

HSM SERIES RF Synthesizer Programming and Integration Guide

Revision 3.27

May 2020

For Firmware Revision 3.85 (HSM Revision A)

For Firmware Revision 5.23 (HSM Revision B)

MODELS COVERED:

HSM SERIES MODULES

HSM1001A & HSM1001B

HSM2001A & HSM2001B

HSM3001A & HSM3001B

HSM4001A & HSM4001B

HSM6001A & HSM6001B

HSM SERIES Module External Connections

Front Panel:

RF Output	SMA
LED Status	Green = Power Good, System Active
	Yellow = Communications Active / Busy / Not Ready
	Red = Error

Rear Panel:

REF In	SMA -10MHz/100MHz Input, software selectable -10MHz: 0dBm to +10dBm Input Lock Range: ± 1 ppm (spec) ± 4 ppm (typ) -100MHz: 4dBm nominal, ± 2 dB Internal OCXO turned off
REF Out	SMA -100MHz, +4dBm out (± 2 dbm)
Modulation	Modulation Input (SMA) – Multiplexed, 50ohm Input Amplitude Modulation: ± 1 V Analog Input Frequency Modulation: ± 1 V Analog Input Phase Modulation: ± 1 V Analog Input Trigger/Pulse mod: 1.00V Threshold
Power/Comm	20pin, 2mm, 2x10 Molex Milli-grid shrouded pin header Contains Power, ground, spi and status indicators.

Mechanical

20-pin Molex Connector

The Molex connector used is part of the 2mm Milli-Grid product line.

Module Connector Part Number:

Thru-Hole, Right Angle: Molex 87833-2020
Polarization and Ramp Locking

Mating Connector Part Numbers:

IDC Ribbon: Molex 87568-2093
Polarization and Ramp Locking
Vertical PCB Thru Hole: Molex 79107-7009
No Polarization or Ramp Locking
Vertical PCB SMT: Molex 79109-1009
No Polarization or Ramp Locking

Module Connector PINOUT:

PIN	Label	PIN	Label
1	GND	2	GND
3	+5V (1500mA Max)	4	+5V (1500mA Max)
5	+12V (600mA Max)	6	N.C. (reserved)
7	-5V/-12V (NA)	8	N.C. (reserved)
9	/RESET (47k PU)	10	N.C. (reserved)
11	/CS (Module Select – 47k PU)	12	Trigger (5V Tolerant Input)
13	SDO (Module Data Output)	14	PowerGood (OC – 47k PU)
15	SDI (Module Data Input)	16	/ERROR (OC – 47k PU)
17	SCLK (Module Clock Input)	18	/BUSY (OC – 47k PU)
19	GND	20	GND

NOTES:

OC = Open Collector
PU = Pull-up, All Pull-ups to 3.3V

PIN Descriptions:

+5V	Nominally pulls 1.2A from the +5V Rail. Initially at power on the draw will be 100mA then increase as subsystems power-on. Tolerance +8% to -1%. 4.95V to 5.4V. The value supplied to the module can be checked via software.
+12V	±5%. Nominally 300mA from this pin (T=25C). Increase to 550mA at startup for 5 mins as OCXO warms. +15V o.k. But increases power dissipation. The value supplied to the module can be checked via software.
-12V/-5V	Not needed on this revision.
/RESET	Active low on this pin puts the module in reset, releasing it returns to reset operation. Module is ready 2-3 seconds after /RESET is released. 47K pullup to 3.3V in parallel to 0.01uF cap to ground.
/CS	Communications chip select, active low. 47K pullup on this line. /CS must be low for any communication to occur. Allows for multiple synthesizer modules on 1 spi bus. 3.3V logic levels, 5V tolerant.
MSDI	Master Serial Data Input (synthesizer module/slave data out). Active when chip select is low. High-Z when /CS is high. 47K pulldown. 3.3V logic levels, 5V tolerant.
MSDO	Master Serial Data Output (synthesizer module/slave data in). High-Z input on module. 3.3V logic levels, 5V tolerant. 47K pulldown.
SCLK	SPI Clock (slave clock input). Idle Low, Active High. Data is transitioned into the module on a rising low to high transition. Data is transitioned out on the same edge and is valid on the falling edge of SCLK. 3.3V logic levels, 5V tolerant. 47K pulldown.
TRIGGER	CMOS Trigger input to the on-board microprocessor. 47K pulldown.
PowerGood	Open collector output, 47k pullup to 3.3V. When high, power is healthy. When low, either voltages or currents are problematic. Module may not operate correctly. There is a 0.5 second delay from when power is applied to a valid PowerGood. Actual PowerGood may take up to 2 seconds to go high due to some very stable internal references that are settling. This may be multiplexed with other HSM series synthesizers.
/ERROR	Open collector output, 47k pullup to 3.3V. Nominally high. If an error condition occurs, such as a PLL unlock or un-leveled condition, this will go active low. This can be multiplexed with other HSM series synthesizers.
READY or /BUSY	Open collector output, 47k pullup to 3.3V. Nominally high. After an SPI communication, if a command has been issued, then the /BUSY will go active low until that command is finished. During this time no communication may occur and SPI bus will be asleep.
N.C.	These are reserved lines for use in our communications module. They should be left floating.

SPI Communication

Bus Overview:

The SPI bus is a byte oriented bus, sending 8bits at a time. Any number of bytes may be sent, from 1 byte to 64 bytes while chip select is low. Bytes sent beyond 64 bytes will be ignored. The data is held in a buffer until chip select goes high, initiating the parsing of the data and execution of the commands. The maximum tested speed of the bus is 10Mbits/s. Data may be written to the module and data may be received from the module. After a command is sent requesting data, the next transfer sends this data out on SDO. During the read, a new command may be sent and will be parsed when chip select goes high. A read is always followed by a write with a read request.

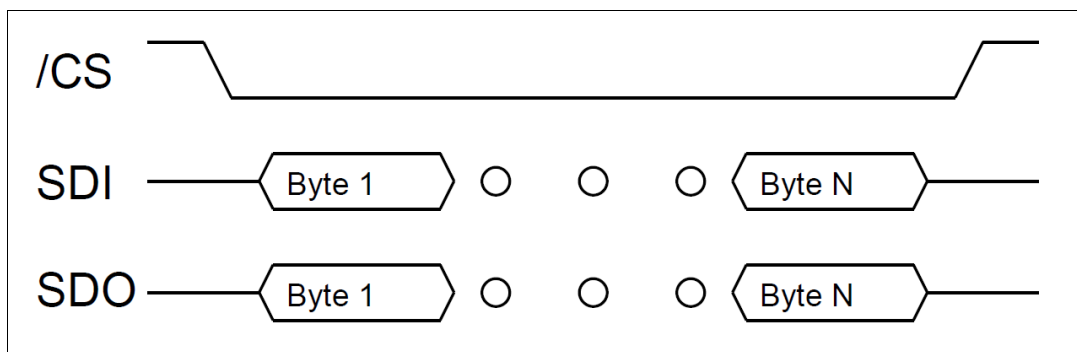
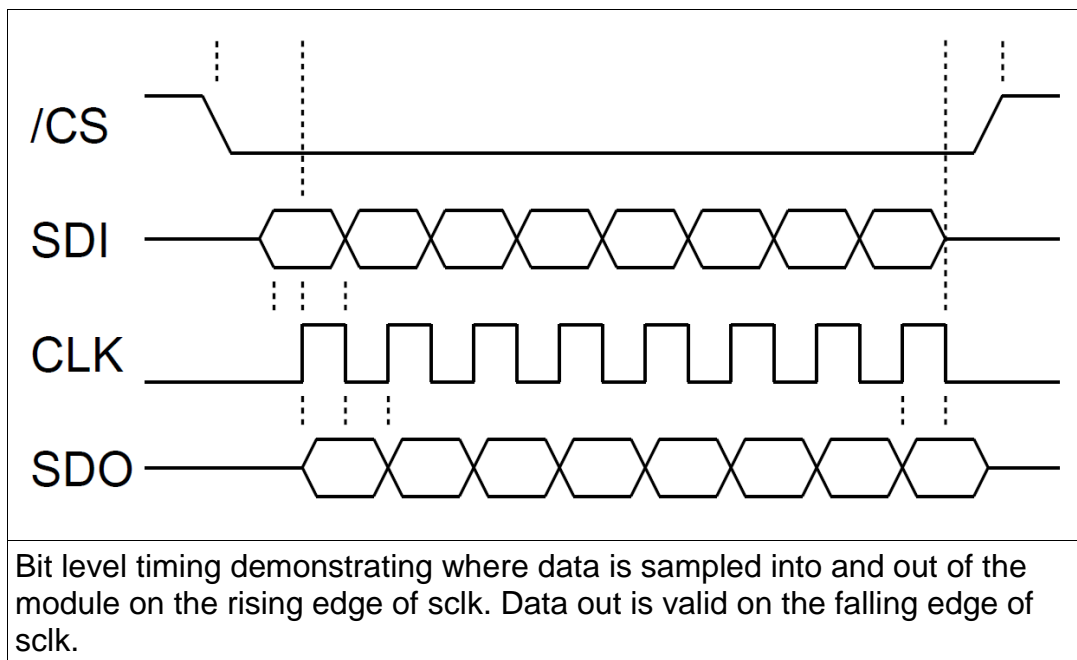
Bus Hardware Protocol:

Data is clocked into the module on the rising edge of sclk. Data is clocked out of the module on this same edge. Data output is valid on the falling edge of sclk. Data is only transferred when chip select is low. When chip select goes high, this initiates the parsing and execution of data.

Controlling Multiple Synthesizers:

The SPI bus may be daisy chained. The Status flags can be daisy chained as well, they are open-collector. Each synthesizer needs its own chip select.

SPI Timing



Binary Programming Commands

Three commands are supported in binary mode over the SPI bus. One command at a time may be issued between chip selects and the module responding with an active ready.

Command	B1 Instruction (Hex)	B2 (MSB)	B3	B4	B5	B6	B7
Set Frequency (mHz)	01h	Unsigned Integer - 48Bits					
Set Power (0.01dBm)	02h	Signed Integer					
Set Phase Offset (0.1deg)	03h	Unsigned Integer					

Always send MSB in the second byte. Position of LSB depends on the size of the integer.

Examples

To set the RF frequency to 1.56GHz, send 01h in the first byte followed by the unsigned integer value of 1560000000000. MSB in the second byte and LSB in the seventh byte.

To set the RF power to 10.12dBm, send 02h in the first byte followed by the signed integer value of 1012. MSB in the second byte and LSB in the third byte.

To set the phase offset to 165.1 degrees, send 03h in the first byte followed by the unsigned integer value of 1651. MSB in the second byte and LSB in the third byte.

SCPI Programming Commands

SCPI commands are ASCII commands sent over the SPI bus. One command at a time may be issued between chip selects and the module responding with an active ready. The ASCII commands begin with a colon (:) or asterisk (*). There is read on a second SPI cycle with chip select low. Any number of characters may be read, or none at all. You do not need to read the RX.

If a command is not understood, the synthesizer will have in it's buffer:

Invalid Command

The format for describing the command instruction is as follows:

:COMMAND:<value>[suffix]

A Description of the command here.

<value> Defined here, if any, queries typically have no value

[suffix] Units, i.e. Hz or dBm. If no suffix is included it is default to whatever is in brackets [Hz].

Example TX: Example ASCII sent in transmission

RX: Example ASCII received back, if a second transmission is made

Capital Letters:

ASCII may be sent in upper or lower case or a mixture. All ASCII received is put to all capitals prior to parsing.

