Quonset Microwave

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QM1002
8-12 GHz 1U Rack Mount Upconverter

Programming Manual

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Notices

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This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the product, is likely to make the product dangerous. Intentional interruption is prohibited. If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means of protection are intact) only.

No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers. For continued protection against fire hazard, replace the line fuse(s) only with fuses of the same type and rating (for example, normal blow, time delay, etc.). The use of other fuses or material is prohibited.

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The following general safety precautions must be observed during all phases of operation of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual or any manual associated with this product violates safety standards of design, manufacture, and intended use of the product. Quonset Microwave assumes no liability for the customer's failure to comply with these requirements.

WARNING

BEFORE APPLYING POWER TO THIS PRODUCT OR MAKING ANY CONNECTIONS TO THIS PRODUCT ensure that all instruments are connected to the protective (earth) ground. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in personal injury or death.

CAUTION

- Use this device with the cables provided.
- Do not attempt to service this device. This device should be returned to Quonset Microwave for any service or repairs.
- Do not open the device.

User Environment

<div align="center">

This instrument is designed for *indoor* use only.

</div>

Markings
The following markings may appear on the equipment or in any related documentation.

ESD Sensitive

This marking indicates that a device, or part of a device, may be susceptible to electrostatic discharges (ESD) which can result in damage to the product. Observed ESD precautions given on the product, or in its user documentation, when handling equipment bearing this mark.

Part 15

This marking indicates that the device complies with applicable sections of part 15 of the FCC rules.

This marking indicates that the device conforms with applicable EC directives.

This marking indicates that the device is equipped with Bluetooth.

This marking indicates that the device is a dual-mode device equipped with both standard and Low Energy Bluetooth.

VISA

This marking indicates that the device complies with the Virtual Instrument Software Architecture (VISA) specification.

SCPI

This marking indicates that the device complies with the Standard Commands for Programmable Instrumentation (SCPI) specification.

USBTMC
USB488

This marking indicates that the device complies with the USB Test & Measurement Class (USBTMC) and the USB 488 subclass specifications.

This marking indicates that the device complies with the VME eXtensions for Instrumentation (VXI) specification.

This marking indicates that the device complies with the LAN eXtensions for Instrumentation (LXI) specification.

This marking indicates that the device communicates over the RS232 Serial Bus.

This marking indicates that the device communicates over the Universal Serial Bus (USB).

This marking indicates that the device communicates over Ethernet.

This marking indicates that the device is USB Low Speed and Full Speed certified.

This marking indicates that the device is USB On The Go (OTG) Low Speed and Full Speed certified.

This marking indicates that the device is USB High Speed certified.

This marking indicates that the device is USB On The Go (OTG) High Speed certified.

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Remote Operation

In This Chapter

The following markings apply to the QM1002 8-12 GHz 1U Rack Mount Upconverter family of products.

ESD Sensitive

VISA

SCPI

USBTMC
USB488

CERTIFIED **USB**
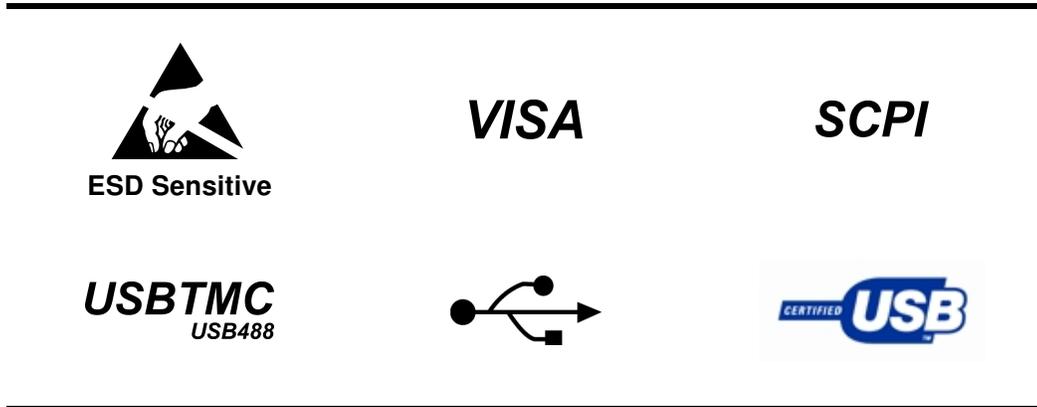
1. Introduction

1.1 USB Configuration

The Quonset Microwave QM1002 8-12 GHz 1U Rack Mount Upconverter has been designed to configure as a USB Test and Measurement Class (USBTMC) device. No additional drivers are required.

The QM1002 has been designed to be Virtual Instrument Software Architecture (VISA) and Standard Commands for Programmable Instrumentation (SCPI) compliant and as such, all you need in order to communicate with the 8-12 GHz 1U Rack Mount Upconverter is a VISA library installed on your machine. The QM1002 will work with any of the three major providers of VISA; National Instruments, Agilent, and Tektronics. If you do not have a VISA library installed, please visit one of the three vendors listed above to obtain a legal copy of the VISA library.

1.2 Command Syntax

In this manual, the following command syntax conventions are used:

- Square brackets ([ ]) indicate multiple keywords, one of which must be used
- Bars(|) can be read as "or" and are used to separate parameter options.

1.2.1 Mnemonic Forms

Each keyword has both a long and short form. A standard notation is used to differentiate the short form and long form keyword. The long form of the keyword is shown, with the short form of the keyword shown in uppercase letters and the rest of the keyword is shown in lowercase letters. For example, the short form of *FREQuency* is *FREQ*.

1.2.2 Using a Semicolon(;)

Use a semicolon to separate two commands within the same command string.

