



Applied Radar, Inc.
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AR2010
USB Stick Synthesizer
Generation II

USB Programming Manual

Revision 1.0.0, August 2011

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Personal Safety Considerations

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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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 Applied Radar, Inc. 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 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 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.



Expansion Bus

This marking indicates that the device communicates over the proprietary Applied Radar Expansion Bus. This expansion bus allows multiple Applied Radar products to be connected to a common host board to provide a single connection to the control computer.

Revision Control

Revision	Description of Changes	Date
1.0.0	Initial Creation	08/18/2011

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Product Overview

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1. AR2010-4400 USB Stick Synthesizer Overview

The AR2010 USB Stick Synthesizer product line is a low-cost, wideband PLL based frequency synthesizer ideally suited for bench top test and measurement as well as low-cost small form-factor radar and communications systems. The AR2010 is USB bus powered so it must be connected to a USB port on the computer or through powered USB hub for operation. The output power of the AR2010 is user adjustable in 0.5 dBm steps. The AR2010 features an internal 10 MHz reference for independent operation. The AR2010 may be operated off an externally applied 10 MHz reference signal through the MMCX connector on the side of the AR2010, allowing the AR2010 to be synchronized with other test equipment.

The AR2010 includes two indicator LEDs on the side of the case, a blue LED which when lit indicates that the AR2010 has been enumerated by the computer and the *Lock* LED. The *Lock* LED indicates the lock status of the AR2010. When green, the AR2010 is locked and when red the AR2010 is unlocked.

The AR2010 USB Stick Synthesizer is available in a black or white housing.

2. Part Number

The part number for the USB Stick Synthesizer is in the format *AR2010-XX-YY*, where *XX* is the lower operating frequency limit in MHz or GHz and *YY* is the upper operating frequency limit in MHz or GHz. For example, *AR2010-138-4400* identifies the USB Stick Synthesizer as having an operating range of 138 MHz to 4400 MHz and a part number of *AR2010-6-12* identifies the USB Stick Synthesizer as having an operating range of 6 GHz to 12 GHz.



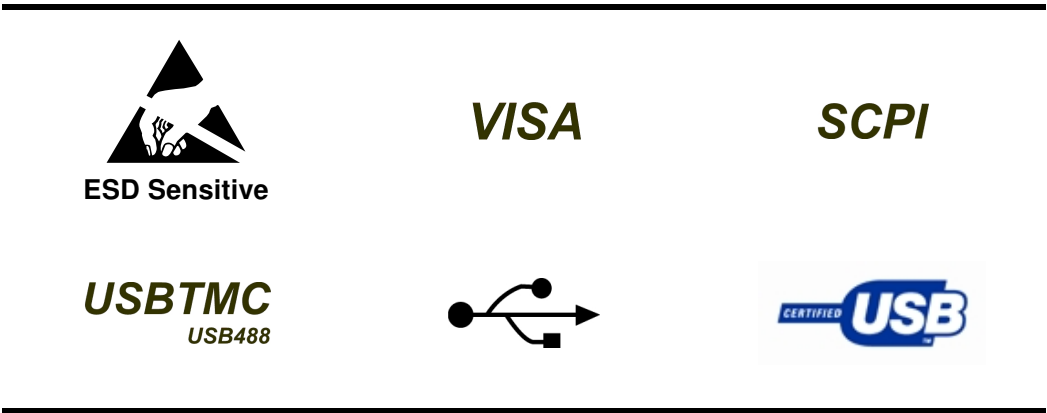
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The following markings apply to the AR2010 USB Stick Synthesizer family of products.



1. Introduction

1.1 USB Configuration

The Applied Radar AR2010 USB Stick Synthesizer has been designed to configure as a USB Test and Measurement Class (USBTMC) device. No additional drivers are required.

The AR2010 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 USB Stick Synthesizer is a VISA library installed on your machine. The AR2010 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 USB Stick Synthesizer.

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 2.2: 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 USB Stick Synthesizer to determine which events have occurred. Status reporting is accomplished by configuring and reading status registers.

The USB Stick Synthesizer 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.