Decimal Places:

In general, any number of usable decimal places may be entered. For example, set frequency may have up to 12 decimal places if sent in GHz. A decimal does not have to be entered.

Preset / Save / Recall / Identify

***RST**

Recall Factory Preset

Example TX: *RST
RX: Instrument Preset

***RCL**

Recall Saved State

Example TX: *RCL
RX: State Recalled

***SAV**

Save Current State

Example TX: *SAV
RX: State Saved

:IDN?

Identify query

Example TX: :IDN?
RX: Holzworth,HSM6001B,M1009-041,Ver3.25,HSM6001B-234
Format: Manufacturer, Device Name, Board Number, Firmware
Version, Instrument Serial Number

Set Frequency

:FREQ:<value><suffix> Set Synthesizer RF Frequency

<value> Synthesizer Dependent

<suffix> Hz, kHz, MHz, GHz

Example TX: :FREQ:2.105GHz
RX: Frequency Set

:FREQ? Query Synthesizer RF Frequency

Example TX: :FREQ?
RX: 22.67 MHz

:FREQ:MAX? Query Synthesizer Maximum RF Set Frequency

Example TX: :FREQ:MAX?
RX: 1.024 MHz

:FREQ:MIN? Query Synthesizer Minimum RF Set Frequency

Example TX: :FREQ:MIN?
RX: 0.25 MHz

Set Power

:PWR:<value>[suffix] Set Synthesizer RF Power

<value> Synthesizer Dependent

[suffix] [dBm]

Example TX: :PWR:9.5dBm
RX: Power Set

:PWR? Query Synthesizer RF Power

Example TX: :PWR?
RX: 9.5

:PWR:MAX? Query Synthesizer Maximum RF Set Power

Example TX: :PWR:MAX?
RX: 10.00 dBm

:PWR:MIN? Query Synthesizer Minimum RF Set Power

Example TX: :PWR:MIN?
RX: -100.00 dbm

Set Phase

:PHASE:<value>[suffix] Set Synthesizer RF Phase Offset

<value> Synthesizer Dependent

[suffix] [deg]

Example TX: :PHASE:270.1deg
RX: Phase Set

:PHASE? Query Synthesizer RF Phase Offset

Example TX: :PHASE?
RX: 270.1

:PHASE:MAX? Query Synthesizer Maximum RF Phase Offset

Example TX: :PHASE:MAX?
RX: 359.9deg

:PHASE:MIN? Query Synthesizer Minimum RF Phase Offset

Example TX: :PHASE:MIN?
RX: 0.0deg

Set Reference EXT/INT

Setting or Reading the reference state does not apply to multichannel synthesizers

:REF:INT Set Synthesizer to internal reference only

Example TX: :REF:INT
RX: Reference Set to Internal

:REF:EXT:<value>[suffix] Set Synthesizer to an External Reference, specify frequency

<value> 10 or 100
[suffix] [MHZ]

Example TX: :REF:EXT:10MHZ
RX: Reference Set to External 10MHz

:REF? Query Synthesizer Reference Setting

Example TX: :REF?
RX: EXT:10MHz <or> EXT:100MHz <or> INT

:REF:PLL? Query Synthesizer PLL Lock Status. Only in use with an external reference.

Example TX: :REF:PLL?
RX: PLL DISABLED <or> PLL UNLOCKED <or> PLL LOCKED

Set RF ON/OFF

:PWR:RF:<value>

Set Synthesizer RF ON/OFF

<value> ON <or> OFF

Example

TX: :PWR:RF:ON

RX: RF POWER ON

:PWR:RF?

Query Synthesizer RF ON/OFF

Example

TX: :PWR:RF?

