MONOPULSE BEACON TEST SET II

OCS VERSION 5.0

IEEE-488 COMMAND SET

Document No. 102299, Rev. 1

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Implementation Notes

Multiple Commands on One Line

Multiple commands can be issued at one time. If multiple commands are issued, they must be separated by semi-colons (';'). Commands are processed one at a time in left-to-right order, and no further commands will be processed until the entire group has been processed.

Any information returned by the commands is output in order, one line per command.

For example:

```
ALARM?;ANTALARM?;MODE STANDBY
```

could return

```
0,8;ON
```

Maximum Command Length

The maximum size of a command line is 4900 bytes. A command line is any sequence of bytes that are terminated by a carriage return and/or EOI. A command line may contain more than one command as shown in the previous section. The maximum command line size is enough for the largest individual command; however length constraints may prevent some large commands being chained together on one line.

Parameter Separators

To conform with IEEE-488 conventions, this document uses a comma (',') as the parameter separator. However, the MBTS will also accept a space character as a parameter separator.

Replies will always use commas to separate multiple data items, regardless of what type of parameter separator was used when issuing a command.

Write Protect for Flash Calibration Parameters

The PCC Module DIP switch labeled "USER 1" controls whether or not data can be written to the FLASH Calibration data memory. If the switch is off (logic "1") it prevents writes; if it is on (logic "0") it allows writes. It returns a **`WRITE PROTECT`** error if an attempt is made to write when the FLASH is protected.

This affects the CALABOFFSET, CALBITLVL, CALPULSEPWR, CALSOTABLE, CALTEMPLIMIT, CALTGTTABLE, and CALUCATTEN commands.

Parameters in [Brackets]

Parameters shown in brackets are optional. The most common optional parameter is an 'M' on commands controlling reply functionality. In these cases leaving the parameter off the command selects the primary targets or the first Reply Generator Module while including the 'M' parameter selects the moveable targets or the optional second Reply Generator Module.

Secondary Targets

Primary targets are always generated by the primary Reply Generator Module. Secondary targets are generated by the second Reply Generator, if it is installed. If the second Reply Generator is not installed, secondary targets are generated by the first Reply Generator Module but run with limited functionality.

When the first parameter of a command is an 'M', that command is applied to the secondary targets.

The following commands are valid for MBTS configuration of either one or two reply generators:

CODE M …
INC3 M …
RANGE M …
TGTMIX M …
TGTCNT M …
PULSEPOS M …
PULSEWID M …
MOVE M …
MOVETAB M …
BER ALL …

The following commands require two reply generators:

TGTAZ M …
MANLVL M …
RAWLVL M …
MANPHASE M …
RAWPHASE M …
RAWPAM M …
CALPULSEPWR M …
CALSOTABLE M …
CALTGTTABLE M …
RAWRGCFREQ M …
FREQOFF M …
BER RGC2 …

Documentation Notes

Each command has a table, like that shown in Figure 1, that identifies the mode in which the command or query can be issued, and also instances in which the command can be issued but the information provided by the command will not be immediately used.

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
COMMAND	✘				▼	▼	▼	✘	
QUERY?									✘

Figure 1

The conditions:

Command or Query
The command name or query name being described.

Standby Mode
Ring Mode
Azimuth Mode
Boresight Mode
CW Mode
Cal Mode
Ref Mode
When the MBTS is in the corresponding operational Mode.

Cal. Write Protect
When the FLASH Calibration data Write Protect DIP switch is in the "Protect" position.

Xilinx Load Fail
When the MBTS has been unable to load the Xilinx FPGA's with any valid configuration data pattern.

The symbols:

✘ The command will be rejected. For one of the mode columns, the error **`WRONG MODE`** will be returned. For *Cal. Write Protect*, the error **`WRITE PROTECT`** will be returned. For *Xilinx Load Fail*, the error **`INTERNAL ERROR`** will be returned.

▼ The command will be accepted, but the information contained in the command will not be immediately acted upon. For example, the TGTAZ command to set the Target Azimuth can be issued while the MBTS is in Ring mode, and will be accepted, but the value provided will not be used until the MBTS is commanded to enter Azimuth mode.

ALARM – Return Alarm Status

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
ALARM?									

Syntax:

ALARM? *Returns the current contents of the Alarm register.*

Description:

The ALARM query returns the latched and the current state of the alarm register in hexadecimal, then clears all bits in the latched register that are not set in the current register. The latched register contains events for all alarms that have occurred since the last time either the alarm register was read or a *CLS command was acted upon.

Examples:

Query: **ALARM?**{CR}{LF}
Response: **30,0**{CR}{LF}

Query: **ALARM?**{CR}{LF}
Response: **14,14**{CR}{LF}

Query Response Format:

l,s
Where **l** *and* **s** *are in the range* **0** *to* **3f**. *The values are encoded as follows:*

20	**ANT APG ALARM**	*The antenna rotation pulses are not valid (wrong number of pulses/rev).*
10	**ANT ROTATE ALARM**	*The antenna is out of the valid speed range.*
8	**FAN FAILED**	*The internal fan has failed. Not used by the MBTS II.*
4	**CAL FAILED**	*MBTS was unable to adjust the outputs to their reference point.*
2	**BIT TEMP ALARM**	*The internal temperature as reported by the BIT module is beyond limits.*
1	**BIT PWR ALARM**	*The power supply voltages as reported by the BIT module are beyond limits.*

l *is the latched version of the alarm status, and* **s** *is the current alarm status.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

Implementation Notes:

Cleared by *CLS.

ANT - Antenna Type

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
ANT	▼				▼	▼	▼		✘
ANT?									

Syntax:

ANT t,b *Select new antenna type and beamshaping on/off*
or
ANT? *Return current antenna type and beamshaping mode*

Where:

t **OFF** - Disable beam shaping
TERMINAL - 5-foot terminal open array
ENROUTE - 6-foot enroute array
ASR11 - ASR-11/MSSR LVA
PRM - Precision Runway Monitor phased array - Track Mode characteristics
USER - User-defined

b Beam shaping compensation. **ON** or **OFF**. Must be **OFF** if **t** is **OFF**.

Description:

The ANT command selects which antenna beam pattern to use when generating azimuth-gated replies. It also controls whether the reply is subject to beam-shaping compensation.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **ANT OFF,OFF**{CR}{LF}

Command: **ANT TERMINAL,OFF**{CR}{LF}

Command: **ANT ENROUTE,ON**{CR}{LF}

Query: **ANT?**{CR}{LF}
Response: **ENROUTE,ON**{CR}{LF}

Query Response Format:

t,b{CR}{LF}
Where **t** *is the antenna type (as described above) and* **b** *is beamshaping compensation, either* **ON** *or* **OFF**.

Default Value:

OFF,OFF

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
NOT POSSIBLE	If the User-defined beam pattern was requested and the FLASH data is corrupt.

ANTALARM - Controls Rotation Alarm and Reply Suppression

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
ANTALARM									
ANTALARM?									

Syntax:

ANTALARM n *Turn the Antenna Rotation Alarm on or off*
or
ANTALARM? *Return the current state of the Antenna Alarm enable*

Where:
n **ON** or **OFF**

Description:

The Antenna Rotation Alarm signals that the antenna is not spinning within specified limits (4 to 15 rpm), or, for PRM phased array systems, that the antenna data strobe is active. An asserted ANTALARM state suppress the generation of reply signals. If the ANTALARM is OFF, however, reply signals may be generated even if the antenna is not rotating within specified limits.

ON means the data from the Azimuth Pulse Generator, as measured at the selected APG input, is tested for an antenna rotation rate of between 4 to 15 rpm, and for the correct number of pulses per revolution (4096 in ACP mode, 16384 in IACP mode). An Antenna Speed alarm is set (see the ALARM query), and the generation of replies to interrogations is suppressed, if an out of bounds condition is detected. If data input from a PRM system is selected then at least two strobe pulses per second are required to suppress an antenna alarm condition.

OFF means that antenna alarms are not generated and that MBTS replies are not suppressed. Note that the status returned by the ALARM query will correctly reflect the state of the antenna rotation and APG alarms.

Examples:

Command: **ANTALARM ON**{CR}{LF}

Command: **ANTALARM OFF**{CR}{LF}

Query: **ANTALARM?**{CR}{LF}
Response: **OFF**{CR}{LF}

Query Response Format:

n{CR}{LF}
Where **n** *is* **ON** *or* **OFF**

Default Value:

ON

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

APGNORTH - Set APG Northmark Offset

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
APGNORTH	▼				▼	▼	▼		✘
APGNORTH?									

Syntax:

`APGNORTH n,m` *Set new Northmark Offset*
or
`APGNORTH?` *Return current Northmark Offsets (all channels)*

Where:
- **`n`** APG input channel, "A" (channel A), "B" (channel B) or "U" (unbalanced)
- **`m`** Offset to magnetic north, 0 to 16383 in IACP units

Description:

The APGNORTH command creates an offset between the ARP pulse of the antenna APG and the azimuth position of the target constellation generated by the MBTS.

The first parameter specifies the input channel for which the north mark is set. Channel A and channel B are the two RS-422 (differential) inputs, and "U" is the unbalanced (single-ended) input.

The second parameter specifies the offset from the channel's ARP pulse to true north. The offset is specified in IACP units, with a range of 0 to 16383. If the specified antenna sends ACP pulses instead of IACP pulses, the command value is divided by four inside the MBTS.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until the azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`APGNORTH A,0`**{CR}{LF}

Command: **`APGNORTH B,16300`**{CR}{LF}

Command: **`APGNORTH U,221`**{CR}{LF}

Query: **`APGNORTH?`**{CR}{LF}
Response: **`A,0,B,16300,U,221`**{CR}{LF}

Query Response Format:

`A,ma,B,mb,U,mu`{CR}{LF}
Where **`ma`**, **`mb`**, *and* **`mu`** *are the APG Northmark Offset for inputs A, B, and U respectively, in IACP units from 0 to 16383.*

Default Value:

A,0,B,0,U,0

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

APGSEL - APG Select

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
APGSEL									✘
APGSEL?									

Syntax:

`APGSEL n,t` *Select new APG input source*
or
`APGSEL?` *Return current APG input*

Where:
`n` APG input channel, **`A`** (channel A), **`B`** (channel B) or **`U`** (unbalanced)
`t` Input type, **`ACP`**, **`IACP`**, **`AUTO`** or **`PRM`**

Description:

The APGSEL command selects data input through one of the three standard APG input channels or through the PRM input channel. Channel A and channel B APG input channels are RS-422 (differential) inputs, and "U" is the unbalanced (single-ended) inputs. The PRM is a parallel RS-422 (differential) bus.

If PRM is selected the channel (**A**, **B**, or **U**) is used to select the proper APGNORTH value only.

If AUTO mode is selected, the returned value for the sensed ACP/IACP type will be "UNKNOWN" until the MBTS has determined the data type, ACP or IACP.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until the azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`APGSEL A,IACP`**{CR}{LF}

Command: **`APGSEL U,AUTO`**{CR}{LF}

Command: **`APGSEL B,ACP`**{CR}{LF}

Query: **`APGSEL?`**{CR}{LF}
Response: **`B,AUTO,ACP`**{CR}{LF}

Command: **`APGSEL A,PRM`**{CR}{LF}

Query: **`APGSEL?`**{CR}{LF}
Response: **`A,PRM,UNKNOWN`** {CR}{LF}

Query Response Format:

n,t,s{CR}{LF}
Where **n** *is either* **A**, **B**, *or* **U** *for the A, B, or Unbalanced input respectively;* **t** *is the selected type as described above, and* **s** *is the sensed ACP/IACP type (UNKNOWN for PRM).*

Default Value:

A,IACP	*Channel A input selected in IACP mode*

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

AZ - Current Azimuth

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
AZ?									

Syntax:

AZ? *Return current antenna azimuth and error flag*

Description:

The AZ command returns the current antenna azimuth and error flag.

Examples:

Query: **AZ?**{CR}{LF}
Response: **12224,0**{CR}{LF}

Query: **AZ?** {CR}{LF}
Response: **3120,0**{CR}{LF}

Query: **AZ?** {CR}{LF}
Response: **0,1**{CR}{LF}

Query Response Format:

a,e{CR}{LF}
Where **a** *is the azimuth in IACP units, 0 to 16383 for IACP units, and* **e** *is the Antenna Azimuth error flag:* **0** *for no error, or* **1** *for error (see also ANTALARM command and ALARM? Query).*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

AZEXTNT - Azimuth Extent

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
AZEXTNT	▼	▼		▼	▼	▼	▼		✘
AZEXTNT?									

Syntax:

`AZEXTNT n.n` *Set target azimuth extent*
or
`AZEXTNT?` *Return current target azimuth extent*

Where:
n.n Target extent, in degrees, 2.0 to 5.0 in 0.2° steps

Description:

The AZEXTNT command sets azimuth extent (width) of every target when the MBTS is in azimuth-gated reply mode. This value is not used when in ring-reply mode.

The azimuth extent must always be specified with the decimal point and the fractional digit, even when the fractional digit is zero. For example, a target extent of 3 degrees must be specified as "3.0". The query response always returns the decimal point and the fractional digit.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until the azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`AZEXTNT 3.2`**{CR}{LF}

Command: **`AZEXTNT 4.8`**{CR}{LF}

Query: **`AZEXTNT?`**{CR}{LF}
Response: **`4.8`**{CR}{LF}

Query Response Format:

`n.n`{CR}{LF}
Where **`n.n`** *is the azimuth extent in degrees.*

Default Value:

`2.0`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

BEAMSHAPE - Antenna Beam-Shaping Table

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
BEAMSHAPE	▼	✘	✘	✘	✘		✘		
BEAMSHAPE?									

Syntax:

BEAMSHAPE **p**$_{-127}$,**p**$_{-126}$,**p**$_{-125}$,**p**$_{-124}$, ... **p**$_{127}$,**p**$_{128}$
Download new user-defined antenna beam shape pattern

or

BEAMSHAPE? *Return current user-defined antenna beam shape pattern*

Where:

p relative power level, from 0 to -95.5 dB of attenuation in 0.5 dB steps

Description:

The BEAMSHAPE command downloads the user-defined beam pattern. This use of this beam pattern is selected by entering an ANT USER command.

The MBTS must be in either STANDBY or CAL mode to use this command (see the MODE command).

Examples:

Command: **BEAMSHAPE -95.5,-94.0,-93.0,-90.0, ... -91.5**{CR}{LF}

Query: **BEAMSHAPE?**{CR}{LF}
Response: **-95.5,-94.0,...,-95.5**{CR}{LF}

Query Response Format:

p$_{-127}$,**p**$_{-126}$,**p**$_{-125}$,**p**$_{-124}$, ... **p**$_{127}$,**p**$_{128}$}{CR}{LF}

Where a **p** *value is returned for each of the 256 azimuth values from -127 to +128;* **p** *is the relative power level, from 0 to -95.5 dB in 0.5 dB steps.*

Default Value:

Loaded from FLASH ROM as stored by last BEAMSHAPE command.

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.
NOT POSSIBLE	The data could not be saved successfully to FLASH.

BER - Bit Error Rate Test

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
BER		X	X	X	X	X	X		X
BER?									

Syntax:

BER t,p
or
BER? *Return current BER results*

Where:

t Function, as follows:
- **OFF** Terminate any BER test currently running.
- **ISI** Tests interrogation detection circuitry.
- **RGC1** Tests primary target reply generation circuitry.
- **RGC2** Tests secondary (moving) target reply generation circuitry.
- **ALL** Run a sequence of BER tests on the reply generation and interrogation detection circuitry.

p The desired number of effective data bits in powers of 10, range 1 to 9 (must be 0 for **OFF**).

Description:

The BER command starts or stops a Bit Error Rate test. **The 'RGC2' parameter requires the system to have two Reply Generator Modules.** The ALL parameter will first run the RGC2 test (if the system has two Reply Generator Modules) followed by the RGC1 test and the ISI test.

The BER query returns the most recent BER results from either a BER command, a *TST? Command, or the automatic *TST? performed upon power-up or reset. While a BER test is in progress, the BER? query returns the intermediate results.

The BER ISI command assigns an "effective number of data bits" to each interrogation generated within the BIT Module. Signal demodulation occurs within the IDR Module. This BER test consists of a random sequence of ATCRBS and Mode-S interrogations, selected from the following list:

Type	bits
Mode 2	3
Mode 3/A with narrow P4	5
Mode C with wide P4	5
Mode S All-Call	58
Mode B	3
Mode S Roll-Call	58
Mode 4 Test Word A	36

The BER RGCx commands assign an "effective number of data bits" to each reply. The MBTS Reply Generation circuits create a random sequence of ATCRBS and Mode-S replies that are then detected within the BIT Module. BER reply sequences are selected from the following list:

Type	**bits**
ATCRBS 2345, X, Emergency	15
ATCRBS 7654, SPI	11
ATCRBS 1267, Emergency	15
ATCRBS 4533, X	10
Mode S 58123456, c3ee39	58
Mode S 20001955, f0440e	58
Mode 4	3

The current mode must be STANDBY in order to initiate a bit error rate test (see the MODE command).

Examples:

Command: **BER ALL,4**{CR}{LF}

Command: **BER OFF,0**{CR}{LF}

Query: **BER?**{CR}{LF}
Response: **3,2,4023**{CR}{LF}

Query Response Format:

t,errs,cnt

errs *is the number of errors*
cnt *is the total effective number of data bits*

t	**Function**
0	Off
1	ISI BER test running
2	RGC1 BER test running
3	RGC2 BER test running

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.
TIME OUT	The command timed out.

BITCMD - BIT Command

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
BITCMD									✘
BITCMD?									

Syntax:

BITCMD n *Passes a command through to the BIT module*
or
BITCMD? *Return most recent BIT command response*

Description:

The BITCMD command passes a command through the PCC Module to the BIT module and returns the BIT module's response. See the BIT Module Command Set, FSE document number 101611, for a listing of all supported BIT Module commands.

The PCC automatically adds the packet delimiters ("{" and "}") when sending the command to the BIT module.

Note that the BIT module returns parameters separated by spaces, not commas.

The BITCMD query returns an empty string if communications with the BIT have failed or no command was successfully sent.

Examples:

Command: **BITCMD SIGLVL**{CR}{LF}
Response: **0 0 -15.12,1234,1237**{CR}{LF}

Query: **BITCMD?**{CR}{LF}
Response: **0 0 -15.12,1234,1237**{{CR}{LF}

Query Response Format:

n
W*here* **n** *is whatever was last transmitted by the BIT module as the response to a command.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
TIME OUT The command timed out.

BITRESET - BIT Reset Command

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
BITRESET									✘

Syntax:

BITRESET *Resets the BIT module*

Description:

The BITRESET command sends a processor reset signal to the BIT module.

Note that it takes 6 seconds for the BIT module to reboot and respond to additional commands.

Examples:

Command: **BITRESET**{CR}{LF}

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

BITSTS - BIT Status

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
BITSTS?									

Syntax:

BITSTS? *Return current BIT results*

Description:

The BITSTS command returns the most recent status information from the BIT module.