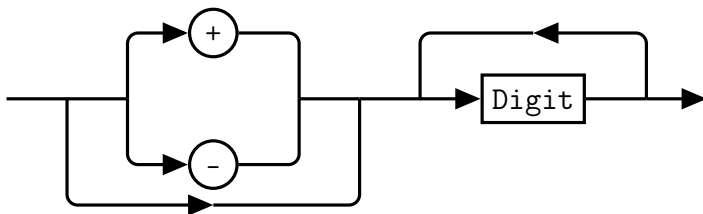
1.6.5 <NRf> Definition

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:

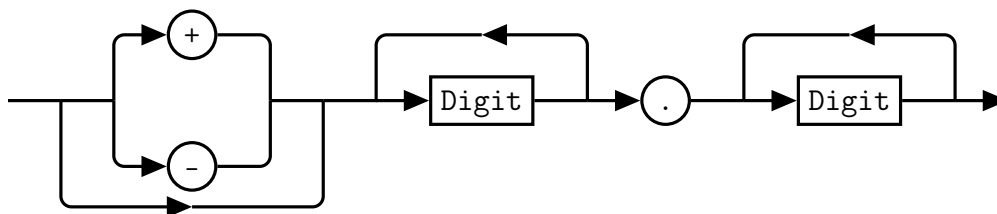


The following shows the examples of <NR1>:

- 127
- +127
- -12345

1.6.7 <NR2> Definition

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

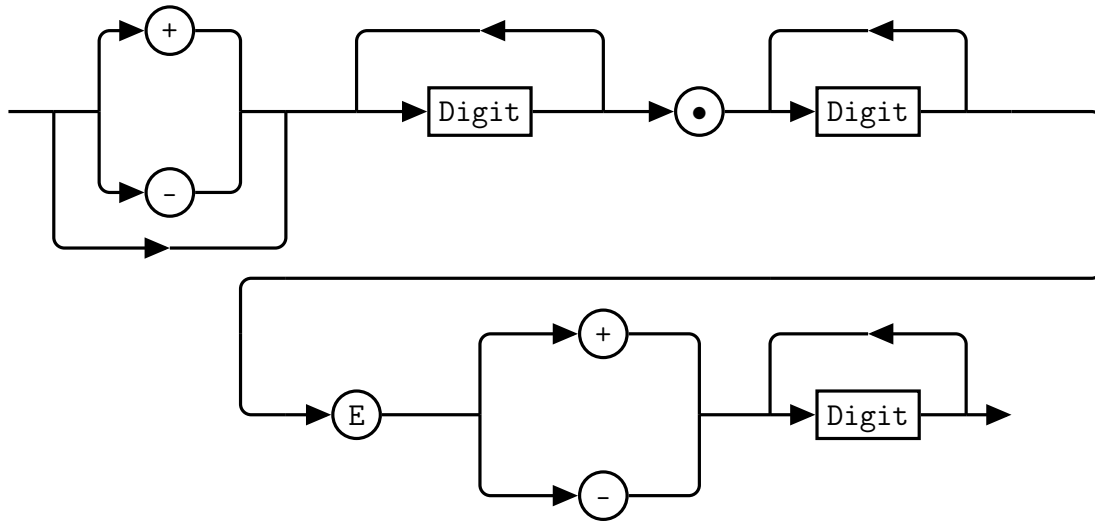


The following shows the examples of <NR2>:

- 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

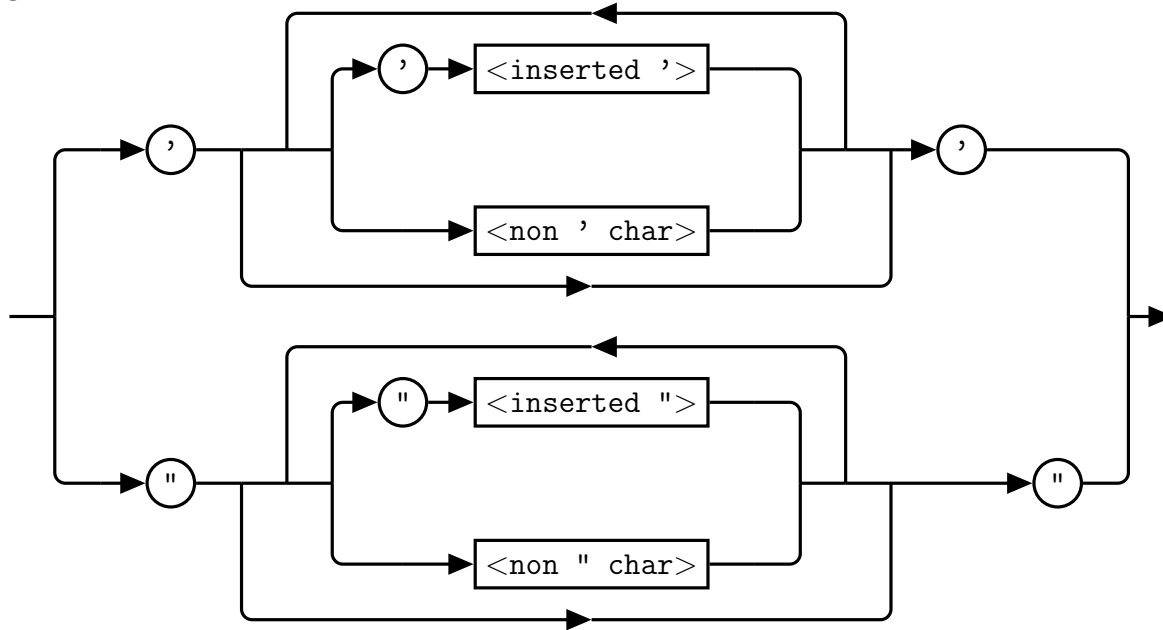
1.6.9 <numeric_value> Definition

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

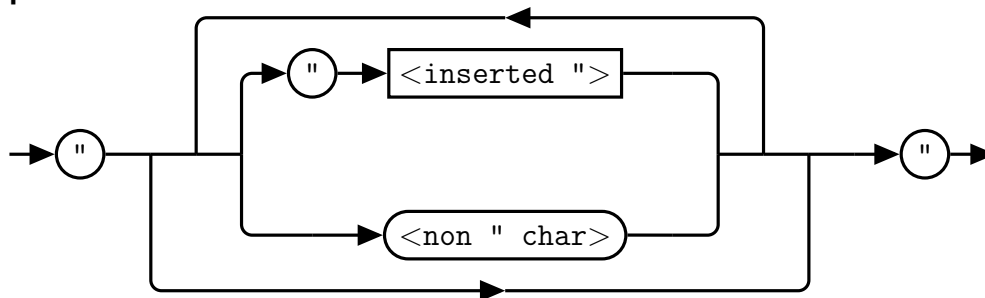
1.6.10 <string> Definition

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

1.8.2 SCPI Compliance

The USB Stick Synthesizer complies with the rules and regulations of the SCPI (Standard Commands for Programmable Instruments). You can determine the SCPI version which the USB Stick Synthesizer complies with by sending the *SYSTem:VERSion?* command from the remote interface.

1.8.3 USBTMC Compliance

The AR2010 USB Stick Synthesizer complies with the rules and regulations of the of the USBTMC (USB Test and Measurement Class). When connected to a USB bus, the AR2010 will configure as a USB Test and Measurement device.

1.8.4 VISA Compliance

The AR2010 USB Stick Synthesizer complies with the rules and regulations of the of the VISA (Virtual Instrument Systems Architecture) standard. Communication with the AR2010 is accomplished through VISA libraries, providing portability between different operating systems. *No additional drivers are required.*