RX: ON <or> OFF

Modulation Enable

:MOD? Query Modulation Enable Status

Example TX: :MOD?
RX: DIS <or> EXT

:MOD:MODE:<value> Set Modulation Mode

<value> OFF <or> PULSE <or> PULSE:SRC:EXT <or> PULSE:SRC:INT
<or> PULSE:SRC:INT:TRIGGER <or> FM <or> AM <or> PM <or>
SWEEP:FREQ <or> LOOKUP:NARROW <or> LOOKUP:WIDE

Example TX: :MOD:MODE:PULSE
RX: Pulse Modulation Set

NOTE: In the value field above, PULSE or PULSE:SRC:EXT enable external pulse modulation.

:MOD:MODE? Query Modulation Mode Status

Example TX: :MOD:MODE?
RX: OFF <or> PULSE:EXT <or> PULSE:INT <or> FM <or> AM <or>
PM <or> SWEEP:FREQ <or> LOOKUP:NARROW <or>
LOOKUP:WIDE

Set FM Deviation

:MOD:FM:DEV:<value>[suffix] Set Synthesizer FM Deviation

 <value> Synthesizer Dependent

 [suffix] Hz, kHz

Example TX: :MOD:FM:DEV:1.2kHz
 RX: FM Deviation Set

:MOD:FM:DEV? Query Synthesizer FM Deviation

Example TX: :MOD:FM:DEV?
 RX: 0.500 kHz

:MOD:FM:DEV:MAX? Query Synthesizer Maximum FM Deviation

Example TX: :MOD:FM:DEV:MAX?
 RX: 100.000 kHz

Set AM Depth

:MOD:AM:DEPTH:<value>[suffix] Set Synthesizer AM Depth

 <value> Synthesizer Dependent

 [suffix] [percent]

Example TX: :MOD:AM:DEPTH:15 percent
 RX: AM Depth Set

:MOD:AM:DEPTH? Query Synthesizer AM Depth

Example TX: :MOD:AM:DEPTH?
 RX: 60 percent

:MOD:AM:DEPTH:MAX? Query Synthesizer Maximum AM Depth

Example TX: :MOD:AM:DEPTH:MAX?
 RX: 75 percent

Set PM Deviation

:MOD:PM:DEV:<value>[suffix] Set Synthesizer PM Deviation

 <value> Synthesizer Dependent

 [suffix] [deg]

Example TX: :MOD:PM:DEV: 45 deg
 RX: PM Deviation Set

:MOD:PM:DEV? Query Synthesizer PM Deviation

Example TX: :MOD:PM:DEV?
 RX: 10 deg

:MOD:PM:DEV:MAX? Query Synthesizer Maximum PM Deviation

Example TX: :MOD:PM:DEV:MAX?
 RX: 180 deg

Set Internal Pulse Rep Rate

:MOD:PULSE:REP:<value><suffix> Set Internal Pulse Rep Rate

<value> Synthesizer Dependent

<suffix> s, ms, [us]

Example TX: :MOD:PULSE:REP:45ms
 RX: Pulse Rep Rate Set

:MOD:PULSE:REP? Query Internal Pulse Rep Rate

Example TX: :MOD:PULSE:REP?
 RX: 45000.0 us

:MOD:PULSE:REP:MAX? Query Maximum Internal Pulse Rep Rate

Example TX: :MOD:PULSE:REP:MAX?
 RX: 10000000.0 us

Set Internal Pulse Width

:MOD:PULSE:WIDTH:<value><suffix> Set Internal Pulse Width

<value> Synthesizer Dependent

<suffix> s, ms, [us]

Example TX: :MOD:PULSE:WIDTH:45ms
RX: Pulse Width Set

:MOD:PULSE:WIDTH? Query Internal Pulse Width

Example TX: :MOD:PULSE:WIDTH?
RX: 45000.0 us

:MOD:PULSE:WIDTH:MAX? Query Maximum Internal Pulse Width

Example TX: :MOD:PULSE:WIDTH:MAX?
RX: 10000000.0 us

Set Number of Output Pulses

:MOD:PULSE:NUM:<value> Set Number of Output Pulses for Internal Pulse Modulation

<value> Synthesizer Dependent

Example TX: :MOD:PULSE:NUM:10
RX: Number of Output Pulses Set

:MOD:PULSE:NUM? Query Number of Output Pulses

Example TX: :MOD:PULSE:NUM?
RX: 10

:MOD:PULSE:NUM:MAX? Query Maximum Number of Output Pulses

Example TX: :MOD:PULSE:NUM:MAX?
RX: 65535

The number of output pulses only applies when using Internal Pulse Modulation with a Trigger.

