe:FDELay" on page 518 performs the same function; in compliance with the SCPI standard, both commands are listed.

For concept information on burst shaping, refer to the **User's Guide**.

:BURSt:SHAPe:FALL:TIME

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FALL:TIME <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FALL:TIME?
```

This command sets the burst shape fall time.

The variable <val> is expressed in bits.

***RST**	+5.00000000E+000
Range	(depends on modulation type and symbol rate)
Key Entry	**Fall Time**
Remarks	To change the modulation type, refer to ":MODulation[:TYPE]" on page 528. Refer to ":SRATe" on page 538 for a list of the minimum and maximum symbol rate values. ":BURSt:SHAPe:FTIMe" on page 518 performs the same function; in compliance with the SCPI standard, both commands are listed. For concept information on burst shaping, refer to the **User's Guide**.

:BURSt:SHAPe:FDELay

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FDELay <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FDELay?
```

This command sets the burst shape fall delay.

The variable <val> is expressed in bits.

***RST**	+0.00000000E+000
Range	(depends on modulation type and symbol rate)
Key Entry	**Fall Delay**
Remarks	To change the modulation type, refer to ":MODulation[:TYPE]" on page 528. Refer to ":SRATe" on page 538 for a list of the minimum and maximum symbol rate values. ":BURSt:SHAPe:FALL:DELay" on page 517 performs the same function; in compliance with the SCPI standard, both commands are listed. For concept information on burst shaping, refer to the **User's Guide**.

:BURSt:SHAPe:FTIMe

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FTIMe <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:FTIMe?
```

This command sets the burst shape fall time.

The variable <val> is expressed in bits.

***RST**	+5.00000000E+000
Range	(depends on modulation type and symbol rate)
Key Entry	**Fall Time**
Remarks	To change the modulation type, refer to ":MODulation[:TYPE]" on page 528. Refer to ":SRATe" on page 538 for a list of the minimum and maximum symbol rate values.
	":BURSt:SHAPe:FALL:TIME" on page 517 performs the same function; in compliance with the SCPI standard, both commands are listed.
	For concept information on burst shaping, refer to the **User's Guide**.

:BURSt:SHAPe:RDELay

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RDELay <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RDELay?
```

This command sets the burst shape rise delay.

The variable <val> is expressed in bits.

***RST**	+0.00000000E+000
Range	(depends on modulation type and symbol rate)
Key Entry	**Rise Delay**
Remarks	To change the modulation type, refer to ":MODulation[:TYPE]" on page 528. Refer to ":SRATe" on page 538 for a list of the minimum and maximum symbol rate values.
	":BURSt:SHAPe:RISE:DELay" on page 519 performs the same function; in compliance with the SCPI standard, both commands are listed.
	For concept information on burst shaping, refer to the **User's Guide**.

:BURSt:SHAPe:RISE:DELay

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RISE:DELay <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RISE:DELay?
```

This command sets the burst shape rise delay.

The variable <val> is expressed in bits.

***RST**	+0.00000000E+000
Range	(depends on modulation type and symbol rate)
Key Entry	**Rise Delay**
Remarks	To change the modulation type, refer to ":MODulation[:TYPE]" on page 528. Refer to ":SRATe" on page 538 for a list of the minimum and maximum symbol rate values.
	":BURSt:SHAPe:RDELay" on page 519 performs the same function; in compliance with the SCPI standard, both commands are listed.
	For concept information on burst shaping, refer to the **User's Guide**.

:BURSt:SHAPe:RISE:TIME

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RISE:TIME <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RISE:TIME?
```

This command sets the burst shape rise time.

The variable <val> is expressed in bits.

***RST**	+5.00000000E+000
Range	(depends on modulation type and symbol rate)
Key Entry	**Rise Time**
Remarks	To change the modulation type, refer to ":MODulation[:TYPE]" on page 528. Refer to ":SRATe" on page 538 for a list of the minimum and maximum symbol rate values.
	":BURSt:SHAPe:RTIMe" on page 520 performs the same function; in compliance with the SCPI standard, both commands are listed.
	For concept information on burst shaping, refer to the **User's Guide**.

:BURSt:SHAPe:RTIMe

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RTIMe <val>
[:SOURce]:RADio:CUSTom:BURSt:SHAPe:RTIMe?
```

This command sets the burst shape rise time.

The variable <val> is expressed in bits.

***RST**	+5.00000000E+000
Range	(depends on modulation type and symbol rate)
Key Entry	**Rise Time**
Remarks	To change the modulation type, refer to ":MODulation[:TYPE]" on page 528. Refer to ":SRATe" on page 538 for a list of the minimum and maximum symbol rate values.
	":BURSt:SHAPe:RISE:TIME" on page 520 performs the same function; in compliance with the SCPI standard, both commands are listed.
	For concept information on burst shaping, refer to the **User's Guide**.

:BURSt:SHAPe[:TYPE]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:BURSt:SHAPe[:TYPE] SINE|"<file name>"
[:SOURce]:RADio:CUSTom:BURSt:SHAPe[:TYPE]?
```

This command specifies the burst shape ("<file name>").

SINE	This choice selects a burst shape that is defined by the burst rise and fall *RST values, as the default burst shape type.
"<file name>"	This choice selects a user designated file from signal generator memory (non-volatile).
***RST**	SINE

Key Entry	**Sine**	**User File**

:CHANnel

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:CHANnel EVM|ACP
[:SOURce]:RADio:CUSTom:CHANnel?
```

This command optimizes the Nyquist and root Nyquist filters to minimize error vector magnitude (EVM) or to minimize adjacent channel power (ACP).

EVM	This choice provides the most ideal passband.
ACP	This choice improves stopband rejection.
***RST**	ACP
Key Entry	**Optimize FIR For EVM ACP**

Remarks To change the current filter type, refer to ":FILTer" on page 524.

:DATA

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:DATA
PN9|PN11|PN15|PN20|PN23|FIX4|"<file name>"|
EXT|P4|P8|P16|P32|P64|PRAM
[:SOURce]:RADio:CUSTom:DATA?
```

This command sets the data pattern for unframed transmission.

