



Quonset Microwave
www.quonsetmicrowave.com

QM1014
LO Synthesizer Distribution Unit

User Manual

Revision 1.2.1, February 2022

Notices

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Manual Part Number

1014-001-21

Edition

Revision 1.2.1, February 2022

Printed in the USA

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A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the likes that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

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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.

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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

This instrument is designed for *indoor* use only.

Markings

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



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.



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 complies with the Virtual Instrument Software Architecture (VISA) specification.



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



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



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



This marking indicates that the device communicates over Ethernet.

Revision Control

| Revision | Description of Changes | Date |
|-----------------|---|-------------|
| 0.0.0 | Initial Release | 10/14/2021 |
| 0.1.0 | Updated Firmware Updates chapter | 10/22/2021 |
| 0.2.0 | Updated Reference Input Power Level Changed LO2 Input to Output in I/O Specifications | 11/09/2021 |
| 1.1.0 | Updated I/O Specifications Updated Firmware Updates chapter Updated Windows Control GUI chapter | 11/22/2021 |
| 1.2.0 | Added FREQ:LO1 and FREQ:LO2 commands Fixed incorrect FREQ:TUNE range error | 12/23/2021 |
| 1.2.1 | Updated FREQ:LO1 and FREQ:LO2 commands Updated Firmware Updates chapter | 02/07/2022 |

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1 Overview

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1. Input/Output Specifications

Table 1.1: Input/Output Specifications

| Parameter | Min | Typ | Max | Unit |
|---|-----|-------------------|-----|------|
| External Reference Input* | | | | |
| Frequency | | 10 | | MHz |
| Power Level | 4 | 10 | 16 | dBm |
| 10 MHz Reference Output | | | | |
| Frequency | | 10 | | MHz |
| Power Level | | 5 | | dBm |
| Type: Sine Wave | | | | |
| External LO1 Output | | | | |
| Frequency | | | | |
| $f_{Tune} < 1.05$ GHz | | $f_{Tune} + 9.5$ | | GHz |
| $1.05 \text{ GHz} \leq f_{Tune} < 1.45$ GHz | | $f_{Tune} + 10.0$ | | GHz |
| $1.45 \text{ GHz} \leq f_{Tune} < 2.85$ GHz | | $f_{Tune} + 9.5$ | | GHz |
| $2.85 \text{ GHz} \leq f_{Tune} < 3.05$ GHz | | $f_{Tune} + 10.0$ | | GHz |
| $3.05 \text{ GHz} \leq f_{Tune} < 4.55$ GHz | | $f_{Tune} + 9.5$ | | GHz |
| $4.55 \text{ GHz} \leq f_{Tune} < 4.85$ GHz | | $f_{Tune} + 10.0$ | | GHz |
| $4.85 \text{ GHz} \leq f_{Tune} < 5.85$ GHz | | $f_{Tune} + 9.5$ | | GHz |
| $f_{Tune} \geq 5.85$ GHz | | $f_{Tune} + 10.0$ | | GHz |
| Power Level | | -5 | | dBm |
| External LO2 Output | | | | |
| Frequency | | | | |
| $f_{Tune} < 2.85$ GHz | | 12.0 | | GHz |
| $2.85 \text{ GHz} \leq f_{Tune} < 3.05$ GHz | | 12.5 | | GHz |
| $3.05 \text{ GHz} \leq f_{Tune} < 4.55$ GHz | | 12.0 | | GHz |
| $4.55 \text{ GHz} \leq f_{Tune} < 4.85$ GHz | | 12.5 | | GHz |
| $4.85 \text{ GHz} \leq f_{Tune} < 5.85$ GHz | | 12.0 | | GHz |
| $f_{Tune} \geq 5.85$ GHz | | 12.5 | | GHz |
| Power Level | | 0 | | dBm |

* NOTE: The external reference must be blocked or held at 0V DC. DC bias not allowed and not blocked internally.

2. General Description

The QM1014 is a LO Synthesizer Distribution Unit housed in a 1U box. The QM1014 is controlled either through the onboard USB or TCP/IP connection. The QM1014 delivery kit contains a user manual, power supply, and USB A- μ B cable. A model of the QM1014 is shown below in Fig. 1.1.



Figure 1.1: QM1014 LO Synthesizer Distribution Unit system

The QM1014 LO Synthesizer Distribution Unit provides four LO1 outputs and four LO2 outputs, suitable for driving QM1013-102 Dual Channel RF Upconverter Units. The Local Oscillators (LOs) in the QM1014 are locked to a common internal 10 MHz reference. The user has the option of supplying their own reference through the BNC connector located on the back panel of the QM1014.

3. System Block Diagram

A System block diagram for the QM1014 LO Synthesizer Distribution Unit is shown in Figure 1.2. The microcontroller outputs basic status messages on a 32-character Liquid Crystal Display (LCD) mounted on the faceplate of the unit. An internal 10 MHz reference clock is phase-locked to all of the internal LOs, with a BNC-F connector providing the option for LOs to lock to a user-provided 10 MHz external reference. An additional BNC-F connector forwards the 10 MHz reference back out for use by external test equipment.

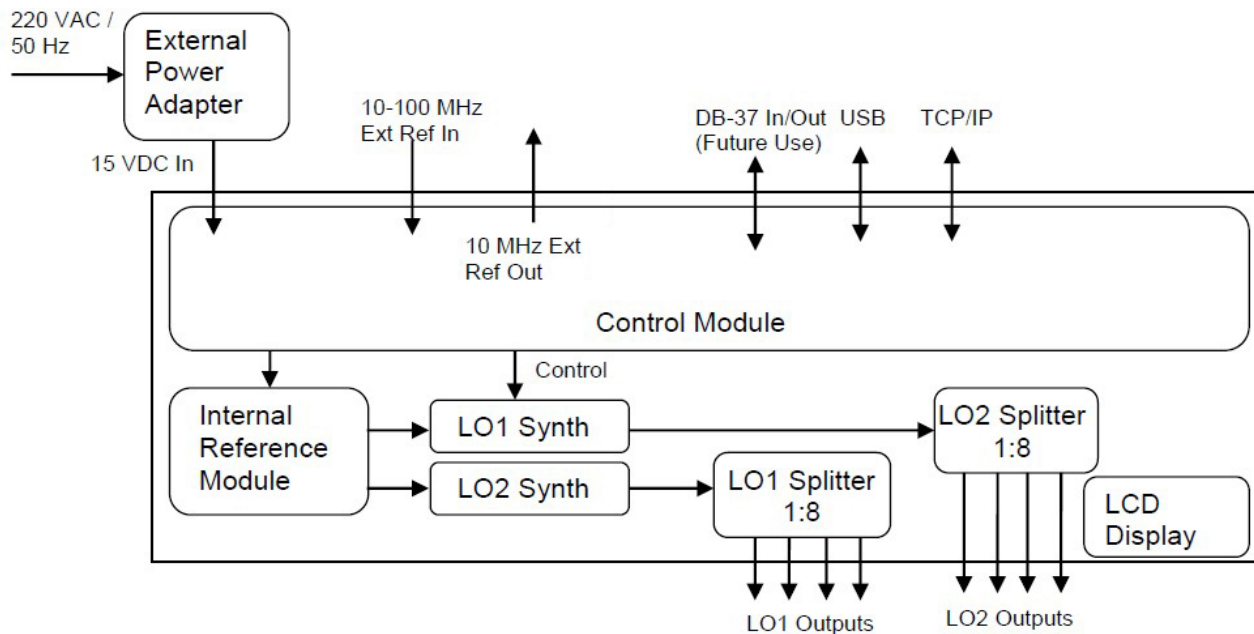


Figure 1.2: QM1014 LO Synthesizer Distribution Unit Block Diagram



2 Firmware Updates

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1. Introduction

The QM1014 LO Synthesizer Distribution Unit is continually being improved and may require firmware updates to correct problems in previous firmware versions or to add new features that were not yet implemented in previous firmware versions. Table 2.1 details Firmware Revisions that have been released and which features they fixed or introduced.