Set Frequency Sweep Start Frequency

:MOD:SWEEP:FREQ:START:<value><suffix> Set Synthesizer Sweep Start RF Frequency

<value> Synthesizer Dependent

<suffix> Hz, kHz, MHz, GHz

Example TX: :MOD:SWEEP:FREQ:START:100.1MHz
RX: Sweep Frequency Start Set

:MOD:SWEEP:FREQ:START? Query Synthesizer Sweep Start RF Frequency

Example TX: :MOD:SWEEP:FREQ:START?
RX: 100.1 MHz

The maximum and minimum for the Sweep Start Frequency are the same as the corresponding values for Set Frequency. Refer to the Set Frequency page for the maximum and minimum values.

Set Frequency Sweep Stop Frequency

:MOD:SWEEP:FREQ:STOP:<value><suffix> Set Synthesizer Sweep Stop RF Frequency

<value> Synthesizer Dependent

<suffix> Hz, kHz, MHz, GHz

Example TX: :MOD:SWEEP:FREQ:STOP:200.1MHz
RX: Sweep Frequency Stop Set

:MOD:SWEEP:FREQ:STOP? Query Synthesizer Sweep Stop RF Frequency

Example TX: :MOD:SWEEP:FREQ:STOP?
RX: 200.1 MHz

The maximum and minimum for the Sweep Stop Frequency are the same as the corresponding values for Set Frequency. Refer to the Set Frequency page for the maximum and minimum values.

Set Frequency Sweep Trigger

:MOD:SWEEP:FREQ:TRIG:<value> Set Synthesizer Sweep Frequency Trigger

<value> FREE or RAMP or POINT

Example TX: :MOD:SWEEP:FREQ:TRIG:FREE

 RX: Sweep Frequency Free Running Set

:MOD:SWEEP:FREQ:TRIG? Query Synthesizer Sweep Frequency Trigger

Example TX: :MOD:SWEEP:FREQ:TRIG?

 RX: FREQ SWEEP TRIGGER FREE <or> FREQ SWEEP TRIGGER
 RAMP <or> FREQ SWEEP TRIGGER POINT

Set Frequency Sweep Direction

:MOD:SWEEP:FREQ:DIR:<value> Set Synthesizer Sweep Frequency Direction

<value> UP or DOWN

Example TX: :MOD:SWEEP:FREQ:DIR:UP

 RX: FREQ SWEEP DIRECTION UP

:MOD:SWEEP:FREQ:DIR? Query Synthesizer Sweep Frequency Direction

Example TX: :MOD:SWEEP:FREQ:DIR?

 RX: FREQ SWEEP DIRECTION UP or FREQ SWEEP DIRECTION
 DOWN

Set Frequency Sweep Dwell Time

:MOD:SWEEP:FREQ:DWL:<value> Set Synthesizer Sweep Dwell Time

<value> Synthesizer Dependent

[suffix] ms, [us]

Example TX: :MOD:SWEEP:FREQ:DWL:1ms
RX: Sweep Frequency Dwell Time Set

:MOD:SWEEP:FREQ:DWL? Query Synthesizer Sweep Dwell Time

Example TX: :MOD:SWEEP:FREQ:DWL?
RX: 700 us

:MOD:SWEEP:FREQ:DWL:MAX? Query Synthesizer Maximum Sweep Dwell Time

Example TX: :MOD:SWEEP:FREQ:DWL:MAX?
RX: 10000000 us

:MOD:SWEEP:FREQ:DWL:MIN? Query Synthesizer Minimum Sweep Dwell Time

Example TX: :MOD:SWEEP:FREQ:DWL:MIN?
RX: 100 us

Set Frequency Sweep Number of Points

:MOD:SWEEP:FREQ:PTS:<value> Set Synthesizer Sweep Number of Points

<value> Synthesizer Dependent

Example TX: :MOD:SWEEP:FREQ:PTS:50

 RX: Sweep Frequency Points Set

:MOD:SWEEP:FREQ:PTS? Query Synthesizer Sweep Points

Example TX: :MOD:SWEEP:FREQ:PTS?