3

Command Quick Reference Guide

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1. Common (*) Commands

Table 3.1: Common (*) Commands Summary

Command	Page	Description
*CLS	44	Clears the data structures. The SCPI registers are cleared.
*ESE <NRf>	45	Sets the Standard Event Status Enable Register.
*ESE?	45	Returns the Standard Event Status Enable Register.
*ESR?	46	Returns the contents of the Standard Event Status Register and then clears it.
*IDN?	47	Returns the identification of the device connected to the computer (Host).
*OPC	48	Causes the USB Stick Synthesizer to set the operation complete bit in the Standard Event Status Register when all pending operations have completed.
*OPC?	48	Returns the operation complete bit in the Standard Event Status Register when all pending operations have completed.
*OPT?	49	Returns the USB Stick Synthesizer installed options.
*RCL <NRf>	50	Recalls the state of the USB Stick Synthesizer from the specified register (memory location).
*RST	51	Returns the USB Stick Synthesizer to its initial power up state.
*SAV <NRf>	52	Saves the state of the USB Stick Synthesizer to the specified register (memory location).
*SRE <NRf>	53	Sets the Service Request Enable register bits.
*SRE?	53	Returns the Service Request Enable register bits.
*STB?	54	Returns the USB Stick Synthesizer status byte.
*TRG	56	Triggers the USB Stick Synthesizer.
*TST?	57	Performs a self test of the USB Stick Synthesizer.
*WAI	58	Causes the USB Stick Synthesizer 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.
DCL	59	Causes all USB instruments to assume a cleared condition.

2. FREQuency Subsystem

Table 3.2: FREQuency subsystem Commands Summary

Command	Page	Description
FREQuency:LOCK	16	Returns the lock status of the device.
FREQuency:REFerence:EXTernal	19	Sets or Returns whether the internal or external supplied reference oscillator is used.
FREQuency:SET	20	Sets or Returns the desired tuning frequency frequency in GHz.

3. POWER Subsystem

Table 3.3: POWER subsystem Commands Summary

Command	Page	Description
POWER:RF	22	Turns on or off the RF output of the device.
POWER:SET	23	Sets or returns the output power of the device.

4. SYSTem Subsystem

Table 3.4: SYSTem subsystem Commands Summary

Command	Page	Description
SYSTem:CLearMemory	25	Clears the contents of the specified memory location.
SYSTem:ERRor	26	Returns the contents of the error queue of the device.
SYSTem:MODElNUMber	32	Returns the model number of the device.
SYSTem:PRESet	33	Returns the device to its initial power-up state.
SYSTem:READSTRing	35	Reads a string from the device.
SYSTem:SENDSTRing	38	Sends a string to the device.
SYSTem:SERialNUMber	39	Returns the serial number of the device.
SYSTem:STATus	40	Returns the status of the device.
SYSTem:VERSion	41	Returns the version of SCPI used by the device.



4 FREQuency Subsystem

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4. FREQuency:SET	20

1. FREQuency:LOCK?

This command returns the lock status of the USB Stick Synthesizer. 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 USB Stick Synthesizer. 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. For example, if the reference frequency is 10 MHz, then when placed in *Integer* mode, the synthesizer would be capable of outputting a frequency of 9.0 GHz and 9.010 GHz, but not a frequency of 9.005 GHz.

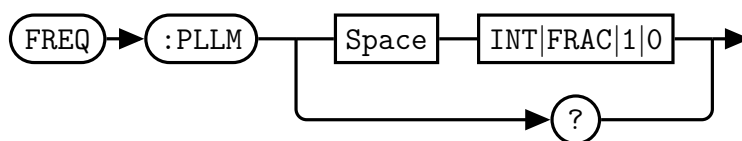
When the PLL is placed in *Fractional* mode, the output frequency can be any non-integer multiple of the reference oscillator frequency. In the above example, the synthesizer would be capable of outputting a frequency of 9.005 GHz when operated in *Fractional* mode.

Table 4.1 summarizes the advantages and disadvantages of the two synthesizer operational modes.

Table 4.1: Comparison between Integer and Fractional PLL modes

Mode	Advantages	Disadvantages
Integer	Lower Phase Noise Phase Synchronization between modules is guaranteed	Frequency must be an integer multiple of the reference frequency
Fractional	Any frequency can be outputted	Increased Phase Noise Phase synchronization is difficult to achieve at best

Syntax



Example

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

Default Condition

On power up, or when a *SYST:PRES* or **RST* command is issued, the PLL mode setting defaults to the mode stored in memory location 0, unless otherwise specified in the product's Operation Manual.

