Quasonix Interpretation

of

IRIG 106-13, Appendix N

Telemetry Transmitter Command and Control Protocol

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1   Introduction

This Appendix provides standards for commands, queries, and status information when communicating with telemetry transmitters configured with communication ports. The commands are divided into two categories of "command sets" as follows:

  a.   Basic - The basic command set contains the minimum (required) commands for transmitter control, query, and status.

  b.   Extended - The extended command set contains optional commands that may or may not be implemented and may be shown as references.

2   Command Line Interface

2.1   User Command Line Interface

This interface is the default upon power up of the transmitter. Each command or query is ended by a carriage return <CR>. Information returned from the transmitter will be followed by a carriage return <CR> and the ">" will be displayed to indicate the transmitter is ready to receive commands or queries.

Note: With regard to this standard, it is assumed that a carriage return <CR> is followed by a line feed. The transmitter will return the "OK" mnemonic for each command that is accepted. The transmitter will return "ERR" for a command or query that was interpreted as an error. In nearly all cases listed, for new transmitter code, in the event of an error, the reason for the error will be returned after the ERR, rather than the current value (which can be retrieved with a query command) since this is more useful in the event of an error. Verification that a query was either accepted or found to be in error will be the response to the query. All commands are case insensitive. The transmitter will operate in half duplex mode and will echo typed characters to the command terminal.

2.1.1   Options

In addition to the required user command line interface items, the following list contains options that may or may not be implemented.

- Backspacing to correct typed errors

- Ctrl-R allows the user to cycle through the last n commands, where n is ≥ 4

3   Initialization

Upon successful communication initialization, the transmitter will provide the controlling terminal with (as a minimum) the manufacturer's name, model number, serial number, and supported IRIG 106 (RCC-106) release number. Other information (such as information on firmware and temperature) deemed appropriate by the manufacture is allowed. This information will be displayed only upon a successful power up and communication initialization of the transmitter. Should an unsuccessful power up occur, based upon criteria of the transmitter manufacturer, the transmitter shall return "ERR" and allow only the RE(RES) command to reset the transmitter (refer to Table 1 and paragraph 4.2.10).

Upon successful communication, after a power up, a communication connection, a command, or a query, the transmitter will send a carriage return followed by a ">" to signify the transmitter is ready to accept commands and queries. In the case of a dual transmitter, the prompt will include the current channel (1, 2, or 3 for both) in front of the normal prompt: "3>".

4   Command Set

4.1   Command Set Summary

The command fields use a minimum two characters with the optional capability of using a maximum of four characters. If possible, the longer four character field should be used to add intuitiveness to the command set. The commands are shown in Table 1. Commands with a double asterisk (**) after them apply ONLY to a dual transmitter.

Table 1: Command Set

Command	Function	Mandatory or Optional	Read/Write (R/W)
AC	Report or set automatic carrier output state	M	R/W
BT	Report or set clock and data input reference levels; Requires a hardware option to switch between TTL and RS-422	O	R/W
BR	Report or set the bit rate of the bit sync that is locking to the externally applied data	M	R/W
CH**	Specify channel used for all subsequent dual transmitter commands until another channel command is received	M	R/W
CF	Reports or sets the clock free state	M	R/W
CP	Reports or sets clock polarity	M	R/W
CS(CLKS)	Reports or sets the clock source	M	R/W
DP(DPOL)	Reports or sets the data polarity state (NORM or INV)	M	R/W
DS(DSRC)	Reports or sets the data source state (INT or EXT)	M	R/W
DE	Reports or sets differential encoding for SOQPSK-TG mode (ON or OFF)	M	R/W
FE(FEC)	Reports or sets legacy Turbo code FEC	Obsolete	
FR(FREQ)	Reports or sets the carrier frequency	M	R/W
FS	Reports or sets the frequency step	M	R/W
[	Tunes transmitter to next lower frequency	O	R/W
]	Tunes transmitter to next higher frequency	O	R/W
HE	Displays available commands	M	R
ID(IDP)	Sets or queries the internal data pattern (one of five possible settings)	M	R/W