Note that the BIT module returns parameters separated by spaces, not commas.

The BITSTS query returns an empty string if communications with the BIT have failed.

Examples:

Query: **BITSTS?**{CR}{LF}
Response: **0 0 +4.092 1 -5.102 1 +15.202 0 28.3 1 0 0 70.000 L 1100.0 L**{CR}{LF}

Query: **BITSTS?**{CR}{LF}
Response: **0 0 +5.053 1 -4.983 1 +15.804 0 28.1 1 0 0 79.200 U 1080.0 L**{CR}{LF}

Query Response Format:

n
W*here* **n** *is the response produced by the BIT Module* **STATUS** *and* **PLLSTATUS** *commands. See the BIT Module Command Set, FSE document number 101611, for a listing of all supported BIT Module commands.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
TIME OUT The command timed out.

BORESIGHT - Off-Boresight-Angle Table

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
BORESIGHT		X	X	X	X		X		
BORESIGHT?									

Syntax:

BORESIGHT $d_{-127},p_{-127},d_{-126},p_{-126},\ldots\ d_{127},p_{127},d_{128},p_{128}$
Download new user-defined OBA pattern

or

BORESIGHT? *Return current user-defined antenna beam shape pattern*

Where:

d delta power level relative to sum power level, from +12.00 to –41.75 dB in 0.25 dB steps
p phase, either 0 or 180 degrees

Description:

The BORESIGHT command downloads the user-defined off-boresight-angle pattern. This beam pattern sets the monopulse (Delta to Sum power ratio and phase) characteristics for target replies. It is selected for use, in the Azimuth Gated Target Mode, by the ANT USER command. The Boresight table contains 256 values, one for each boresight position from –127 to +128.

Note that Delta/Sum power ratios greater than +6 dB require the adjustment of the Target and Aux Delta/Sum attenuators.

The MBTS must be in either STANDBY or CAL mode to use this command (see the MODE command).

Examples:

Command: **BORESIGHT -41.00,0,-41.25,0,-40.75,0... -40.25,180, -41.75,180**{CR}{LF}

Command: **BORESIGHT -5.00,0,-5.00,0,-5.00,0,... -5.00,180**{CR}{LF}

Query: **BORESIGHT?**{CR}{LF}
Response: **-25.75,0,-25.25,0, ... -35.75,180**{CR}{LF}

Query Response Format:

d,p,d,p,d,p, ... d,p,d,p{CR}{LF}
Where one set of **d** *and* **p** *values is returned for each of the 256 azimuth values from -127 to +128;* **d** *is the power level, from +12.00 to –41.75 dB in 0.25 dB steps, and* **p** *is the phase, either* **0** *or* **180**.

Default Value:

Loaded from FLASH ROM as stored by the most recent BORESIGHT command.

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.
NOT POSSIBLE	The data could not be saved successfully to FLASH.

**CAL* - Force recalibration for temperature and frequency

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CAL?		✘	✘	✘	✘		✘		✘

Syntax:

***CAL?** *Causes a recalibration for temperature and frequency, and returns the results of the recalibration.*

Description:

The *CAL? query causes the MBTS to recalibrate the RF section for the current ambient temperature and output frequency. It does this by routing the RF output of the Sum Channel Upconverter to the BIT module, measures the level of this signal, and then compensates for the current conditions based on the CALBITLVL settings.

The *CAL? query can compensate for up to ±4.0 dB of signal level drift. If the output level changes by more than this amount, the *CAL? query returns an error and sets the calibration offset to 0 dB.

A successful recalibration is indicated by a query response of 0. The CAL FAILED event in the ALARM status register is set if the calibration fails.

The MBTS must be in STANDBY or CAL mode to run this command (see the MODE command).

Examples:

Query: ***CAL?**{CR}{LF}
Response: **0**{CR}{LF}

Query: ***CAL?**{CR}{LF}
Response: **1**{CR}{LF}

Query Response Format:

n
Where **n** *is* **0** *for successful calibration,* **1** *for Sum level calibration error on Reply Generator 1, and* **2** *for Sum level calibration error on Reply Generator 2 .*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
WRONG MODE	The command is not possible in the current mode.
INTERNAL	BIT module communication failed.
TIME OUT	The command timed out.

Implementation Notes:

Part of the IEEE-488.2-1992 Command Set.
BIT communication errors will cause the *CAL? status to show “CAL FAILED.”

CALABOFFSET - Calibration Offset from Output A to Output B

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CALABOFFSET		X	X	X	X		X	X	
CALABOFFSET?									

Syntax:

CALABOFFSET n.n *Set new offset of Output Channel B relative to Output Channel A*
or
CALABOFFSET? *Return current offset of Output Channel B relative to Output Channel A*

Where:
n.n offset power level setting of Channel B from Channel A, from +0.8 to –0.8 dB in 01 dB increments

Description:

The CALABOFFSET command sets a power level offset between the levels generated by Output Channel A and Output Channel B.

The calibration data stored by the CALSOTABLE and CALTGTTABLE commands is determined by the performance of Output Channel A. Output power level is adjusted by the value of the CALABOFFSET when Output Channel B is active.

The MBTS must be in the STANDBY or CAL mode to run this command (see the MODE command).

Examples:

Command: **CALABOFFSET 0.5**{CR}{LF}

Command: **CALABOFFSET -0.2**{CR}{LF}

Query: **CALABOFFSET?**{CR}{LF}
Response: **-0.2**{CR}{LF}

Query Response Format:

n.n{CR}{LF}
Where **n.n** *is the offset between Output A and Output B, from +0.8 to –0.8 dB.*

Default Value:

Loaded from FLASH ROM. Adjusted at factory as needed.

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.
NOT POSSIBLE	The data could not be saved successfully to FLASH.
WRITE PROTECT	The FLASH RAM is write protected..

CALBITLVL - Calibration of BIT RF Level Detector

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CALBITLVL		X	X	X	X		X	X	
CALBITLVL?									

Syntax:

CALBITLVL s,0,0 *Set new A/D value for calibration of the output power level, from 0 to 4095.*
or
CALBITLVL? *Return current A/D calibration value*

Where:
s reference A/D value to use for the adjustment of the Sum Channel output signal level.

Description:

The CALBITLVL command sets the A/D value that is used as a comparative reference for signals detected and measured in the BIT Module during the calibration process. The signal level used to determine the reference CALBITLVL value is 0 dBm. The calibration process is invoked by the use of the *CAL? query.

The MBTS must be in the STANDBY or CAL mode to run this command (see the MODE command).

Examples:

Command: **CALBITLVL 3024,0,0**{CR}{LF}

Command: **CALBITLVL 3125,0,0**{CR}{LF}

Query: **CALBITLVL?**{CR}{LF}
Response: **3125,0,0**{CR}{LF}

Query Response Format:

s,0,0{CR}{LF}
Where **s** *is the A/D value measured in the BIT module necessary for the Sum channel to be at its reference power level.*

Default Value:

Loaded from FLASH ROM as stored by the most recent CALBITLVL command. Adjusted at factory as needed.

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.
WRONG MODE The command is not possible in the current mode.
NOT POSSIBLE The data could not be saved successfully to FLASH.
WRITE PROTECT The FLASH RAM is write protected.

CALPULSEPWR - Calibration Pulse Power Offset

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CALPULSEPWR		X	X	X	X		X	X	
CALPULSEPWR?									

Syntax:

`CALPULSEPWR [M,]n.n` *Set new offset for pulsed modes, the optional 'M' parameter selects moveable targets*

or

`CALPULSEPWR? [M]` *Return current offset for pulsed modes*

Where:

`n.n` offset from steady-state power level, from 0.00 to +0.8 dB in 0.1 dB increments

Description:

The CALPULSEPWR command sets a factor to compensate for differences between CW and pulsed output signal levels. This value is added to the target signal level and compensates for the effects of the rise time limiting circuits found within the Reply Generator Module.
The optional 'M' parameter requires the system to have two Reply Generator Modules.

The MBTS must be in the STANDBY or CAL mode to run this command (see the MODE command).

Examples:

Command: **`CALPULSEPWR 0.4`**{CR}{LF}

Command: **`CALPULSEPWR M 0.2`**{CR}{LF}

Query: **`CALPULSEPWR?`**{CR}{LF}
Response: **`0.4`**{CR}{LF}

Query: **`CALPULSEPWR? M`**{CR}{LF}
Response: **`0.2`**{CR}{LF}

Query Response Format:

`n.n` {CR}{LF}
Where **`n.n`** *is the offset between steady-state and pulsed modes, from 0.00 to +0.8 dB.*

Default Value:

Loaded from FLASH ROM. Adjusted at factory as needed.

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.
NOT POSSIBLE	The data could not be saved successfully to FLASH.
WRITE PROTECT	The FLASH RAM is write protected.

CALSOTABLE - Calibration Sum/Omni vs. Target Table

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CALSOTABLE		X	X	X	X		X	X	
CALSOTABLE?									

Syntax:

`CALSOTABLE [M,]n.nnnn,n.nnnn,n.nnnn,... n.nnnn,n.nnnn` *Set offset to Target attenuator values for each value of the Sum/Omni attenuator from +20 to -27 dB (48 entries). The optional 'M' parameter selects moveable targets*

or

`CALSOTABLE? [M]` *Returns the current sum/omni vs. target offset table*

Where:

`n.nnnn` power offset, from –2.0000 to +2.0000 dB in 0.0625 dB steps

Description:

The CALSOTABLE command loads a new offset table that compensates the Target output level at all possible Sum/Omni output power ratio settings (+20 to -27 dB).

The optional 'M' parameter requires the system to have two Reply Generator Modules.

The MBTS must be in the STANDBY or CAL mode to run this command (see the MODE command).

Examples:

Command: **`CALSOTABLE,`**
`0.0000,0.0000,0.0625,0.0000,0.1875,0.1250,0.1875,0.0625,0.0625,`
`0.0000,0.0625,0.0000,0.1250,0.0625,0.1250,0.0000,0.3125,0.1250,`
`0.2500,0.0625,0.2500,0.0625,0.1875,0.0000,-0.1250,-0.1875,`
`-0.1250,-0.2500,-0.0625,-0.1875,-0.1250,-0.2500,0.4375,0.1250,`
`0.3125,-0.0625,0.3750,0.0000,0.2500,-0.1250,0.2500,-0.1250,`
`0.0625,-0.2500,0.1250,-0.2500,0.0000,-0.3750`
{CR}{LF}

Query: **`CALSOTABLE? M`**{CR}{LF}
Response: **`0.0000,0.0000,0.0625,0.0000,0.1875,0.1250,0.1875,0.0625,`**
`0.0625,0.0000,0.0625,0.0000,0.1250,0.0625,0.1250,0.0000,0.3125,`
`0.1250,0.2500,0.0625,0.2500,0.0625,0.1875,0.0000,-0.1250,-0.1875,`
`-0.1250,-0.2500,-0.0625,-0.1875,-0.1250,-0.2500,0.4375,0.1250,`
`0.3125,-0.0625,0.3750,0.0000,0.2500,-0.1250,0.2500,-0.1250,`
`0.0625,-0.2500,0.1250,-0.2500,0.0000,-0.3750`
{CR}{LF}

Query Response Format:

n.nnnn,n.nnnn,n.nnnn,... n.nnnn,n.nnnn{CR}{LF}
Where **n.nnnn** *is the offset to the Target attenuators, from –2.0000 to +2.0000 dB.*

Default Value:

Loaded from FLASH ROM. Adjusted at factory as needed.

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.
NOT POSSIBLE	The data could not be saved successfully to FLASH
WRITE PROTECT	The FLASH RAM is write protected.

CALSTS – Return recalibration status

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CALSTS?									

Syntax:

CALSTS? *Returns the status of the calibration.*

Description:

The CALSTS? query returns the current status of the calibration, including whether or not the calibration was successful, the amount of offset applied to each output, and the temperature at the last calibration.

Examples:

Query: **CALSTS?**{CR}{LF}
Response: **2,80,79,26**{CR}{LF}

Query: **CALSTS?**{CR}{LF}
Response: **0,81,82,28**{CR}{LF}

Query Response Format:

sts,rgc1,rgc2,t
Where:
sts *is* **0** *for successful calibration, or* **1** *for RGC1 failure, or* **2** *for RGC2 failure, or* **3** *for RGC1 & RGC2 failure.*
rgc1 *is the current calibration gain setting for RGC1*
rgc2 *is the current calibration gain setting for RGC2*
t *is the temperate in degrees Celsius at the last calibration*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

CALTEMPLIMIT - Calibration Temperature Limit

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CALTEMPLIMIT		X	X	X	X		X	X	
CALTEMPLIMIT?									

Syntax:

CALTEMPLIMIT n *Set temperature limit*
or
CALTEMPLIMIT? *Return current temperature limit*

Where:
n temperature limit, from 1 to 100, in degrees Celsius

Description:

The CALTEMPLIMIT command sets the limit of the maximum temperature variation since the last RF power level calibration (see *CAL? query) before a "RECAL SUGGESTED" event is signaled via the SRQ. Temperature calibration **(***CAL?) keeps MBTS output signal levels within specified limits, and is recommended when the "RECAL SUGGESTED" SRQ is asserted. .

Examples:

Command: **CALTEMPLIMIT 5**{CR}{LF}

Command: **CALTEMPLIMIT 10**{CR}{LF}

Query: **CALTEMPLIMIT?**{CR}{LF}
Response: **10**{CR}{LF}

Query Response Format:

n{CR}{LF}
Where **n** *is the temperature change limit in degrees Celsius from 1 to 100.*

Default Value:

Loaded from FLASH ROM. Factory default is 3.

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.
NOT POSSIBLE The data could not be saved successfully to FLASH

CALTGTTABLE - Calibration Table of Target vs. Absolute Output Power

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CALTGTTABLE		✘	✘	✘	✘		✘	✘	
CALTGTTABLE?									

Syntax:

CALTGTTABLE [M,]n.nnnn,n.nnnn,n.nnnn,... n.nnnn,n.nnnn *Set to the Target absolute output power level for each attenuator value (384 entries). The optional 'M' parameter enters levels for the secondary, moveable, targets.*

or

CALTGTTABLE? [M] *Returns the current absolute power table*

Where:

n.nnnn Measured power level in steps of 0.0625 dB.

Description:

The CALTGTTABLE command loads a table of absolute power levels for each Target attenuator setting, (384 entries). This table compensates for inaccuracies or non-linearity in the Target attenuator. The first value corresponds to an attenuator setting of 0 (RAWLVL T 0), and the last value corresponds to an attenuator setting of 511 (RAWLVL T 511).

Because the Target attenuator uses two 32 dB attenuators instead of a 32 dB and a 64 dB attenuator valid Target attenuator values range from 0 to 127, and then 256 to 511, instead of from the expected range of from 0 to 383.

Measurements should be made with the Sum/Omni ratio set to 20 (MANLVL S 20) and the Delta/Sum ratio set to 0 (MANLVL D 0.0).

The MBTS must be in the STANDBY or CAL mode to run this command (see the MODE command).

Query Response Format:

n.nnnn,n.nnnn,n.nnnn,... n.nnnn,n.nnnn {CR}{LF}
Where **n** *is the Target power level, from –90.0000 to +15.0000.*

Default Value:

Loaded from FLASH ROM. Adjusted at factory as needed.

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.
NOT POSSIBLE	The data could not be saved successfully to FLASH.
WRITE PROTECT	The FLASH RAM is write protected.

CALUCATTEN - Calibration Upconverter Attenuators

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CALUCATTEN		X	X	X	X		X	X	
CALUCATTEN?									

Syntax:

CALUCATTEN p,s.s,o.o,d.d *Sets Upconverter attenuator values for output* **p** *to* **s.s** *dB for the Sum Upconverter,* **o.o** *dB for the Omni Upconverter, and* **d.d** *dB for the Delta Upconverter.*

or

CALUCATTEN? *Return current Upconverter attenuator defaults*

Where:

p is the output Channel, either **A** or **B**
s.s is the Sum Upconverter attenuator value, from 0 to 15.5 dB in 0.5 dB steps
o.o is the Omni Upconverter attenuator value, from 0 to 15.5 dB in 0.5 dB steps
d.d is the Delta Upconverter attenuator value, from 0 to 15.5 dB in 0.5 dB steps

Description:

The CALUCATTEN command sets the level of signal attenuation within each Upconverter (Sum, Omni, and Delta) Module. These values can be specified individually for either output Channel A or B.

The MBTS must be in the STANDBY or CAL mode to run this command (see the MODE command).

Examples:

Command: **CALUCATTEN A,7.0,6.5,8.0**{CR}{LF}

Command: **CALUCATTEN B,4.5,5.0,4.5**{CR}{LF}

Query: **CALUCATTEN?**{CR}{LF}
Response: **A,7.0,6.5,8.0,B,4.5,5.0,4.5**{CR}{LF}

Query Response Format:

A,s.s,o.o,d.d,B,s.s,o.o,d.d {CR}{LF}
Where **s.s** *is the Sum Upconverter default attenuator value, from 0 to 15.5 dB in 0.5 dB steps;* **o.o** *is the Omni Upconverter default attenuator value, from 0 to 15.5 dB in 0.5 dB steps;* **d.d** *is the Delta Upconverter default attenuator value, from 0 to 15.5 dB in 0.5 dB steps.*

Default Value:

Loaded from FLASH ROM. Adjusted at factory as needed.

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.
WRONG MODE The command is not possible in the current mode.
NOT POSSIBLE The data could not be saved successfully to FLASH.
WRITE PROTECT The FLASH RAM is write protected.

CAPTREPLY – Capture Replies

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CAPTREPLY									✘
CAPTREPLY?									

Syntax:

`CAPTREPLY state` *Sets Reply Capture State.*
or
`CAPTREPLY?` *Return current Reply Capture State*

Where:

`state`	**Function**
0	Disable reply captures
1	Clear the reply table and capture one reply (single shot)
2	Clear the reply table and capture all replies (armed)

Description:

The CAPTREPLY command sets the state of the reply detection state machine. When set to 1 the state will switch to 0 when the first reply is captured. The reply table is viewed using the READREPLY query.

Refer to the READREPLY command for notational comments on the operation and limitations of the data detection and analysis circuits used in this process.

The CAPTREPLY command cannot execute while a BER test is running.

Examples:

Command: **`CAPTREPLY 2`**{CR}{LF}

Command: **`CAPTREPLY 1`**{CR}{LF}

Query: **`CAPTREPLY?`**{CR}{LF}
Response: **`0`**{CR}{LF}

Query Response Format:

`d` {CR}{LF}
Where **`d`** *0, 1, or 2.*

Default Value:

0

Possible Error Conditions:

`PARAM CNT`	The wrong number of parameters was supplied.
`BAD PARAM`	A supplied parameter is out of the acceptable range.
`OPTION CONFLICT`	CAPTREPLY attempted while BER test is running.

**CLS* - Clear Status Command

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*CLS									

Syntax:

***CLS** *Clears the status registers.*

Description:

The CLS command clears SRQ/RQS bits and other error condition flags in the PLL, ALARM, *ESR, CMDSTS and INTERR registers.