***RST** PN23

Key Entry							
	PN9	**PN11**	**PN15**	**PN20**	**PN23**	**FIX4**	**User File**
	Ext	**4 1's & 4 0's**	**8 1's & 8 0's**				
	16 1's & 16 0's	**32 1's & 32 0's**	**64 1's & 64 0's**	**PRAM File**			

Remarks Refer to "File Name Variables" on page 43 for information on the file name syntax.

:DATA:FIX4

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:DATA:FIX4 <val>
[:SOURce]:RADio:CUSTom:DATA:FIX4?
```

This command sets the binary, 4-bit repeating sequence data pattern for unframed transmission according to the modulation type, symbol rate, filter, and burst shape selected for the custom modulation format.

***RST** #B0000

Range #B0000–#B1111 or 0–15

Key Entry **FIX4**

Remarks FIX4 must be already be defined as the data type. To change the data type, refer to ":DATA" on page 522.

:DATA:PRAM

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:DATA:PRAM "<file_name>"
[:SOURce]:RADio:CUSTom:DATA:PRAM?
```

This command selects a pattern RAM (PRAM) file as the pattern data type for a custom communications format.

"<file_name>"	This variable designates the PRAM file in the signal generator's volatile memory (WFM). Refer to "File Name Variables" on page 43 for information on the file name syntax.
Key Entry	**PRAM File**
Remarks	Selecting this data source forces the burst source to `INTernal` to allow framing control. The PRAM file must reside in the signal generator's volatile memory (WFM) in order to be accessed by this command.

:DENCode

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:DENCode ON|OFF|1|0
[:SOURce]:RADio:CUSTom:DENCode?
```

This command enables or disables the differential data encoding function.

***RST**	0
Key Entry	**Diff Data Encode Off On**
Remarks	Executing this command encodes the data bits prior to modulation; each modulated bit is 1 if the data bit is different from the previous one, or 0 if the data bit is the same as the previous one.

:EDATa:DELay

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:EDATa:DELay?
```

This query returns the amount of delay (in symbols) from the external data input to the beginning of the symbol on the I OUT and Q OUT rear panel connectors and the front-panel RF OUTPUT connector.

Remarks When the format is turned off, the delay value is unchanged; the query will return the same delay value if the format is on or off.

:EDCLock

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:EDCLock SYMBol|NORMal
[:SOURce]:RADio:CUSTom:EDCLock?
```

This command sets the external data clock use.

SYMBol	This choice specifies that a continuous symbol clock signal must be provided to the SYMBOL SYNC input connector.
NORMal	This choice specifies that the DATA CLOCK input connector requires a bit clock. The SYMBOL SYNC input connector requires a (one-shot or continuous) symbol sync signal.
***RST**	NORM
Key Entry	**Ext Data Clock Normal Symbol**

:FILTer

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:FILTer
RNYQuist|NYQuist|GAUSsian|RECTangle|IS95|
IS95_EQ|IS95_MOD|IS95_MOD_EQ|AC4Fm|UGGaussian|"<user FIR>"
[:SOURce]:RADio:CUSTom:FILTer?
```

This command selects the pre-modulation filter type.

IS95	This choice selects a filter that meets the criteria of the IS-95 standard.
IS95_EQ	This choice selects a filter which is a combination of the IS-95 filter (above) and the equalizer filter described in the IS-95 standard. This filter is only used for IS-95 baseband filtering.
IS95_MOD	This choice selects a filter that meets the criteria of the IS-95 error function (for improved adjacent channel performance) with lower passband rejection than the filter specified in the IS-95 standard.
IS95_MOD_EQ	This choice selects a filter which is a combination of the equalizer filter described in the IS-95 standard and a filter that meets the criteria of the IS-95 error function (for improved adjacent channel performance), with lower passband rejection.
AC4Fm	This choice selects a predefined Association of Public Safety Communications Officials (APCO) specified compatible 4-level frequency modulation (C4FM) filter.

UGGaussian	This choice selects a GSM Gaussian filter (Gaussian filter with a fixed BbT value of 0.300).
"<user FIR>"	This variable is any filter file that you have stored into memory. Refer to “File Name Variables” on page 43 for information on the file name syntax.
***RST**	RNYQ

Key Entry				
	Root Nyquist	**Nyquist**	**Gaussian**	
	Rectangle	**IS-95**	**IS-95 w/EQ**	**IS-95 Mod**
	IS-95 Mod w/EQ	**APCO 25 C4FM**	**UN3/4 GSM Gaussian**	
	User FIR	**UN3/4 GSM Gaussian**	**User FIR**	

:IQ:MODulation:ATTen

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:IQ:MODulation:ATTen <value>
[:SOURce]:RADio:CUSTom:IQ:MODulation:ATTen?
```

This command sets the attenuation level of the I/Q signals being modulated through the signal generator RF path.

The variable <value> is expressed in units of decibels (dB).

***RST**	Varies (instrument dependent)
Range	0 to 50
Key Entry	**Modulator Atten Manual Auto**

:IQ:MODulation:ATTen:AUTO

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:IQ:MODulation:ATTen:AUTO ON|OFF|1|0
[:SOURce]:RADio:CUSTom:IQ:MODulation:ATTen:AUTO?
```

This command enables or disables the I/Q attenuation auto mode.

ON (1)	This choice enables the attenuation auto mode which optimizes the modulator attenuation for the current conditions.