Command	Function	Mandatory or Optional	Read/Write (R/W)
TE(TEMP)	Reports internal temperature in degrees Celsius	M	R
IC(ICR)	Reports or sets the internal clock rate	M	R/W
LC	List stored configurations	O	R/W
LD(LDPC)	Reports or sets the LDPC coding selection	M	R/W
MO(MOD)	Sets or queries the current modulation	M	R/W
MS	Scales deviation of transmitted signal relative to standard default deviation	O	R/W
OC	Reports or enables overtemperature control	O	R/W
CR	Reports currently selected preset, from a hardware boot or an RC command	M	R
<	Incrementally steps down the output power level	O	W
>	Incrementally steps up the output power level	O	W
QA(QALL)	Queries the status of all basic commands	M	R
RA(RAND)	Sets or queries the setting of data randomization (ON or OFF)	M	R/W
RL(RCLL)	Retrieves a transmitter setup from on-board nonvolatile RAM	M	R/W
RE(RES)	Resets the transmitter to a known configuration	O	W
RF	Sets or queries the RF output (ON or OFF)	M	R/W
RZ	Sets or shows polarity of the RF On/Off pin	M	R/W
SV(SAVE)	Saves the current setup of the transmitter to on-board nonvolatile RAM	M	W
VP	Reports or sets variable power level	M	R/W
VE(VERS)	Queries, at a minimum, the manufacturer's name, model number, and serial number of the transmitter	M	R

4.2   Command Details

4.2.1   Automatic Carrier Output

The AC command reports or sets the automatic carrier output state. This command requires the unit to have the -AC option.

With automatic carrier ON (AC 1), the SEAT will output an unmodulated on-frequency carrier if there is no clock present. When automatic carrier is OFF (AC 0), the RF output is muted in the absence of clock. Note that the CF and CS commands can create a clock in the absence of an eternal clock.

a.   Set Automatic Carrier Output - Use "AC X <CR>" where X corresponds to a 1 or 0. If the command is accepted, an "OK <CR>" is issued as a response.

b.   Query Automatic Carrier Output - "AC <CR>" queries the currently set automatic carrier status and returns "AC X <CR>" where integer X is represented in the example below.

Examples:

AC   Report the state

AC 0 (disabled

AC 0   Set automatic carrier OFF

OK AC 0 (disabled)

AC 1   Set automatic carrier ON

OK AC 1 (enabled)

AC 6   Invalid command

ERR AC Cmd needs 0 or 1

4.2.2   Baseband Interface Type

This command is only valid if the unit has the -VR option or the appropriate interface part number.

Baseband Interface Type reports or sets the clock and data input reference levels.

- Clock and data interfaces are set to either TTL or RS-422.
- Clock interface and data interface are always the same type.

This can be set automatically by the IS command if it is implemented on the unit.

a.   Set Baseband Interface Type - Use "BT X <CR>" where X corresponds to TTL or RS-422. If the command is accepted, an "OK <CR>" is issued as a response.

b.   Query Baseband Interface Type - "BT <CR>" queries the currently set baseband interface type and returns "BT X <CR>" where integer X is represented in the example below.

Examples:

BT   Report the ref level

BT RS422

BT T   Set the baseband type to TTL

OK BT TTL

BT R   Set the baseband type to RS-422

OK BT RS422

BT 5   Invalid command

ERR BT BB type is T (TTL) or R (RS422)

4.2.3 Bit Rate

The bit rate command is used when the Clock Free (-CF) option is specified and clock free clock generator is in use.

BR reports or sets the bit rate of the bit sync that is locking to the externally applied data.

- Not to be confused with "IC", which sets the rate of the internally generated clock

- Bit rate range is 0.1 to 40 Mb/s (or manufacturers maximum) for all waveform modes

a. Set Bit Rate - Use "BR X <CR>" where X corresponds to a specific value or automatic. If the command is accepted, an "OK <CR>" is issued as a response.

b. Query Bit Rate - "BR <CR>" queries the currently set bit rate and returns "BR X <CR>" where integer X is represented in the example below.

Examples:

BR   Report the bit rate

BR 7.500 Mbps

BR 5   Set the bit rate to 5 Mb/s

OK BR 5.000 Mbps

BR A   Set the bit rate automatically

OK BR Auto

OK BR 7.500 Mbps

BR G   Invalid command

ERR BR Bitrates are 0.075 to 30.800 Mbps in current mode

4.2.4 Channel

This command applies specifically to Dual Transmitters. It allows the user to specify the channel to be used for all subsequent commands until another channel command is received. The choices are 1,2, or 3 meaning RF channel 1, RF channel 2, or both channels. A Dual Transmitter will always report the current channel as the first item in the prompt, for example:

```
1>    or
3>
```

This ensures that the user always knows which channel(s) is being controlled.

With this in mind, all other Appendix N commands remain the same and apply (as appropriate) to the currently enabled channel or channels. For instance, VE for version will return the version response, regardless of the enabled channel.