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

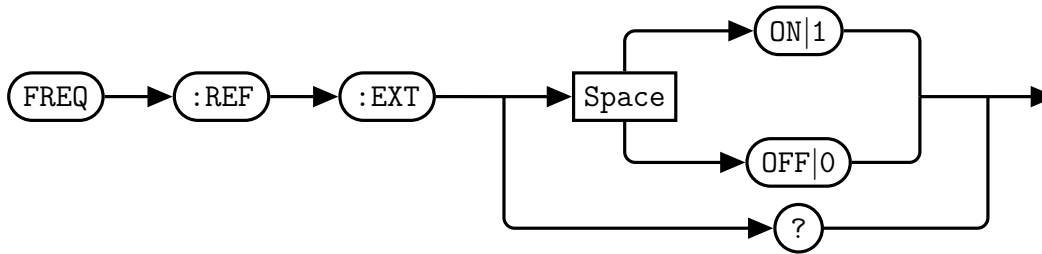
3. FREQuency:REFerence:EXTernal [ON|OFF|1|0]

This command allows the user to select between the internal 10 MHz reference and an externally supplied 10 MHz reference.

When *OFF* or *0* is specified, the internal reference oscillator is used by the USB Stick Synthesizer.

When *ON* or *1* is specified, the external reference input is used by the USB Stick Synthesizer.

Syntax



Example

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

Default Condition

On power up, or when a *SYST:PRES* or **RST* command is issued, the USB Stick Synthesizer defaults to the reference oscillator state stored in memory location 0.

Query

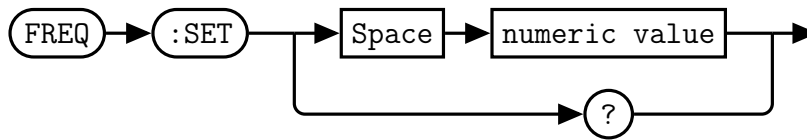
FREQ:REF:EXT? *This query returns a 0 or 1 to indicate the selected USB Stick Synthesizer reference mode*

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

4. FREQuency:SET <numeric value>

This command allows the user to set the frequency of the USB Stick Synthesizer. The frequency value is specified in MHz.

Syntax



Example

FREQ:SET 2400 *This command sets the tuning frequency of the device to 2400 MHz*

Default Condition

On power up, or when a *SYST:PRES* or **RST* command is issued, the synthesizer frequency defaults to the frequency stored in memory location 0, unless otherwise specified in the product's Operation Manual.

Query

FREQ:SET? *This query returns the frequency for the device in 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

POWEr Subsystem

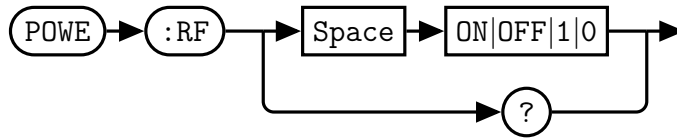
In This Chapter

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| 2. POWER:SET | 23 |

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

This command allows the user to turn on and off the RF output of the USB Stick Synthesizer.

Syntax



Example

POWE:RF 0 *This command turns off the RF.*

Default Condition

On power up, or when a *SYST:PRES* or **RST* command is issued, the USB Stick Synthesizer RF output defaults to the *RF OFF* state, unless otherwise specified in the product's Operation Manual.

Query

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

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

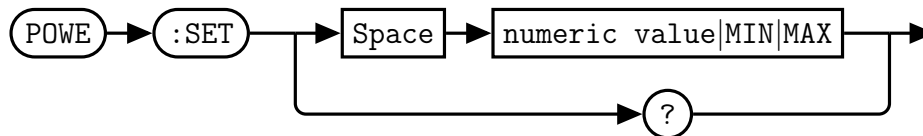
Error Messages

If the device does not have an integrated mute capability, an error message of 110, *"Invalid Command For Specified Device"* is placed in the device's error queue.