THIS COMMAND SHOULD BE USED WITH EXTREME CAUTION! It clears all the events in each register. A better solution is to issue the PLL?, ALARM?, *ESR?, CMDSTS?, and INTERR? queries to read and clear each register.

Example:

Command: ***CLS**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

Implementation Notes:

Part of the IEEE-488.2-1992 Command Set.

CMDSTS – Return Command Status

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CMDSTS?									

Syntax:

CMDSTS? *Returns the current contents of the Command Status register.*

Description:

The CMDSTS query returns the current state of the command status register in hexadecimal. The register is cleared by a query except for the AMP Conflict and TRIG Conflict entries. This register contains events for all command errors that have occurred since the last time the command status register was read or the most recent *CLS command. The Trig Conflict alert is issued when the Range and Internal Trigger rate settings are incompatible. The Amplitude Conflict alert is created when the selected Sum power level cannot support a chosen D/S ratio or S/O ratio.

Examples:

Query: **CMDSTS?**{CR}{LF}
Response: **0**{CR}{LF}

Query: **CMDSTS?**{CR}{LF}
Response: **20**{CR}{LF}

Query Response Format:

n
Where **n** *is in the range* **0** *to* **7ff**. *The values are encoded as follows:*

400	**AMP CONFLICT 2**	*The moveable targets S/O or D/S ratio setting not compatible with Sum level setting or the primary and movable targets output levels are not compatible.*
200	**TRIG CONFLICT**	*Internal trigger rate incompatible with Range setting*
100	**AMP CONFLICT**	*S/O or D/S ratio setting not compatible with Sum level setting*
80	**OPTION CONFLICT**	*Attempt to enter AZ mode while internal trigger selected.*
40	**WRITE PROTECT**	*Calibrate data command issued while Write Protect DIP switch was set.*
20	**TIME OUT**	*Command has timed out*
10	**NOT POSSIBLE**	*Command is not possible, i.e. setting requested cannot be achieved because of other settings made, etc.*
8	**WRONG MODE**	*Command was issued while we were not in a compatible mode, i.e. Debug command while not in Debug mode, etc.*
4	**BAD PARAM**	*Parameter is outside of the acceptable range for that parameter.*
2	**PARAM CNT**	*Wrong number of parameters supplied for command*
1	**NO COMMAND**	*Command is not recognized.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

Implementation Notes:

Cleared by *CLS.

CODE - Reply Code

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
CODE	▼				▼	▼	▼		✘
CODE?									

Syntax:

`CODE [M,]t,c,f1,f2,x,spi,id` *Set reply code for given reply type, the optional 'M' parameter selects secondary targets*

or

`CODE? [M]` *Return current reply code settings*

Where:

`t` Reply type, as follows:
- **`3`** - Mode 3/A reply
- **`2`** - Mode 2 reply
- **`B`** - Mode B reply
- **`C`** - Mode C reply
- **`S`** - Mode S All-Call reply
- **`SA`** - Mode S Altitude (altitude reply)
- **`4`** - Mode 4 reply

`c` Code value, the format depends on the mode as follows:
- **`3`**, **`2`**, **`B`**, **`C`** - 0000 to 7777 (octal, see bit ordering below)
- **`S`** - 000000 to FFFFFF (hexadecimal) Aircraft Address (AA) code
- **`SA`** - 0000 to 1FFF (hexadecimal) 25' altitude and aircraft status information – see below
- **`4`** - 0 to 60 (decimal) Delay (in μsec)

`f1` Generate F1 pulse, **`0`**=no, **`1`**=yes (not used for Modes-S, SA and 4 and must be 0)

`f2` Generate F2 pulse, **`0`**=no, **`1`**=yes (not used for Modes-S, SA and 4 and must be 0)

`x` Generate x pulse, **`0`**=no, **`1`**=yes (not used for Modes-S, SA and 4 and must be 0)

`spi` Generate SPI pulse, **`0`**=no, **`1`**=yes (not used for Modes-S and 4 and must be 0)

`id` for Mode SA: this bit used to set the Aircraft Status value 0 = Airborne 1 = On Ground
for Mode 3/A: this bit manually controls the Alert bit in Mode S replies; 0 = OFF, 1 = ON. The Alert signal controlled through this means is set until cleared by another Mode 3/A command.
For Mode 2: this bit select the Mode 2 and Mode 3 Emergency code.
For all other modes: must be set to **0**

NOTE: The Mode S Roll Call ID information, used in a Mode S identity reply (DF=5), is the same as the Mode 3/A code entry. The MBTS responds to changes to the Mode 3/A code value by setting the Alert bit in Mode S responses for a period of 18 seconds. The MBTS automatically sets a permanent Alert bit when ID values of 7500, 7600, or 7700 are loaded.

The "SA" option must be used to enter Mode S Roll Call altitude information. Mode SA and Mode C altitude values should be loaded concurrently to keep Mode S and ATCRBS altitude reply information compatible. If non-valid Mode C altitude gray code values are loaded the 25 foot encoded Mode S altitude value should be set to –1000 feet.

The CODE setting generally controls the timing of Mode 4 interrogation responses. However, if the MBTS detects a Mode 4 Test Word A or Test Word B interrogation then the reply response will be such so as to be consistent with the specifications of these test signals. Refer to DOD AIMS 97-1000 for more information on these specific test conditions.

The CODE command applies the current TGTCNT, TGTMIX, RANGE, and INC3 command settings and overrides earlier GCNTTYPE, GCODE, GINC, GRANGE, PCODE, PPROB, PRANGE, PTGT, PTYPE, SCNTTYPE, SCODE, SINC, SPROB, and SRANGE commands. Each sector will have at most one target.

Description:

The CODE command sets the reply code contents for the various possible reply codes. These codes are used in both the ring-reply and the azimuth-gated reply modes. In azimuth-reply mode, the Mode S All-Call (AA) code value applies to the first target. This is incremented by one for each additional Mode-S target in an antenna revolution. The Mode 3/A can also be incremented, see the INC3 command.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Bit Order:

For Mode C replies, the code value is the gray coded altitude data. For all ATCRBS replies, the MBTS re-orders the code bits as described in International Civil Aviation Organization (ICOA) Annex 10, *Volume IV – Surveillance Radar and Collision Avoidance Systems* and FAA document 1010.51A, *U.S. National Aviation Standard for the IFF Mark X (SIF)/Air Traffic Control Radar Beacon System Characteristics*. The code value is a four-digit octal number, with each octal digit containing three bits. The digits are labeled "A" through "D" from left to right (the left-most digit is "A"). The bits within each digit are labeled "1", "2" or "4", corresponding to the bit position within the digit (bit "1" is the least-significant bit and bit "4" is the most-significant). During the reply, the code bits are sent in the following order:

C1 A1 C2 A2 C4 A4 X(**) B1 D1 B2 D2 B4 D4

Where C1 is the first data bit following the F1 framing pulse. The "**" indicates a bit controlled by the "x" parameter in the CODE command. Using the examples from Section 2.6.6.1 of FAA document 1010.51A (referenced above), here are example translations to the required Code command format:

ATCRBS Code value (octal)	Bits Set	Reply bit order
3600	A1, A2, B2, B4	f1 0 1 0 1 0 0 x 0 0 1 0 1 0 f2 spi
2057	A2, C1, C4, D1, D2, D4	f1 1 0 0 1 1 0 x 0 1 0 1 0 1 f2 spi
0301	B1, B2, D1	f1 0 0 0 0 0 0 x 1 1 1 0 0 0 f2 spi

For Mode S replies, in MBTS System Revision level F and subsequent revisions, Mode S Roll Call is implemented. This includes the ability to generate surveillance altitude (DF=4) and identity (DF=5) replies. Identity (ID field) information is taken directly from the Mode 3/A code entry. 25' and 100' altitude information must be entered, as defined below, through the use of the "SA" command option. The "SA" option also includes the ability to activate the use of a non-timed SPI bit and to set the aircraft Airborne or On Ground condition. A metric altitude encoding control setting is defined but is not implemented.
Mode "S" command entry is unaltered from previous software versions.

Mode "SA" - The code value is a 4 digit hex number (code value = 0000 to 1FFF).

For 100 foot altitude encoding the data format is similar to that of a Mode C ATCRBS reply and the following bit order applies:

[0, 0, 0, C1] [A1 C2, A2 C4] [A4, M, B1, Q] [B2, D2, B4, D4]

M sets metric encoding (not implemented), always set to 0
Q sets 25' altitude encoding, 0= 100' encoding, 1= 25' encoding

For 25 foot altitude encoding the data format is as following:

[0, 0, 0, X] [X X, X X] [X, M, X, Q] [X, X, X, X]

X is the binary equivalent of the altitude (-1,000' to +50,175')
M sets metric encoding, always set to 0
Q sets 25' altitude encoding, 0= 100' encoding, 1= 25' encoding

Altitude limits are –1,000 feet (code value = [0000][0000][000Q][0000]) and +50,175 feet (code value = [0001][1111][101Q][1111]).

The "SA" altitude entry should be closely linked with the Mode C code entry. The MBTS does not link altitude entries through these commands.

The SPI bit of the "SA" command option sets or clears the SPI bit in the Mode S reply. The SPI bit in the "S" option is non-functional and should always be set to 0.

For more information on altitude encoding see section 2.2.13.1.2 of RTCA/DO-181C (MOPS for ATCRBS/Mode S Airborne Equipment).

Examples:

Command: **CODE 2,2417,1,1,0,1,0**{CR}{LF}

Command: **CODE M,C,2057,1,1,0,0,0**{CR}{LF}

Query: **CODE?**{CR}{LF}
Response: **3,5442,1,1,0,0,0,2,2417,1,1,0,1,0,B,3254,1,1,0,0,0,C,2057,1,1,0, 0,0,S,15C24F,0,0,0,0,0,SA,3B91,0,0,0,1,1,4,05,0,0,0,0,0**{CR}{LF}

Query: **CODE? M**{CR}{LF}
Response: **3,5442,1,1,0,0,0,2,2417,1,1,0,1,0,B,3254,1,1,0,0,0,C,2057,1,1,0, 0,0,S,15C24F,0,0,0,0,0,SA,3B91,0,0,0,1,1,4,05,0,0,0,0,0**{CR}{LF}

Query Response Format:

3,c,f1,f2,x,spi,id,2,c,f1,f2,x,spi,id,B,c,f1,f2,x,spi,id,C,c,f1,f2,x, spi,id,S,c,f1,f2,x,spi,id, SA,c,f1,f2,x,spi,id,4,c,f1,f2,x,spi,id {CR}{LF}
Where a complete set of data is returned for each of the modes, in the order Mode 3, Mode 2, Mode B, Mode C, Mode S, Mode SA and Mode 4.

Default Value:

Mode **3**, **c=0000, f1=1, f2=1, x=0, spi=0, id=0**
Mode **2**, **c=0000, f1=1, f2=1, x=0, spi=0, id=0**
Mode **B**, **c=0000, f1=1, f2=1, x=0, spi=0, id=0**
Mode **C**, **c=0000, f1=1, f2=1, x=0, spi=0, id=0**
Mode **S**, **c=000000, f1=0, f2=0, x=0, spi=0, id=0**
Mode **SA**, **c=0000, f1=0, f2=0, x=0, spi=0, id=0**
Mode **4**, **c=00, f1=0, f2=0, x=0, spi=0, id=0**

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

DIPSW – Get Current State of DIP Switches

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
DIPSW?									✘

Syntax:

DIPSW? *Return the current DIP Switch settings*

Description:

The DIPSW? Query returns the current value of the DIP switches on the PCC module of the MBTS.

Examples:

Query: **DIPSW?**{CR}{LF}
Response: **208**{CR}{LF}

Query Response Format:

n{CR}{LF}
Where **n** *is the current value of the DIP switches, from 0 to 255.*
These values are encoded as follows:

128	**USER3**	
64	**USER2**	
32	**USER1**	*CAL Flash Write Protect*
16	**ADDRESS5**	*IEEE-488 Address bit 5*
8	**ADDRESS4**	*IEEE-488 Address bit 4*
4	**ADDRESS3**	*IEEE-488 Address bit 3*
2	**ADDRESS2**	*IEEE-488 Address bit 2*
1	**ADDRESS1**	*IEEE-488 Address bit 1*

The USER2 and USER3 entries are encoded as follows:

USER3	**USER2**	
0	**0**	*Normal boot sequence*
0	**1**	*Force Flash Download from aux serial port*
1	**0**	*Ignore user code and attempt factory code.*
1	**1**	*Force factory code at 0x8000 to run, ignoring errors.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

**ESE* – Events Status Enable

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*ESE									
*ESE?									

Syntax:

***ESE n** *Set the Events Status Enable register to* **n**
or
***ESE?** *Return the current Events Status Enable register value*

Where:
n is Events Status Enable register value, from 0 to 255

Description:

The *ESE command controls which bits in the Events Status Register are allowed to set the ESB bit in the *STB register. A one in a corresponding bit position means that bit in the ESR can cause the ESB bit in *STB to be set; a zero means that the event bit will be set in the ESR but will not cause the ESB bit to be set.

To have the ESB bit in *STB generate an SRQ, set the corresponding bit in the *SRE register.

Examples:

Command: ***ESE 192**{CR}{LF}

Command: ***ESE 0**{CR}{LF}

Query: ***ESE?**{CR}{LF}
Response: **208**{CR}{LF}

Query Response Format:

n{CR}{LF}
Where **n** *is the Events Status Enable register value, from 0 to 255.*

Default Value:

0 *(all disabled)*

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

Implementation Notes:

Part of the IEEE-488.2-1992 Command Set.

**ESR* – Events Status Register

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*ESR?									

Syntax:

***ESR?** *Return the current Events Status Register value*

Description:

The *ESR query returns the current value of the Events Status Register and clears it. This register contains events that have occurred since the last time the Events Status register was read or since the most recent *CLS command.

Example:

Query: *__ESR?__{CR}{LF}
Response: __32__{CR}{LF}

Query Response Format:

__n__{CR}{LF}
Where __n__ is the Events Status Enable register value, from 0 to 255. The values are encoded as follows:

128	**PON**	*Power-on. This event is set upon power-on.*
64	**USER REQ**	*User Request. This event is set if the MBTS starts or stops operation or if Alert or Lockout events are active (flags in OP).*
32	**CMD ERROR**	*Command Error. This flag is set if the NO COMMAND flag is set in CMDSTS.*
16	**EXEC ERROR**	*Execution Error. This flag is set if the PARAM CNT or BAD PARAM flags are set in CMDSTS.*
8	**DEV ERROR**	*Device Error. This flag is set if the WRONG MODE, NOT POSSIBLE, TIMEOUT, WRITE PROTECT, OPTION CONFLICT, AMP CONFLICT, or TRIG CONFLICT flags are set in CMDSTS.*
4	**QUERY ERROR**	*Query Error. Not used by the MBTS.*
2	**REQ CONTROL**	*Request Control. Not used by the MBTS.*
1	**OP COMPLETE**	*Operation Complete. Set by the *OPC command.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

Implementation Notes:

Cleared by *CLS. Part of the IEEE-488.2-1992 Command Set.

EXTTRIGDLY – External Trigger Delay

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
EXTTRIGDLY	▼				▼	▼	▼		✘
EXTTRIGDLY?									

Syntax:

`EXTTRIGDLY n` *Set external trigger delay to n*
or
`EXTTRIGDLY?` *Return current external trigger delay*

Where:

`n` Amount of external trigger delay in units of 62.5 ns, from 0 to 48000 (0 to 3.0 ms), where 0 corresponds to a minimum possible delay of 500 ns from external trigger in to external trigger out (±25 ns).

Description:

The EXTTRIGDLY command sets the delay between the external trigger signal and the ISI signaling the RGC for a reply.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`EXTTRIGDLY 100`**{CR}{LF}

Command: **`EXTTRIGDLY 32172`**{CR}{LF}

Query: **`EXTTRIGDLY?`**{CR}{LF}
Response: **`32172`**{CR}{LF}

Query Response Format:

`n`{CR}{LF}
where **`n`** *is the external trigger delay, in units of 62.5 ns.*

Default Value:

`0`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

FACTORYCAL – Restore Calibration Data from Factory FLASH Memory Area

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
FACTORYCAL		X	X	X	X		X	X	

Syntax:

FACTORYCAL *Restore Calibration data from Factory FLASH calibration data area*

Description:

The FACTORYCAL command copies the calibration data currently in the Factory calibration data area into the User calibration data area.

The Factory calibration data area provides a "safe" copy of the calibration data to use in case the "user" area becomes corrupted or is set to an undesirable state. If the user area fails its integrity check, the MBTS uses the Factory data.

This command is only available in STANDBY or CAL mode (see the MODE command).

Examples:

Command: **FACTORYCAL**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.
NOT POSSIBLE	The data could not be saved successfully to FLASH.
WRITE PROTECT	The FLASH RAM is write protected.

FLASH – Download Program to FLASH Memory

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
FLASH		X	X	X	X	X	X		

Syntax:

`FLASH program xyzzy` *Start FLASH program mode*

Description:

The FLASH command starts the PCC in Flash Program Download mode. In this mode the PCC module communicates using a serial program download protocol.

This command is only available in STANDBY mode (see the MODE command).

This command is not available on the IEEE-488 port. It is only available on the two serial ports.

NOTE: After accepting the FLASH command, the PCC stops processing commands on both serial ports and the IEEE-488 port.

Examples:

Command: **`FLASH program xyzzy`**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

`PARAM CNT`	The wrong number of parameters was supplied.
`BAD PARAM`	A supplied parameter is out of the acceptable range.
`WRONG MODE`	The command is not possible in the current mode.
`NOT POSSIBLE`	The data could not be saved successfully to FLASH.

FLASHCAL – Transfer Calibration Data to Factory FLASH Memory Area

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
FLASHCAL		X	X	X	X		X	X	

Syntax:

FLASHCAL C*opy Calibration data into Factory FLASH calibration data area*

Description:

The FLASHCAL command copies the calibration data currently in the User calibration data area into the Factory calibration data area.

The Factory calibration data area provides a "safe" copy of the calibration data to use in case the "user" area becomes corrupted. When the user area fails its integrity check, the MBTS uses the Factory data.

This command is only available in STANDBY or CAL mode (see the MODE command).

Examples:

Command: **FLASHCAL**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.
NOT POSSIBLE	The data could not be saved successfully to FLASH.
WRITE PROTECT	The FLASH RAM is write protected.

FREQOFF –Frequency Offset To Secondary Targets Replies

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
FREQOFF									✘
FREQOFF?									

Syntax:

`FREQOFF n.nn` *Set frequency offset to secondary targets replies*
or
`FREQOFF?` *Return current Reply frequency*

Where:
`n.nn` Output frequency offset, in MHz, from -2.0 to 2.0 in 0.05 MHz steps

Description:

The REPLYFREQ command sets the output frequency of the Reply signal for primary targets. The FREQOFF command modifies this setting and sets the output frequency of the Reply signal for secondary targets. The Reply Generator signal on the second Reply Generator Module is changed from 70 MHz to generate the MBTS output signal at the correct frequency.