 RX: 50

:MOD:SWEEP:FREQ:PTS:MAX? Query Synthesizer Maximum Sweep Points

Example TX: :MOD:SWEEP:FREQ:PTS:MAX?

 RX: 65535

Set Wide Band List Number of Points

:MOD:LIST:WIDE:PTS:<value> Set Wide Band List Number of Points

<value> Synthesizer Dependent

Example TX: :MOD:LIST:WIDE:PTS:500
RX: Wide Band Points Set

:MOD:LIST:WIDE:PTS? Query Wide Band List Points

Example TX: :MOD:LIST:WIDE:PTS?
RX: 500

:MOD:LIST:WIDE:PTS:MAX? Query Maximum Wide Band Points

Example TX: :MOD:LIST:WIDE:PTS:MAX?
RX: 3232

*Minimum number of points is 2.

Set Wide Band List Values

:MOD:LIST:WIDE:<point>,<freq><freq suffix>,<power>[power suffix],[dwell time][dwell suffix] Set Wide Band List Value (for the given point)

<point> Point location. **Cannot be greater than the value set using :MOD:LIST:WIDE:PTS:**

<freq> Synthesizer Dependent

<freq suffix> GHz,MHz, kHz, Hz

<power> Synthesizer Dependent

[power suffix] [dBm]

[dwell time] Synthesizer Dependent OPTIONAL

[dwell suffix] ms, [us] OPTIONAL

Example TX: :MOD:LIST:WIDE:1,100.1MHz,-1.0dBm,3.4ms

RX: Stored frequency , power, and dwell time for point 1 <or> Invalid point

:MOD:LIST:WIDE?<point> Query Wide Band List Value (for the given point)

<point> Point location. **Cannot be greater than the value set using :MOD:LIST:WIDE:PTS:**

Example TX: :MOD:LIST:WIDE?1

RX: 1001.000 MHz,-1.00 ,3400 us <or> Invalid Point

NOTE: If a dwell time is not specified with each point, then the value used for dwell time will be the value set using the Set Wide Band Dwell Time command.

The list of dwell times is not saved to the device. If the synthesizer is power cycled, then the complete list with dwell times must be reloaded.

Set Wide Band Trigger

:MOD:MODE:LIST:WIDE:<value> Set Wide Band Trigger

<value> FREE or LIST or POINT

Example TX: :MOD:MODE:LIST:WIDE:FREE

 RX: Wide Band Free Running Set

:MOD:MODE:LIST:WIDE? Query Wide Band Trigger

Example TX: :MOD:MODE:LIST:WIDE?

 RX: WIDE LIST MODE TRIGGER FREE <or> WIDE LIST MODE
 TRIGGER LIST <or> WIDE LIST MODE TRIGGER POINT

Set Wide Band Dwell Time

:MOD:LIST:WIDE:DWL:<value> Set Wide Band Dwell Time

<value> Synthesizer Dependent

[suffix] ms, [us]

Example TX: :MOD:LIST:WIDE:1ms
RX: Wide Band Dwell Time Set

:MOD:LIST:WIDE:DWL? Query Wide Band Dwell Time

Example TX: :MOD:LIST:WIDE:DWL?
RX: 1000 us

:MOD:LIST:WIDE:DWL:MAX? Query Maximum Wide Band Dwell Time

Example TX: :MOD:LIST:WIDE:DWL:MAX?
RX: 10000000 us

:MOD:LIST:WIDE:DWL:MIN? Query Minimum Wide Band Dwell Time

Example TX: :MOD:LIST:WIDE:DWL:MIN?
RX: 100 us

NOTE: If a dwell time is loaded with each point in the Set Wide Band List Values, then the value for Set Wide Band Dwell Time will be ignored.