OFF (0)	This choice holds the attenuator at its current setting or at a selected value. Refer to the :IQ:MODulation:ATTen command for setting the attenuation value.
***RST**	1
Key Entry	**Modulator Atten Manual Auto**

:IQ:SCALe

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:IQ:SCALe <val>
[:SOURce]:RADio:CUSTom:IQ:SCALe?
```

This command sets the amplitude of the I/Q outputs for better adjacent channel power (ACP); lower scaling values equate to better ACP.

The variable <val> is expressed in units of percent.

***RST**	+70
Range	1–100
Key Entry	**I/Q Scaling**
Remarks	This command has no effect with MSK or FSK modulation.

:MODulation:ASK[:DEPTh]

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:MODulation:ASK[:DEPTh] <0% - 100%>
[:SOURce]:RADio:CUSTom:MODulation:ASK[:DEPTh]?
```

This command changes the depth for the amplitude shift keying (ASK) modulation. Depth is set as a percentage of the full power on level.

***RST**	+1.00000000E+002
Range	0 to 100
Key Entry	**ASK Depth 100%**
Remarks	The modulation is applied to the I signal, the Q value is always kept at zero.

:MODulation:FSK[:DEViation]

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:MODulation:FSK[:DEViation] <val>
[:SOURce]:RADio:CUSTom:MODulation:FSK[:DEViation]?
```

This command sets the symmetric FSK frequency deviation value.

The variable <val> is expressed in units of Hertz and the maximum range value equals the current symbol rate value multiplied by four, limited to 20 MHz.

***RST**	+4.00000000E+002
Range	0–2E7
Key Entry	**Freq Dev**
Remarks	To change the modulation type, refer to ":MODulation[:TYPE]" on page 528.
	Refer to ":SRATe" on page 538 for a list of the minimum and maximum symbol rate values.
	To set an asymmetric FSK deviation value, refer to the **User's Guide** for more information.

:MODulation:MSK[:PHASe]

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:MODulation:MSK[:PHASe] <val>
[:SOURce]:RADio:CUSTom:MODulation:MSK[:PHASe]?
```

This command sets the MSK phase deviation value.

The variable <val> is expressed in units of degrees.

***RST**	+9.00000000E+001
Range	0–100
Key Entry	**Phase Dev**

:MODulation:UFSK

Supported	N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:MODulation:UFSK "<file name>"
[:SOURce]:RADio:CUSTom:MODulation:UFSK?
```

This command selects a user-defined FSK file from the signal generator memory.

Key Entry	**User FSK**
Remarks	The user-defined FSK file is held in signal generator memory until the command that selects user FSK as the modulation type is sent. Refer to ":MODulation[:TYPE]" on page 528 to change the current modulation type.
	Refer to "File Name Variables" on page 43 for information on the file name syntax.

:MODulation:UIQ

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:MODulation:UIQ "<file name>"
[:SOURce]:RADio:CUSTom:MODulation:UIQ?
```

This command selects a user-defined I/Q file from the signal generator memory.

Key Entry **User I/Q**

Remarks The user-defined I/Q file is held in signal generator memory until the command that selects user I/Q as the modulation type is sent. Refer to ":MODulation[:TYPE]" on page 528 to change the current modulation type.

Refer to "File Name Variables" on page 43 for information on the file name syntax.

:MODulation[:TYPE]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:MODulation[:TYPE]
ASK|BPSK|QPSK|UQPSk|IS95QPSK|GRAYQPSK|
OQPSK|IS95OQPSK|P4DQPSK|PSK8|PSK16|D8PSK|EDGE|MSK|FSK2|FSK4|
FSK8|FSK16|C4FM|
QAM4|QAM16|QAM32|QAM64|QAM128|QAM256|QAM1024|UIQ|UFSK|VSAQAM
16|VSAQAM32|VSAQAM64|
VSAQAM128|VSAQAM256|VSAQAM512|VSAQAM1024
[:SOURce]:RADio:CUSTom:MODulation[:TYPE]?
```

This command sets the modulation type for the Custom personality.

***RST** P4DQPSK

Key Entry

ASK	**BPSK**	**QPSK**	**Unbalanced QPSK**		
IS-95 QPSK	**Gray Coded QPSK**	**OQPSK**			
IS-95 OQPSK	**$\pi/4$ DQPSK**	**8PSK**	**16PSK**		
D8PSK	**EDGE**	**MSK**	**C4FM**	**4QAM**	**16QAM**

32QAM	**64QAM**	**128QAM**	**256QAM**	**1024QAM**	**Select User IQ**

Select User FSK	**VSA 16QAM**	**VSA 32QAM**	**VSA 64QAM**

VSA 128QAM	**VSA 256QAM**	**VSA 512QAM**	**VSA 1024QAM**

:NOISe:BANDwidth

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:BANDwidth <value><unit>
[:SOURce]:RADio:CUSTom:NOISe:BANDwidth?
```

This command selects the flat noise bandwidth value of the real–time noise for an ARB waveform. Typically, this value is set slightly wider than the signal bandwidth. The minimum increment value is 0.001 Hz.

***RST**	+1.00000000E+000
Range	1 Hz to 160 MHz (depends on the installed baseband generator option)
Key Entry	**Noise Bandwidth**

:NOISe:CBRate

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:CBRate <1bps - 999Mbps>
[:SOURce]:RADio:CUSTom:NOISe:CBRate?
```

This command sets a value of the carrier bit rate (gross bit rate) for purposes of calculating the Eb/N0 (energy per bit over noise power density at the receiver). When the carrier to noise ratio format is set to Eb/N0 (refer to the :NOISe:CNFormat command), the adjustment of the carrier bit rate will have an immediate impact on the carrier to noise ratio as specified by Eb/N0. The carrier bit rate is derived from the symbol rate and bits per symbol of the modulation. The carrier bit rate is a saved instrument state that is recorded in the waveform header.

The query returns the current carrier bit rate setting.

Example

```
:RAD:ARB:NOIS:CBR 5
```

The preceding example sets the carrier bit rate to 5 bps.

Default 1.000 bps

Range	1 bps to 999 Mbps
Key Entry	**Carrier Bit Rate**

:NOISe:CBWidth

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:CBWidth <value><unit>
[:SOURce]:RADio:CUSTom:NOISe:CBWidth?
```

This command selects the carrier bandwidth over which the additive white gaussian noise (AWGN) is applied. The carrier RMS power and the noise power will be integrated over the selected carrier–bandwidth for the purposes of calculating carrier to noise ratio (C/N). The minimum increment value is 0.001 Hz. For more information, refer to the ":NOISe[:STATe]" command and the ":NOISe:BANDwidth"command.