Table 2.1: PIC Firmware Revision History

| PIC Firmware Version | Reason To Update |
|-----------------------------|--|
| v0.3.0 | N/A (Initial release) |
| v1.0.0 | Fixes an issue with user states |
| v1.1.0 | Fixes USB enumeration issue Adjusts frequency plan |
| v1.2.0 | Added <code>FREQ:LO1</code> and <code>FREQ:LO2</code> override commands |
| v1.2.1 | Opened range of input for <code>FREQ:LO1</code> and <code>FREQ:LO2</code> commands |

2. Firmware Update Files

The required files to perform firmware updates are uploaded onto the Quonset Microwave FTP server and need to be downloaded and extracted to a location on the computer performing the update prior to continuing.

Firmware updates can be obtained by clicking the following link and navigating to the download link in the Software tab:

<http://www.quonsetmicrowave.com/QM104-p/qm1014.htm>

The zip files contain the necessary files required to perform the firmware updates. PIC Firmware Updates require *.hex files.

All firmware updates are applied with the QM1014 powered on.

3. PIC Firmware Updates

The QM1014 uses a Microchip Tehcnology, Inc. PIC32MZ2048EFH144 processor. The PIC firmware update process is done using an In-Circuit Serial Programmer (ICSP) with an RJ-12 connection. The following figure lists the currently supported programmers.

| "G" Green indicates full, production tested support. | | | | | | | | | | | | | | | | | | | | | |
|--|-----------------------|-----------------------|------------------|------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------|------------------|-------------|----------------------------|------------------|-----------------------|----------------------------|-------------|------------------|------------------|------|
| "Y" Yellow indicates preliminary, beta support, not production tested. Yellow light support is often intended for early adopters of new parts who need quick support and understand that some operations or functions may not be available. | | | | | | | | | | | | | | | | | | | | | |
| "R" Red indicates no support for this device. Support may be forthcoming or inappropriate for the tool, compiler or device, e.g., PIC24 devices cannot be supported by XC32 compiler. | | | | | | | | | | | | | | | | | | | | | |
| Device Support 2021-05-13 3202 devices | S N A P D | S N A P D | P K 4 D | P K 4 P | I C D 4 D | I C D 4 P | R I C E D | R I C E P | I C D 3 D | I C D 3 P | P K 3 D | P K 3 P | P M 3 | S I M I S A | S I M P | A I C E P | P I C - A S | X C 8 | X C 1 6 | X C 3 2 | |
| PIC32MZ2048EFH144 | G | G | G | G | G | G | G | G | G | G | G | G | G | G | Y | R | R | R | R | R | 1.41 |

Figure 2.1: Supported PIC Programmers

An updated list of devices supported can be found in the MPLAB installation directory (typically C:\Program Files\Microchip\MPLABX\vX.XX\docs\Device Support.htm where X.XX is the MPLAB version number installed).

The PIC firmware update process documented below is performed using a Custom Computer Services, Inc. (CCS) ICD-U64 Debugger/Programmer. The ICD-U64 from CCS includes the CCSLOAD free programmer control software, which is used to load the update. The update can also be performed using Microchip's MPLAB X IPE or any supported programmer's native software.



Figure 2.2: CCSLOAD: PIC Programming

After opening CCSLOAD, simply click the Open File icon and select the QM1014_v1.0.0.hex file. The PIC32MZ version currently also requires additionally selecting the Device field, which opens the Select Target Device dialog, where the PIC32MZ2048EFH144 device must be selected. Once properly setup, select the 'Write to Chip' icon. After programming, close CCSLOAD to run the new firmware version.



3 Remote Operation

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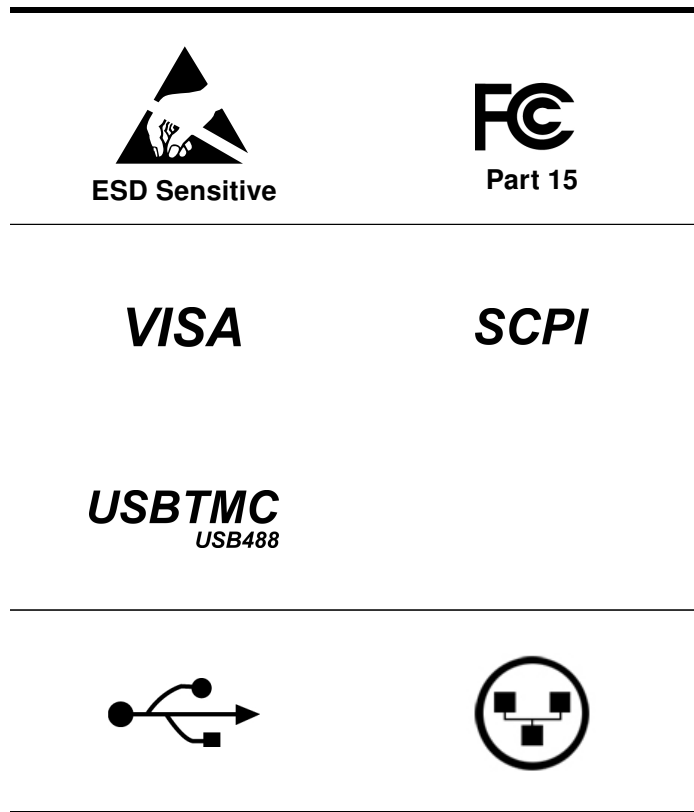
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2.1.1 VISA Descriptors 17

2.1.2 USBTMC VISA Code Example 17

The following markings apply to the QM1014 LO Synthesizer Distribution Unit family of products.



1. Introduction

1.1 USB Configuration

The Quonset Microwave QM1014 LO Synthesizer Distribution Unit has been designed to configure as a USBTMC or TCPIP device. No additional drivers are required.

The QM1014 has been designed to be VISA and SCPI compliant and as such, all you need in order to communicate with the LO Synthesizer Distribution Unit is a VISA library installed on your machine. The QM1014 has been designed using the NI-VISA Runtime Engine, which is included with the GUI.

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 LO Synthesizer Distribution Unit.

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 3.2: Default Units

| | |
|-------------|---------|
| Current | A |
| Frequency | GHz |
| Power | dBm |
| Time | μ s |
| Temperature | °C |
| Voltage | Volts |

1.5 Status Reporting

Status reporting is used to monitor the LO Synthesizer Distribution Unit to determine which events have occurred. Status reporting is accomplished by configuring and reading status registers.

The LO Synthesizer Distribution Unit 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.

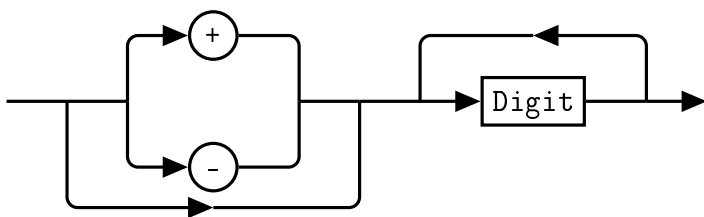
1.6.5 <NRf> Definition

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:

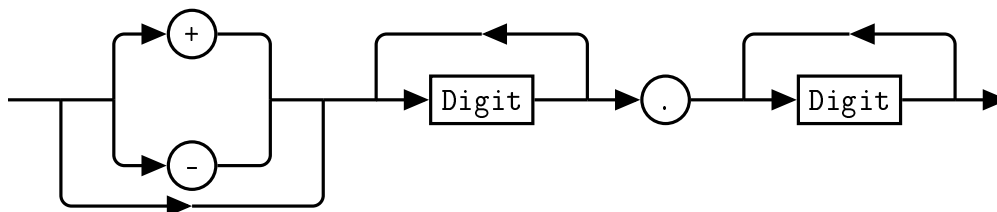


The following shows the examples of <NR1>:

- 127
- +127
- -12345

1.6.7 <NR2> Definition

Throughout this document, <NR2> numeric response data is defined as:

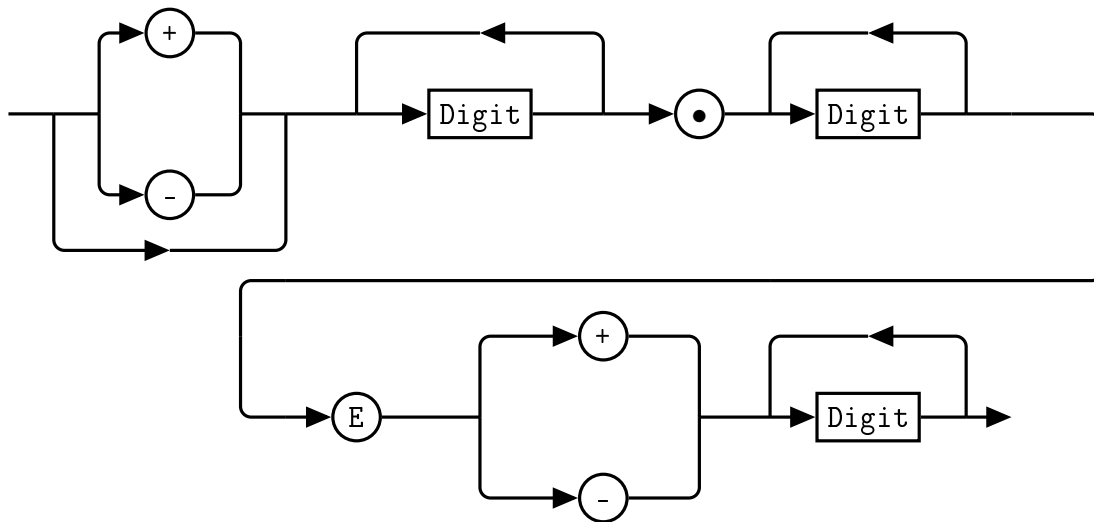


The following shows the examples of <NR2>:

- 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

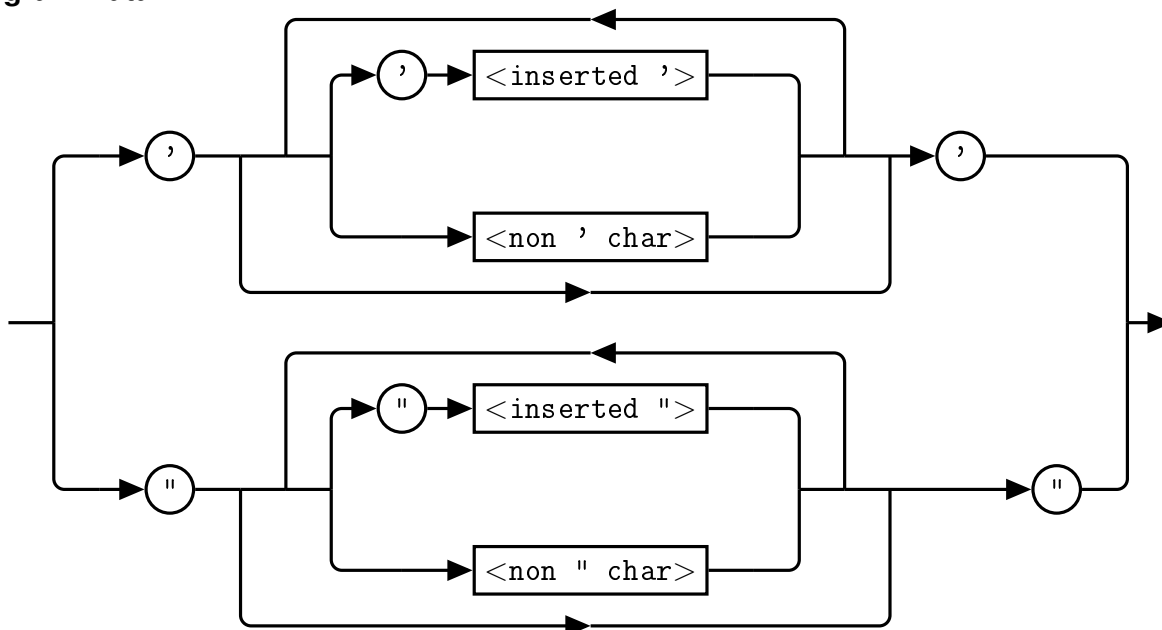
1.6.9 <numeric_value> Definition

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

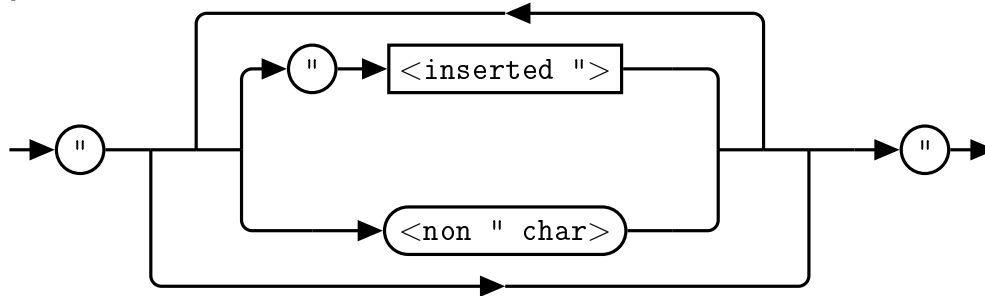
1.6.10 <string> Definition

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 LO Synthesizer Distribution Unit complies with the rules and regulations of the of the IEEE-488.2 standard which are applicable to USB controlled devices.

1.8.2 USBTMC Compliance

The QM1014 LO Synthesizer Distribution Unit complies with the rules and regulations of the of the USBTMC (USB Test and Measurement Class). When connected to a USB bus, the QM1014 will configure as a USB Test and Measurement device.

1.8.3 VISA Compliance

The QM1014 LO Synthesizer Distribution Unit complies with the rules and regulations of the of the VISA (Virtual Instrument Systems Architecture) standard. Communication with the QM1014 is accomplished through VISA libraries, providing portability between different operating systems. *No additional drivers are required.*

2. VISA Descriptors and Configuration

2.1 USBTMC

2.1.1 VISA Descriptors

To communicate with the Quonset Microwave QM1014 LO Synthesizer Distribution Unit as a USBTMC device, use the following USB VISA descriptor format:

```
USB[board number]::manufacturer ID::model code::serial number::INSTR
```

Descriptor Example

```
USB0::0x2012::0x0027::0001::INSTR
```

2.1.2 USBTMC VISA Code Example

```
ViSession rscmng;  
ViSession qm1014;  
char buf[256] = 0;  
  
viOpenDefaultRM(&rscmng);  
viOpen(rscmng,(ViRsrc)"USB0::0x2012::0x0027::0001::INSTR",VI_NULL,VI_NULL,&qm1014);  
viPrintf(qm1014,(ViString)"*IDN?\n");  
viScanf(qm1014,(ViString)"%t",&buf);  
viClose((ViObject)qm1014);  
viClose((ViObject)rscmng);
```



4 Control Commands

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1. Command Quick Reference Guide

1.1 Common (*) Commands

Table 4.1: Common (*) Commands Summary

| Command | Page | Description |
|------------|------|---|
| *CLS | 53 | Clears the data structures. The SCPI registers are cleared. |
| *ESE <NRf> | 54 | Sets the Standard Event Status Enable Register. |
| *ESE? | 54 | Returns the Standard Event Status Enable Register. |
| *ESR? | 55 | Returns the contents of the Standard Event Status Register and then clears it. |
| *IDN? | 56 | Returns the identification of the device connected to the computer (Host). |
| *OPC | 57 | Causes the LO Synthesizer Distribution Unit to set the operation complete bit in the Standard Event Status Register when all pending operations have completed. |
| *OPC? | 57 | Returns the operation complete bit in the Standard Event Status Register when all pending operations have completed. |
| *RCL <NRf> | 58 | Recalls the settings of the LO Synthesizer Distribution Unit from the specified register (memory location). |
| *RST | 59 | Returns the LO Synthesizer Distribution Unit to its initial power up state. |
| *SAV <NRf> | 60 | Saves the settings of the LO Synthesizer Distribution Unit to the specified register (memory location). |
| *SDS <NRf> | 61 | Saves the default settings of the LO Synthesizer Distribution Unit to the specified register (memory location). |
| *SRE <NRf> | 62 | Sets the Service Request Enable register bits. |
| *SRE? | 62 | Returns the Service Request Enable register bits. |
| *STB? | 63 | Returns the LO Synthesizer Distribution Unit status byte. |
| *TST? | 64 | Performs a self-test and returns the result. |
| *WAI | 65 | Causes the LO Synthesizer Distribution Unit to wait until either all pending commands are complete, the Device Clear command is received, or the power is cycled before executing any subsequent commands or queries. |