This command has no effect if the system does not have two Reply Generator Modules.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`FREQOFF -1.45`**{CR}{LF}

Query: **`FREQOFF?`**{CR}{LF}
Response: **`-1.45`**{CR}{LF}

Query Response Format:

`n.nn`{CR}{LF}
Where **`n.nn`** *is the frequency offset in MHz.*

Default Value:

`-0.50`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

GCNTTYPE – Global Count and Type

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
GCNTTYPE	▼	▼		▼	▼	▼	▼		✘

Syntax:

GCNTTYPE [M,] t, <ATCRBS, S, AFIRST, SFIRST, NONE> [,4]

Where:

t Number of targets in each sector from 0 to 32

Description:

The **GCNTTYPE** command is a shortcut for sending identical **SCNTTYPE** commands to each sector. The format, other than the missing sector number, is identical to the **SCNTTYPE** command.

There is no query for the GCNTTYPE command.

Examples:

Command: **GCNTTYPE M,8,AFIRST**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

GCODE – Global Code

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
GCODE	▼	▼		▼	▼	▼	▼		✘

Syntax:

GCODE [M,] <2, 3, 4, B, C, S, SA> …

Description:

The **GCODE** command is a shortcut for sending identical **SCODE** commands to each sector. The **GCODE** command sets the code of every target in every sector. The format, other than the missing sector number, is identical to the **SCODE** command. Refer to the **CODE** command for information about different code types.

There is no query for the GCODE command.

Examples:

Command: **GCODE M,8,2,4321,1,1,0,0,0**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

GINC – Global Increment

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
GINC	▼	▼		▼	▼	▼	▼		✘

Syntax:

GINC [M]

Description:

The **GINC** command is a shortcut for sending multiple **PCODE** commands. The **GINC** command takes the Code 3/A and Code S settings for sector 0 plane 0 and increments it in each active target in all sectors. The Code 3/A is incremented for each ATCRBS or Mode S target. The Code S is incremented for each Mode S target.

There is no query for the GINC command.

Examples:

Command: **GINC**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

GRANGE – Global Range

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
GRANGE	▼	▼		▼	▼	▼	▼		✘

Syntax:

GRANGE [M,] r

Where:

r [50:64000] the range spacing to each target in every sector in 62.5 ns range units

Description:

The **GRANGE** command is a shortcut for sending identical **SRANGE** commands to each sector. The **GRANGE** command sets the range spacing of every target in every sector. The format, other than the missing sector number, is identical to the **SRANGE** command.

Targets that are set to a range greater than 64000 are removed.

There is no query for the GRANGE command.

Examples:

Command: **GRANGE M,8000**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

IDATA – Interrogation Data

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
IDATA									✘

Syntax:

`IDATA data` *Set User Defined Interrogation*

Description:

The IDATA command sets the user defined interrogation pattern. Refer to the INTGEN command for the use and selection of interrogation patterns.

The **`data`** is made up of tokens, with each token separated by either commas or spaces. The valid tokens are:

P0	Phase off (DPSK to 0 degrees)
P1	Phase on (DPSK 180 degrees)
A0	Amplitude off (PAM output enabled)
A1	Amplitude on (PAM output disabled)
nnn	Delta time, in nano-seconds (must be a multiple of 50 ns)

The interrogation starts with a default state of "A0 P0" (PAM off, DPSK at 0 degrees). It also turns the PAM off and DPSK to zero degrees at the end of the interrogation sequence. For example, the string "A1 P0 500 P1 500 A0 P0" generates a 1000 ns wide pulse, with a phase change after 500 ns. The string "A1 500 P1 500" will generate the same interrogation signal.

The maximum *text* string length is 1023 bytes. The maximum time length of the generated interrogation signal is 25,600 ns (25.6 µs).

The IDATA command cannot execute while a BER test is running.

Examples:

Command: **`IDATA A1,P0,800,A0,4200,A1,800,A0`**{CR}{LF} *Mode 2 interrogation*

Command: **`IDATA A1,500,P1,500`**{CR}{LF}

Default Value:

`N/A`

Possible Error Conditions:

`PARAM CNT`	The wrong number of parameters was supplied.
`BAD PARAM`	A supplied parameter is out of the acceptable range.
`OPTION CONFLICT`	IDATA attempted while BER test is running.

**IDN* – Identification Query

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*IDN?									

Syntax:

***IDN?** *Return the Identification string for the MBTS.*

Description:

The *IDN query returns the identification string for the MBTS, in accordance with the IEEE-488.2-1992 Command Set. The identification string includes Manufacturer, Model, Serial Number, and Firmware Level. The MBTS always returns a serial number of zero.

If the Xilinx Load fails, the MBTS returns 0 for all FPGA and BIT versions.

Example:

Query: ***IDN?**{CR}{LF}
Response: **FREESTATE ELECTRONICS INC,FS-1420,0,4.2-2-4.1-3**{CR}{LF}

Query Response Format:

FREESTATE ELECTRONICS INC,FS-1420,0,p.pp-c-b.bb-f {CR}{LF}
The values are encoded as follows:

- **p.pp** is the PCC firmware version
- **c** is the PCC CPU FPGA version
- **b.bb** is the B.I.T. Controller firmware version
- **f** is the B.I.T FPGA version

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

Implementation Notes:

Part of the IEEE-488.2-1992 Command Set.

IDRFREQ – Set Interrogation Demodulator Frequency

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
IDRFREQ									✘
IDRFREQ?									

Syntax:

`IDRFREQ nnnn.n` *Set IDR input frequency*
or
`IDRFREQ?` *Return current IDR input frequency*

Where:
`nnnn.n` Input frequency, in MHz, from 1020.0 to 1040.0 in 0.2 MHz steps

Description:

The IDRFREQ command sets the IDR input frequency.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`IDRFREQ 1030.4`**{CR}{LF}

Command: **`IDRFREQ 1021.0`**{CR}{LF}

Query: **`IDRFREQ?`**{CR}{LF}
Response: **`1021.0`**{CR}{LF}

Query Response Format:

`nnnn.n`{CR}{LF}
Where **`nnnn.n`** *is the input frequency in MHz.*

Default Value:

`1030.0`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

IDRSRC - Set Interrogation Source

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
IDRSRC									✘
IDRSRC?									

Syntax:

IDRSRC n *Selects interrogation signal source*
or
IDRSRC? *Return current interrogation signal source*

Where:

n Interrogation source, as follows:
- **INA** - Channel A input
- **INB** - Channel B input
- **SUMA** - SUM Channel A input
- **SUMB** - SUM Channel B input
- **BIT** - BIT module

Description:

The IDRSRC command determines the source used in interrogation decoding (see also the TRIG command).

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **IDRSRC INA**{CR}{LF}

Command: **IDRSRC SUMA**{CR}{LF}

Command: **IDRSRC BIT**{CR}{LF}

Query: **IDRSRC?**{CR}{LF}
Response: **BIT**{CR}{LF}

Query Response Format:

n
Where **n** *is* **INA**, **INB**, **SUMA**, **SUMB** *or* **BIT**.

Default Value:

"**INA**"

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

INC3 – Increment Code 3/A

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
INC3	▼	▼		▼	▼	▼	▼		✘
INC3?									

Syntax:

`INC3 [M,]n` *Enable/ Disable incrementing code 3/A, the optional 'M' parameter selects secondary targets*

or

`INC3? [M]` *Return current setting*

Where:

`n` **`ON`** or **`OFF`**

Description:

The INC3 command sets the MBTS to generate replies with incrementing Code 3/A, transponder ID, settings when operating in Azimuth Gated Target mode. When INC3 is ON the target at the TGTAZ setting will use the current CODE 3 setting. Each successive target generates a reply with an incremented CODE 3 value. This command only affects Azimuth mode operation. Any targets with an ID of 7500, 7600, or 7700 set a permanent alert (SPI) bit in its interrogation response.

The INC3 command applies the current TGTCNT, TGTMIX, RANGE, and CODE command settings and overrides earlier GCNTTYPE, GCODE, GINC, GRANGE, PCODE, PPROB, PRANGE, PTGT, PTYPE, SCNTTYPE, SCODE, SINC, SPROB, and SRANGE commands. Each sector will have at most one target.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`INC3 ON`**{CR}{LF}

Command: **`INC3 M OFF`**{CR}{LF}

Query: **`INC3? M`**{CR}{LF}
Response: **`OFF`**{CR}{LF}

Query Response Format:

`n`{CR}{LF} *Where* **`n`** *is* **`ON`** *or* **`OFF`**

Default Value:

`OFF`

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

INTERR – Internal Error Events Register

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
INTERR?									

Syntax:

INTERR? *Return the current Internal Error Events Register value*

Description:

The INTERR query returns the current value of the Internal Error Events Register in hexadecimal and clears it. This register contains events that have occurred since the last time the Internal Error Events register was read or the most recent *CLS command (except for XILINX LOAD FAIL, which is permanent until PCC reset). These errors are errors detected during power-up testing, or by running the *TST command.

Example:

Query: **INTERR?**{CR}{LF}
Response: **1c503**{CR}{LF}

Query Response Format:

n{CR}{LF}
Where **n** *is the Internal Error Events register value, from* ***0*** *to* ***2dffffff****. The values are encoded as follows:*

20000000	**FACT XILINX BAD**	*An error was detected in the Factory Xilinx FPGA data area.*
8000000	**BER RGC2 FAIL**	*The RGC2 Bit Error Rate Test failed.*
4000000	**XILINX SRAM FAIL**	*The Xilinx SRAM failed self-test.*
1000000	**PAM2 ATTEN FAILED**	*The PAM control attenuator of RGC2 failed self-test.*
800000	**PHASE2 MOD FAILED**	*The Phase modulator of RGC2 failed self-test.*
400000	**ADS2 ATTEN FAILED**	*The Aux Delta/Sum attenuator of RGC2 failed self-test.*
200000	**DS2 ATTEN FAILED**	*The Delta/Sum attenuator of RGC2 failed self-test.*
100000	**SO2 ATTEN FAILED**	*The Sum/Omni attenuator of RGC2 failed self-test.*
80000	**TGT2 ATTEN FAILED**	*The Target attenuator of RGC2 failed self-test.*
40000	**SUP2 ATTEN FAILED**	*The Sum Up Converter attenuator of RGC2 failed self-test.*
20000	**OUP2 ATTEN FAILED**	*The Omni Up Converter attenuator of RGC2 failed self-test.*
10000	**DUP2 ATTEN FAILED**	*The Delta Up Converter attenuator of RGC2 failed self-test.*
8000	**USER PROG BAD**	*An error was detected in the downloadable User Program.*
4000	**USER CAL BAD**	*An error was detected in the User Calibration Constants.*
2000	**USER XILINX BAD**	*An error was detected in the User Xilinx FPGA data area.*
1000	**BER ISI FAIL**	*The ISI Bit Error Rate Test failed.*
800	**BER RGC1 FAIL**	*The RGC1 Bit Error Rate Test failed.*
400	**FACTORY CAL BAD**	*An error was detected in the Factory Calibration Constants.*
200	**XILINX LOAD FAILED**	*The PCC was unable to download a Xilinx pattern.*
100	**PAM1 ATTEN FAILED**	*The PAM control attenuator of RGC1 failed self-test.*
80	**PHASE1 MOD FAILED**	*The Phase modulator of RGC1 failed self-test.*
40	**ADS1 ATTEN FAILED**	*The Aux Delta/Sum attenuator of RGC1 failed self-test.*
20	**DS1 ATTEN FAILED**	*The Delta/Sum attenuator of RGC1 failed self-test.*
10	**SO1 ATTEN FAILED**	*The Sum/Omni attenuator of RGC1 failed self-test.*
8	**TGT1 ATTEN FAILED**	*The Target attenuator of RGC1 failed self-test.*

4	**SUP1 ATTEN FAILED**	*The Sum Up Converter attenuator of RGC1 failed self-test.*
2	**OUP1 ATTEN FAILED**	*The Omni Up Converter attenuator of RGC1 failed self-test.*
1	**DUP1 ATTEN FAILED**	*The Delta Up Converter attenuator of RGC1 failed self-test.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.

INTFREQ – Interrogation Output Frequency

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
INTFREQ									✘
INTFREQ?									

Syntax:

`INTFREQ ffff.ff` *Set Interrogation Output Frequency*
or
`INTFREQ?` *Return Interrogation Output Frequency*

Where `ffff.ff` is 1029.00 to 1031.00 MHz in steps of .05 MHz

Description:

The INTFREQ command sets the interrogation output frequency of the BIT Module.

The INTFREQ command cannot execute while a BER test is running.

Examples:

Command: **`INTFREQ 1029.95`**{CR}{LF}

Command: **`INTFREQ 1030.00`**{CR}{LF}

Query: **`INTFREQ?`**{CR}{LF}
Response: **`1030.00`**{CR}{LF}

Query Response Format:

`ffff.ff` {CR}{LF}
Where **`f`** *is the interrogation output frequency.*

Default Value:

`1030.00`

Possible Error Conditions:

`PARAM CNT`	The wrong number of parameters was supplied.
`BAD PARAM`	A supplied parameter is out of the acceptable range.
`OPTION CONFLICT`	INTFREQ attempted while BER test is running.

INTGEN – Interrogation Generation Control

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
INTGEN									X
INTGEN?									

Syntax:

`INTGEN t[,R]` *Generate Interrogation*
or
`INTGEN?` *Return Generate Interrogation Status*

Where:

t	**Function**
0	User defined interrogation (see the IDATA command)
1	Mode 2 interrogation
2	Mode 3/A, narrow P4, interrogation
3	Mode C, wide P4, interrogation
4	Mode S interrogation (UF11)
5	Mode B interrogation
6	Mode C, no P4, interrogation
7	Mode 3/A, no P4, interrogation
8	Mode C, narrow P4, interrogation
9	Mode 3/A, wide P4, interrogation
A	Mode S interrogation (UF4, AA=123456)
B	Mode 4 Test Word A
C	Mode 4 Test Word B
D	Mode 4 C271507B (test word B plus one)

Description:

The INTGEN command causes the BIT Module to generate the requested interrogation. If the optional second parameter 'R' is present the interrogation will be repeated every 10 ms. Sending a valid INTGEN command without the optional second parameter 'R' halts the repeating interrogation.

The IDATA command must be used prior to using interrogation type 0.

The INTGEN command cannot execute while a BER test is running.

Examples:

Command: **`INTGEN 4,R`**{CR}{LF}

Command: **`INTGEN 3`**{CR}{LF}

Command: **`INTGEN B,R`**{CR}{LF}

Query: **`INTGEN?`**{CR}{LF}
Response: **`B R`** {CR}{LF}

Query Response Format:

Matches the command format.

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
OPTION CONFLICT	INTGEN attempted while BER test is running or INTGEN 0 attempted without first executing an IDATA command.

INTLVL – Interrogation Output Power Level

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
INTLVL									✘
INTLVL?									

Syntax:

`INTLVL s,n` *Set Interrogation Output Power Level*
or
`INTLVL?` *Return Interrogation Output Power Level*

Where:

s	**n**	Function
R	-83 to -20 dBm in 1 dB steps	Coarse output power level setting
F	-2.0 to 2.0 dB in 0.1 dB steps	Fine output power level adjustment

Description:

The INTLVL command sets the interrogation output power level of the BIT Module.

The INTLVL command cannot execute while a BER test is running.

Examples:

Command: **`INTLVL R,-42`**{CR}{LF}

Command: **`INTLVL F,1.3`**{CR}{LF}

Query: **`INTLVL?`**{CR}{LF}
Response: **`R,-42,F,1.3`**{CR}{LF}

Query Response Format:

`R,r,F,f.f` {CR}{LF}
Where **`r`** *is the rough interrogation output level and* **f.f** *is the fine interrogation output level.*

Default Value:

`R,-83,F,0.0`

Possible Error Conditions:

`PARAM CNT`	The wrong number of parameters was supplied.
`BAD PARAM`	A supplied parameter is out of the acceptable range.
`OPTION CONFLICT`	INTLVL attempted while BER test is running.

INTSID - Mode S Interrogator ID

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
INTSID	▼			▼	▼	▼	▼		✘
INTSID?									

Syntax:

`INTSID n` *Set Mode S interrogator ID*
or
`INTSID?` *Return current Mode S interrogator ID*

Where:
`n` Interrogator ID, from 0 to 63.

Description:

The INTSID command sets the Mode S interrogator ID that is used in all modes in which it is not determined by the demodulated interrogation data, i.e. in INTernal or EXTernal trigger modes, the ID specified by INTSID provides the ID of the interrogator. Values greater than 15 automatically set the PR and CL fields in the Mode S reply.

Examples:

Command: **`INTSID 2`**{CR}{LF}

Command: **`INTSID 15`**{CR}{LF}

Command: **`INTSID 4`**{CR}{LF}

Query: **`INTSID?`**{CR}{LF}
Response: **`4`**{CR}{LF}

Query Response Format:

`m` {CR}{LF}
Where **`m`** *is the interrogator ID for Mode S.*

Default Value:

`0`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

INTTRIGPRF - Internal Trigger Pulse Repetition Frequency

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
INTTRIGPRF	▼		▼		▼	▼	▼		✘
INTTRIGPRF?									

Syntax:

INTTRIGPRF n *Sets internal trigger pulse repetition frequency*
or
INTTRIGPRF? *Return current internal trigger pulse repetition frequency*

Where:
n Trigger frequency in Hz, 10 to 1000 in 5 Hz steps

Description:

The INTTRIGPRF command sets the internal trigger repetition rate.

Examples:

Command: **INTTRIGPRF 500**{CR}{LF}

Command: **INTTRIGPRF 725**{CR}{LF}

Query: **INTTRIGPRF?**{CR}{LF}
Response: **725**{CR}{LF}

Query Response Format:

n
Where **n** *is the trigger repetition rate in Hz, from 10 to 1000.*

Default Value:

10

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

INTTYPE – Set Interrogation Type

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
INTTYPE	▼				▼	▼	▼		✘
INTTYPE?									

Syntax:

INTTYPE m *Set interrogation type*
or
INTTYPE? *Return current interrogation type settings*

Where:
m Interrogation type, as follows:
3 - Mode 3/A
2 - Mode 2
B - Mode B
C - Mode C
S - Mode S All Call
SA - Mode S Altitude
SI - Mode S Identity
4 - Mode 4

Description:

The INTTYPE command sets the reply type for all modes in which it is not determined by the data, i.e. in INTernal or EXTernal trigger modes, the type specified by INTTYPE determines the type of interrogation. When triggering is from RF or Mode Pair signals the interrogation type is determined from the received interrogation..

Examples:

Command: **INTTYPE 2**{CR}{LF}

Command: **INTTYPE C**{CR}{LF}

Command: **INTTYPE S**{CR}{LF}

Query: **INTTYPE?**{CR}{LF}
Response: **S**{CR}{LF}

Query Response Format:

m {CR}{LF}
Where **m** *is the interrogation mode.*

Default Value:

Mode **2**

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

MANLVL – Set RF Output signal levels

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
MANLVL	▼								✘
MANLVL?									