1.2.3 Using Whitespace

You *must* use whitespace characters, [tab], or [space] to separate a parameter from a keyword.

1.2.4 Using "?" Commands

The bus controller may send commands at any time, but a SCPI instrument may only send a response when specifically instructed to do so. Only commands that end with a "?", henceforth referred to as queries, instruct the instrument to send a response message. Queries can return either measured values, instrument settings, or internal status codes.

Note: *If you send multiple queries without reading the response between queries, only the result of the last query will be returned when the response is read. The query buffer is a first-in first-out configuration.*

1.2.5 Using "*" Commands

Commands starting with a "*" are called common commands. They are required to perform identical functions for all instruments that are compliant with the IEEE-488.2 interface standard. The "*" commands are used to control reset, self-test, and status operations in the 8-12 GHz 1U Rack Mount Upconverter.

1.3 Diagram Syntax Conventions

- Solid lines represent the recommended path

- Ovals enclose command mnemonics. The command mnemonic must be entered exactly as shown in the oval.
- Dotted lines indicate an optional path for passing secondary or optional keywords.
- Arrows and curved intersections indicate command path direction.
- All diagrams flow from left to right. A path may not travel to the left except in a bypass loop.

1.4 Default Units
Unless otherwise specified, the following units are assumed:

Table 1.2: Default Units

Current	mA
Frequency	GHz
Power	dBm
Time	ms
Temperature	°C
Voltage	Volts

1.5 Status Reporting
Status reporting is used to monitor the 8-12 GHz 1U Rack Mount Upconverter to determine which events have occurred. Status reporting in accomplished by configuring and reading status registers.

The 8-12 GHz 1U Rack Mount Upconverter has the following main registers:

- Status Register
- Standard Event Register
- Operation Status Register
- Questionable Status Register
- Device Status Register

Status and Standard Event registers are read using the IEEE-488.2 common commands.

Operation and Questionable Status registers are read using the SCPI *STAT* subsystem.

1.6 SCPI Data Types
The SCPI language defines different formats for use in program messages and response messages. Instruments are flexible listeners and can accept commands and parameters in various formats. However, SCPI instruments are precise talkers. This means that SCPI instruments *always* responds to a particular query in a predefined, rigid format.

1.6.1 <boolean> Definition
Throughout this document <*boolean*> is used to represent *ON|OFF| <NRf>*. Boolean parameters have a value of *0* or *1* and are unitless. *ON* corresponds to *1* and *OFF* corresponds to *0*.

On input, an <NRf> is rounded to an integer. A nonzero result is interpreted as 1.

Queries always return a *1* or a *0*, never *ON* or *OFF*.

1.6.2 <character_data> Definition

Throughout this document, <character_data> is used to represent character data, that is, A-Z, a-z, 0-9 and _ (underscore). STOP and A4_U2 are examples of character data. The first character must be alphanumeric, followed by either alphanumeric or underscore characters up to a maximum of 12 characters.

1.6.3 <NAN> Definition

Not a number (NAN) is represented as 9.91 E37. Not a number is defined in IEEE 754.

1.6.4 <non-decimal numeric> Definition

Throughout this document, <non-decimal numeric> is used to represent numeric information in bases other than 10 (that is, hexadecimal, octal, and binary). Examples of non-decimal numeric include #HFF4, #hff4, #Q25, #q25, and #B101011.

1.6.5 <NRf> Definition

Throughout this document, <NRf> is used to denote a flexible numeric representation. The following show examples of <NRf>

- +185
- -10
- +1.2E09

1.6.6 <NR1> Definition

Throughout this document, <NR1> numeric response data is defined as:
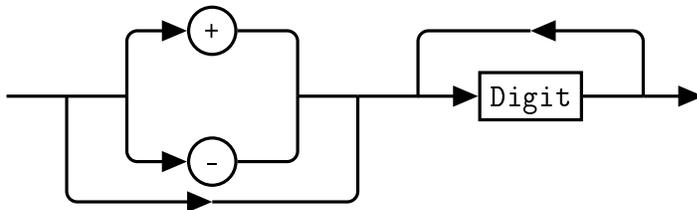
The following shows the examples of <NR1>:

- 127
- +127
- -12345

1.6.7 <NR2> Definition

Throughout this document, <NR2> numeric response data is defined as:
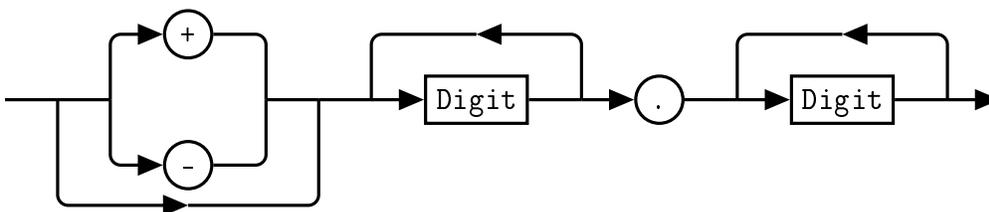
The following shows the examples of <NR2>:

- 12.7
- +127
- -1.2345
- -0.123

1.6.8 <NR3> Definition

Throughout this document, <NR3> numeric response data is defined as:
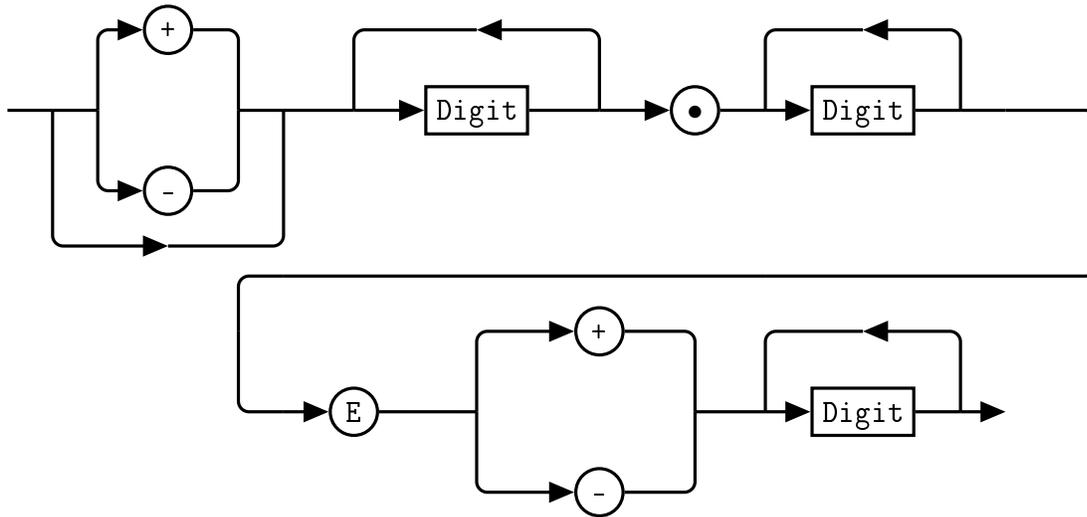
The following shows the examples of <NR3>:

- 1.23E+4
- 12.3E-45

1.6.9 <numeric_value> Definition

Throughout this document, the decimal numeric element is abbreviated to <numeric_value>.

1.6.10 <string> Definition

Throughout this document, <string> is used to represent the 7-bit ASCII characters. The format is defined as:

Program Data
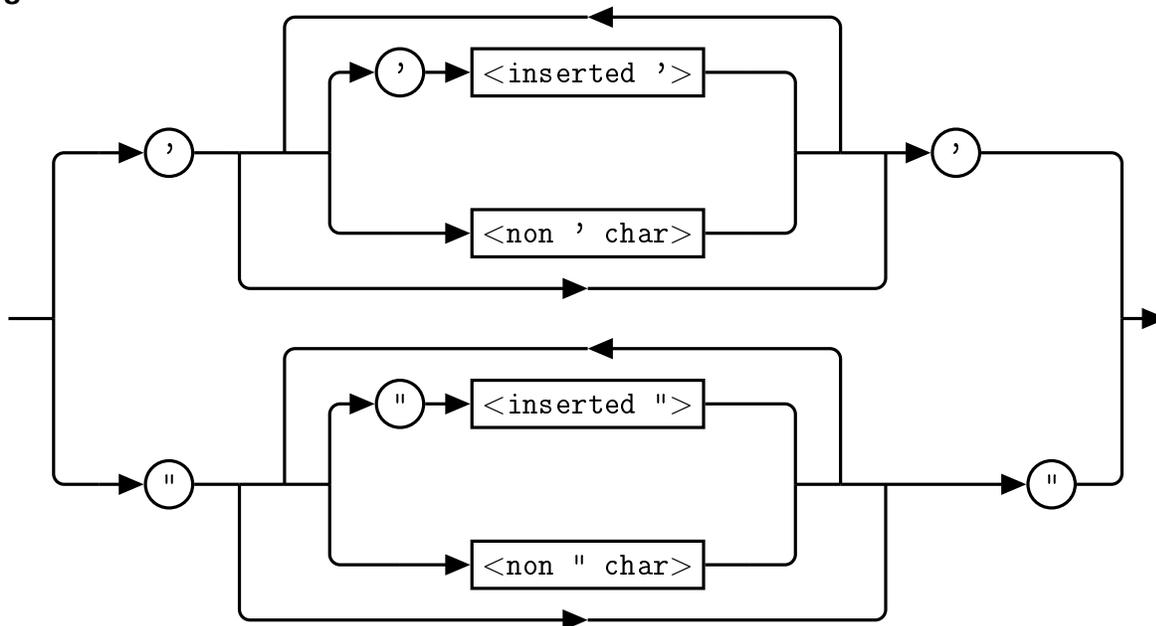
Response Data
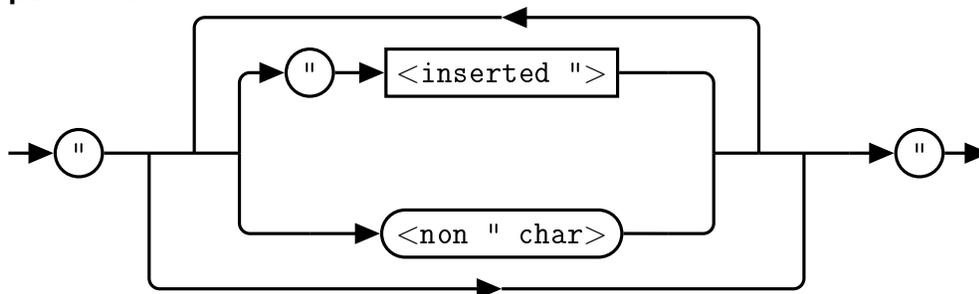
1.7 Input Message Terminators

Program messages sent to a SCPI instrument *must* terminate with a <newline> character. The IEEE.488 EOI (end or identify) signal is interpreted as a <newline> character and may also be used to terminate a message in place of the <newline> character. A <carriage return> followed by a <newline> character is also accepted. Many programming languages allow you to specify a message terminator character or EOI state to be automatically sent with each bus transaction. Message termination *always* sets the current path back to the root-level.