Set Narrow Band List Number of Points

:MOD:LIST:NARROW:PTS:<value> Set Narrow Band List Number of Points

<value> Synthesizer Dependent

Example TX: :MOD:LIST:NARROWPTS:300
 RX: Narrow Band Points Set

:MOD:LIST:NARROW:PTS? Query Narrow Band List Points

Example TX: :MOD:LIST:NARROW:PTS?
 RX: 300

:MOD:LIST:NARROW:PTS:MAX? Query Maximum Narrow Band Points

Example TX: :MOD:LIST:NARROW:PTS:MAX?
 RX: 3232

*Minimum number of points is 2.

Set Narrow Band List Values

:MOD:LIST:NARROW:<point>,<freq><freq
suffix>,[dwell time][dwell suffix]

Set Narrow Band List Value (for the
given point)

<point> Point location. **Cannot be greater than the value set using
:MOD:LIST:NARROW:PTS:**

<freq> Synthesizer Dependent. **All frequency values must be less than
the first frequency point plus 5 percent.**

<freq suffix> GHz,MHz, kHz, Hz

[dwell time] Synthesizer Dependent OPTIONAL

[dwell suffix] ms, [us] OPTIONAL

Example TX: :MOD:LIST:NARROW:2,996MHz,10us

RX: Stored frequency and dwell time for point 2 <or> Invalid point

:MOD:LIST:NARROW?<point>

Query Narrow Band List Value (for the given point)

<point> Point location. **Cannot be greater than the value set using
:MOD:LIST:NARROW:PTS:**

Example TX: :MOD:LIST:NARROW?2

RX: 996.0000000 MHz,10 us <or> Invalid point

NOTE: If a dwell time is not specified with each point, then the value used for dwell time will be the
value set using the Set Narrow Band Dwell Time command.

The list of dwell times is not saved to the device. If the synthesizer is power cycled, then the complete
list with dwell times must be reloaded.

Set Narrow Band Trigger

:MOD:MODE:LIST:NARROW:<value> Set Narrow Band Trigger

<value> FREE or LIST or POINT

Example TX: :MOD:MODE:LIST:NARROW:FREE
RX: Narrow Band Free Running Set

:MOD:MODE:LIST:NARROW? Query Narrow Band Trigger

Example TX: :MOD:MODE:LIST:NARROW?
RX: NARROW LIST MODE TRIGGER FREE <or> NARROW LIST
MODE TRIGGER LIST <or> NARROW LIST MODE TRIGGER
POINT

Set Narrow Band Dwell Time

:MOD:LIST:NARROW:DWL:<value> Set Narrow Band Dwell Time

<value> Synthesizer Dependent

[suffix] ms, [us]

Example TX: :MOD:LIST:NARROW:700us
 RX: Narrow Band Dwell Time Set

:MOD:LIST:NARROW:DWL? Query Narrow Band Dwell Time

Example TX: :MOD:LIST:NARROW:DWL?
 RX: 700 us

:MOD:LIST:NARROW:DWL:MAX? Query Maximum Narrow Band Dwell Time

Example TX: :MOD:LIST:NARROW:DWL:MAX?
 RX: 10000000 us

:MOD:LIST:NARROW:DWL:MIN? Query Minimum Narrow Band Dwell Time

Example TX: :MOD:LIST:NARROW:DWL:MIN?
 RX: 6 us

NOTE: If a dwell time is loaded with each point in the Set Narrow Band List Values, then the value for Set Narrow Band Dwell Time will be ignored.

Read Temperature

:TEMP?

Query the temperature of the channel

Example	TX:	:TEMP?
	RX:	Temp = 40C