Syntax:

`MANLVL [M,]n,p` *Sets power level of Output n to p, the optional 'M' parameter selects secondary targets*
or
`MANLVL? [M]` *Return current setting of all Outputs*

Where:

n	p	Function
T	+10.0 to –85.0 dBm in 0.5 dB steps	Target (Sum) power level
S	+20 to –27 dB in 1 dB steps	Sum/Omni ratio
D	+12.00 to –42.00 dB in 0.25 dB	Delta/Sum ratio
C	-1.0 to 1.0 in .1 dB steps	Target (Sum) power level offset

Description:

The MANLVL command sets the signal level for the Target (Sum) output, the Sum/Omni ratio, and the Delta/Sum ratio. Sum and Sum/Omni ratio settings are applicable to all operational modes. Delta/Sum settings are applicable only when the MBTS is not operating in Azimuth-gated mode. In this case the D/S ratio is automatically calculated from the antenna table selected for use (see the ANT command). The output signal level of the Target (Sum) interface is offset in small increments through the use of the "C", calibration attenuator, control. The use of this control has no effect on any of the other signal level controls.

Note: The MBTS may not meet output power level accuracy requirements if the Target power level offset is other than 0.0 dB.

The optional 'M' parameter requires the system to have two Reply Generator Modules.
The MANLVL command (other than "MANLVL C") should not be used in Azimuth mode as it overrides earlier SPHASE and SLVL commands.

Note: In a system with two Reply Generator Modules both Reply Generators share common 32 dB target attenuators located in the Upconverter modules. This configuration requires a coupling of the output power level settings of the primary and secondary targets so that there is not a conflict on the setting of these attenuators. To accomplish this, when the MBTS is actively generating primary and secondary target replies, MANLVL T and MANLVL M T must both be set to less than -25 dBm. If either MANLVL T or MANLVL M T is set higher than -25 dBm the MBTS will generate an Amplitude Conflict.

Note: The MBTS will not generate replies when Amplitude Conflict is set.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **MANLVL T,42.5**{CR}{LF}

Command: **MANLVL M,D,2.25**{CR}{LF} (this requires two Reply Generator Modules)

Query: **MANLVL?**{CR}{LF}
Response: **T,42.5,S,20,D,0.00,C,0.0**{CR}{LF}

Query: **MANLVL? M**{CR}{LF}
Response: **T,0.0,S,20,D,2.25,C,0.0**{CR}{LF}

Query Response Format:

T,t.t,S,s,D,d.dd,C,c.c{CR}{LF}
where **t.t**, **s**, **d.dd**, *and* **c.c** *are the Target, Sum/Omni, Delta/Sum power levels, and calibration attenuator offset, respectively.*

Default Value:

T,0.0,S,20,D,0.00,C,0.0

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
NOT POSSIBLE	The device cannot achieve the request outputs.

MANPHASE – Manual Output Phase

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
MANPHASE	▼								✘
MANPHASE?									

Syntax:

MANPHASE [M,]n *Set output phase, the optional 'M' parameter selects secondary targets*
or
MANPHASE? [M] *Return current output phase*

Where:
n Output phase, either 0 or 180 degrees

Description:

The MANPHASE command sets the phase relationship of the Sum and Delta outputs. When in the Azimuth gated mode the selected antenna pattern automatically sets the phase relationship of the Sum and Delta outputs (see the ANT command).
The optional 'M' parameter requires the system to have two Reply Generator Modules.
The MANPHASE command should not be used in Azimuth mode as it overrides earlier SPHASE and SLVL commands.
If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **MANPHASE 0**{CR}{LF}

Command: **MANPHASE M 180**{CR}{LF}

Query: **MANPHASE? M**{CR}{LF}
Response: **180**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is the phase, either 0 or 180 degrees.*

Default Value:

0

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

MODE – MBTS Mode

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
MODE									✘
MODE?									

Syntax:

MODE n *Set mode*
or
MODE? *Return current mode*

Where:

n	**STANDBY**	- Disable interrogation replies, route outputs to dummy load and BIT module
	RING	- Enter "ring reply" mode
	AZ	- Enter "azimuth-gated" reply mode
	BORESIGHT	- Enter Boresight calibration mode
	CW	- Enter CW Reference Output mode
	CAL	- Enter Calibration mode
	REF	- Enter Reference (1060 MHz) mode

Description:

The MODE command sets the current MBTS operational mode.

Changing operational modes disables all outputs (they are switched to the BIT setting). An OUTPUTSELECT command must be issued to route signals to an output interface.

The MBTS uses the following default settings whenever it enters each of the following modes:

STANDBY
- Outputselect to BIT
- Disable reply generation
- Reference output disabled
- Issue a “STOP OP”

RING
- Reply frequency (RGM freq. to 70.0 MHz, Ref freq to [replyfreq – 70.0])
- Outputselect to BIT
- Enable reply generation
- Reference output disabled
- Attenuators and target tables reloaded with current information

AZ
- Reply frequency (RGM freq. to 70.0 MHz, Ref freq to [replyfreq – 70.0])
- Outputselect to BIT
- Enable reply generation (after “first target”)
- Reference output disabled
- Issue a “STOP OP”, then “START OP” on northmark
- Attenuators and target tables reloaded with current information

BORESIGHT
- Reply frequency (RGM freq. to 70.0 MHz, Ref freq to [replyfreq – 70.0])
- Outputselect to BIT
- Enable reply generation (after "first target")
- Reference output disabled
- Issue a "STOP OP", then "START OP" on northmark
- Attenuators and target tables reloaded with BORESIGHT-specific data

CW
- Disable replies
- Reply frequency (RGM freq. to 70.0 MHz, Ref freq to [replyfreq – 70.0])
- Outputselect to BIT
- Phase output set to MANPHASE setting
- PAM output enabled
- Reference output disabled
- Issue a "STOP OP"
- Attenuators reloaded with current information

CAL
- Disable replies
- Reply frequency (RGM freq. to 70.0 MHz, Ref freq to [replyfreq – 70.0])
- Outputselect to BIT
- Phase output set to MANPHASE setting
- Reference output disabled
- Issue a "STOP OP"
- Attenuators reloaded with current information

REF
- Disable replies
- Reference frequency set to 1060 MHz.
- Outputselect to BIT (all rear panel outputs disabled)
- Reference output (at front of Reference Module) enabled
- Issue a "STOP OP"
- Attenuators reloaded with current information

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **MODE STANDBY**{CR}{LF}

Command: **MODE RING**{CR}{LF}

Query: **MODE?**{CR}{LF}
Response: **RING**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is* **STANDBY**, **AZ**, **RING**, **BORESIGHT**, **CW**, *or* **CAL**.

Default Value:

STANDBY

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
OPTION CONFLICT	Change to AZ mode attempted while in internal trigger mode or change to BORESIGHT mode attempted while in TRANS trigger mode.

MOVE – Movement Enable

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
MOVE	X			X	X	X	X		X
MOVE?									

Syntax:

MOVE [M,]e *Where e is* **ON** *or* **OFF**.
or
MOVE? [M] *Returns the movement enable state.*

Description:

Movement control must be configured using the MOVETAB command before executing the MOVE command.

Changing the MBTS operational mode (a mode command that sets a different mode than the current mode) automatically disables movement.

TGTAZ settings and RANGE settings are not used while movement is enabled. For moving targets, this information is contained in the MOVETAB command. When movement is disabled the current TGTAZ and RANGE settings are applied.

Examples:

Command: **MOVE M,ON**{CR}{LF}

Query: **MOVE?**{CR}{LF}
Response: **ON**{CR}{LF}

Query Response Format:

n
Where **n** *is* **ON** *or* **OFF**.

Default Value:

OFF

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range (not ON or OFF).
WRONG MODE	The command is not possible in the current mode.
OPTION CONFLICT	The MOVETAB command was not run.

MOVETAB – Movement Table

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
MOVETAB									✘
MOVETAB?									

Syntax:

MOVETAB [M,]0, [1:4000 (hex entry count)] ,[U, D (iacp offset direction)], [0:3FFF (hex initial azimuth)], [0:1FFF (hex final azimuth offset)], [19:27100 (hex initial 25 ns range)], [19:27100 (hex final 25 ns range)], {[U, D (range change direction)], [0:FFFFFFF (hex range timer)], [0:1FFFFFFF (hex azimuth timer)]} with up to 100 table entries

or

MOVETAB [M,] [100:8100 (first entry number)], {[U, D (range change direction)], [0:FFFFFFF (hex range timer)], [0:1FFFFFFF (hex azimuth timer)]} with up to 100 table entries

or

MOVETAB? [M,] [0:8100 (first entry number)] *Returns the movement table.*

Notes:

For MBTS systems with a single Reply Generator the entry count must be 1, the final azimuth offset must be 0, and the initial azimuth is ignored. The azimuth timer should be zero. This restricts secondary target movement to along an azimuth radial, resulting in changes in target range, only.

Target movement, in either range or azimuth, is defined in 5 usec intervals. Movement is linear and unidirectional. Movement within 10 range units of the range locus is not allowed. Each table entry covers an arc 1 IACP unit (0.02°) wide. When the azimuth timer expires the timers and range direction for the next table entry are used. Motion is halted then restarted at the beginning target location when the azimuth offset equals the final azimuth offset and the range equals the final range. Range units are in 25 ns units to improve accuracy.

Large (greater than 100 entries) move tables are entered in groups of 100 entries. The first group uses “0” for the first entry number and includes all the parameters shown above. Additional table entries are sent 100 entries at a time with the first parameter indicating the initial entry number for that group of entries.

The MBTS does not verify the implementation defined by the downloaded movement table. The OCS movement table generator verifies that user supplied movement parameters do not conflict with MBTS capability.

Description:

A movement table defines the flight path of secondary targets. MBTS systems with a single Reply Generator Module have the flight path of the secondary target limited to the azimuth axis of the primary target. MBTS systems with a dual Reply Generator configuration have much enhanced flight path options.

Movement table generation is facilitated through the use of the MBTS OCS. Use of the OCS is highly recommended. Please contact Freestate Electronics, Inc. should you wish to generate movement tables through other means or if more complex target movement patterns are desired.

Movement control must be configured using the MOVETAB command before executing the MOVE command.

Mode changes disable movement. Use the MOVE command to restart target movement.

TGTAZ settings and RANGE settings are not used while movement is enabled. Range and azimuth information applicable to moving targets is contained in the MOVETAB command. When movement is disabled the settings from the last TGTAZ and RANGE commands are reapplied to the moveable targets.

Executing a MOVETAB command while movement is enabled (see the MOVE command) will create an option conflict.

Examples:

Command: **MOVETAB 0,1,D,0,0,9105,f1b3,U,71a2,0**{CR}{LF}

Command: **MOVETAB M,0,6d,D,327f,1b02,18e9f,18ea2,D,757b,4137a1,D,764b,**
369218,D,772c,2e64c3,D,7825,27f763,D,7934,22d44a,D,7a5a,1ea811,
D,7b9b,1b387a,D,7cf4,185c36,D,7e69,15f579,D,7ffb,13e972,D,81aa,
1229d6,D,837c,10a718,D,8571,f5642,D,8785,e31c1,D,89a7,d30ec,D,
8c2e,c4b8a,D,8ebd,b8249,D,917e,aceb2,D,946b,a2ea8,D,979f,99d8b,
D,9b11,91aea,D,9eb2,8a659,D,a265,83ca6,D,a6f0,7db1c,D,ab1d,
78511,D,b06a,7341d,D,b5e2,6ea8d,D,bb2c,6a90d,D,c1c6,66c13,D,
c8cb,6338c,D,d04e,60046,D,d897,5d114,D,e146,5a6b3,D,eb99,57e41,
D,f657,55a4b,D,1025a,5382e,D,10f68,51a27,D,11fcd,4fd21,D,130cc,
4e488,D,14628,4cc33,D,15be4,4b6c3,D,17686,4a3f2,D,19908,49195,D,
1bcfd,48233,D,1e67a,47430,D,222b4,46794,D,267f1,45c66,D,2c473,
452f4,D,33b8c,44b16,D,3f526,4444d,D,5085d,43f0e,D,7514f,43b01,D,
bbe8c,4387a,D,21b8ff,4371f,U,21b907,43720,U,c46f3,43863,U,7513b,
43af6,U,539a5,43ed6,U,403f7,44437,U,34f38,44abd,U,2cb85,452d3,U,
267df,45c45,U,22274,46710,U,1e97c,47396,U,1bf6c,48184,U,198f1,
49154,U,1781f,4a324,U,15d61,4b677,U,14615,4cbea,U,132bb,4e2e6,U,
120bc,4fcc3,U,110f2,51909,U,1030f,537ca,U,f75c,5583b,U,eb86,
57dcd,U,e177,5a46a,U,d884,5d091,U,d01a,5fec7,U,c8fe,631fb,U,
c22c,66966,U,bba0,6a754,U,b5fe,6e8c6,U,b081,7324c,U,ab72,780c8,
U,a6c6,7d924,U,a2bb,83959,U,9ea1,8a2f1,U,9b00,91773,U,97b1,
999ee,U,9473,a283f,U,9194,ac979,U,8ece,b7cf8,U,8c3b,c4626,U,
89d5,d285d,U,8797,e2904,U,857f,f4d63,U,838d,109ae2,U,81b7,
121d82,U,8009,13d99a,U,7e75,15e3cc,U,7d00,18471c,U,7ba5,1b1fa6,
U,7a64,1e8a01,U,793c,22b0b6,U,782d,27c94a,U,7734,2e2a62,U,7651,
36494f,U,7584,40d5e6,U,7545,482690{CR}{LF}

Query: **MOVE? M,0**{CR}{LF}
Response: **1,D,0,0,9105,f1b3,U,71a2,0**{CR}{LF}

Query Response Format:

The response matches the command format following the 'M' parameter.

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
OPTION CONFLICT	Movement is enabled. See the Move Off command.

OP – Return Operational Status

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
OP?									

Syntax:

OP? *Returns the latched and current operational status.*

Description:

The OP query returns the current operational state of the MBTS in hexadecimal, as well as latch history about any past states since the OP command was last issued. Reading this register clears the latched values.

Examples:

Query: **OP?**{CR}{LF}
Response: **4,STARTED**{CR}{LF}

Query: **OP?**{CR}{LF}
Response: **7,STOPPED**{CR}{LF}

Query Response Format:

n,m
Where **n** *is in the range* **1** *to* **31**. *The values are encoded as follows:*

20	**RG2_PRESENT**	*A second Reply Generator Module is present*
10	**ALERT**	*Mode S alert signal is active (alert set by change in Mode S ID field, timed for 18 seconds)*
8	**LOCKOUT**	*Mode S reply lockout active on at least 1 target (lockout set by interrogator, timed for 18 seconds)*
4	**STOP OP**	*Set when the MBTS stops generating replies.*
2	**SUSPEND**	*Set when the MBTS is suspended waiting for Northmark*
1	**START OP**	*Set when the MBTS starts operation, i.e. commences sending replies.*

Where **m** *is the current operational state, either* **STARTED**, **SUSPENDED**, *or* **STOPPED**. *The text message is not affected by the value of the upper three data bits.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

**OPC* – Operation Complete Command

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*OPC?									

Syntax:

***OPC** *Set the Operation Complete event in the Event Status Register (ESR).*
or
***OPC?** *Return the Operation Complete flag*

Description:

The *OPC command causes the Operation Complete event to be set in the Event Status Register. If the enable masks are set appropriately, this can cause an SRQ. This command could be used to signal the processor when a lengthy series of commands has completed execution.

For example:

```
MODE CAL;*SRE 32;*ESE 1;CALTGTTABLE .....;*OPC
```

MODE CAL	Enter CAL mode
***SRE 32**	Enable ESB to generate SRQ
***ESE 1**	Enable OPC bit in ESR to generate ESB
CALTGTTABLE	Load new target calibration table into FLASH
***OPC**	Causes SRQ when FLASH update is complete

Examples:

Command: ***OPC**{CR}{LF}

Query: ***OPC?**{CR}{LF}
Response: **1**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is always a* **1** *if this command is executing.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

Implementation Notes:

Part of the IEEE-488.2-1992 Command Set.

OUTPUTSELECT – Select Output

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
OUTPUTSELECT	✘						✘		✘
OUTPUTSELECT?									

Syntax:

`OUTPUTSELECT n` *Select Output A, Output B, or the BIT module*
or
`OUTPUTSELECT?` *Return the current output selection*

Where:
`n` Output selection, either **`A`**, **`B`**, or **`BIT`**.

Description:

The OUTPUTSELECT command controls the routing of the RF outputs. BIT is equivalent to standby or Dummy Load.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`OUTPUTSELECT A`**{CR}{LF}

Command: **`OUTPUTSELECT B`**{CR}{LF}

Command: **`OUTPUTSELECT BIT`**{CR}{LF}

Query: **`OUTPUTSELECT?`**{CR}{LF}
Response: **`BIT`**{CR}{LF}

Query Response Format:

`n`{CR}{LF}
where **`n`** *is the either* **`A`**, **`B`**, *or* **`BIT`**.

Default Value:

`BIT`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

PASSTHROUGH - BIT Passthrough Command

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
PASSTHROUGH									✘

Syntax:

PASSTHROUGH *Enters passthrough mode to the BIT module*

Description:

The PASSTHROUGH command places the MBTS in a mode in which all data entered from the serial port is passed to the BIT module, and vice versa, until the "terminate" sequence is received. To terminate PASSTHROUGH mode, send no characters for at least 0.5 seconds, then send three tilde characters ('~'), then no characters for at least 0.5 seconds. You should then see the normal PCC prompt.

When exiting PASSTHROUGH mode, the PCC forces the BIT command port into "terse" mode.

This command is only valid on the two serial ports. It is not allowed on the IEEE-488 port and will generate an UNKNOWN COMMAND error.

NOTE: While in PASSTHROUGH mode, the PCC stops processing commands from the other serial port and from the IEEE-488 port.

Examples:

Command: **PASSTHROUGH**{CR}{LF}
Response: **Hit '~' to exit.** {CR}{LF}

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
UNKNOWN COMMAND The command was entered from the IEEE-488 port.

PCODE – Plane Code

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
PCODE	▼	▼		▼	▼	▼	▼		✘
PCODE?									

Syntax:

PCODE [M,] n, p, [2, 3, B, C, S, SA] …
or
PCODE? [M,] n, p

Where:

n	Sector Number from 0 to 63.
p	Plane (Target) Number from 0 to 31.

Description:

The **PCODE** command sets the code of the specified target in the specified sector. Refer to the **CODE** command for information about different code types.

Use the **SCODE** command to set the Mode 4 codes as every target in a sector shares the same Mode 4 code setting. All other code settings are unique for each target. The **PCODE?** query returns the current Mode 4 configured code.

Examples:

Command: **PCODE M,58,8,2,4321,1,1,0,0,0**{CR}{LF}

Query: **PCODE? 15,3**{CR}{LF}
Response: **3,5442,1,1,0,0,0,2,2417,1,1,0,1,0,B,3254,1,1,0,0,0,C,2057,1,1,0,0,0,S,15C24F,0,0,0,0,0,SA,3B91,0,0,0,1,1,4,05,0,0,0,0,0**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

PLL – PLL Alarm Register

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
PLL?									