1.8 Compliance Information

1.8.1 IEEE-488.2 Compliance

The 8-12 GHz 1U Rack Mount Upconverter complies with the rules and regulations of the of the IEEE-488.2 standard which are applicable to USB controlled devices.

1.8.2 SCPI Compliance

The 8-12 GHz 1U Rack Mount Upconverter complies with the rules and regulations of the of the SCPI (Standard Commands for Programmable Instruments). You can determine the SCPI version which the 8-12 GHz 1U Rack Mount Upconverter complies with by sending the *SYSTem:VERSion?* command from the remote interface.

1.8.3 USBTMC Compliance

The QM1002 8-12 GHz 1U Rack Mount Upconverter complies with the rules and regulations of the of the USBTMC (USB Test and Measurement Class). When connected to a USB bus, the QM1002 will configure as a USB Test and Measurement device.

1.8.4 VISA Compliance

The QM1002 8-12 GHz 1U Rack Mount Upconverter complies with the rules and regulations of the of the VISA (Virtual Instrument Systems Architecture) standard. Communication with the QM1002 is accomplished through VISA libraries, providing portability between different operating systems. *No additional drivers are required.*

2
Command Quick Reference Guide

In This Chapter

1. Common (*) Commands

<p align="center">**Table 2.1:** Common (*) Commands Summary</p>

Command	Page	Description
*IDN?	41	Returns the identification of the device connected to the computer (Host).
*OPT?	42	Returns the 8-12 GHz 1U Rack Mount Upconverter installed options.
*RCL <NRf>	43	Recalls the state of the 8-12 GHz 1U Rack Mount Upconverter from the specified register (memory location). Functionally the same as SYSTem:LOADSTATE
*RST	44	Returns the 8-12 GHz 1U Rack Mount Upconverter to its initial power up state.
*SAV <NRf>	45	Saves the state of the 8-12 GHz 1U Rack Mount Upconverter to the specified register (memory location). Functionally the same as SYSTem:SAVESTATE

2. FREQuency Subsystem

Table 2.2: FREQuency subsystem Commands Summary

Command	Page	Description
FREQuency:LOCK	15	Returns the lock status of the device.
FREQuency:PLLMode	16	Sets or Returns the PLL Mode of the device (*Integer* or *Fractional*).
FREQuency:REFerence:DIVider	18	Sets or Returns the reference divider value for the PLL of the device.
FREQuency:REFerence:EXTernal	21	Sets or Returns whether the internal or external supplied reference oscillator is used. (External reference input power should not exceed 10 dBm and be at least 4 dBm.)
FREQuency:REFerence:FREQuency	22	Sets or Returns the reference frequency in MHz. When using the internal reference, this should always be 100 MHz.
FREQuency:TUNEr	19	Sets or Returns the desired tuning frequency in GHz.
FREQuency:TUNErACTual	20	Returns the actual tuning frequency of the device in GHz. This query is useful when internal frequency rounding occurs in integer mode on units with internal LOs (Options 100 or 110).

3. POWER Subsystem

Table 2.3: POWER subsystem Commands Summary

Command	Page	Description
POWEr:RF	24	Turns on or off the RF boards.

4. SYSTem Subsystem

Table 2.4: SYSTem subsystem Commands Summary

Command	Page	Description
SYSTem:ERRor	26	Returns the contents of the error queue of the device.
SYSTem:SERialNUMber	32	Returns the serial number of the device.
SYSTem:CURRent	33	Returns the current draw (in Amperes) of the frequency converter unit at its 12V input
SYSTem:VERSion	34	Returns the version of SCPI used by the device.

SYSTem:SAVESTATE	35	Saves the current parameters to a specified state number.
SYSTem:LOADSTATE	36	Loads and sets the parameters from the specified state.
SYSTem:BOOTSTATE	37	Specifies a state to boot to at device startup.
SYSTem:READSTATE	38	Reads the parameters from the specified state without changing the current device setup.

3
FREQuency Subsystem

In This Chapter

1. FREQuency:LOCK?

This command returns the lock status of the 8-12 GHz 1U Rack Mount Upconverter. A lock status of *0* indicates that the device is unlocked, while a lock status of *1* indicates that the device is locked.

Syntax

Query Example

FREQ:LOCK?   *This query returns the lock status of the device*

2. FREQuency:PLLMode [INT|FRAC|1|0]

This command sets the Phase Lock Loop (PLL) mode of the tunable Local Oscillator (LO) located inside the 8-12 GHz 1U Rack Mount Upconverter. A PLL mode of *INT* or *1* indicates that the PLL is operating in Integer mode, while a PLL mode of *FRAC* or *0* indicates that the PLL is operating in Fractional Mode.

When the PLL is placed in *Integer* mode (also referred to as *Integer-N* mode), the output frequency is an integer multiple of the reference oscillator frequency divided by the reference divider multiplied by the prescaler. In the case of the 8-12 GHz 1U Rack Mount Upconverter, the reference frequency is set to 50 MHz, and the prescaler is set to 4. Therefore, with a reference divider of 1 (FREQuency:REFerence:DIVider), the frequency resolution of FREQuency:TUNEr is 200 MHz. This means that 9 GHz would be a tunable frequency, as it is divisible by 200 MHz, but 9.100 GHz would not be. The next tunable frequency after 9 GHz while in integer mode would be 9.200 GHz. The user can manipulate the frequency resolution in integer mode by changing the reference divider. By increasing the reference divider value to 2, the reference frequency effectively becomes 50 MHz / 2 = 25 MHz. Multiplying 5 MHz by 4 provides a frequency resolution of 100 MHz. Now, 9.100 GHz becomes a tunable frequency. While increasing the reference divider value decreases the tunable frequency step size, phase noise performance is degraded.