2. POWER:SET [<numeric value>|MIN|MAX]

This command allows the user to set the output power of the AR2010 in 0.5 dB steps with a ± 0.25 dBm accuracy. The output power value is specified in dBm and rounded to the nearest 0.5 dBm. See your Product's Configuration Sheet for valid output power ranges. Selecting *MAX* or *MIN* configures the AR2010 to output the maximum and minimum power levels, respectively, achievable at the current frequency. When using *Max* or *MIN* no attempt is made to level the output power across frequency.

Syntax



Example

- POWE:SET -10 *This command sets the output power of the device to -10 dBm*
- POWE:SET MAX *This command sets the output power of the device to the maximum value achievable at the current frequency*
- POWE:SET MIN *This command sets the output power of the device to the minimum value achievable at the current frequency*

Default Condition

On power up, or when a *SYST:PRES* or **RST* command is issued, the PLO output power defaults to the power level stored in memory location 0, unless otherwise specified in the product's Operation Manual.

Query

- POWE:SET? *This query returns the output power for the device in dBm.*

Error Messages

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



6 SYSTem Subsystem

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1. SYSTem:CLearMemory [1-9]

This command clears the specified memory location. Memory location 0 is a protected memory location and can not be cleared. To erase the parameters stored in Memory location 0, use the *SYSTem:REStore* command to overwrite the parameters stored in Memory Location 0 with the factory defaults.

Syntax



Example

SYST:CLRM 3 *This command clears memory location 3.*

2. SYSTem:ERRor?

This query returns error numbers and messages from the AR2010 error queue. When an error is generated by the AR2010, 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



Query Example

SYST:ERR? *Queries the system error.*

Error queue messages have the following format:



For example, 100, "Syntax Error"

Reset Condition

On reset, the error queue is cleared.

Error Message List

Table 6.1: 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 USB Stick Synthesizer.
-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 USB Stick Synthesizer was not in the wait for trigger state.
-213	Trigger ignored Indicates that a trigger command was received but ignored because the USB Stick Synthesizer 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 USB Stick Synthesizer has changed such that the measurement is no longer valid.
-241	Hardware missing The USB Stick Synthesizer is unable to execute the command because the hardware does not support that feature.
-310	System error This error indicates a failure with the USB Stick Synthesizer.
-330	Self-test failed The -330, "Self-test failed" error indicates a problem with the USB Stick Synthesizer.
-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 off or after a *RST or SYST:PRES command has been issued.
-420	Query UNTERMINATED The USB Stick Synthesizer 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.

3. SYSTem:FIRMware?

This command returns the current software firmware of the AR2010.

Syntax

Syntax



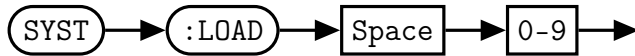
Query Example

SYST:FIRM? *This query returns the current firmware version of the USB Stick Synthesizer.*

4. SYSTem:LOAD [0-9]

This command loads the settings from the specified memory location. There are 10 memory locations, with location 0 being the default location which is restored upon power-on or reset. For a detailed description of the parameters saved, see your product's Operation Manual.

Syntax



There are 10 memory locations, numbered 0 through 9. Memory location 0 is a special memory location as the default conditions are loaded from this memory location on power-up or reset.

Example

SYST:LOAD 3 *This command loads the settings from memory location 3*

5. SYSTem:MODeINUMber?

This command returns the model number of the device.



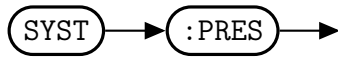
Query Example

SYST:MODNUM? *This query returns the model number of the device.*

6. **SYSTem:PRESet**

The *SYSTem:PRESet* command returns the USB Stick Synthesizer to its initial power-up state.

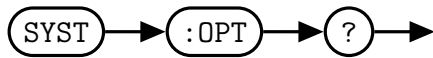
Syntax



7. SYSTem:OPTions?

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

Syntax



Query Example

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

8. SYSTem:READSTRing?

This command reads a string, unaltered, from the device.

CAUTION

The string is read directly from the device. No error checking or formatting is performed. USE WITH EXTREME CAUTION!

Syntax



Allowed Values

The returned string can be any ASCII string with a maximum length of 256 characters.