1.2 FREQUENCY Subsystem

Table 4.2: FREQUENCY Subsystem Commands Summary

| Command | Page | Description |
|------------------------------|------|---|
| FREQUENCY:LO1 | 23 | Sets or Returns the frequency of the internal LO1. |
| FREQUENCY:LO2 | 24 | Sets or Returns the frequency of the internal LO2. |
| FREQUENCY:LOCK | 25 | Returns the lock status of the internal LOs. |
| FREQUENCY:TUNE | 26 | Sets or Returns the desired tuning frequency in GHz. |
| FREQUENCY:TUNERACTual | 27 | Returns the actual tuning frequency of the device in GHz. This query is useful when internal frequency rounding occurs in integer mode. |
| FREQUENCY:LO1:LOCK | 28 | Returns the lock status of the internal LO1s for both channels. |
| FREQUENCY:LO2:LOCK | 29 | Returns the lock status of the internal LO2 for the system. |
| FREQUENCY:REFERENCE:EXTERNAL | 30 | Sets or Returns whether the internal or external supplied reference oscillator is used. |

1.3 POWER Subsystem

Table 4.3: POWER Subsystem Commands Summary

| Command | Page | Description |
|----------|------|--|
| POWER:RF | 31 | Turns on or off the RF output of the device. |

1.4 STATUS Subsystem

Table 4.4: STATUS Subsystem Commands Summary

| Command | Page | Description |
|-------------------------------|------|--|
| STATUS:OPERation | 32 | Returns the contents of the status event register. |
| STATUS:OPERation:CONDition | 33 | Returns the contents of the condition register. |
| STATUS:OPERation:ENABLE | 34 | Sets the enable bit mask for the status event register. |
| STATUS:PRESet | 35 | Presets the STATUS:QUESTIONable:ENABLE register. |
| STATUS:QUESTIONable | 36 | Returns the contents of the questionable register. |
| STATUS:QUESTIONable:CONDition | 37 | Returns the contents of the questionable condition register. |
| STATUS:QUESTIONable:ENABLE | 38 | Sets the enable bit mask for the questionable register. |

1.5 SYSTem Subsystem

Table 4.5: SYSTem Subsystem Commands Summary

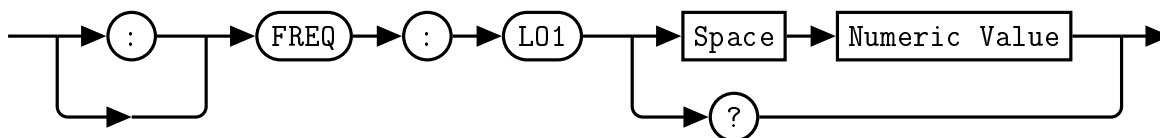
| Command | Page | Description |
|---------------------|-------------|---|
| SYSTem:BOOTstate | 39 | Specifies a state to boot to at device startup. |
| SYSTem:CURRent | 40 | Returns the current draw of the device. |
| SYSTem:ERRor | 41 | Returns error numbers and messages from the error queue. |
| SYSTem:FIRMware | 45 | Returns the current firmware version of the device. |
| SYSTem:LOADstate | 46 | Loads and sets the parameters from the specified state. |
| SYSTem:READstate | 47 | Reads the parameters from the stored state without changing the current device setup. |
| SYSTem:SAVEstate | 48 | Saves the current parameters to a specified state number. |
| SYSTem:SERialNUMBER | 49 | Returns the serial number of the device. |
| SYSTem:USBPID | 50 | Returns the USB PID of the device. |
| SYSTem:VERSion | 51 | Returns the version of SCPI implemented in the LO Synthesizer Distribution Unit. |

2. FREQUENCY Subsystem Command Reference

2.1 FREQUENCY:LO1 <numeric value>

This command allows the user to set the LO1 frequency of the QM1014. The frequency value is specified in GHz. The range of acceptable LO1 frequency values is 10-20 GHz with a 6 decimal places and a 1 Hz tuning resolution. This resolution can be made finer if necessary via a future firmware update.

Syntax



Example

:FREQ:LO1 13

This command sets the LO1 frequency of the QM1014 to 13 GHz.

Default Condition

On power up, or when a *RST command is issued, the QM1014 returns to the boot state's setting. The LO Synthesizer Distribution Unit default setting is 13. This is an override setting for debugging purposes. Subsequent tune commands will remove this override.

Query

:FREQ:LO1? *This query returns the LO1 frequency of the QM1014 in GHz.*

Error Message

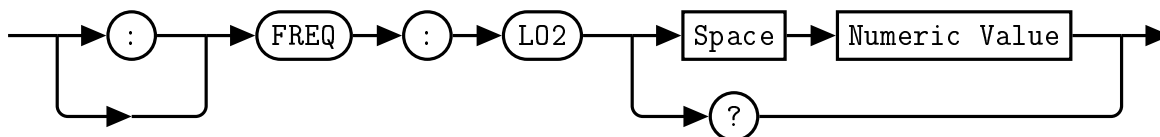
If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is not between 9.501 and 16, error -222, "Data out of range" occurs.

2.2 FREQuency:LO2 <numeric value>

This command allows the user to set the LO2 frequency of the QM1014. The frequency value is specified in GHz. The range of acceptable LO2 frequency values is 10-20 GHz with a 6 decimal places and a 1 Hz tuning resolution. This resolution can be made finer if necessary via a future firmware update.

Syntax



Example

:FREQ:LO2 12.5 *This command sets the LO2 frequency of the QM1014 to 12.5 GHz.*

Default Condition

On power up, or when a *RST command is issued, the QM1014 returns to the boot state's setting. The LO Synthesizer Distribution Unit default setting is 12.5. This is an override setting for debugging purposes. Subsequent tune commands will remove this override.

Query

:FREQ:LO2? *This query returns the LO2 frequency of the QM1014 in GHz.*

Error Message

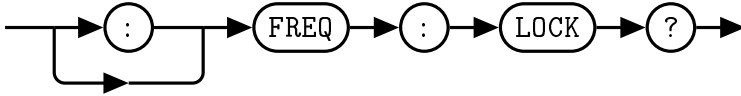
If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is not 12 or 12.5, error -222, "Data out of range" occurs.

2.3 FREQuency:LOCK

This query allows the user to check the lock status of the internal LOs to the reference signal.

Syntax



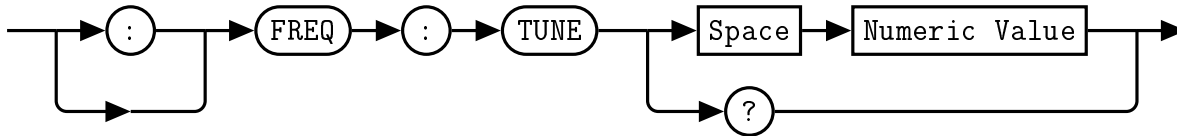
Query

:FREQ:LOCK? *This query returns the lock status of the internal LOs. A lock status of 0 indicates that the LOs are unlocked, while a lock status of 1 indicates the LOs are locked.*

2.4 FREQuency:TUNE <numeric value>

This command allows the user to set the tuner frequency of the QM1014. The frequency value is specified in GHz. The range of acceptable tune frequency values is 0.001-6 GHz with a 6 decimal places and a 2 Hz tuning resolution. This resolution can be made finer if necessary via a future firmware update.

Syntax



Example

:FREQ:TUNE 3 *This command sets the center frequency of the QM1014 to 3 GHz.*

Default Condition

On power up, or when a *RST command is issued, the QM1014 returns to the boot state's setting. The LO Synthesizer Distribution Unit default setting is 3.

Query

:FREQ:TUNE? *This query returns the center frequency of the QM1014 in GHz.*

Error Message

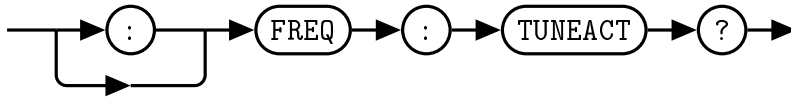
If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is not between 0.001 and 6, error -222, "Data out of range" occurs.

2.5 FREQuency:TUNErACTual

This query returns the actual tuner frequency of the QM1014 in GHz. This can be different than the set frequency if a set frequency finer than the tuning resolution is entered.