Syntax:

PLL? *Return the current PLL Alarm Register value*

Description:

The PLL query returns the current value of the PLL Alarm Events and latched PLL Alarm Events registers in hexadecimal and clears the latched PLL Alarm Events register. The latched PLL Alarm Events register contains events that have occurred since the last time the latched PLL Alarm Events register was read, or the most recent *CLS command.

The PLL ERROR bit in the STB is set whenever a PLL unlock condition exists (i.e. when either the current or latched status words are non-zero).

Examples:

Query: **PLL?**{CR}{LF}
Response: **18,18**{CR}{LF}

Query: **PLL?**{CR}{LF}
Response: **14,4**{CR}{LF}

Query Response Format:

l,s{CR}{LF}
Where **l** *and* **s** *are the PLL Alarm register value, from 0 to 3f. The values are encoded as follows:*

20	**RGC2 PLL**	*The Reply Generator 2 PLL is out of lock.*
10	**70BIT PLL**	*The 70 MHz PLL in the BIT module is out of lock.*
8	**1100BIT PLL**	*The 1100 MHz PLL in the BIT module is out of lock.*
4	**IDR PLL**	*The Interrogator PLL is out of lock.*
2	**RGC PLL**	*The Reply Generator 1 PLL is out of lock.*
1	**REF PLL**	*The Reference PLL is out of lock.*

l *is the latched version of the PLL Alarm register, and* **s** *is the current error status.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

PPROB – Plane Probability

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
PPROB	▼	▼		▼	▼	▼	▼		✘
PPROB?									

Syntax:

PPROB [M,] n, p, r
or
PPROB? [M,] n, p

Where:

n	Sector Number from 0 to 63.
p	Plane (Target) Number from 0 to 31.
r	[0:0xff] in hexadecimal, the probability of ignoring an interrogation in steps of 1/0x100.

Description:

The **PPROB** command sets the probability of NOT replying to an interrogation. r = 0 always replies, r = 0x80 replies half the time.

Examples:

Command: **PPROB M,43,20,2e**{CR}{LF}

Query: **PPROB? M,15,3**{CR}{LF}
Response: **c7**{CR}{LF}

Default Value:

0

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

PRANGE – Plane Range

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
PRANGE	▼	▼		▼	▼	▼	▼		✘
PRANGE?									

Syntax:

PRANGE [M,] n, p, r
or
PRANGE? [M,] n, p

Where:

n	Sector Number from 0 to 63.
p	Plane (Target) Number from 0 to 31.
r	[50:64000] the range spacing to each target in every sector in 62.5 ns range units

Description:

The **PRANGE** command sets the range from the previous target, or from the radar if p = 0. Targets farther out in the string (larger plane numbers in the same sector) are shifted in or out with the specified target. If the farthest target is shifted farther than 64000 range units the command will fail (Bad Param) and command will be ignored.

Examples:

Command: **PRANGE M,43,20,8000**{CR}{LF}

Query: **PRANGE? M,15,3**{CR}{LF}
Response: **4000**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

PTGT – Plane Target Definition

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
PTGT	▼	▼		▼	▼	▼	▼		✘
PTGT?									

Syntax:

`PTGT [M,] n, p, Code3, CodeC, Code2, CodeB, CodeSA, CodeS, Code4, Emerg, Range, Tmask, Probability, Clear_Lockout, Set_Alert`

or

`PTGT? [M,] n, p`

or

`PTGT? [M,] n, p, H` Request header line – use only with the serial interface

Where:

`n` Sector Number from 0 to 63.

`p` Plane (Target) Number from 0 to 31.

`Code3`, **`CodeC`**, **`Code2`**, and **`CodeB`** are in hexadecimal and coded as follows:

Bits 11:0	Code
Bit 12	Transmit SPI
Bit 13	Transmit X
Bit 14	Inhibit F2
Bit 15	Inhibit F1

`CodeSA` is in hexadecimal and coded as follows:

Bits 12:0	Code
Bit 13	Mode S On Ground
Bit 14	Mode S Alert
Bit 15	Mode S SPI

`Code4` is in hexadecimal in the range [0:f] **This sets the Code 4 for all targets in the specified sector**.

`Emerg` is a single binary digit for ATCRBS Mode 2 and Mode 3 Emergency codes.

`Range` is in hexadecimal using **25 ns range units**. This is the range from the previous target (or the radar if P = 0). Values in the range [7d:27100] are recommended. Argument is not checked.

`Tmask` is in hexadecimal and coded as follows:

Bit 0	ATCRBS Target
Bit 1	Mode S Target
Bit 2	Mode 4 Target
Bit 3	ATCRBS Targets follow
Bit 4	Mode S Targets follow
Bit 5	Mode 4 Targets follow

`Probability` [0:ff] is in hexadecimal, probability of NOT responding to an interrogation in steps of 1/256. Zero means we always reply.

`Clear_Lockout`, a non zero value causes the lockout timer to be cleared. The query returns the current lockout timer.

`Set_Alert`, a non zero value causes the Mode S alerting timer to be set. The query returns the current alerting timer.

Description:

The **PTGT** command completely configures a target in one command. The range of a target (the sum of the ranges of the target and all earlier targets in the specified sector) is not checked. The Code4 setting overwrites the Code4 setting for all other targets in the specified sector.
The Tmask determines current target type and the types of any additional targets in the specified sector. Setting bits 5:3 of the Tmask to zero indicate that this is the last target in the specified sector.

Examples:

Command: **PTGT M,23,18,0,310,22,0,1339,10000,0,0,1356,2,0,1,0**{CR}{LF}

Query: **PTGT? 23,18**{CR}{LF}
Response:

```
23 18:    0  310   22    0 1339  10000 0 0  1356  2  0   0  0 {CR}{LF}
```

Query: **PTGT? 23,18,H**{CR}{LF}
Response:

```
Sc Pl:  C3   CC   C2   CB   CSa   AA   4 E Range TM Pb LO  Alrt{CR}{LF}
23 18:    0  310   22    0 1339  10000 0 0  1356  2  0   0  0 {CR}{LF}
```

Default Value:

0 0 0 0 0 0 0 0 0 0 0 0 0

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

PTYPE – Plane Type

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
PTYPE	▼	▼		▼	▼	▼	▼		✘
PTYPE?									

Syntax:

PTYPE [M,] n,p, <ATCRBS, S, BOTH, NONE> [,4]
or
PTYPE? [M,] n,p

Where:

n	Sector Number from 0 to 63.
p	Plane (Target) Number from 0 to 31.

Description:

The **PTYPE** command sets the type of an individual target within a chain of targets for the specified sector. Each target is identified uniquely using a sector number and a target number.

Refer to the **TGTMIX** command for details of the different types available.

Examples:

Command: **PTYPE 60,8,S,4**{CR}{LF}

Query: **PTYPE? M,15,3**{CR}{LF}
Response: **ATCRBS**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

PULSEPOS - Reply Pulse Position

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
PULSEPOS	▼				▼	▼	▼		✘
PULSEPOS?									

Syntax:

PULSEPOS [M,]n *Set reply pulse position, the optional 'M' parameter selects secondary targets*
or
PULSEPOS? [M] *Return current reply pulse position*

Where:
n pulse position in nanoseconds, -250 to 250 in 50 ns steps

Description:

The PULSEPOS command sets the reply pulse positions (rising edge) relative to the ideal position. This parameter applies to all ATCRBS pulses and to the Mode-S preamble pulses, except for the first (P1) pulse. The Mode-S 56 and 112-bit data pulses cannot be modified.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **PULSEPOS -200**{CR}{LF}

Command: **PULSEPOS M 150**{CR}{LF}
Query: **PULSEPOS?**{CR}{LF}
Response: **-200**{CR}{LF}

Query: **PULSEPOS? M**{CR}{LF}
Response: **150**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is the pulse position offset, from -250 to +250 ns in 50 ns steps.*

Default Value:

0

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

PULSEWID - Reply Pulse Width

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
PULSEWID	▼				▼	▼	▼		✘
PULSEWID?									

Syntax:

PULSEWID [M,]n *Set reply pulse width, the optional 'M' parameter selects secondary targets*
or
PULSEWID? [M] *Return current reply pulse width*

Where:
n pulse width in nanoseconds, -250 to 750 in 50 ns steps

Description:

The PULSEWID command sets the reply pulse widths relative to the ideal width. This parameter applies to all ATCRBS pulses and to the Mode-S preamble pulses. The Mode-S 56 and 112-bit data pulses cannot be modified. This command alters the trailing edge of the pulses (the leading edge is determined by the PULSEPOS command).

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **PULSEWID -200**{CR}{LF}

Command: **PULSEWID M 150**{CR}{LF}
Query: **PULSEWID?**{CR}{LF}
Response: **-200**{CR}{LF}

Query: **PULSEWID? M**{CR}{LF}
Response: **150**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is the pulse width offset, from -250 to +250 ns in 50 ns steps.*

Default Value:

0

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

RANGE - Target Range

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
RANGE	▼				▼	▼	▼		✘
RANGE?									

Syntax:

RANGE [M,]n *Set target range, the optional 'M' parameter selects secondary targets*
or
RANGE? [M] *Return current target range*

Where:
n target range, from 10 to 64000 in Range Units of 62.5 ns

Description:

The RANGE command sets the target range (distance from the radar). The MBTS uses this value for the delay from the "zero range" reference of the interrogation to the start of the reply in all modes that generate replies.

The RANGE command applies the current CODE, TGTCNT, TGTMIX, and INC3 command settings and overrides earlier GCNTTYPE, GCODE, GINC, GRANGE, PCODE, PPROB, PRANGE, PTGT, PTYPE, SCNTTYPE, SCODE, SINC, SPROB, and SRANGE commands. Each sector will have at most one target.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

There are approximately 198 Range Units per nautical mile.

Examples:

Command: **RANGE 3000**{CR}{LF}

Command: **RANGE M 200**{CR}{LF}

Query: **RANGE?**{CR}{LF}
Response: **3000**{CR}{LF}

Query: **RANGE? M**{CR}{LF}
Response: **200**{CR}{LF}

Query Response Format:

n{CR}{LF} *where* **n** *is the range in units of 62.5 ns, from 8 to 64000.*

Default Value:

6400

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
OPTION CONFLICT	SECENABLE is ON and the RANGE, SECPOS, and SPEED settings will place the secondary aircraft closer than 18 range units or farther than 64,000 range units

RAWFGAIN – Directly set fine gain attenuator

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
RAWLVL									✘
RAWLVL?									✘

Syntax:

`RAWFGAIN [M,]n` *Sets fine gain control to n, the optional 'M' parameter selects moveable targets*
or
`RAWFGAIN? [M]` *Return current setting of all attenuators*

Where:
`n` raw fine gain setting, from 1 to

Description:

The RAWFGAIN command directly sets the fine gain attenuators. Settings do not represent an absolute power level. This value is not modified by calibration constants.

The optional 'M' parameter requires the system to have two Reply Generator Modules.

Examples:

Command: **`RAWFGAIN 80`**{CR}{LF}

Command: **`RAWFGAIN M,79`**{CR}{LF}

Query: **`RAWFGAIN?`**{CR}{LF}
Response: **`80`**{CR}{LF}

Query: **`RAWFGAIN? M`**{CR}{LF}
Response: **`79`**{CR}{LF}

Query Response Format:

`n` {CR}{LF}
where **`n`** *is the value sent to the fine gain attenuator.*

Default Value:

N/A - Set by temperature calibration, output select and calaboffset, mode select and calpulsepwr, and MANLVL C commands.

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

RAWLVL – Directly set the attenuators

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
RAWLVL	X	X	X	X			X		X
RAWLVL?	X	X	X	X			X		X

Syntax:

`RAWLVL [M,]n,p` *Sets attenuator n to p, the optional 'M' parameter selects moveable targets*

or

`RAWLVL? [M]` *Return current setting of all attenuators*

Where:

n	p	Function	Sensitivity
T	0 to 511	Target Attenuator	0.25 dB
S	0 to 63	Sum/Omni Attenuator	1 dB
D	0 to 255	Delta/Sum Attenuator	0.25 dB
A	0 to 7	Aux Delta/Sum Attenuator	1 dB

Description:

The RAWLVL command directly sets the Target, Sum, Delta, and Aux Delta/Sum attenuators. Settings are not relative to each other, nor do they represent an absolute power level. These values are not modified by calibration constants. A zero value corresponds to zero attenuation. This command is active in CAL and CW modes.

The optional 'M' parameter requires the system to have two Reply Generator Modules.

Setting a bit in the raw level command turns on the corresponding attenuator.
T for Target:

1	0.25 dB
2	0.5 dB
4	1 dB
8	2 dB
16	4 dB
32	8 dB
64	16 dB
128	32 dB A
256	32 dB B

The 32 dB B bit is shared by both primary and secondary Reply Generators. The user must act to keep them equal when applying the RAWLVL T and RAWLVL M T commands.

S for Sum/Omni:

1	1 dB
2	2 dB
4	4 dB
8	8 dB
16	16 dB
32	32 dB

D for Delta/Sum:

1	0.25 dB
2	0.5 dB
4	1 dB
8	2 dB
16	4 dB
32	8 dB
64	16 dB A
128	16 dB B

A for Aux Delta/Sum:

1	1 dB
2	2 dB
4	4 dB

Examples:

Command: **RAWLVL T,422**{CR}{LF}

Command: **RAWLVL M,D,225**{CR}{LF}
Query: **RAWLVL?**{CR}{LF}
Response: **T,422,S,0,D,24,A,0**{CR}{LF}

Query: **RAWLVL? M**{CR}{LF}
Response: **T,40,S,0,D,225,A,0**{CR}{LF}

Query Response Format:

T,t,S,s,D,d,A,a {CR}{LF}
where **t**, **s**, **d**, *and* **a** *are the Target, Sum/Omni, Delta/Sum, and Aux Delta/Sum attenuator respectively.*

Default Value:

T,40,S,0,D,24,A,0

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode.

RAWPAM – Directly control the PAM output

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
RAWPAM	X	X	X	X			X		X
RAWPAM?	X	X	X	X			X		X

Syntax:

RAWPAM [M,]n *Set the PAM either* **ON** *or* **OFF**, *the optional 'M' parameter selects secondary targets*
or
RAWPAM? [M] *Return current PAM setting*

Where:
n Either **ON** or **OFF**

Description:

The RAWPAM command directly sets the state of the PAM circuit in the Reply Generator Module. This command is only active in CAL or CW mode.

The optional 'M' parameter requires the system to have two Reply Generator Modules.

Examples:

Command: **RAWPAM ON**{CR}{LF}

Command: **RAWPAM M OFF**{CR}{LF}
Query: **RAWPAM?**{CR}{LF}
Response: **ON**{CR}{LF}

Query: **RAWPAM? M**{CR}{LF}
Response: **OFF**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is the state of the output, either* **ON** *or* **OFF**.

Default Value:

ON for Reply Generator one (primary) and **OFF** for Reply Generator two (secondary).

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.
WRONG MODE The command is not possible in the current mode.

RAWPHASE – Directly control the Phase output

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
RAWPHASE	X	X	X	X			X		X
RAWPHASE?	X	X	X	X			X		X

Syntax:

`RAWPHASE [M,]n` *Set output phase, the optional 'M' parameter selects secondary targets*
or
`RAWPHASE? [M]` *Return current output phase*

Where:
`n` Output phase, either 0 or 180 degrees

Description:

The RAWPHASE command sets the phase relationship of the Sum and Delta signals. This command is only active in CAL or CW mode.

The optional 'M' parameter requires the system to have two Reply Generator Modules.

Examples:

Command: **`RAWPHASE 0`**{CR}{LF}

Command: **`RAWPHASE M 180`**{CR}{LF}
Query: **`RAWPHASE?`**{CR}{LF}
Response: **`0`**{CR}{LF}

Query: **`RAWPHASE? M`**{CR}{LF}
Response: **`180`**{CR}{LF}

Query Response Format:

`n`{CR}{LF}
where **`n`** *is the phase, either 0 or 180 degrees.*

Default Value:

`0`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.
`WRONG MODE` The command is not possible in the current mode.

RAWREFLVL – Directly set the Reference attenuator

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
RAWREFLVL	X	X	X	X					X
RAWREFLVL?	X	X	X	X					X

Syntax:

RAWREFLVL m *Sets Reference attenuator to m*
or
RAWREFLVL? *Return current setting of the reference attenuator*

Where:
m Reference attenuator setting, 0 to 31.

Description:

The RAWREFLVL command directly sets the Reference attenuator. Settings are not relative, nor do they represent an absolute power level. These values are not modified by calibration constants. A 0 value corresponds to zero attenuation, and 31 is maximum attenuation. Also see the REFLVL command.

Examples:

Command: **RAWREFLVL 22**{CR}{LF}
Command: **RAWREFLVL 5**{CR}{LF}

Query: **RAWREFLVL?**{CR}{LF}
Response: **5**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is the Reference attenuator setting.*

Default Value:

0

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.
WRONG MODE The command is not possible in the current mode.

RAWRGCFREQ – Set Reply Generator Frequency

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
RAWRGCFREQ									✘
RAWRGCFREQ?									

Syntax:

RAWRGCFREQ [M,]nn.nn *Set RGC output frequency, the optional 'M' parameter selects secondary targets*

or

RAWRGCFREQ? [M] *Return current RGC output frequency*

Where:

nn.nn Output frequency, in MHz, from 65.00 to 75.00 in 0.05 MHz steps (50 KHz)

Description:

The RAWRGCFREQ command sets the signal frequency of Reply Generator Module outputs. Note that the REPLYFREQ command resets the primary RGC frequency to 70 MHz and the secondary RGC frequency to the offset (from 70 MHz) current in the FREQOFFSET command.

The optional 'M' parameter requires the system to have two Reply Generator Modules.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **RAWRGCFREQ 70.40**{CR}{LF}

Command: **RAWRGCFREQ M 71.00**{CR}{LF}
Query: **RAWRGCFREQ?**{CR}{LF}
Response: **70.40**{CR}{LF}

Query: **RAWRGCFREQ? M**{CR}{LF}
Response: **71.00**{CR}{LF}

Query Response Format:

nn.nn{CR}{LF}
Where **nn.nn** *is the output frequency in MHz.*

Default Value:

70.00 (69.50 for secondary RGC)

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

RAWUCLVL – Directly set the Up Converter Attenuators

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
RAWUCLVL	X	X	X	X			X		X
RAWUCLVL?									

Syntax:

RAWUCLVL n,m — *Set the Up Converter attenuator* **n** *to* **m**, *where* **n** *is* **S** *for Sum,* **O** *for Omni, or* **D** *for Delta.*

or

RAWUCLVL? — *Return current up converter attenuator settings*

Where:

n is the Up Converter, **S** for Sum, **O** for Omni, or **D** for Delta
m is the Up Converter attenuator value, from 0 to 31

Description:

The RAWUCLVL command directly sets the attenuation values for the Sum, Omni, and Delta Upconverters. Settings are not relative, nor do they represent an absolute power level. These values are not modified by calibration constants. A zero value corresponds to zero attenuation, and 31 corresponds to maximum attenuation. Also see the CALUCATTEN command.