When the PLL is placed in *Fractional* mode, the tuneable frequency can be any integer value in MHz. In the above example, the synthesizer would be capable of outputting a frequency of 9.005 GHz when operated in *Fractional* mode. When operating in fractional mode, the reference divider should always be 1 for best phase noise performance.

Table 3.1 summarizes the advantages and disadvantages of the two synthesizer operational modes.

Table 3.1: Comparison between Integer and Fractional PLL modes

Mode	Advantages	Disadvantages
Integer	Lower Phase Noise	Frequency must be an integer multiple of $\frac{10MHz}{refdiv} * 4$
	Phase Synchronization between modules is guaranteed	
Fractional	Any frequency can be outputted	Increased Phase Noise
		Phase synchronization is difficult to achieve at best

Syntax
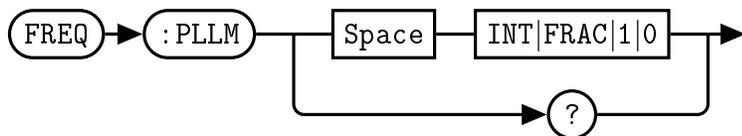
Example

FREQ:PLLM 1   *This command sets the PLL mode of the device to Integer mode.*

Default Condition

On power up, or when a *RST* command is issued, the PLL mode setting defaults to the mode stored in the selected SYSTem:BOOTSTATE.

Query Example

FREQ:PLLM?   *This query returns the PLL mode of the device.*

- 0 is returned if the synthesizer is Fractional Mode

- 1 is returned if the synthesizer is in Integer Mode

3. FREQuency:REFerence:DIVider <numeric value>

This command allows the user to set the frequency reference divider of the 8-12 GHz 1U Rack Mount Upconverter. The reference frequency divider is used to provide finer resolution steps in integer mode. The acceptable range for the reference divider is 1 through 127. The frequency step size in integer mode is $\frac{f_{ref}}{N} * 4$, where $f_{ref} = 10\,MHz$, $N = reference\,divider$, and $prescaler = 4$.

Note: Phase noise will degrade as the REFDIV value increases.

Syntax
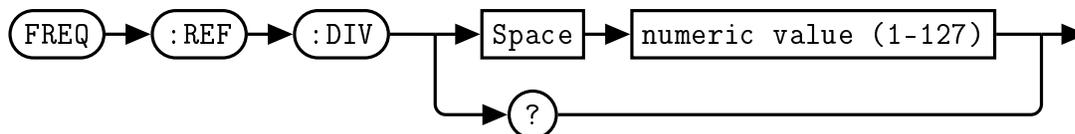
Allowed Values

The reference frequency divider value can be set to any integer value between 1 and 127.

Example

 FREQ:REF:DIV 10   *This command sets the reference divider value to 10.*

Default Condition

On power up, or when a *RST* command is issued, the reference divider value defaults to the frequency stored in the selected SYSTem:BOOTSTATE.

Query

 FREQ:REF:DIV?   *This query returns the reference divider value*

4. FREQuency:TUNEr <channel>,<numeric value>

This command allows the user to set the tuner frequency of the 8-12 GHz 1U Rack Mount Upconverter. The *channel* argument is only valid on dual channel systems with independent LOs (QM1002-8-12-2 with Option 010). Its value acts as a bitmask for specifying which channels' tune frequency will be updated.

NOTICE

The FREQ:TUNE command is necessary even on QM1002 units without external LOs. This is due to the tunable filtering present in the system.

Valid channel arguments are as follows:

- 1 - Channel 1 tune frequency is updated

- 2 - Channel 2 tune frequency is updated

- 3 - Channel 1 and Channel 2 tune frequencies are updated

Syntax
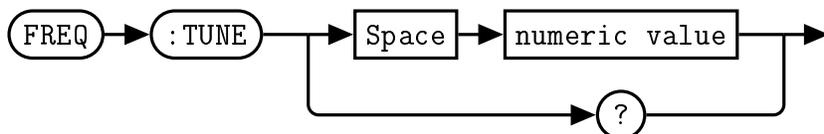
Example

FREQ:TUNE 3,10   *This command sets the Channel 1 and Channel 2 tune center frequencies of the upconverter to 10 GHz. Each channel will upconvert a 1 GHz input signal with 500 MHz of instantaneous bandwidth to a 10 GHz transmit frequency.*

Default Condition

On power up, or when a **RST* command is issued, the synthesizer frequency defaults to the frequency stored in the selected SYSTem:BOOTSTATE.

Query

FREQ:TUNE?   *10.000,8.800*

Channel 1 is tuned to 10 GHz and Channel 2 is tuned to 8.8 GHz

Error Messages

If the frequency entered is out of the operational range of the device, an error message of *201, "Parameter specified out of Device operating range"* is placed in the device's error queue.

---

5. FREQuency:TUNErACTual?

This command returns the actual tuner frequency in GHz of the 8-12 GHz 1U Rack Mount Upconverter. When in integer mode, the 8-12 GHz 1U Rack Mount Upconverter is capable of only tuning in discrete steps, and therefore the actual tuned frequency may vary slightly from the desired frequency set using the *FREQ:TUNE* command. To achieve exact tuned frequencies (down to the MHz level), the user must use fractional mode or increase the reference divider value.