Syntax



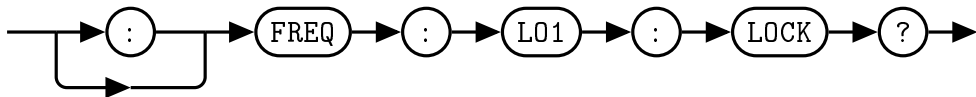
Query

:FREQ:TUNEACT? *This query returns the actual tuner frequency of the QM1014 in GHz.*

2.6 FREQuency:LO1:LOCK

This query allows the user to check the lock status of the internal LO1 to the reference signal for the LO Synthesizer Distribution Unit.

Syntax



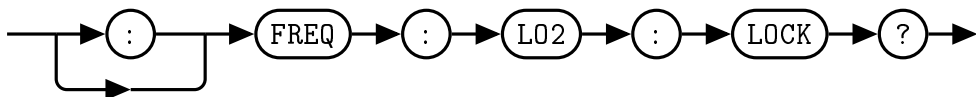
Query

:FREQ:LO1:LOCK? *This query returns the lock status of the internal LO1. A lock status of 0 indicates that the LO1 is unlocked, while a lock status of 1 indicates the LO1 is locked.*

2.7 FREQuency:LO2:LOCK

This query allows the user to check the lock status of the internal LO2 to the reference signal for the LO Synthesizer Distribution Unit.

Syntax



Query

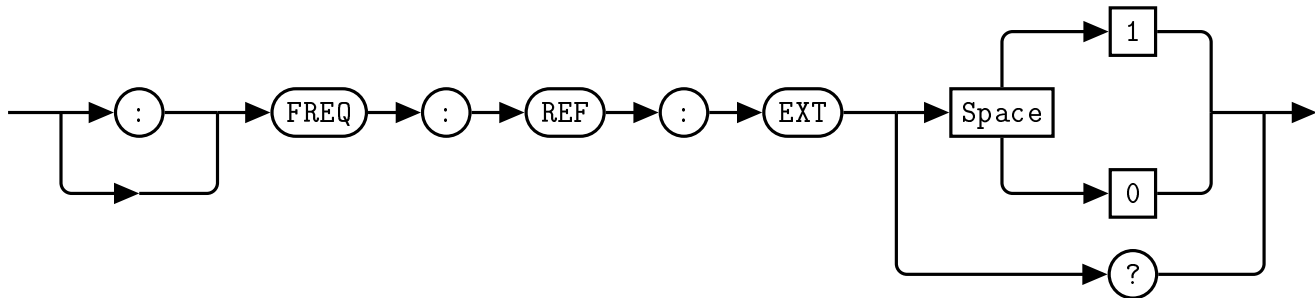
:FREQ:LO2:LOCK? *This query returns the lock status of the internal LO2. A lock status of 0 indicates that the LO2 is unlocked, while a lock status of 1 indicates the LO2 is locked.*

2.8 FREQuency:REFerence:EXTernal [1|0]

This command allows the user to select between the internal 10 MHz reference and an externally supplied reference. Issuing this command overrides the back panel toggle switch setting.

When *0* is specified, the internal reference oscillator is used by the LO Synthesizer Distribution Unit. When *1* is specified, the external reference input is used by the LO Synthesizer Distribution Unit.

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 QM1014 returns to the boot state's setting. The LO Synthesizer Distribution Unit default setting is 0.

Query

:FREQ:REF:EXT? *This query returns a 0 or 1 to indicate the selected LO Synthesizer Distribution Unit reference mode*

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

Error Message

If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is not 1 or 0, error -222, "Data out of range" occurs.

3. POWER Subsystem Command Reference

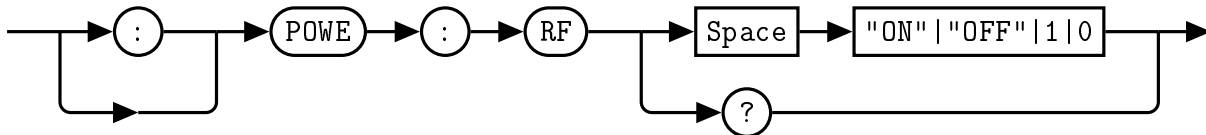
3.1 POWER:RF [ON|OFF|1|0]

This command allows the user to turn on and off the RF power of the QM1014.

When *0* or *OFF* is specified, the RF power is turned off.

When *1* or *ON* is specified, the RF power is turned on.

Syntax



Example

`:POWER:RF 0` This command turns off the RF power.

Default Condition

On power up, or when a **RST* command is issued, the QM1014 returns to the boot state's setting. The LO Synthesizer Distribution Unit default setting is 0.

Query

`:POWER:RF?` This query returns a 0 or 1 to indicated the LO Synthesizer Distribution Unit power state.

- 0 is returned if the RF power is *OFF*
- 1 is returned if the RF power is *ON*

Error Message

If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

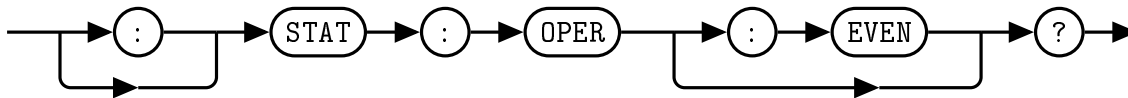
4. STATus Subsystem Command Reference

4.1 STATus:OPERation?

This query returns the contents of the status event register. Reading from this event register clears it.

The use of the :EVENT token is optional.

Syntax



Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 32767.

Query

:STAT:OPER? *The status event register is queried.*

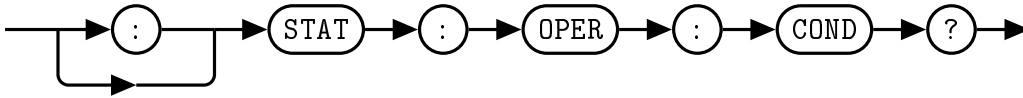
Reset Condition

On reset, the status event register is cleared.

4.2 STATus:OPERation:CONDition?

This query returns the contents of the condition register.

Syntax



Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 32767.

Query

:STAT:OPER:COND? *The condition register is queried.*

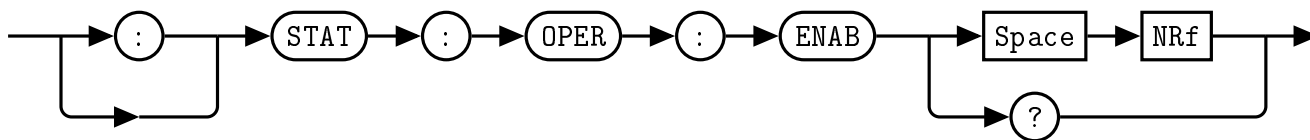
Reset Condition

On reset, the condition register is cleared.

4.3 STATus:OPERation:ENABle <NRf>

This command sets the enable mask for the status event register. A bit value of 1 in the mask will allow a positive transition in the associated summary bit of the event register if the event bit transitions to true.

Syntax



Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 32767.

Query

:STAT:OPER:ENAB? *The event register enable bit mask is queried.*

Reset Condition

On reset, the enable bit mask register is cleared.

Error Message

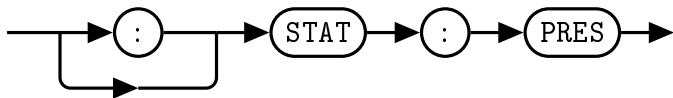
If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is less than 0 or greater than 32767, error -222, "Data out of range" occurs.

4.4 STATus:PRESet

The PRESet command presets the STATus:QUESTionable:ENABle register to 0. No other registers are affected. *CLS;*SRE 0;*ESE 0 is the recommended command sequence to reset all other status/event registers.

Syntax



Example

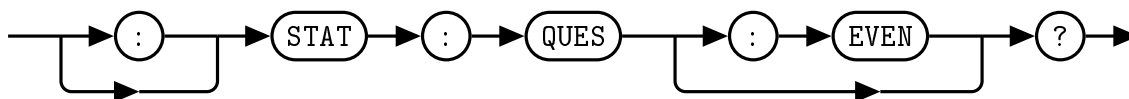
:STAT:PRES *The questionable enable register is preset.*

4.5 STATus:QUEStionable?

This query returns the contents of the questionable status register. A value of 1 in the bit indicates the accuracy of the signal is of questionable quality.

The use of the :EVENT token is optional.

Syntax



Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 32767.