***RST**	+1.00000000E+000
Range	1 Hz to 200 MHz
Key Entry	**Carrier Bandwidth**

:NOISe:CN

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:CN <value><unit>
[:SOURce]:RADio:CUSTom:NOISe:CN?
```

This command sets the carrier to noise ratio (C/N) in dB. The carrier power is defined as the total modulated signal power without noise power added. The noise power is applied over the specified bandwidth of the carrier signal. For more information, refer to ":NOISe:CBWidth" on page 530.

Example

```
:RAD:ARB:NOIS:CN 50DB
```

The preceding example sets the carrier to noise ratio to 50 dB.

***RST**	+0.00000000E+000
Range	–100 to 100 dB
Key Entry	**Carrier to Noise Ratio**

:NOISe:CNFormat

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:CNFormat CN|EBNO
[:SOURce]:RADio:CUSTom:NOISe:CNFormat?
```

This command selects either the Carrier to Noise Ratio (C/N) or energy per bit over noise power density at the receiver (Eb/N0) as the variable controlling the ratio of carrier power to noise power in the carrier bandwidth.

Example

```
:RAD:ARB:NOIS:CNF EBNO
```

The preceding example sets the carrier to noise ratio format to EbNo.

Default	Carrier to Noise Ratio Format C/N
Key Entry	**Carrier to Noise Ratio Format C/N Eb/No**

:NOISe:EBNO

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:EBNO <ebno in dB>
[:SOURce]:RADio:CUSTom:NOISe:EBNO?
```

This command allows the C/N to be set using the Eb/N0 (energy per bit over noise power density at the receiver) form. This requires that the carrier bit rate (:NOISe:CBRate on page 529) be set properly. The range of Eb/N0 is limited to the range that is equivalent to –100 to 100 dB of C/N. This value is only effective when Eb/N0 has been enabled by the :NOISe:CNFormat command.

The query returns the value of EBNO.

Default	0 dB
Range	–100 to 100 dB
Key Entry	**Carrier to Noise Ratio Format Eb/No**

:NOISe:MUX

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:MUX SUM|CARRier|NOISe
[:SOURce]:RADio:CUSTom:NOISe:MUX?
```

This command enables diagnostic control of additive noise, such that only the noise, only the carrier, or the sum of both the noise and the carrier are output from the internal baseband generator. With the ALC off, this feature enables direct measurement of just the carrier or the noise contributions to the total power. The system will still behave as if both the noise and the carrier are present on the output when it comes to determining the Auto Modulation Attenuation and the RMS level for RMS Power Search.

Example

```
:RAD:CUST:NOIS:MUX CARR
```

The preceding example enables the direct measurement of the carrier contribution to the total power.

Default	Carrier+Noise
Key Entry	**Carrier+Noise** | **Carrier** | **Noise**

:NOISe:POWer:CARRier

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:POWer:CARRier <carrierPower>
[:SOURce]:RADio:CUSTom:NOISe:POWer:CARRier?
```

This command sets the current carrier power level if noise is on.

In the CARRier control mode, the total power will be adjusted to achieve the specified carrier power and the carrier power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the carrier power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total power is adjusted.

In the NOISe control mode, this will adjust the total noise power once for the specified carrier power level, after which the carrier power could change if any noise parameters are adjusted or the total noise power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] and :NOISe:POWer:NOISe:TOTal commands.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Carrier Power**

:NOISe:POWer:CONTrol[:MODE]

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:POWer:CONTrol[:MODE]TOTal|CARRi
er|NOISe [:SOURce]:RADio:CUSTom:NOISe:POWer:CONTrol[:MODE]?
```

This command sets the power control to one of the three following modes:

Total	This is the default mode where the total power and C/N are independent variables and the carrier power and total noise power are dependent variables set by the total power, C/N and the rest of the noise settings. The carrier power and total noise power will change as any noise parameter is adjusted to keep the total power and the C/N at their last specified values.

Carrier	In this mode the carrier power and C/N are independent variables and the total power and total noise power are dependent variables set by the carrier power, C/N and the rest of the noise settings. The total power and total noise power will change as any noise parameter is adjusted to keep the carrier power and the C/N at their last specified values.
Total Noise	In this mode the total noise power and C/N are independent variables and the total power and carrier power are dependent variables set by the total noise power, C/N and the rest of the noise settings. The total power and carrier power will change as any noise parameter is adjusted to keep the total noise power and the C/N at their last specified values.

Default Total

Key Entry **Total Carrier Total Noise**

:NOISe:POWer:NOISe:CHANnel?

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:POWer:NOISe:CHANnel?
```

The query returns the current noise power across the carrier bandwidth in dBm.

:NOISe:POWer:NOISe:TOTal

Supported N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe:POWer:NOISe:TOTal
<totalNoisePowerInDbm>
[:SOURce]:RADio:CUSTom:NOISe:POWer:NOISe:TOTal?
```

This command sets the current total noise power level if noise is on.

In the NOISe control mode, the total power will be adjusted to achieve the specified total noise power and the total noise power level will be maintained regardless of changes to the other noise parameters. A change to the total power will change the total noise power setting appropriately to maintain the C/N ratio.