Syntax

FREQ → :TUNEACT → ? →

Query Example

FREQ:TUNEACT?   *This query returns the actual tuner frequency in GHz.*

6. FREQuency:REFerence:EXTernal [ON|OFF|1|0]

This command allows the user to select between the internal reference and an externally supplied reference. Note that when an external reference is applied, the appropriate reference frequency and reference divider values must be set. When digitially switching from an external reference to the internal reference, the reference frequency value will automatically be set to the internal reference clock frequency.

When *OFF* or *0* is specified, the internal reference oscillator is used by the 8-12 GHz 1U Rack Mount Upconverter.

When *ON* or *1* is specified, the external reference input is used by the 8-12 GHz 1U Rack Mount Upconverter.

Syntax
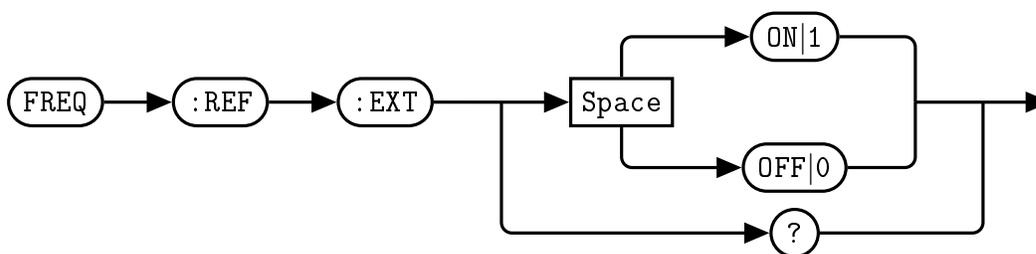
Example

FREQ:REF:EXT 0   *This command selects the internal reference oscillator.*

Default Condition

On power up, or when a **RST* command is issued, the 8-12 GHz 1U Rack Mount Upconverter defaults to the reference oscillator state stored in the selected SYSTem:BOOTSTATE.

Query

FREQ:REF:EXT?   *This query returns a 0 or 1 to indicate the selected 8-12 GHz 1U Rack Mount Upconverter reference mode*

- 0 is returned if the internal reference is selected
- 1 is returned if the external reference oscillator is selected

7. FREQuency:REFerence:FREQuency <numeric value>

This command allows the user to lock the internal LOs (for frequency converters with Option 100 or 110) to an externally applied reference oscillator. This register value must match the user applied reference for the LOs to lock. Valid arguments include integer values between 10 MHz and 100 MHz.

Syntax
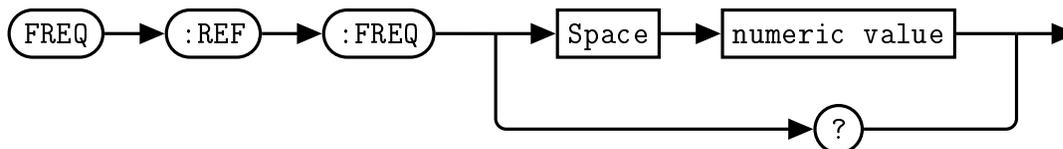
Allowed Values

The reference frequency can be set to any integer value between 10 and 100.

Example

FREQ:REF:FREQ 10   *This command sets the internal reference oscillator to 10 MHz*

Default Condition

On power up, or when a *RST* command is issued, the synthesizer reference oscillator frequency defaults to the reference frequency stored in the selected SYSTem:BOOTSTATE. On first startup, LOs will lock to the internal reference.

Query

FREQ:REF:FREQ?   *This query returns the synthesizer reference frequency in MHz.*

4
POWEr Subsystem

In This Chapter

1. POWEr:RF [ON|OFF|1|0]

This command allows the user to turn on and off system RF power. RF power applies to (1) any frequency conversion channels, (2) all LOs (valid for systems with Option 100 selected), and (3) all reference circuitry (valid for systems with Option 100 selected).

NOTICE

The **POWEr:RF** command does not terminate the input or output of the frequency converter channels. RF power should not be applied when **POWEr:RF** is OFF.

Syntax
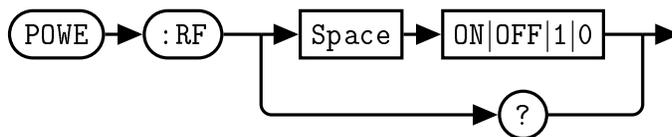
Example

 POWE:RF 0   *This command turns off the QM100x series frequency converter RF power.*

Default Condition
By default, QM100x series frequency converters start up with RF power ON. The user can modify this start condition with the SYST:SAVESTATE command.

Query

 POWE:RF?   *This query returns the RF power state of the device.*

- *0* is returned if the RF output is *OFF*

- *1* is returned if the RF output is *ON*

5
SYSTem Subsystem

In This Chapter

1. SYSTem:ERRor?

This query returns error numbers and messages from the QM1002 error queue. When an error is generated by the QM1002, the error number and corresponding error message is stored in the error queue. Each time the error queue is queried, the first error in the error queue is returned. The errors are read out in the order of first-in first-out. To clear all errors in the error queue, use the *CLS* command.

When the error queue is empty, a query of the error queue will return a 0, "No error" message. The error queue has a maximum capacity of 10 errors.

Syntax

```
( SYST ) ──▶ ( :ERR ) ──▶ ( ? ) ──▶
```

Query Example

SYST:ERR?   *Queries the system error.*

Error queue messages have the following format:

```
[ Error Number ] ──▶ ( , ) ──▶ ( " ) ──▶ [ Error Description ] ──▶ ( " )
```

For example, *100, "Syntax Error"*

Reset Condition

On reset, the error queue is cleared.