Query

:STAT:QUES? *The questionable register is queried.*

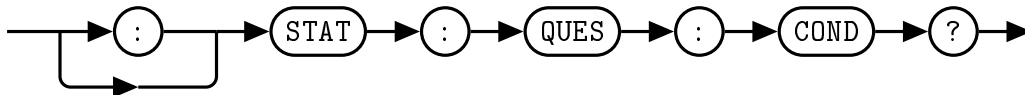
Reset Condition

On reset, the questionable register is cleared.

4.6 STATus:QUEStionable:CONDition?

This query returns the contents of the questionable condition register.

Syntax



Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 32767.

Query

:STAT:QUES:COND? *The questionable condition register is queried.*

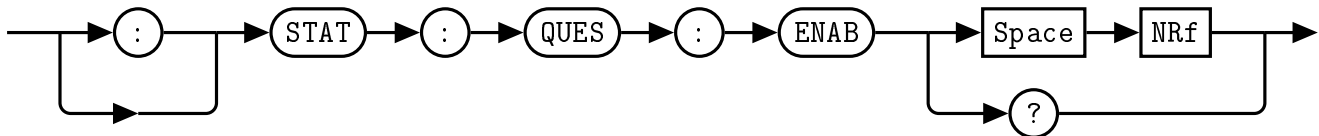
Reset Condition

On reset, the questionable condition register is cleared.

4.7 STATus:QUEStionable:ENABle <NRf>

This command sets the enable mask for the questionable event register. A bit value of 1 in the mask will allow a positive transition in the associated summary bit of the questionable event register if the event bit transitions to true.

Syntax



Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 32767.

Query

:STAT:QUES:ENAB? *The questionable register enable bit mask is queried.*

Reset Condition

On reset, the enable bit mask register is cleared.

Error Message

If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

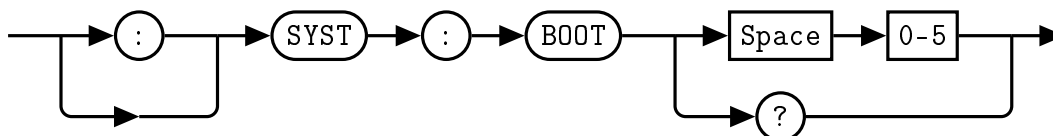
If the parameter is less than 0 or greater than 32767, error -222, "Data out of range" occurs.

5. SYSTem Subsystem Command Reference

5.1 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 the *RF Power State*, *External Reference Enabled*, *External Reference Switch Override*, *Tune Frequency*. For a detailed description of the parameters saved, see the relevant command descriptions in this manual. When this command is issued, the selected state will be loaded on the next power cycle or by issuing the **RST* command.

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

Default Condition

The factory default setting for SYST:BOOT is 0.

Query

:SYST:BOOT? *This query returns a 0 - 5 to indicate the LO Synthesizer Distribution Unit selected boot state.*

- 0 is returned if the selected boot state is 0

Error Message

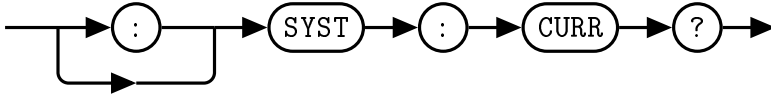
If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is less than 0 or greater than 5, error -222, "Data out of range" occurs.

5.2 SYSTem:CURRent?

This command returns the current reading from the LO Synthesizer Distribution Unit in Amps.

Syntax



Query Example

:SYST:CURR? *This query returns the QM1014 current draw in Amps.*

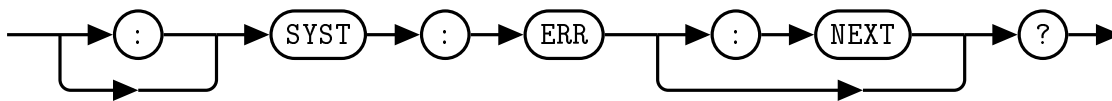
5.3 SYSTem:ERRor[:NEXT]?

This query returns error numbers and messages from the QM1014 error queue. When an error is generated by the QM1014, the error number and corresponding error message are 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.

The use of the :NEXT token is optional.

Syntax



Query Example

:SYST:ERR? *Queries the system error.*

Error queue messages have the following format:



For example, -102, "Syntax error"

Reset Condition

On reset, the error queue is cleared.

Error Message List

Table 4.6: Error Codes and Messages

| | |
|------|--|
| -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 LO Synthesizer Distribution Unit. |
| -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. |

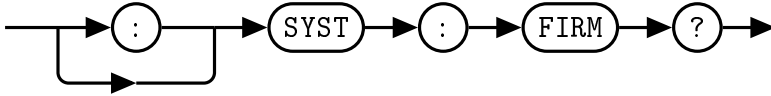
| | |
|------|---|
| -178 | Expression data not allowed A legal expression data element was encountered but not allowed by the Product. |
| -200 | Execution error Indicates that an execution error has occurred. |
| -211 | Trigger ignored Indicates that a trigger command was received but ignored because the LO Synthesizer Distribution Unit was not in the wait for trigger state. |
| -213 | Trigger ignored Indicates that a trigger command was received but ignored because the LO Synthesizer Distribution Unit 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 or the state of the LO Synthesizer Distribution Unit has changed such that the measurement is no longer valid. |
| -241 | Hardware missing The LO Synthesizer Distribution Unit is unable to execute the command because the hardware does not support that feature. |
| -310 | System error This error indicates a failure with the LO Synthesizer Distribution Unit. |
| -330 | Self-test failed The -330,"Self-test failed" error indicates a problem with the LO Synthesizer Distribution Unit. |
| -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 on or after a *RST command has been issued. |
| -420 | Query UNTERMINATED The LO Synthesizer Distribution Unit 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. |
| +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. |

5.4 SYSTem:FIRMware?

This command returns the current PIC firmware version of the LO Synthesizer Distribution Unit.

Syntax



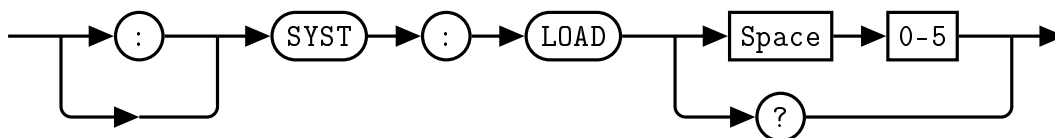
Query Example

:SYST:FIRM? *This query returns the current firmware versions of the LO Synthesizer Distribution Unit.*

5.5 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 the *RF Power State*, *External Reference Enabled*, *External Reference Switch Override*, *Tune Frequency*. For a detailed description of the parameters saved, see the relevant command descriptions in this manual. When the SYSTem:LOADstate command is called, these parameters will be applied to the device.

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:SAVEstate.

Example

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

Error Message

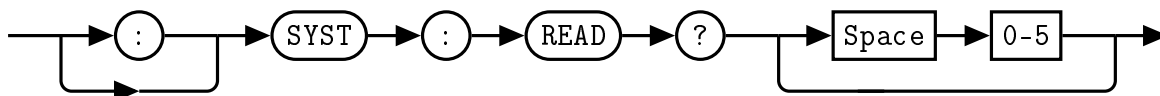
If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is less than 0 or greater than 5, error -222, "Data out of range" occurs.

5.6 SYSTem:READstate? [0-5]

This query allows the user to read the parameters of the stored states without changing any internal registers. The query output is a list of parameters for the selected state. If no state parameter is given, the returned state is state 0. The list of state parameters contains comma separated values, without spaces, in the following order: *RF Power State*, *External Reference Enabled*, *External Reference Switch Override*, *Tune Frequency*. See the respective command definitions for descriptions of each parameter.

Syntax



Query

:SYST:READ? 0 *This query requests the parameter values of state 0.*

Response: 0,0,0,10.000000

- 0 = POWER:RF is set to 0 or OFF. (page 31)
- 0 = FREQUENCY:REFERENCE:EXTERNAL is set to 0 or Internal. (page 30)
- 0 = External Reference Switch Override is 0 (switch-controlled).
- 10.000000 = FREQUENCY:TUNE is set to 10 GHz. (page 26)

Error Message

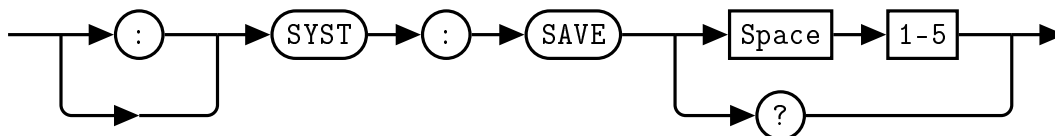
If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is less than 0 or greater than 5, error -222, "Data out of range" occurs.