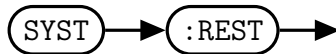
Query Example

SYST:READSTR? *This command reads a string from the device.*

9. SYSTem:REStore

This command restores the AR2010 to the factory default state. Memory location 0 is overwritten with the factory default settings. For a detailed description of the parameters saved, see your product's Operation Manual.

Syntax



Example

SYST:REST *This command restores the factory default settings to memory location 0*

10. SYSTem:SAVE [0-9]

This command saves the current setup to memory. There are 10 memory locations, with location 0 being the default location which is restored upon power-on or reset. For a detailed description of the parameters saved, see your product's Operation Manual.

Syntax



There are 10 memory locations, numbered 0 through 9. Memory location 0 is a special memory location as the default conditions are loaded from this memory location on power-up or reset.

Example

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

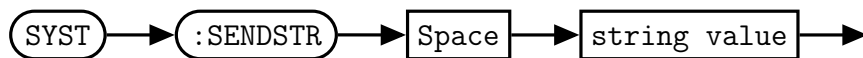
11. SYSTem:SENDSTRing <string value>

This command sends a string, unaltered, to the device.

CAUTION

The supplied string is passed directly to the device. No error checking is performed. USE WITH EXTREME CAUTION!

Syntax



Allowed Values

The <string value> can be any ASCII string with a maximum of 256 characters.

Example

SYST:SENDSTR "RESET;" *This command sends the string RESET; to the device.*

12. 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.*

13. SYSTem:STATus?

This command returns the status of the USB Stick Synthesizer.

Syntax



Query Example

SYST:STAT? *This query returns the status of the USB Stick Synthesizer.*

Status messages have the following format:



For example, 0, "Operational"

Status Message List

Table 6.2: Status Codes and Messages

0	Operational Device is operating normally
1	Device Has Been Reset The device has been recently reset
2	Awaiting User Input Unit is awaiting user input.
100	Recoverable Error Has Occurred An error has occurred from which the device can recover.
101	Non-Recoverable Error Has Occurred An error has occurred from which the device can not recover.
110	Over Temperature The operating temperature of the device exceeds safe operating temperatures.

14. SYSTem:VERSion?

This query returns the version of SCPI used in the USB Stick Synthesizer. 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 USB Stick Synthesizer.*



7

IEEE 488.2 Command Reference

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1. SCPI Compliance Information

This chapter contains information on the IEEE-488 Common Commands that the USB Stick Synthesizer supports.

The IEEE-488.2 Common Command descriptions are listed below.

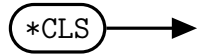
Table 7.1: IEEE 488.2 Common commands

<i>*CLS</i>	Clear Status	Page 44
<i>*ESE</i> and <i>*ESE?</i>	Event Status Enable	Page 45
<i>*ESR?</i>	Event Status Register	Page 46
<i>*IDN?</i>	Identify	Page 47
<i>*OPC</i> and <i>*OPC?</i>	Operation Complete	Page 48
<i>*OPT?</i>	Options	Page 49
<i>*RCL</i>	Recall	Page 50
<i>*RST</i>	Reset	Page 51
<i>*SAV</i>	Save	Page 52
<i>*SRE</i> and <i>*SRE?</i>	Service Request Enable	Page 53
<i>*STB?</i>	Status Byte	Page 54
<i>*TRG</i>	Trigger	Page 56
<i>*TST?</i>	Test	Page 57
<i>*WAI</i>	Wait	Page 58

2. *CLS

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

Syntax



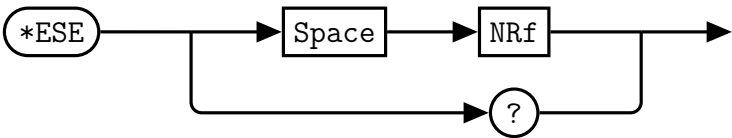
3. *ESE <NRf>

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 7.2 shows the contents of this register.

Table 7.2: *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.

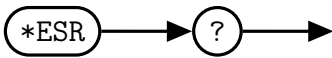
4. ***ESR?**

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 7.3 shows the contents of this register.

Table 7.3: *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



5. *IDN?