In the TOTal control mode, this will adjust the total power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the total power is adjusted.

In the CARRier control mode, this will adjust the carrier power once for the specified total noise power level, after which the total noise power could change if any noise parameters are adjusted or the carrier power is adjusted. See also :NOISe:POWer:CONTrol[:MODE] command.

Range	The range varies based on the bounds of the total power that results from the noise settings.
Default	The appropriate value given the current total power and the current Carrier to Noise (C/N).
Key Entry	**Total Noise Power**

:NOISe[:STATe]

Supported	N5172B/82B with Option 431 and 403

```
[:SOURce]:RADio:CUSTom:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:CUSTom:NOISe[:STATe]?
```

This command enables or disables adding real-time additive white gaussian noise (AWGN) to the carrier modulated by the waveform being played by the dual ARB waveform player.

Example

```
:RAD:CUST:NOIS ON
```

The preceding example applies real-time AWGN to the carrier.

***RST**	0
Key Entry	**Real-Time AWGN Off On**

:PHASe:NOISe:F1

Supported	N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:CUSTom:PHASe:NOISe:F1 <value><unit>
[:SOURce]:RADio:CUSTom:PHASe:NOISe:F1?
```

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :F2 command). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the *User's Guide*.

***RST**	+1.00000000E+003
Range	0 Hz to 77.500524490 MHz
Key Entry	**Desired Start Freq (f1)**

:PHASe:NOISe:F1:ACTual?

Supported N5172B/82B with Option 431 and 432

`[:SOURce]:RADio:CUSTom:PHASe:NOISe:F1:ACTual?`

This SCPI command returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:PHASe:NOISe:F2

Supported N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:CUSTom:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:CUSTom:PHASe:NOISe:F2?
```

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see the :PHASe:NOISe:F1 command). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the *User’s Guide*.

***RST**	+3.00000000E+004
Range	1 Hz to 77.500524490 MHz
Key Entry	**Desired Stop Freq (f2)**

:PHASe:NOISe:F2:ACTual?

Supported N5172B/82B with Option 431 and 432

`[:SOURce]:RADio:CUSTom:PHASe:NOISe:F2:ACTual?`

This SCPI command returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:PHASe:NOISe:LMID

Supported N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:CUSTom:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:CUSTom:PHASe:NOISe:LMID?
```

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the *User's Guide*.

NOTE **The amplitude range varies depending on the f2 value (see the** **":F2" on page 547****). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.**

The range values are expressed in units of dBc/Hz.

***RST**	−7.00000000E+001
Range	−300 to 100
Key Entry	**Desired Flat Amplitude (Lmid)**

:PHASe:NOISe:LMID:ACTual?

Supported N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:CUSTom:PHASe:NOISe:LMID:ACTual?
```

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

:PHASe:NOISe[:STATe]

Supported N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:CUSTom:PHASe:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:CUSTom:PHASe:NOISe[:STATe]?
```

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the *User's Guide*.

***RST**	0
Key Entry	**Phase Noise Off On**

:PHASe:NOISe:TRACe?

Supported N5172B/82B with Option 431 and 432

```
[:SOURce]:RADio:CUSTom:PHASe:NOISe:TRACe?
<startFreq>,<stopFreq>,<numSamples>
```

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range	<startFreq>	1 Hz to 100 MHz
	<stopFreq>	1 Hz to 100 MHz
	<numSamples>	1 to 8192

:POLarity[:ALL]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:POLarity[:ALL] NORMal|INVerted
[:SOURce]:RADio:CUSTom:POLarity[:ALL]?
```

This command sets the rotation direction of the phase modulation vector.

NORMal	This choice selects normal phase polarity.
INVerted	This choice inverts the internal Q signal.
***RST**	NORM
Key Entry	**Phase Polarity Normal Invert**

:RETRigger

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:RETRigger ON|OFF|1|0|IMMediate
[:SOURce]:RADio:CUSTom:RETRigger?
```

This command enables or disables the ARB retriggering mode. The retrigger mode controls how the retriggering function performs while a waveform is playing.

ON (1)	This choice (Buffered Trigger) specifies that if a trigger occurs while a waveform is playing, the waveform will retrigger at the end of the current waveform sequence and play once more.
OFF (0)	This choice (No Retrigger) specifies that if a trigger occurs while a waveform is playing, the trigger will be ignored.
IMMediate	This choice (Restart on Trigger) specifies that if a trigger occurs while a waveform is playing, the waveform will reset and replay from the start immediately upon receiving a trigger.

***RST** ON

Key Entry	No Retrigger	Buffered Trigger	Restart on Trigger

Remarks This command applies to the single trigger type only.

:SRATe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:SRATe <val>
[:SOURce]:RADio:CUSTom:SRATe?
```

This command sets the transmission symbol rate. Symbol rate is the bit rate divided by the bits per symbol. A change in the symbol rate affects the bit rate. Refer to “:BRATe” on page 515 for information on bit rate.

The variable <val> is expressed in units of symbols per second (sps–Msps) and the maximum symbol rate depends on the filter. Refer to “:FILTer” on page 524 for minimum filter symbol widths.

The filter may have to be truncated down to 32 or 16 symbols wide to achieve the highest symbol rate. The signal generator’s internal filters are not truncated below their minimum filter length and user-defined FIR filters are not truncated. If the filter cannot be truncated then the symbol rate is limited to the maximum rate of the narrowest filter size possible.

The relative timing of the modulated data, as well as the actual filter response is affected when the filter is truncated.

When the symbol rate changes, the signal generator reconfigures the baseband generator. The time required to reconfigure the baseband generator is inversely proportional to the symbol rate: lower symbol rates require more time.