Examples:

Command: **RAWUCLVL S,21**{CR}{LF}

Command: **RAWUCLVL D,4**{CR}{LF}

Query: **RAWUCLVL?**{CR}{LF}
Response: **S,21,O,0,D,4**{CR}{LF}

Query Response Format:

S,s,O,o,D,d {CR}{LF}
Where **s** *is the Sum Up Converter attenuator value, from 0 to 31;* **o** *is the Omni Up Converter attenuator value, from 0 to 31; and* **d** *is the Delta Up Converter default attenuator value, from 0 to 31.*

Default Value:

S,0,O,0,D,0

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.
WRONG MODE The command is not possible in the current mode.

READREPLY – Read Reply

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
READREPLY									✘

Syntax:

`READREPLY [S, V]` *The optional V parameter selects a more verbose output format*

The optional S parameter limits the reply type count to 200. The S and V parameters cannot be used together.

When controlling the ADSB Test Set through the GPIB interface use the READREPLY S command. This limits the reply size to less than 3,000 characters, all placed upon a single line. Without any parameters the reply length can reach 30,190 characters, all placed upon a single line. Using the READREPLY V command the reply length can reach 126,956 characters on up to 4096 lines.

Description:

The READREPLY query transmits the detected reply table, generated within the BIT module, and presents it to the user. The reply tables can be long and cryptic so two output formats are available. The reply table is emptied each time it is read. Reading the reply table does not interrupt the detection and capture of new replies. If the reply table overflows the data lost flag is set on the next READREPLY response. When the reply table overflows the unread data is discarded and is replaced by new detected reply information. An individual table entry can indicate up to 256 successive occurrences of the same reply. If the same reply occurs more than 256 times in a row it will be reported using multiple table entries. Replies are reported in the order received.

Only those data sequences that generally fit within the pulse timing and pulse width formats established for ATCRBS or Mode S signals are recorded by the ADSB Test Set. Data that is determined to be extraneous and non-standard is discarded. The data reported through the READREPLY process provides a good indication of reply signal activity. However, the user is advised to respect the limitations of this process and to use it with caution when testing operationally critical equipment.

The detection of replies is controlled by the CAPTREPLY command.

The READREPLY query cannot execute while a BER test is running.

Verbose Mode Examples:

Query: **`READREPLY V`**{CR}{LF}
Response: **`ModeS: 58000002 e0f316 R: 16`**{CR}{LF} *17 occurrences of Mode S DF=11, AA=2*
`ATCRBS: 0006 R: 16`{CR}{LF} *17 occurrences of ATCRBS 0006*
`ATCRBS: 0010 SPI R: 16`{CR}{LF} *17 occurrences of ATCRBS 0010, SPI*
`ATCRBS: 0012 X R: 4`{CR}{LF} *5 occurrences of ATCRBS 0012, X*
`ModeS: 58000005 1f2332 R: 16`{CR}{LF} *17 occurrences of Mode S DF=11, AA=5*
`ModeS: 89000052 87654321 abcdef 614b83 R: 1`{CR}{LF} *2 occurrences of Mode S DF=17, AA=52, ME=87654321abcdef, PI=0*

Query: **`READREPLY V`**{CR}{LF}
Response: **`Lost Data`**{CR}{LF} *The Reply buffer overflowed since the last READREPLY command*
`ATCRBS: 0014 X SPI R: 16`{CR}{LF} *17 occurrences of ATCRBS 0014, X, SPI*

	Mode 4 R: 1{CR}{LF}	*2 occurrences of Mode 4*
	ATCRBS: 0016 Emerg{CR}{LF}	*1 occurrence of ATCRBS 0016 Emergency*
	ModeS: 58000007 1f3f29{CR}{LF}	*1 occurrence of Mode S DF=11, AA=7*
	ATCRBS: 0020 R: 255{CR}{LF}	*256 occurrences of ATCRBS 0020*
	ATCRBS: 0020 R: 8{CR}{LF}	*9 more occurrences of ATCRBS 0020*
Query:	**READREPLY V**{CR}{LF}	
Response:	**ATCRBS: 1234 SPI**{CR}{LF}	*single shot ATCRBS 1234, SPI*

Query Response Verbose Format:

Mode Data Repeat
Where **Mode** *is* **MODES 56 bit**, **MODES 112 bit**, **ATCRBS**, *or* **MODE 4**
Data *describes the reply and is blank for Mode 4*
Repeat *is* **R: d** *where d is the number of additional times the reply occurs. If the reply only occurred once this field is blank.*

Non Verbose Mode Examples:

These examples match the Verbose Mode examples above.

Query:	**READREPLY S**{CR}{LF}	
Response:	**0 2 2 1 5**	*No lost data, 2 ATCRBS defs, 2 Mode S 56 bit defs, 1 Mode S 112 bit def, 5 Reply types*
	6 0	*ATCRBS def 0: code = 0006*
	10 2	*ATCRBS def 1: code = 0010, SPI*
	12 1	*ATCRBS def 2: code = 0012, X*
	58000002 e0f316	*Mode S 56 bit def 0: DF=11, AA=2*
	58000005 1f2332	*Mode S 56 bit def 0: DF=11, AA=5*
	89000052 87654321	*Mode S 112 bit def 0: DF=17, AA=52*
	abcdef 614b83	*ME=87654321abcdef, PI=0*
	80 16	*17 occurrences of Mode S 56 bit def 0*
	40 16	*17 occurrences of ATCRBS def 0*
	41 16	*17 occurrences of ATCRBS def 1*
	00 2	*3 occurrences of Mode S 112 bit def 0*
	81 16{CR}{LF}	*17 occurrences of Mode S 56 bit def 1*
Query:	**READREPLY**{CR}{LF}	
Response:	**1 2 1 0 6**	*Lost data, 2 ATCRBS defs, 1 Mode S def, 0 Mode S 112 bit defs, 6 Reply types*
	14 3	*ATCRBS def 0: code = 0014, X, SPI*
	16 7e	*ATCRBS def 1: code = 0016 Emergency*
	58000007 1f3f29	*Mode S def 0: DF=11, AA=7*
	40 16	*17 occurrences of ATCRBS def 0*
	c0 1	*2 occurrences of Mode 4*
	80 16	*17 occurrences of Mode S def 0*
	41 0	*1 occurrence of ATCRBS def 1*
	80 255	*256 occurrence of Mode S def 0*
	80 8{CR}{LF}	*9 more occurrences of Mode S def 0*
Query:	**READREPLY S**{CR}{LF}	
Response:	**0 1 0 0 1**	*No lost data, 1 ATCRBS def, 0 Mode S 56 bit defs, 0 Mode S 112 bit defs, 1 Reply type*

	1234 2	*ATCRBS def 0: code = 1234, SPI*
	40 0{CR}{LF}	*1 occurrence of ATCRBS def 0*

Query:	**READREPLY**{CR}{LF}	
Response:	**0 0 0 0 0**{CR}{LF}	*No lost data, 0 ATCRBS defs, 0 Mode S 56 bit defs, 0 Mode S 112 bit defs, 0 Reply types. The reply table is empty.*

Query Response Non Verbose Format:

[0:1 Data Lost Flag][0:63 ATCRBS definition count][0:63 Mode S 56 bit definition count] [0:63 Mode S 112 bit definition count] [0:4095 Reply Type count]
{[ATCRBS code (octal)][ATCRBS bits (hex)]} *ATCRBS Definitions*
{[Mode S code (long hex)][Mode S Checksum (long hex)]} *Mode S 56 bit Defs*
{[Mode S [1-32] (long hex)][Mode S [33-64] (long hex)] [Mode S [65-88] (long hex)][Mode S Checksum (long hex)]} *Mode S 112 bit Defs*
{[00:c0 Type (hex)][0:255 Repeat (int)]} *Reply Type Entries*

The response starts with 4 decimal integers. The first is 1 if the read table overflowed since the last REPLYDATA query. The second is a count of the number of different types of ATCRBS replies that were detected. The third is a count of the number of different types of Mode S 56 bit replies that were detected. The fourth is a count of the number of different types of Mode S 112 bit replies that were detected. The fifth is a count of the Reply Type records in this response.

The second section of the response is a series of ATCRBS reply definitions. The number of ATCRBS definitions was provided by the second parameter above **and could be zero**. Each ATCRBS definition uses two numbers. The first is the ATCRBS code in octal. The second is a hex bits field where bit 0 = X, bit 1 = SPI, and bits [6:1] = emergency pulses.

The third section of the response is a series of Mode S 56 bit reply definitions. The number of Mode S 56 bit definitions was provided by the third parameter above **and could be zero**. Each Mode S 56 bit definition uses two numbers. The first is the 32 bit Mode S reply in hex. The second is the 24 bit CRC in hex.

The fourth section of the response is a series of Mode S 112 bit reply definitions. The number of Mode S 112 bit definitions was provided by the fourth parameter above **and could be zero**. Each Mode S 112 bit definition uses four numbers. The first two each contain 32 bits of the Mode S 112 bit reply in hex. The last two each contain 24 bits of the Mode S 112 bit reply in hex. The last number contains the CRC.

The fifth section of the response is a series of Reply Types listed in the order received. The number of Reply Types was provided by the fifth parameter above. Each Reply Type uses two numbers. The first is a hex char where:

bits [7:6] = 1 for ATCRBS replies and bits [5:0] index into ATCRBS reply definitions
bits [7:6] = 2 for Mode S 56 bit replies and bits [5:0] index into Mode S 56 bit replies definitions
bits [7:6] = 0 for Mode S 112 bit replies and bits [5:0] index into Mode S 112 bit replies definitions
bits [7:6] = 3 for Mode 4 replies

The second is a repeat count of additional adjacent occurrences of the reply.

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
INTERNAL	The data received from the BIT module was corrupted.
OPTION CONFLICT	READREPLY attempted while BER test is running

REFFREQ – Set Reference Frequency

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
REFFREQ	X	X	X	X	X	X			X
REFFREQ?									

Syntax:

`REFFREQ nnnn.n` *Set Reference output frequency*
or
`REFFREQ?` *Return current Reference output frequency*

Where:
`nnnn.n` Output frequency, in MHz, from 1010.0 to 1070.0 MHz in 0.2 MHz steps

Description:

The REFFREQ command sets the Reference output frequency.

This command only works in REF mode (see the MODE command).

Examples:

Command: **`REFFREQ 1060.4`**{CR}{LF}

Command: **`REFFREQ 1031.0`**{CR}{LF}

Query: **`REFFREQ?`**{CR}{LF}
Response: **`1031.0`**{CR}{LF}

Query Response Format:

`nnnn.n`{CR}{LF}
Where **`nnnn.n`** *is the output frequency in MHz.*

Default Value:

`1020.0`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

REFLVL – Set the Reference attenuator

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
REFLVL	X	X	X	X					X
REFLVL?									

Syntax:

REFLVL m *Sets Reference attenuator to power level* **m**
or
REFLVL? *Return current setting of the reference power level*

Where:
m Reference power level, from +8 to –23 dBm in 1 dB steps.

Description:

The REFLVL command sets the level of the Reference signal at the front panel of the Reference Module.

Examples:

Command: **REFLVL -12**{CR}{LF}

Command: **REFLVL 5**{CR}{LF}

Query: **REFLVL?**{CR}{LF}
Response: **5**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is the Reference power level.*

Default Value:

8

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

REFOE –Control the Reference Output Enable output

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
REFOE	X	X	X	X					X
REFOE?									

Syntax:

REFOE n *Set the Reference Output Enable output either* **ON** *or* **OFF**
or
REFOE? *Return current Reference Output Enable output setting*

Where:
n Either **ON** or **OFF**

Description:

The REFOE command directly sets the state of the Reference Output control. This command is only active in CAL, REF, and CW modes.

Examples:

Command: **REFOE ON**{CR}{LF}

Command: **REFOE OFF**{CR}{LF}

Query: **REFOE?**{CR}{LF}
Response: **OFF**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is the state of the output, either* **ON** *or* **OFF**.

Default Value:

OFF

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.
WRONG MODE The command is not possible in the current mode.

REPLYFREQ – Set the Frequency of the MBTS Reply Signal

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
REPLYFREQ									✘
REPLYFREQ?									

Syntax:

`REPLYFREQ nnnn.n` *Set Reply frequency*
or
`REPLYFREQ?` *Return current Reply frequency*

Where:
`nnnn.n` Output frequency, in MHz, from 1080.0 to 1100.0 in 0.2 MHz steps

Description:

The REPLYFREQ command sets the output frequency of the Reply signal for primary targets. The FREQOFF sets the output frequency of the Reply signal of secondary (moveable) targets to an offset from the REPLYFREQ entry. The primary Reply Generator signal is forced to 70 MHz, and the Reference Module signal is set to the appropriate frequency to generate the MBTS output signal at the correct frequency.

If the RAWRGCFREQ command is used, the REPLYFREQ? query will return the correct value, the RGC frequency plus the reference frequency.

Note: Because of interaction with the RAWRGCFREQ command, the query response can return two decimal places. The query may also return values that are impossible to obtain using only the REPLYFREQ command (e.g. 1090.05).

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`REPLYFREQ 1090.4`**{CR}{LF}

Command: **`REPLYFREQ 1081.0`**{CR}{LF}

Query: **`REPLYFREQ?`**{CR}{LF}
Response: **`1081.0`**{CR}{LF}

Query Response Format:

`nnnn.n`{CR}{LF}
Where **`nnnn.n`** *is the output frequency in MHz.*

Default Value:

1090.0

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

Implementation Notes:

The RGC frequency gets reset to 70.0 MHz on every mode change.

REPSEL –Reply Source Select

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
REPSEL									✘
REPSEL?									

Syntax:

REPSEL s *Set Reply Source*
or
REPSEL? *Return Reply Source*

Where:
s is **EXT**, **SUM**, **OMNI**, or **DELTA**

Description:

The REPSEL command selects the signal source for reply detection and analysis by the MBTS BIT Module. Internal BIT processes automatically control the REPSEL setting. Users who wish to monitor reply signals from external transponder equipment must use the EXT selection. If this selection is changed, through the implementation of a BIT or calibration function, it will be restored once the interrupting process terminates.

The REPSEL command cannot execute while a BER test is running.

Examples:

Command: **REPSEL EXT**{CR}{LF}

Query: **REPSEL?**{CR}{LF}
Response: **EXT** {CR}{LF}

Query Response Format:

s{CR}{LF}
Where **s** is **EXT**, **SUM**, **OMNI**, or **DELTA**

Default Value:

EXT

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
OPTION CONFLICT	REPSEL attempted while BER test is running.

**RST* – Reset

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*RST									

Syntax:

`*RST` *Reset the MBTS*

Description:

The *RST command causes the MBTS to generate a hardware reset. This resets the PCC and BIT processors and reloads the PLLs, attenuators, and switches with their power-on default settings.

Example:

Command: **`*RST`**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.

Implementation Notes:

Part of the IEEE-488.2-1992 Command Set.

RUNTIME – Return seconds of Run Time

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
RUNTIME?									

Syntax:

RUNTIME? *Return the number of seconds of run time*

Description:

The RUNTIME query returns the number of seconds since the MBTS was powered on or reset (via the *RST command or a watchdog timeout). This value is a an unsigned 32-bit number, therefore it will roll over after 4,294,967,296 seconds or approximately 136 years of continuous operation.

Example:

Query: **RUNTIME?**{CR}{LF}
Response: **1253**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is the number of seconds the MBTS has been operational.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

**SRE* - Service Request Enable

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*SRE									
*SRE?									

Syntax:

***SRE n** *Set new service request enable mask*
or
***SRE?** *Return current service request enable mask*

Where:
n 0 to 255 (decimal), see description below

Description:

The SERVICE REQUEST ENABLE command controls the conditions that generate a service request (SRQ) on the IEEE-488 bus. Each bit position controls the corresponding bit in the status register (STB). Setting a mask bit to a one enables service requests for that condition. Setting a mask bit to zero disables that service requests. The service request mask is set to zero on power-up or when a *Device Clear* command is received.

Note: The MBTS will automatically clear the RQS/MSS bit in the *SRE register if it was set. This is not an error. For example:

```
*SRE 255;SRE?
```

returns

```
191
```

Examples:

Command: ***SRE 192**{CR}{LF}

Command: ***SRE 0**{CR}{LF}

Query: ***SRE?**{CR}{LF}
Response: **0**{CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is the Service Request Enable mask, from 0 to 255.*

Default Value:

0 *(all disabled)*

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

**STB* – Status Byte

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*STB?									

Syntax:

***STB?** *Return the current Status Byte*

Description:

The *STB query returns the current value of the Status Byte. This register contains events that have occurred since the last time the Status Byte was read.

Example:

Query: ***STB?**{CR}{LF}
Response: **9**{CR}{LF}

Query Response Format:

n{CR}{LF}
Where **n** *is the Status Byte value, from 0 to 255. The values are encoded as follows:*

128	**INT ERR**	*Internal Error. Details returned by INTERR?*
64	**RQS/MSS**	*RQS.*
32	**ESB**	*Extended Status Byte. Details returned by *ESR?*
16	**MAV**	*Message Available.*
8	**ALARM**	*Alarm. Details returned by ALARM?*
4		*(not used)*
2	**PLL ERROR**	*PLL Alarm. Details returned by PLL?*
1	**RECAL SUGGESTED**	*Output signal levels should be recalibrated (use the *CAL command).*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

Implementation Notes:

Part of the IEEE-488.2-1992 Command Set.

SCNTTYPE – Sector Count and Type

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
SCNTTYPE	▼	▼		▼	▼	▼	▼		✘

Syntax:

SCNTTYPE [M,] n,t, <ATCRBS, S, AFIRST, SFIRST, NONE> [,4]

Where:

n Sector Number from 0 to 63.
t Number of targets in each sector from 0 to 32.

Description:

The **SCNTTYPE** command is a shortcut for sending multiple **PTYPE** commands to each target in the specified sector.

The sector will be set for the specified number of targets. If ATCRBS, S, or NONE is specified the first t targets will be set to match. If AFIRST or SFIRST is specified the target types alternate between Mode S and ATCRBS, starting with ATCRBS (AFIRST) or Mode S (SFIRST). The optional "**4**" enables Mode 4 targets. Targets with a range greater than 300 NMI will not be set by a SCNTTYPE command.

There is no query for the SCNTTYPE command.

Examples:

Command: **SCNTTYPE M,60,8,AFIRST**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.
BAD PARAM A supplied parameter is out of the acceptable range.

SCODE – Sector Code

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
SCODE	▼	▼		▼	▼	▼	▼		✘

Syntax:

SCODE [M,] n, <2, 3, 4, B, C, S, SA> …

Where:

n Sector Number from 0 to 63.

Description:

The **SCODE** command is a shortcut for sending identical **PCODE** commands to each target in the specified sector. The **SCODE** command sets the code of every target in the specified sector. The format, other than the missing target number, is identical to the **PCODE** command. Refer to the **CODE** command for information about different code types.