Error Message List

<div align="center">Table 5.1: Error Codes and Messages</div>

-101	Invalid character
	Invalid character was found in the command string.
-102	Syntax error
	Invalid syntax was found in the command string.
-103	Invalid separator
	Invalid separator was found in the command string.
-105	GET not allowed
	A Group Execute Trigger (GET) is not allowed within a command string.
-108	Parameter not allowed
	More parameters were received than expected for the command.
-109	Missing parameter
	Fewer parameters were received than expected for the command.
-112	Program mnemonic too long
	A command header was received which contained more than the maximum 12 characters allowed.

-113	Undefined header
	A command was received that is not valid for the 8-12 GHz 1U Rack Mount Upconverter.
-121	Invalid character in number
	An invalid character was found in the number specified for a parameter value.
-123	Exponent too large
	A numeric parameter was found whose exponent was larger than 32,000.
-124	Too many digits
	A numeric parameter was found whose mantissa contained more than 255 digits.
-128	Numeric data not allowed
	A numeric value was received within a command which does not accept a numeric value.
-131	Invalid suffix
	A unit was incorrectly specified for a numeric parameter.
-134	Suffix too long
	A unit used contained more than 12 characters.
-138	Suffix not allowed
	A unit was received following a numeric parameter which does not accept a unit.
-141	Invalid character data
	An invalid character was received.
-148	Character data not allowed
	A discrete parameter was received but a character string or numeric parameter was expected.
-151	Invalid string data
	An invalid string was received.
-158	String data not allowed
	A character string was received but not allowed for the command.
-161	Invalid block data
	A block data element was expected but was invalid.
-168	Block data not allowed
	A legal block data element was encountered but not allowed by the Product.
-178	Expression data not allowed
	A legal expression data element was encountered but not allowed by the Product.
-200	Execution error
	Indicates that an execution error has occurred.
-211	Trigger ignored

		Indicates that a trigger command was received but ignored because the 8-12 GHz 1U Rack Mount Upconverter was not in the wait for trigger state.
-213	Trigger ignored	
		Indicates that a trigger command was received but ignored because the 8-12 GHz 1U Rack Mount Upconverter was not in the wait for trigger state.
-222	Data out of range	
		A numeric parameter value is outside the valid range for the command.
-224	Illegal parameter value	
		A discrete parameter was received which was not a valid choice for the command.
-230	Data corrupt or stale	
		This occurs when a measurement command is attempted and either a reset has been received of the state of the 8-12 GHz 1U Rack Mount Upconverter has changed such that the measurement is no longer valid.
-241	Hardware missing	
		The 8-12 GHz 1U Rack Mount Upconverter is unable to execute the command because the hardware does not support that feature.
-310	System error	
		This error indicates a failure with the 8-12 GHz 1U Rack Mount Upconverter.
-330	Self-test failed	
		The -330,"Self-test failed" error indicates a problem with the 8-12 GHz 1U Rack Mount Upconverter.
-350	Queue overflow	
		The error queue is full and another error has occurred which could not be recorded.
-410	Query INTERRUPTED	
		A command was received which sends data to the output buffer, but the output buffer contained data from a previous command. The output buffer is cleared when power has been of or after a *RST command has been issued.
-420	Query UNTERMINATED	
		The 8-12 GHz 1U Rack Mount Upconverter was addressed to talk but a command has not been received which sends data to the output buffer.
-430	Query DEADLOCKED	
		A command was received which generates too much data to fit in the output buffer and the input buffer is also full. Command execution continues but data is lost.
-440	Query UNTERMINATED after indefinite response	
		The *IDN? command must be the last query command within a command string.
-900	Query Temperature above user defined threshold	

The temperature on the device is higher than the user defined threshold temperature. The device is powered off for safety, and will remain powered off until a user manually powers the device back on.

-901	Query Temperature above factory defined threshold
	The temperature on the device is higher than the factory defined threshold temperature above which components may be damaged. The device is powered off for safety, and will remain powered off until a user manually powers the device back on.
+0	No error
	No errors in the error queue. Device is operating normally.
+110	Invalid Command For Specified Device
	The issued command is invalid for the specified device.

2. SYSTem:FIRMware?

This command returns the current firmware version of the QM1002.

Syntax
Syntax

Query Example

SYST:FIRM?   *This query returns the current firmware version of the 8-12 GHz 1U Rack Mount Upconverter.*

3. SYSTem:OPTions?

This command returns the installed options from the device. The options are returned as a comma sep-
arated string of option codes. If no options are installed, a *0* is returned.

Syntax

$$\text{SYST} \longrightarrow \text{:OPT} \longrightarrow \text{?} \longrightarrow$$

Query Example

SYST:OPT?   *This query returns the installed options of the device.*

4. SYSTem:SERialNUMber?

This command returns the serial number of the device.

Syntax

Query Example

SYST:SERNUM?   *This query returns the serial number of the device.*

5. SYSTem:CURRent?

The CURRent query returns the system current draw, iin Amperes, at the 12V input to the unit. The return value is an approximatation whose accuracy is within $\pm 5\%$ of acutal system current draw.

Syntax

Query

SYST:CURR?   *This query requests the current draw of the QM100x series frequency converter at its 12V.*

Response*: 3.5*

- The current draw of the frequency converter is approximately 3.5A.

6. SYSTem:VERSion?

This query returns the version of SCPI used in the 8-12 GHz 1U Rack Mount Upconverter. The respeonse is in the format XXXX.Y, where XXXX is the year and Y is the version number.

Syntax

Query Example

SYST:VERS?   *This query returns the version of SCPI used in the 8-12 GHz 1U Rack Mount Upconverter.*

7. SYSTem:SAVESTATE [1-5]

This command saves the current setup to non-volatile memory. There are 5 re-writeable memory locations, specified by choosing an index between 1 and 5. Any of the 5 states can be restored on startup when specified with the SYSTem:BOOTSTATE command.