To change the modulation type, refer to “:MODulation[:TYPE]” on page 528.

***RST** +1.00000000E+06

The following table shows the symbol range for internal Custom data operation.

Range

Min Symbol Rate	N5172B Opt 653 Max Symbol Rate	N5172B Opt 655 Max Symbol Rate	N5182B Opt 656 Max Symbol Rate	N5182B Opt 657 Max Symbol Rate
1 sps	37.5 Msps	57 Msps	50 Msps	100 Msps

The limits shown in the following table apply to Custom PRAM and Custom external serial data.

Range

Bits/Symbol	Min Symbol Rate	N5172B Opt 653 Max Symbol Rate	N5172B Opt 655 Max Symbol Rate	N5182B Opt 656 Max Symbol Rate	N5182B Opt 657 Max Symbol Rate
1	1 sps	37.5 Msps	50.0 Msps	50.0 Msps	50.0 Msps
2	1 sps	18.7 Msps	37.5 Msps	25.0 Msps	50.0 Msps
3	1 sps	12.5 Msps	25.0 Msps	16.6 Msps	33.3 Msps
4	1 sps	9.3 Msps	18.7 Msps	12.5 Msps	25.0 Msps
5	1 sps	7.5 Msps	15.0 Msps	10.0 Msps	20.0 Msps
6	1 sps	6.2 Msps	12.5 Msps	8.3 Msps	16.6 Msps
7	1 sps	5.3 Msps	10.7 Msps	7.1 Msps	14.2 Mbss
8	1 sps	4.6 Msps	9.3 Msps	6.2 Msps	12.5 Msps
9	1 sps	4.1 Msps	8.3 Msps	5.5 Msps	11.1 Msps
10	1 sps	3.7 Msps	7.5 Msps	5.0 Msps	10.0 Msps

The bits per symbol are determined by the modulation type:

Table 9-1

Bits/Symbol	Modulation Type
1	2-Lvl FSK, ASK, BPSK, MSK
2	4-Lvl FSK, 4QAM, C4FM, Gray Coded QPSK, IS95 OQPSK, IS95 QPSK, OQPSK, QPSK, pi/4 DQPSK, Unbalanced QPSK
3	8-Lvl FSK, 8PSK, D8PSK, EDGE
4	16-Lvl FSK, 16PSK, 16QAM, VSA 16QAM
5	32QAM, VSA 32QAM
6	64QAM, VSA 64QAM
7	128QAM, VSA 128QAM
8	256QAM, VSA 256QAM
9	VSA 512QAM
10	1024QAM, VSA 1024QAM

Key Entry **Symbol Rate**

:STANdard:SELect

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:STANdard:SELect
NONE|AC4Fm|ACQPsk|BLUEtooth|CDPD
[:SOURce]:RADio:CUSTom:STANdard:SELect?
```

This command selects a predefined setup for Custom (with the appropriate defaults) and/or clears the selection.

NONE	This choice clears the current predefined Custom format.
AC4Fm	This choice sets up an Association of Public Safety Communications Officials (APCO) compliant, compatible 4-level frequency modulation (C4FM) format.
ACQPsk	This choice sets up an Association of Public Safety Communications Officials (APCO) compliant, compatible quadrature phase shift keying (CQPSK) format.
BLUEtooth	This choice sets up a Bluetooth® (2-level frequency shift keying) format.
CDPD	This choice sets up a minimum shift keying Cellular Digital Packet Data (CDPD) format.
***RST**	NONE

Key Entry	**None**	**APCO 25w/C4FM**	**APCO 25 w/CQPSK**
	Bluetooth		**CDPD**

:TRIGger:TYPE

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:TRIGger:TYPE CONTinuous|SINGle|GATE
[:SOURce]:RADio:CUSTom:TRIGger:TYPE?
```

This command sets the trigger type.

CONTinuous	The framed data sequence repeats continuously; the sequence restarts every time the previous playback is completed. To customize continuous triggering, refer to ":TRIGger:TYPE:CONTinuous[:TYPE]" on page 541.
SINGle	The framed data sequence plays once for every trigger received.

GATE	An external trigger signal interrupts the playback while the gating signal is in the inactive state. Playback resumes when the external control signal returns to the active state. The active state can be set to high or low.
***RST**	CONT

Key Entry	**Continuous**	**Single**	**Gated**

:TRIGger:TYPE:CONTinuous[:TYPE]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:TRIGger:TYPE:CONTinuous[:TYPE]
FREE|TRIGger|RESet
[:SOURce]:RADio:CUSTom:TRIGger:TYPE:CONTinuous[:TYPE]?
```

This commands selects the waveform's response to a trigger signal while using the continuous trigger mode.

For more information on triggering and to select the continuous trigger mode, see ":TRIGger:TYPE" on page 540.

The following list describes the waveform's response to each of the command choices:

FREE	Turning the ARB format on immediately triggers the waveform. The waveform repeats until you turn the format off, select another trigger, or choose another waveform file.
TRIGger	The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously until you turn the format off, select another trigger, or choose another waveform file.
RESet	The waveform waits for a trigger before play begins. When the waveform receives the trigger, it plays continuously. Subsequent triggers reset the waveform to the beginning. For a waveform sequence, this means to the beginning of the first segment in the sequence.
***RST**	FREE

Key Entry	**Free Run**	**Trigger & Run**	**Reset & Run**

:TRIGger:TYPE:GATE:ACTive

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:TRIGger:TYPE:GATE:ACTive LOW|HIGH
[:SOURce]:RADio:CUSTom:TRIGger:TYPE:GATE:ACTive?
```

This command selects the active state (gate polarity) of the gate while using the gating trigger mode.