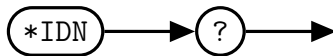
The **IDN?* query allows the connected device to identify itself. The string returned is:

Applied Radar,<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



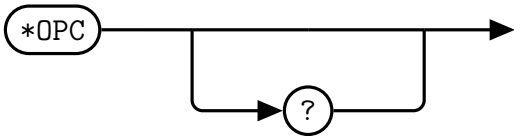
6. *OPC

The **OPC* (Operation Complete) command causes the AR2010 USB Stick Synthesizer to set the operation complete bit in the Standard Event Status Register when all pending device operations have been completed.

Table 7.4: *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



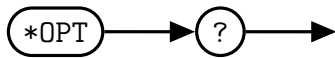
Query

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

7. *OPT?

The **OPT?* query reports the options installed in the AR2010 USB Stick Synthesizer and returns " " empty string if no options have been installed.

Syntax



8. *RCL <NRf>

The *RCL (ReCaLI) command restores the state of the AR2010 USB Stick Synthesizer from the specified save or recall register. Valid register addresses are 0 to 9. A configuration must have been stored previously in the specified register.

Syntax



Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 9.

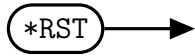
Error Message

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

9. *RST

The **RST* (ReSeT) command returns the AR2010 USB Stick Synthesizer to its initial power-up state.

Syntax



10. *SAV <NRf>

The *SAV (SAVe) command restores the state of the AR2010 USB Stick Synthesizer from the specified save or recall register. Valid register addresses are 0 to 9. A configuration must have been stored previously in the specified register.

Syntax



Allowed Values

The *NRf* parameter can be any integer in the range of 0 to 9.

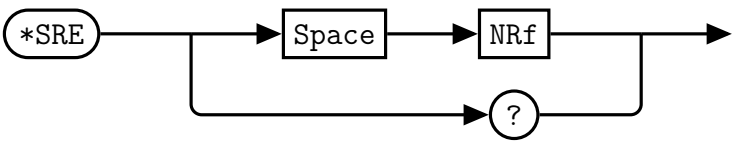
11. *SRE <NRf>

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 7.5 shows the contents of this register.

Table 7.5: *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

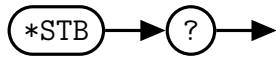
**SRE?* This query returns the contents of bits 0 to 5 and bit 7 of the Service Request Enable Register. Bit 6 is always 0.

12. *STB?

The *STB? (STatus Byte) query returns bit 0 to 5 and bit 7 of the AR2010 USB Stick Synthesizer 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 7.6 shows the contents of this register.

Table 7.6: *STB? mapping

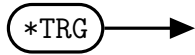
Bit	Base 2	Meaning
0	1	Not used
1	2	Device Dependent 0 - No device status condition has occurred 1 - A device status condition has occurred
2	4	Error/Event Queue 0 = Queue empty 1 = Queue not empty
3	8	Questionable Status Summary 0 - No QUEStionable status conditions have occurred 1 - A QUEStionable 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 - USB Stick Synthesizer 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

13. *TRG

The *TRG (TRiGger) command triggers the AR2010 USB Stick Synthesizer when it is in the waiting for trigger state.

Syntax



Error Message

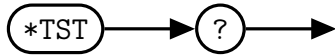
If the USB Stick Synthesizer is not in the wait-for-trigger state, error 210, *"Trigger Ignored"* occurs.

14. *TST?

The **TST?* query causes the AR2010 USB Stick Synthesizer to perform a self-test. The result of the self-test is placed in the output queue.

- 0 is returned if the test passes
- 1 is returned if the test fails

Syntax



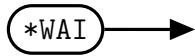
15. *WAI

The *WAI (WAI) command causes the AR2010 USB Stick Synthesizer 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



16. USBTMC/USB488 Universal Commands

DCL

The *DCL* (Device CLear) command causes all USB instruments to assume a cleared condition. The definition of Device Clear is unique for each instrument. For the AR2010 USB Stick Synthesizer:

- All pending operations are halted
- The parser (the software that interprets the programming codes) is reset and is waiting for the first character of a programming code.
- The output buffer is cleared.
- The ARI expansion bus is scanned for attached modules. Any modules found on the ARI expansion bus are identified.

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