5.7 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 the *RF Power State*, *External Reference Enabled*, *External Reference Switch Override*, *Tune Frequency*. For a detailed description of the parameters saved, see the relevant command descriptions in this manual. NOTE: The MEM_CLR button on the back panel will rewrite the contents of states 1-5 with the contents of state 0 when depressed, serving as a reset to factory defaults.

Syntax



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

Example

:SYST:SAVE 3 *This command saves the current state to memory location 3*

Error Message

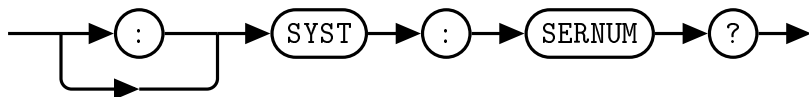
If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is less than 1 or greater than 5, error -222, "Data out of range" occurs.

5.8 SYSTem:SERialNUMBER?

This query returns the serial number of the device.

Syntax



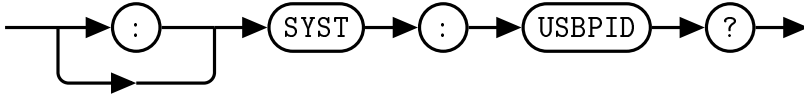
Query Example

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

5.9 SYSTem:USBPID?

This query returns the USB PID of the LO Synthesizer Distribution Unit.

Syntax



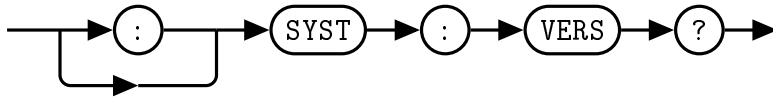
Query Example

:SYST:USBPID? *This query returns USB PID of the LO Synthesizer Distribution Unit.*

5.10 SYSTem:VERSion?

This query returns the version of SCPI used in the LO Synthesizer Distribution Unit. The response 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 LO Synthesizer Distribution Unit.*

6. IEEE 488.2 Command Reference

6.1 Introduction

This chapter contains information on the IEEE-488.2 Common Commands that the LO Synthesizer Distribution Unit supports.

The IEEE-488.2 Common Command descriptions are listed below.

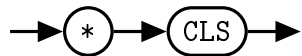
Table 4.7: IEEE 488.2 Common commands

| | | |
|------------------------------|------------------------|---------|
| <i>*CLS</i> | Clear Status | Page 53 |
| <i>*ESE</i> and <i>*ESE?</i> | Event Status Enable | Page 54 |
| <i>*ESR?</i> | Event Status Register | Page 55 |
| <i>*IDN?</i> | Identify | Page 56 |
| <i>*OPC</i> and <i>*OPC?</i> | Operation Complete | Page 57 |
| <i>*RCL</i> | Recall | Page 58 |
| <i>*RST</i> | Reset | Page 59 |
| <i>*SAV</i> | Save | Page 60 |
| <i>*SDS</i> | Save Default Settings | Page 61 |
| <i>*SRE</i> and <i>*SRE?</i> | Service Request Enable | Page 62 |
| <i>*STB?</i> | Status Byte | Page 63 |
| <i>*TST?</i> | Test | Page 64 |
| <i>*WAI</i> | Wait | Page 65 |

6.2 *CLS

The *CLS (CLear Status) command clears the data structures. The SCPI registers are all cleared.

Syntax



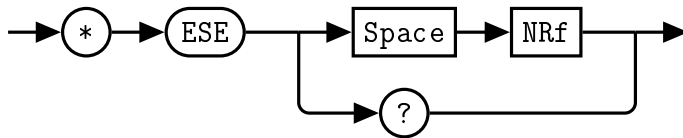
6.3 *ESE <NRf>

The *ESE (Event Status Enable) command sets the Standard Event Status Enable Register. This register contains a mask value for the bits to be enabled in the Standard Event Status Register. A 1 in the enable register enables the corresponding bit in the Status Register, a 0 disables the corresponding bit in the Status Register. The parameter value when expressed in base 2, represents the bit values of the Standard Event Status Enable Register. Table 4.8 shows the contents of this register.

Table 4.8: *ESE bit mapping

| Bit | Base 2 | Meaning |
|-----|--------|----------------------------|
| 0 | 1 | Operation Complete |
| 1 | 2 | Request Control (not used) |
| 2 | 4 | Query Error |
| 3 | 8 | Device Dependent Error |
| 4 | 16 | Execution Error |
| 5 | 32 | Command Error |
| 6 | 64 | Not Used |
| 7 | 128 | Power On |

Syntax



Allowed Values

The NRf parameter can be any integer in the range of 0 to 255.

Query

*ESE? This query returns the contents of the Standard Event Status Enable Register.

Error Message

If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is less than 0 or greater than 255, error -222, "Data out of range" occurs.

6.4 *ESR?

The **ESR?* query returns the contents of the Standard Event Status Register then clears it. The returned value is in the range of 0 to 255. Table 4.9 shows the contents of this register.

Table 4.9: *ESR? mapping

| Bit | Base 2 | Meaning |
|-----|--------|------------------------|
| 0 | 1 | Operation Complete |
| 1 | 2 | Not Used |
| 2 | 4 | Query Error |
| 3 | 8 | Device Dependent Error |
| 4 | 16 | Execution Error |
| 5 | 32 | Command Error |
| 6 | 64 | Not Used |
| 7 | 128 | Power On |

Syntax



6.5 *IDN?

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

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

where:

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

Syntax



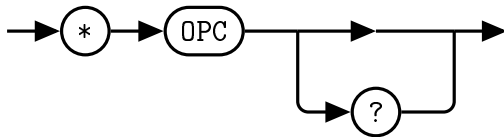
6.6 *OPC

The *OPC (Operation Complete) command causes the QM1014 LO Synthesizer Distribution Unit to set the operation complete bit in the Standard Event Status Register when all pending device operations have been completed.

Table 4.10: *OPC mapping

| Bit | Base 2 | Meaning |
|-----|--------|------------------------|
| 0 | 1 | Operation Complete |
| 1 | 2 | Not Used |
| 2 | 4 | Query Error |
| 3 | 8 | Device Dependent Error |
| 4 | 16 | Execution Error |
| 5 | 32 | Command Error |
| 6 | 64 | Not Used |
| 7 | 128 | Power On |

Syntax



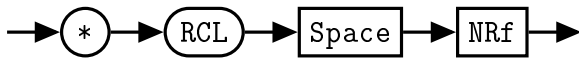
Query

*OPC? *This query places a 1 in the output queue when all device operations have been completed.*

6.7 *RCL <NRf>

The *RCL (ReCaLL) 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 the *RF Power State*, *External Reference Enabled*, *External Reference Switch Override*, *Tune Frequency*. For a detailed description of the parameters saved, see the relevant command descriptions in this manual. When the *RCL command is called, these parameters will be applied to the device.

Syntax



Allowed Values

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

Error Message

If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is less than 0 or greater than 5, error -222, "Data out of range" occurs.

6.8 *RST

The **RST* (ReSeT) command returns the QM1014 LO Synthesizer Distribution Unit to its initial power-up state.

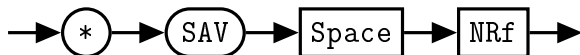
Syntax



6.9 *SAV <NRf>

The *SAV (SAVe) 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 the *RF Power State, External Reference Enabled, External Reference Switch Override, Tune Frequency*. For a detailed description of the parameters saved, see the relevant command descriptions in this manual. NOTE: The MEM_CLR button on the back panel will rewrite the contents of states 1-5 with the contents of state 0 when depressed, serving as a reset to factory defaults.

Syntax



Allowed Values

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

Error Message

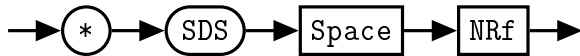
If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is less than 1 or greater than 5, error -222, "Data out of range" occurs.