The parameters saved are

- Channel 1 Tune Frequency (GHz)

- Channel 2 Tune Frequency (GHz)

- RF Power

Syntax
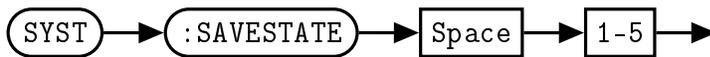
There are 5 memory locations, numbered 1 through 5. Memory location 0 contains the factory default settings and is write-protected.

Example

SYST:SAVESTATE 3   *This command saves the current state of the downconverter to memory location 3*

8. SYSTem:LOADSTATE [0-5]

This command restores a previously saved state from non-volatile memory. In addition to factory default state 0, there are 5 re-writeable memory locations, specified by choosing an index between 1 and 5. The restored parameters are as follows.

- Channel 1 Tune Frequency (GHz)

- Channel 2 Tune Frequency (GHz)

- RF Power

Syntax

$$\boxed{\text{SYST}} \rightarrow \boxed{\text{:LOADSTATE}} \rightarrow \boxed{\text{Space}} \rightarrow \boxed{\text{0-5}} \rightarrow$$

There are 6 memory locations, numbered 0 through 5. Memory location 0 contains the factory default settings, while locations 1-5 are user re-writeable using SYSTem:SAVESTATE.

Example

SYST:LOADSTATE 4   *This command loads the state 4 parameters from non-volatile memory and applies them to the device.*

9. SYSTem:BOOTSTATE [0-5]

This command specifies a previously saved state to be loaded upon device startup. In addition to factory default state 0, there are 5 re-writeable memory locations. Any of these 6 boot states can be selected by choosing an index between 0 and 5.

The restored parameters are

- Channel 1 Tune Frequency (GHz)
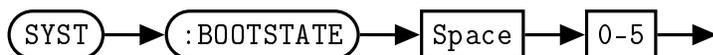
- Channel 2 Tune Frequency (GHz)

- RF Power

Syntax

There are 6 memory locations, numbered 0 through 5. Memory location 0 contains the factory default settings, while locations 1-5 are user re-writeable using SYSTem:BOOTSTATE.

Example

SYST:BOOTSTATE 1   *This command specifies state 1 to be loaded upon device powerup.*

Default Condition

The factory default setting for *SYST:BOOTSTATE* is 0.

10. SYST:READSTATE?[value]

The READSTATE query allows the user to read the parameters of the specified state without changing any internal registers.

The query output is a list of comma separated values, without spaces, in the following order:

- Channel 1 Tune Frequency (GHz)

- Channel 2 Tune Frequency (GHz)

- RF Power

See the respective command definitions for descriptions of each parameter.

Syntax

$$\boxed{SYST} \rightarrow \boxed{:READSTATE?} \rightarrow \boxed{state\ number}$$

Query

SYST:READSTATE?4   *This query requests the parameter values of state 4.*

Response*: 8.000,1,1,50,1,1,0*

- *8.000 = Tune frequency is set to 8 GHz*

- *1 = LO Power is ON*

- *1 = RF Power is ON*

- *50 = Reference frequency is set to 50 MHz*

- *1 = LOs are set to integer mode*

- *1 = Reference divider is set to 1*

- *1 = LOs will lock to the internal reference*

6
IEEE 488.2 Command Reference

In This Chapter

1. SCPI Compliance Information

This chapter contains information on the IEEE-488 Common Commands that the 8-12 GHz 1U Rack Mount Upconverter supports. All commands listed in the table are supported by the device, but only commands with page descriptions are used.

The IEEE-488.2 Common Command descriptions are listed below.

Table 6.1: IEEE 488.2 Common commands

CLS	Clear Status	
ESE and *ESE?*		
ESR?	Event Status Register	
IDN?	Identify	Page 41
OPC and *OPC?*		
OPT?	Options	Page 42
RCL	Recall	Page 43
RST	Reset	Page 44
SAV	Save	Page 45
SRE and *SRE?*		
STB?	Status Byte	
TRG	Trigger	
TST?	Test	
WAI	Wait	

2. *IDN?

The *IDN?* query allows the connected device to identify itself. The string returned is:

Quonset Microwave,<Product Number>,<Serial Number>,<Firmware>,<Device Id>

where:

- *<Product Number>* identifies the product number of the host
- *<Serial Number>* uniquely identifies the host
- *<Firmware>* returns the firmware of the host
- *<Device Id>* returns the device id of the host

Syntax
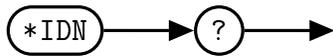
3. *OPT?

The *OPT?* query reports the options installed in the QM1002 8-12 GHz 1U Rack Mount Upconverter and returns " " empty string if no options have been installed. The 8-12 GHz 1U Rack Mount Upconverter has one valid option response - Option 100 for integrated LOs.

Syntax
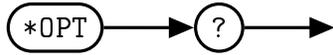
4. *RCL <NRf>

The *RCL* (ReCaLl) command is functionally the same as SYSTem:LOADSTATE. Please see (page 36) for more information.

Syntax

Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 5.

Error Message

If the register does not contain a previously saved state, error *115, "Illegal parameter value"* occurs.

5. *RST

The *RST* (ReSeT) command returns the QM1002 8-12 GHz 1U Rack Mount Upconverter to its initial power-up state.

Syntax

6. *SAV <NRf>

The *SAV* (SAVe) command is functionally the same as SYSTem:SAVESTATE. Please see (page 35) for more information.

Syntax

Allowed Values

The *NRf* parameter can be any integer in the range of 1 to 5.

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