Use the **SCODE** command to set the Mode 4 codes as every target in a sector shares the same Mode 4 code setting. All other code settings are unique for each target.

There is no query for the SCODE command.

Examples:

Command: **SCODE M,58,8,2,4321,1,1,0,0,0**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

SINC – Sector Increment

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
SINC	▼	▼		▼	▼	▼	▼		✘

Syntax:

SINC [M,] n

Where:

n Sector Number from 0 to 63.

Description:

The **SINC** command is a shortcut for sending multiple **PCODE** commands for a specified sector. The **SINC** command takes the Code 3/A and Code S settings for the specified sector plane 0 and increments it in each active target in all sectors. The Code 3/A in incremented for each ATCRBS or Mode S target. The Code S is incremented for each Mode S target.

There is no query for the SINC command.

Examples:

Command: **SINC 23**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

SLVL – Sector Power Level

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
SLVL	▼	▼		▼	▼	▼	▼		✘
SLVL?									

Syntax:

SLVL [M,] n,o,p
or
SLVL? [M,] n

Where:

n Sector Number from 0 to 63.

o	**p**	**Function**
T	+10.0 to –85.0 dBm in 0.5 dB steps	Target (Sum) power level
S	+20 to –27 dB in 1 dB steps	Sum/Omni ratio
D	+12.00 to –42.00 dB in 0.25 dB	Delta/Sum ratio

Description:

The **SLVL** command sets the power level for the specified sector. See the **MANLVL** command for a full description of the Target, Sum/Omni, and Delta/Sum parameters. Note that the SLVL does not accept a "C" parameter and does not set the calibration attenuator control. Use the MANLVL command to set the calibration attenuator control.

Examples:

Command: **SLVL M,34,O,20**{CR}{LF}

Command: **SLVL M,34,T,42.5**{CR}{LF}

Command: **SLVL 14,D,2.25**{CR}{LF}

Query: **SLVL? 23**{CR}{LF}
Response: **T,-30.0,S,20,D,0.00**{CR}{LF}

Query Response Format:

T,t.t,S,s,D,d.dd {CR}{LF}
where **t.t**, **s**, *and* **d.dd** *are the Target, Sum/Omni, and Delta/Sum power levels, respectively.*

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

SPHASE – Sector Phase

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
SPHASE	▼	▼		▼	▼	▼	▼		✘
SPHASE?									

Syntax:

SPHASE [M,] n,q
or
SPHASE? [M,] n

Where:

n	Sector Number from 0 to 63.
q	Output phase, either 0 or 180 degrees

Description:

The **SPHASE** command sets the power level for the specified sector. See the **MANPHASE** command for a full description of the Phase parameter.

Examples:

Command: **SPHASE M,34,0**{CR}{LF}

Command: **SPHASE 4,180**{CR}{LF}

Query: **SPHASE? M,34**{CR}{LF}
Response: **0**{CR}{LF}

Query: **SPHASE? 4**{CR}{LF}
Response: **180**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

SPROB – Sector Probability

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
SPROB	▼	▼		▼	▼	▼	▼		✘

Syntax:

SPROB [M,] n, r

Where:

n	Sector Number from 0 to 63.
r	[0:0xff] in hexadecimal, the probability of ignoring an interrogation in steps of 1/0x100.

Description:

The **SPROB** command is a shortcut for sending multiple **PPROB** commands for a specified sector. The **SPROB** command sets the probability of NOT replying to an interrogation for every target in the specified sector. r = 0 always replies, r = 0x80 replies half the time.

There is no query for the SPROB command.

Examples:

Command: **SPROB M,43,2e**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

SRANGE – Sector Range

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
SRANGE	▼	▼		▼	▼	▼	▼		✘

Syntax:

SRANGE [M,] n, r

Where:

n	Sector Number from 0 to 63.
r	[50:64000] the range spacing to each target in every sector in 62.5 ns units

Description:

The **SRANGE** command is a shortcut for sending identical **PRANGE** commands to each target in the specified sector. The **SRANGE** command sets the range spacing of every target in the specified sector. The format, other than the missing target number, is identical to the **PRANGE** command.

Targets that are set to a range greater than 64000 are removed.

There is no query for the SRANGE command.

Examples:

Command: **SRANGE M,17,8000**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

STGT – Sector Target Definition Query

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
STGT?									

Syntax:

STGT? [M,] n

or

STGT? [M,] n, H Request header line

Where:

n Sector Number from 0 to 63.

Description:

The **STGT?** Query **should be used only on the serial interface**. The STGT? query provides a table of all settings for each target in the specified sector. The optional "H" parameter provides a header line.

See the PTGT? command for format information.

Examples:

Query: **STGT? 56,H**{CR}{LF}

Response:

```
Sc Pl:  C3   CC   C2   CB   CSa   AA   4 E Range TM Pb LO  Alrt{CR}{LF}
56  0:   4  310   22    0 1339 123459 0 0  1356 19  0   0  0{CR}{LF}
56  1:   5  310   22    0 1339 123459 0 0  1356 1a  0   0  0{CR}{LF}
56  2:   6  310   22    0 1339 12345a 0 0  1356 19  0   0  0{CR}{LF}
56  3:   7  310   22    0 1339 12345a 0 0  1356 1a  0   0  0{CR}{LF}
56  4:   8  310   22    0 1339 12345b 0 0  1356 19  0   0  0{CR}{LF}
56  5:   9  310   22    0 1339 12345b 0 0  1356 1a  0   0  0{CR}{LF}
56  6:   a  310   22    0 1339 12345c 0 0  1356 19  0   0  0{CR}{LF}
56  7:   b  310   22    0 1339 12345c 0 0  1356 1a  0   0  0{CR}{LF}
56  8:   c  310   22    0 1339 12345d 0 0  1356 19  0   0  0{CR}{LF}
56  9:   d  310   22    0 1339 12345d 0 0  1356 1a  0   0  0{CR}{LF}
56 10:   e  310   22    0 1339 12345e 0 0  1356 19  0   0  0{CR}{LF}
56 11:   f  310   22    0 1339 12345e 0 0  1356 1a  0   0  0{CR}{LF}
56 12:  10  310   22    0 1339 12345f 0 0  1356 19  0   0  0{CR}{LF}
56 13:  11  310   22    0 1339 12345f 0 0  1356 1a  0   0  0{CR}{LF}
56 14:  12  310   22    0 1339 123460 0 0  1356 19  0   0  0{CR}{LF}
56 15:  13  310   22    0 1339 123460 0 0  1356 1a  0   0  0{CR}{LF}
56 16:  14  310   22    0 1339 123461 0 0  1356 19  0   0  0{CR}{LF}
56 17:  15  310   22    0 1339 123461 0 0  1356 1a  0   0  0{CR}{LF}
56 18:  16  310   22    0 1339 123462 0 0  1356 19  0   0  0{CR}{LF}
56 19:  17  310   22    0 1339 123462 0 0  1356 1a  0   0  0{CR}{LF}
56 20:  18  310   22    0 1339 123463 0 0  1356 19  0   0  0{CR}{LF}
56 21:  19  310   22    0 1339 123463 0 0  1356 1a  0   0  0{CR}{LF}
56 22:  1a  310   22    0 1339 123464 0 0  1356 19  0   0  0{CR}{LF}
56 23:  1b  310   22    0 1339 123464 0 0  1356 1a  0   0  0{CR}{LF}
```

```
56 24:   1c  310   22    0 1339 123465 0 0  1356 19  0   0  0{CR}{LF}
56 25:   1d  310   22    0 1339 123465 0 0  1356 1a  0   0  0{CR}{LF}
56 26:   1e  310   22    0 1339 123466 0 0  1356 19  0   0  0{CR}{LF}
56 27:   1f  310   22    0 1339 123466 0 0  1356 1a  0   0  0{CR}{LF}
56 28:   20  310   22    0 1339 123467 0 0  1356 11  0   0  0{CR}{LF}
56 29:   21  310   22    0 1339 123467 0 0  1356  2  0   0  0{CR}{LF}
56 30:    0    0    0    0    0      0 0 0     0  0  0   0  0{CR}{LF}
56 31:    0    0    0    0    0      0 0 0     0  0  0   0  0{CR}{LF}
```

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

TGTAZ - Target Azimuth

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
TGTAZ	▼	▼		▼	▼	▼	▼		✘
TGTAZ?									

Syntax:

`TGTAZ [M,]n` *Set target azimuth, the optional 'M' parameter selects secondary (moveable) targets*
or
`TGTAZ? [M]` *Return current target azimuth*

Where:
`n` Azimuth in IACP units, 0 to 16383

Description:

The TGTAZ command sets the azimuth position of the center of the first (and possibly only) target. This target position is applicable only to replies generated when the MBTS is in azimuth-gated reply mode. When there is only one target, this value specifies the azimuth of that target. When there is more than one target, all targets are evenly spaced around the azimuth circle at the applied Range setting. Note that the target at the TGTAZ position may not generate the first reply after receipt of the Northmark signal. For example, if TGTAZ is 4096 and TGTCNT is 16, a reply will be generated by the target at 0 (at the Northmark). The target at 4096, the "first" target as set by the TGTAZ command, will have the Mode S Aircraft Address specified by the CODE command. The Aircraft Address of each additional Mode S target is sequentially incremented from this value.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`TGTAZ 12192`**{CR}{LF}

Command: **`TGTAZ M 45`**{CR}{LF}
Query: **`TGTAZ?`**{CR}{LF}
Response: **`12192`**{CR}{LF}

Query: **`TGTAZ? M`**{CR}{LF}
Response: **`45`**{CR}{LF}

Query Response Format:

`n`{CR}{LF}
where **`n`** *is the azimuth of the first target in IACP units, from 0 to 16383.*

Default Value:

0

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.

TGTCNT - Target Count

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
TGTCNT	▼	▼		▼	▼	▼	▼		✘
TGTCNT?									

Syntax:

`TGTCNT [M,]n` *Set number of targets, the optional 'M' parameter selects secondary (moveable) targets*
or
`TGTCNT? [M]` *Return current number of targets*

Where:
`n` 1, 2, 4, 8, 16, 32 or 64

Description:

The TGTCNT command sets the number of targets that the MBTS simulates when in azimuth-gated reply mode.

The TGTCNT command applies the current CODE, TGTMIX, RANGE, and INC3 command settings and overrides earlier GCNTTYPE, GCODE, GINC, GRANGE, PCODE, PPROB, PRANGE, PTGT, PTYPE, SCNTTYPE, SCODE, SINC, SPROB, and SRANGE commands. Each sector will have at most one target.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`TGTCNT 1`**{CR}{LF}

Query: **`TGTCNT?`**{CR}{LF}
Response: **`1`**{CR}{LF}

Query: **`TGTCNT? M`**{CR}{LF}
Response: **`16`**{CR}{LF}

Query Response Format:

`n`{CR}{LF}

Default Value:

`8`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

TGTMIX - Target Type Mix

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
TGTMIX	▼			▼	▼	▼	▼		✘
TGTMIX?									

Syntax:

`TGTMIX [M,]n[,4]` *Set target type mix, the optional 'M' parameter selects secondary (moveable) targets.*

or

`TGTMIX? [M]` *Return current target type mix*

Where:

`n` Target type mix, one of the following:
"**`NONE`**" - No targets enabled
"**`ATCRBS`**" - ATCRBS targets only
"**`S`**" - Mode-S targets only
"**`BOTH`**" - 50/50 split of ATCRBS and Mode-S targets

`4` Enable Mode 4 targets. This option parameter is independent of the other parameters.

Description:

The TGTMIX command sets the MBTS to create replies emulating the protocols of an ATCRBS or a Mode S transponder. Mode 4 transponder replies are generated independent of the ATCRBS or Mode S TGTMIX setting. For instance, if the TGTMIX setting is NONE with the Mode 4 switch enabled then Mode 4 responses are still generated at the target locations when a Mode 4 interrogation is detected.

The TGTMIX command applies the current CODE, TGTCNT, RANGE, and INC3 command settings and overrides earlier GCNTTYPE, GCODE, GINC, GRANGE, PCODE, PPROB, PRANGE, PTGT, PTYPE, SCNTTYPE, SCODE, SINC, SPROB, and SRANGE commands. Each sector will have at most one target.

For the Azimuth-gated mode, if the TGTMIX is BOTH, the first target (at the location set by the TGTAZ command) will be an ATCRBS target. If the TGTCNT is set to 1 and TGTMIX is set to BOTH, then only ATCRBS replies will be generated.

For Ring mode, if TGTMIX is set to BOTH, the MBTS will respond as an ATCRBS target to all ATCRBS interrogations. The MBTS will respond with a Mode-S reply only to Mode-S interrogations.

Use the TGTMIX M NONE command to disable the generation of secondary targets.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **TGTMIX M ATCRBS**{CR}{LF}

Command: **TGTMIX S**{CR}{LF}

Command: **TGTMIX BOTH 4**{CR}{LF}

Query: **TGTMIX?**{CR}{LF}
Response: **BOTH 4**{CR}{LF}

Query: **TGTMIX? M**{CR}{LF}
Response: **ATCRBS** {CR}{LF}

Query Response Format:

n{CR}{LF}
where **n** *is* **ATCRBS**, **S**, *or* **BOTH**.

Default Value:

"**ATCRBS**"

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
OPTION CONFLICT	SECENABLE is ON and the TGTMIX is not being set to ATCRBS.

TRIG - Trigger Source

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
TRIG	▼				▼	▼	▼		✘
TRIG?									

Syntax:

`TRIG n` *Sets the reply generation trigger source*
or
`TRIG?` *Returns the current trigger source setting*

Where:

`n` Trigger mode, as follows
"**`RFIN`**" - Use decoded RF interrogations from an RF input
"**`TRANS`**" - Use decoded RF interrogations from an RF input and use the External Trigger input to modulate the RF replies.
"**`MODE`**" - Use mode pair triggers from the EXT/MODE input
"**`INT`**" - Use internally generated triggers (not allowed in AZ mode)
"**`EXT`**" - Use external triggers from the EXT/MODE input

Description:

The TRIG command determines the trigger mode and source. When the trigger mode is "RFIN" or “TRANS”, the RF source is determined by the IDRSRC command setting.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.
The INT option is not available when the MBTS is in Azimuth Gated reply mode.

The TRANS (transparent modulation) option is available only when the MBTS is operating in RING or Azimuth Gated Modes. Pulse Amplitude Modulating signals are applied to the MBTS through the EXT/MODE interface on the front panel of the MBTS. The PAM signals directly control the generation of pulsed RF signals from the MBTS. The PAM signal must be applied to the MBTS within a time window that starts with detection of a valid RF interrogation. The MBTS allows the application of PAM signals for 3.5 mSec after detection of the trigger. After 3.5 mSec the reply detection circuits of the MBTS are reset and will respond to the next valid trigger. The monopulse characteristics of reply signals are determined by the timing of the detected RF interrogations and remain latched throughout the 3.5 mSec long modulation window. The RF output will contain higher incident noise levels during this process when the output level is set to greater than -22 dBm. The TRIG output interface on the front panel of the MBTS generates a 3.5 mSec pulse that signals when the external PAM pulses should be applied.

Examples:

Command: **TRIG RFIN** {CR}{LF}

Command: **TRIG MODE**{CR}{LF}

Command: **TRIG INT**{CR}{LF}

Command: **TRIG EXT**{CR}{LF}

Query: **TRIG?**{CR}{LF}
Response: **EXT**{CR}{LF}

Query Response Format:

n
Where **n** is **RFIN, TRANS**, **MODE**, **INT**, or **EXT**.

Default Value:

"**RFIN**"

Possible Error Conditions:

PARAM CNT	The wrong number of parameters was supplied.
BAD PARAM	A supplied parameter is out of the acceptable range.
WRONG MODE	The command is not possible in the current mode. A change to TRIG INT was attempted while in AZ mode or a change to TRIG TRANS was attempted while in BORESIGHT mode..

TRIGPW - Trigger Pulse Width

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
TRIGPW	▼				▼	▼	▼		✘
TRIGPW?									

Syntax:

`TRIGPW n.n` *Sets internal trigger pulse width*
or
`TRIGPW?` *Return current internal trigger pulse width*

Where:
`n.n` Trigger pulse width in micro-seconds, 0.1 to 5.0 μs in 0.1 μs steps.

Description:

The TRIGPW command sets the trigger pulse width on the "TRIGGER OUT" BNC connector.

If this command is issued while the MBTS is in an operational mode, the MBTS will go off-line and stop generating replies to interrogations while it updates its internal hardware with the new values. A STOP OPERATION event will be activated. The MBTS will then enter a SUSPENDED state (which will cause a SUSPENDED event to become active) until azimuth position is re-established. A START OPERATION event will then be generated and normal MBTS operation will resume. The Operation event flags are described in the OP register.

Examples:

Command: **`TRIGPW 2.8`**{CR}{LF}

Command: **`TRIGPW 4.6`**{CR}{LF}

Query: **`TRIGPW?`**{CR}{LF}
Response: **`4.6`**{CR}{LF}

Query Response Format:

`n`
Where **`n`** *is the trigger pulse width in micro-seconds, from 0.1 to 5.0 in 0.1 μs steps.*

Default Value:

`0.1`

Possible Error Conditions:

`PARAM CNT` The wrong number of parameters was supplied.
`BAD PARAM` A supplied parameter is out of the acceptable range.

**TST* – Self-Test Query

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*TST?		✘	✘	✘	✘	✘	✘		✘

Syntax:

`*TST?` *Return the result of the Self-Test.*

Description:

The *TST query forces the MBTS to perform a complete self-test diagnostic routine. The result of the self-test is returned in the command response. Self-test results are also reflected in the INTERR register. The BER limit for that portion of the self-test is $1x10^{-3}$.

The MBTS must be in STANDBY mode to run this command (see the MODE command).

Example:

Query: **`*TST?`**{CR}{LF}
Response: **`1`**{CR}{LF}

Query Response Format:

`n`{CR}{LF}
where **`n`** *is* **`0`** *if no errors occurred during self-test, otherwise* **`1`**.

Default Value:

N/A

Possible Error Conditions:

`PARAM CNT`	The wrong number of parameters was supplied.
`WRONG MODE`	The command is not possible in the current mode.

Implementation Notes:

Part of the IEEE-488.2-1992 Command Set.

**WAI* – Wait to Continue Command

Command or Query	Standby Mode	Ring Mode	Azimuth Mode	Bore-sight Mode	CW Mode	Cal Mode	Ref Mode	Cal. Write Protect	Xilinx Load Fail
*WAI									

Syntax:

***WAI** *Wait to Continue*

Description:

The *WAI causes the MBTS to stop processing commands from a communications port until all active operations are complete. The MBTS will continue to process commands from other communication interfaces.

Currently, the *WAI command has no effect unless the MBTS is running a BER test.

Example:

Command: ***WAI**{CR}{LF}

Default Value:

N/A

Possible Error Conditions:

PARAM CNT The wrong number of parameters was supplied.

Implementation Notes:

Part of the IEEE-488.2-1992 Command Set.

STATUS REGISTERS