The LOW and HIGH selections correspond to the low and high states of an external trigger signal. For example, when you select HIGH, the active state occurs during the high of the trigger signal. When the active state occurs, the signal generator stops the waveform playback at the last played sample point, then restarts the playback at the next sample point when the inactive state occurs. For more information on triggering and to select gating as the trigger mode, see ":TRIGger:TYPE" on page 540.

The following list describes the gating behavior for the polarity selections:

LOW	The waveform playback stops when the trigger signal goes low (active state) and restarts when the trigger signal goes high (inactive state).
HIGH	The waveform playback stops when the trigger signal goes high (active state) and restarts when the trigger signal goes low (inactive state).
***RST**	HIGH
Key Entry	**Gate Active Low High**

:TRIGger[:SOURce]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce] KEY|EXT|BUS
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]?
```

This command sets the trigger source.

For more information on triggering, see ":TRIGger:TYPE" on page 540. The following list describes the command choices:

KEY	This choice enables manual triggering by pressing the front-panel **Trigger** key.
EXT	An externally applied signal triggers the waveform. This is the only choice that works with gating. The following conditions affect an external trigger:

– The input connector selected for the trigger signal. You have a choice between the rear-panel PATTERN TRIG IN connector or the PATT TRIG IN 2 pin on the rear-panel AUXILIARY I/O connector. To make the connector selection, see ":TRIGger[:SOURce]:EXTernal[:SOURce]" on page 545.

  For more information on the connectors and on connecting the cables, see the *User's Guide*.

- The trigger signal polarity:
  - gating mode, see “:TRIGger:TYPE:GATE:ACTive” on page 541
  - continuous and single modes, see “:TRIGger[:SOURce]:EXTernal:SLOPe” on page 544
- The time delay between when the signal generator receives a trigger and when the waveform responds to the trigger. There are two parts to setting the delay:
  - setting the amount of delay, see “:TRIGger[:SOURce]:EXTernal:DELay” on page 543
  - turning the delay on, see “:TRIGger[:SOURce]:EXTernal:DELay:STATe” on page 544

BUS	This choice enables triggering over the GPIB or LAN using the ***TRG** or **GET** commands or the AUXILIARY INTERFACE (RS-232) using the ***TRG** command.
***RST**	KEY

Key Entry	**Trigger Key**	**Ext**	**Bus**

:TRIGger[:SOURce]:EXTernal:DELay

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:DELay <val>
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:DELay?
```

This command sets the number of bits to delay the signal generator’s response to an external trigger.

The bit delay is a delay between when the signal generator receives the trigger and when it responds to the trigger. The delay uses the clocks of the bit-clock to time the delay. After the signal generator receives the trigger and the set number of delay bits (clocks) occurs, the signal generator transmits the data pattern.

The delay occurs after you enable the state. See “:TRIGger[:SOURce]:EXTernal:DELay:STATe” on page 544. You can set the number of bits either before or after enabling the state.

For more information on configuring an external trigger source and to select external as the trigger source, see “:TRIGger[:SOURce]” on page 542.

***RST**	+0
Range	0–1048575

Key Entry **Ext Delay Bits**

:TRIGger[:SOURce]:EXTernal:DELay:STATe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:DELay:STATe
ON|OFF|1|0
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:DELay:STATe
?
```

This command enables or disables the operating state of the external trigger delay function.

For setting the delay time, see ":TRIGger[:SOURce]:EXTernal:DELay" on page 543, and for more information on configuring an external source, see ":TRIGger[:SOURce]" on page 542.

***RST** 0

Key Entry **Ext Delay Off On**

:TRIGger[:SOURce]:EXTernal:SLOPe

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:SLOPe
POSitive|NEGative
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal:SLOPe?
```

This command sets the polarity for an external trigger signal while using the continuous, single triggering mode. To set the polarity for gating, see ":TRIGger:TYPE:GATE:ACTive" on page 541.

The POSitive and NEGative selections correspond to the high (positive) and low (negative) states of the external trigger signal. For example, when you select POSitive, the waveform responds (plays) during the high state of the trigger signal. When the signal generator receives multiple trigger occurrences when only one is required, the signal generator uses the first trigger and ignores the rest.

For more information on configuring an external trigger source and to select external as the trigger source, see ":TRIGger[:SOURce]" on page 542.

***RST** NEG

Key Entry **Ext Polarity Neg Pos**

:TRIGger[:SOURce]:EXTernal[:SOURce]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal[:SOURce]
EPT1|EPT2|
EPTRIGGER1|EPTRIGGER2
[:SOURce]:RADio:CUSTom:TRIGger[:SOURce]:EXTernal[:SOURce]?
```

This command selects which PATTERN TRIG IN connection the signal generator uses to accept an externally applied trigger signal when external is the trigger source selection.

For more information on configuring an external trigger source and to select external as the trigger source, see ":TRIGger[:SOURce]" on page 542. For more information on the rear-panel connectors, see the *User's Guide*.

The following list describes the command choices:

EPT1	This choice is synonymous with EPTRIGGER1 and selects the PATTERN TRIG IN rear-panel connector.
EPT2	This choice is synonymous with EPTRIGGER2 and selects the PATT TRIG IN 2 pin on the rear-panel AUXILIARY I/O connector.
EPTRIGGER1	This choice is synonymous with EPT1 and selects the PATTERN TRIG IN rear-panel connector.
EPTRIGGER2	This choice is synonymous with EPT2 and selects the PATT TRIG IN 2 pin on the rear-panel AUXILIARY I/O connector.
***RST**	EPT1

Key Entry	**Patt Trig In 1**	**Patt Trig In 2**

[:STATe]

Supported N5172B/82B with Option 431

```
[:SOURce]:RADio:CUSTom[:STATe] ON|OFF|1|0
[:SOURce]:RADio:CUSTom[:STATe]?
```

This command enables or disables the Custom modulation.

***RST**	0
Key Entry	Custom Off On
Remarks	Although the Custom modulation is enabled with this command, the RF carrier is not modulated unless you also activate the front-panel **Mod On/Off** key.

Fsimulator Subsystem–Option 660 ([:SOURce])

:FSIMulator:FADer:MODE

Supported N5172B/82B with Option 660