6.10 *SDS <NRf>

The *SDS (Save Default device Settings) command restores the specified state of the QM1014 LO Synthesizer Distribution Unit to the default state settings. There are 5 re-writable memory locations, specified by choosing an index between 1 and 5. The parameters restored are the *RF Power State*, *External Reference Enabled*, *External Reference Switch Override*, *Tune Frequency*. For a detailed description of the parameters saved, see the relevant command descriptions in this manual. Issuing this command does not change the current settings. NOTE: The MEM_CLR button on the back panel will rewrite the contents of states 1-5 with the contents of state 0 when depressed, serving as a reset to factory defaults.

Syntax



Allowed Values

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

Error Message

If the parameter is not in the recognized format, error -102, "Syntax error" occurs.

If the parameter is less than 1 or greater than 5, error -222, "Data out of range" occurs.

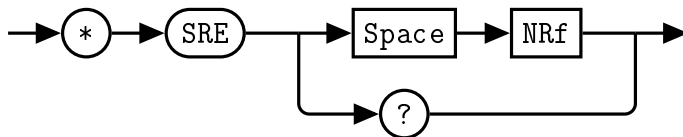
6.11 *SRE <NRf>

The **SRE* command sets the Service Request Enable register bits. This register contains a mask value for the bits to be enabled in the Status Byte Register. A 1 in the enable register enables the corresponding bit in the Status Register, a 0 disables the corresponding bit in the Status Register. The parameter value when expressed in base 2, represents bits 0 to 5 and bit 7 of the Service Request Enable Register. Bit 6 is not used and is always 0. Table 4.11 shows the contents of this register.

Table 4.11: *SRE bit mapping

| Bit | Base 2 | Meaning |
|-----|--------|-----------------------------|
| 0 | 1 | Not used |
| 1 | 2 | Not Used (not used) |
| 2 | 4 | Device Dependent |
| 3 | 8 | Questionable Status Summary |
| 4 | 16 | Message Available |
| 5 | 32 | Event Status Bit |
| 6 | 64 | Not Used |
| 7 | 128 | Operation Status Summary |

Syntax



Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 255.

Query

**SRE?* This query returns the contents of bits 0 to 5 and bit 7 of the Service Request Enable Register. Bit 6 is always 0.

Error Message

If the parameter is not in the recognized format, error -102, "Syntax error" occurs.
 If the parameter is less than 0 or greater than 255, error -222, "Data out of range" occurs.

6.12 *STB?

The **STB?* (Status Byte) query returns bit 0 to 5 and bit 7 of the QM1014 LO Synthesizer Distribution Unit status byte and returns the Master Summary Status (MSS) as bit 6. The MSS is inclusive OR of the bitwise combination (excluding bit 6) of the Status Byte and the Service Request Enable registers. The format of the return is an integer between 0 and 255. Table 4.12 shows the contents of this register.

Table 4.12: *STB? mapping

| Bit | Base 2 | Meaning |
|-----|--------|---|
| 0 | 1 | Not used |
| 1 | 2 | Device Dependent 0 - No device status condition has occurred 1 - A device status condition has occurred |
| 2 | 4 | Error/Event Queue 0 = Queue empty 1 = Queue not empty |
| 3 | 8 | Questionable Status Summary 0 - No QUEStionable status conditions have occurred 1 - A QUEStionable status condition has occurred |
| 4 | 16 | Message Available 0 - no output messages are ready 1 - an output message is ready |
| 5 | 32 | Event Status Bit 0 - no event status has occurred 1 - an event status condition has occurred |
| 6 | 64 | Master Summary Status 0 - LO Synthesizer Distribution Unit not requesting service 1 - there is at least one reason for requesting service |
| 7 | 128 | Operation Status Summary 0 = No OPERation status conditions have occurred 1 = An OPERation status condition has occurred |

Syntax



6.13 *TST?

The **TST?* query causes the QM1014 LO Synthesizer Distribution Unit to perform a self-test. The result of the self-test is placed in the output queue.

- 0 is returned if the test passes

Syntax



6.14 *WAI

The **WAI* (WAI) command causes the QM1014 LO Synthesizer Distribution Unit to wait until either:

- All pending operations are complete
- The *Device Clear* command is received
- Power is cycled

before executing any subsequent commands or queries.

Syntax





5 Windows Control GUI

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1. Overview

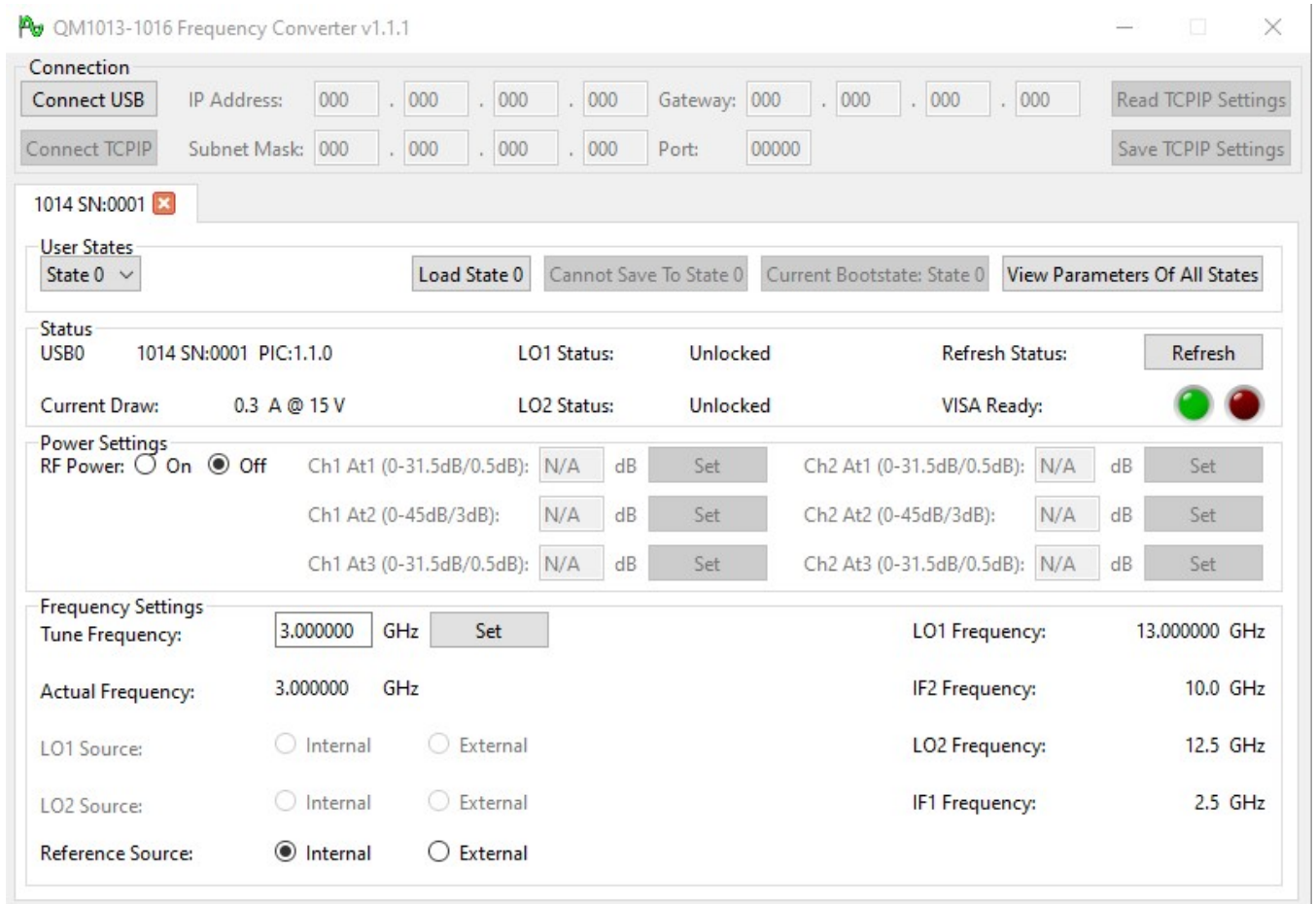


Figure 5.1: Windows® Control GUI

The Graphical User Interface (GUI) for the QM1014 is shown above in Figure 5.1. This GUI controls all QM1013-1016 products and provides the current status and all of the essential functionality for controlling the systems. The GUI allows the user to toggle RF power, and to set user states, attenuation control, tune the device, and change reference settings.

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1014-001-21 Revision 1.2.1, February 2022