```
[:SOURce]:FSIMulator:FADer:MODE OFF|ON|THR
[:SOURce]:FSIMulator:FADer:MODE?
```

This command sets the state of Real-Time Fading simulation.

– Selecting **OFF** sets the state of Real-Time Fading simulation to OFF; do not route through the Fading path.

– Selecting **ON** sets the state of Real-Time Fading simulation to **ON**; route through the Fading path with the Fader in operation; the Fader can only be set to On when a digital personality is on. If all digital personalities are off, the Fader is turned off.

– Selecting **THR** sets the state of Real-Time Fading simulation to Pass-Through; route through the Fading path with the Fader having only a latency and scale effect.

***RST**	OFF
Range	OFF | ON | THR
Key Entry	**Mode > More > Real-Time Fading > Fading Mode > Off | On | Pass-Through**

NOTE

Before Real-Time Fading can be set to On or **Pass-Through**, a modulation format must be selected and Real-Time Custom Modulation must be set to On; if this is not done, an Error: -221 Setting Conflict is generated and written to the error queue.
If an error occurs, clear the error queue and turn on a modulation format.

To clear the error queue, see *CLS on page 152.

Phase Noise Subsystem–Option 432 ([SOURce:RADio:PHASe:NOISe)

:F1

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:PHASe:NOISe:F1 <value><unit>
[:SOURce]:RADio:PHASe:NOISe:F1?
```

This command sets the start frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see :F2). If the value is set greater than the stop frequency value, the signal generator resets the stop value to equal the start value.

The actual value may vary logarithmically depending on the value of the stop frequency. This behavior is more noticeable at higher frequency values. For more information, see the *User's Guide*.

***RST**	+1.00000000E+003
Range	0 Hz to 77.500524490 MHz
Key Entry	**Desired Start Freq (f1)**
Key Path	**Mode > More 2 of 2 > Real-Time Phase Noise Impairment > Desired Start Freq (f1)**

:F1:ACTual?

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:PHASe:NOISe:F1:ACTual?
```

This query returns the actual f1 in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when f1 is varied, based on the capabilities of the hardware.

:F2

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:PHASe:NOISe:F2 <value><unit>
[:SOURce]:RADio:PHASe:NOISe:F2?
```

This command sets the stop frequency value of the flat area for the phase noise impairment.

Ensure that this value is less than or equal to the stop frequency value (see :F1). If the value is set less than the start frequency value, the signal generator resets the start value to equal the stop value.

The actual value may vary logarithmically, which is more noticeable at higher frequency offset values. For more information, see the *User's Guide*.

***RST**	+3.00000000E+004
Range	1 Hz to 77.500524490 MHz
Key Entry	**Desired Stop Freq (f2)**
Key Path	**Mode > More 2 of 2 > Real-Time Phase Noise Impairment > Desired Stop Freq (f2)**

:F2:ACTual?

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:PHASe:NOISe:F2:ACTual?
```

This query returns the actual f2 in use with the current set of desired values. This value may or may not vary if the desired f2 value is changed, based on the capabilities of the hardware.

:LMID

Supported N5172B/82B with Option 432

```
[:SOURce]:RADio:PHASe:NOISe:LMID <value>
[:SOURce]:RADio:PHASe:NOISe:LMID?
```

This command sets the level amplitude of the flat area for the phase noise impairment. This phase noise is added to the base phase noise of the signal generator.

The signal generator has an automatic DAC over-range protection feature that is always on for this subsystem.

For more information on the phase noise impairment option, see the *User's Guide*.

NOTE **The amplitude range varies depending on the f2 value (":F2" on page 547). As f2 increases in value, the range for Lmid decreases. If the current Lmid setting is too high for the new f2 value, the signal generator changes the Lmid value and generates an error.**

The range values are expressed in units of dBc/Hz.

***RST**	–7.00000000E+001
Range	–300 to 100
Key Entry	**Desired Flat Amplitude (Lmid)**
Key Path	**Mode > More 2 of 2 > Real-Time Phase Noise Impairment > Desired Flat Amplitude (Lmid)**

:LMID:ACTual?

Supported	N5172B/82B with Option 432

`[:SOURce]:RADio:PHASe:NOISe:LMID:ACTual?`

This query returns the actual Lmid in use with the current set of desired values. This value may vary if the desired f2 value is changed, and may or may not vary when Lmid is varied, based on the capabilities of the hardware.

[:STATe]

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:PHASe:NOISe[:STATe] ON|OFF|1|0
[:SOURce]:RADio:PHASe:NOISe[:STATe]?
```

This command turns the phase noise impairment on or off. For more information on the phase noise impairment option, see the *User's Guide*.

***RST**	0
Key Entry	**Phase Noise Off On**
Key Path	**Mode > More 2 of 2 > Real-Time Phase Noise Impairment > Phase Noise Off On**

:TRACe?

Supported	N5172B/82B with Option 432

```
[:SOURce]:RADio:PHASe:NOISe:TRACe?
<startFreq>,<stopFreq>,<numSamples>
```

This query returns the theoretical phase noise amplitude mask applied with the current settings if the phase noise feature is on. This mask does not take the natural phase noise of the instrument into account, only the impairment from the phase noise feature. The output is over the start frequency to the stop frequency for the number of samples specified. The samples are taken at logarithmic frequency steps and the output is in dBc/Hz.

Range	<startFreq>	1 Hz to 100 MHz
	<stopFreq>	1 Hz to 100 MHz
	<numSamples>	1 to 8192

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KEYSIGHT
TECHNOLOGIES

This information is subject to change without notice.

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