On the other hand, RF 0 will turn OFF RF on whatever channel is currently selected (or on BOTH if the current channel is 3.)

Responses will be the same UNLESS the values of the parameter for the two channels are NOT the same. In that case, the different values will be reported and preceded by the string "Chan 1" or "Chan 2". For instance, if the command DE is issued with channel set to 3, the user may see the following:

```
3>DE
Ch1 DE 1
Ch2 DE 0
```
(double response since values are different)

```
3>DE 0
OK DE 0
```

```
3>DE 1
OK DE 1
```

```
3>DE
DE 1
```
(single command issued to both—single response)

Examples:

CH   Report the current channel (also shown in the prompt)

CH3

CH 2   Change to Channel 2 only

OK CH 2

CH 7   Invalid command

ERR CH Cmd needs channel 1, 2, or 3 (both)

4.2.5   Clock Free

The CF command reports or sets the clock free state.

a. Set Clock Free - Use "CF X <CR>" where X corresponds to a 0 or 1. If the command is accepted, an "OK <CR>" is issued as a response.

b. Query Clock Free - "CF <CR>" queries the currently set clock free state and returns "CF X <CR>" where integer X is represented in the example below.

Examples:

CF   Report the clock free state

CF 1 (Normal)

CF 0   Unit uses its internal bit sync (internally synthesized)

OK CF 0 (Clock Free)

CF Bitrate set to 7.000 kbps

CF 1   Unit uses its externally applied clock

OK CF 1 (Normal)

CF 8   Invalid command

ERR CF Cmd needs 0 (clk free) or 1 (ext clk provided)

4.2.6   Clock Polarity

The CP command reports or sets clock polarity.

a.   Set Clock Polarity - Use "CP X <CR>" where X corresponds to a 0, a 1, or automatic. If the command is accepted, an "OK <CR>" is issued as a response.

b.   Query Clock Polarity - "CP <CR>" queries the currently set clock polarity state and returns "CP X <CR>" where integer X is represented in the example below.

Examples:

CP   Display the current clock polarity

CP 0

CP 0   Set clock polarity to NOT inverted

OK CP 0

CP 1   Set clock polarity to inverted

OK CP 1

CP A   Set clock polarity to auto; automatically selects the most reliable clock edge

OK CP A

CP 5   Invalid command

ERR CP bad parameter

Note that some transmitters (notably the Dual Transmitters) always use CP A so the CP command does nothing, regardless of what is reported.

4.2.7   Clock Source

The CS(CLKS) command reports or sets the clock source.

- Allows the SEAT to be a test source by selecting an internal data pattern

- SEAT reverts to CS 0 (external) at power-up as an operational fail safe unless the unit has the -ID option installed and the setting was saved as CS 1

a.   Set Clock Source - Use "CS X <CR>" where X corresponds to a 0 or 1. If the command is accepted, an "OK <CR>" is issued as a response.

b.   Query Clock Source - "CS <CR>" queries the currently set clock source and returns "CS X <CR>" where integer X is represented in the example below.

Examples:

CS   Display the current clock source

CS 0

CS 0   Set clock source to external

OK CS 0

CS 1   Set clock source to internal

OK CS 1

CS 7   Invalid command

ERR CS Cmd needs 0 or 1

When set to internal clock source, the data source on a *non-Dual Transmitter* must also be set to internal via the DS command to generate synchronous, usable data. Dual Transmitters do not have separate CS and DS enables. Use CS only on a Dual Transmitter to enable or disable BOTH internal sources.

4.2.8   Data Polarity

Data Polarity state is set or queried with the "DP(DPOL)" mnemonic.

    a.   Set Data Polarity - Use "DP X <CR>" where X corresponds to a 0 or 1. If the command is accepted, an "OK <CR>" is issued as a response.

    b.   Query Data Polarity - "DP <CR>" queries the currently set data polarity state and returns "DP X <CR>" where integer X is represented in the example below.

Examples:

DP   Display the current data polarity

DP 0

DP 0   Set data polarity to NOT inverted (OFF)

OK DP 0

DP 1   Set data polarity to inverted (ON)

OK DP 1

DP 7   Invalid command

ERR DP Cmd needs 0 or 1

4.2.9   Data Source

Data Source state is set or queried with the "DS(DSRC)" mnemonic.

The transmitter always reverts to DS 0 (external) at power-up as an operational fail safe unless the unit has the -ID option installed and was saved with DS 1.

    a.   Set Data Source - Use "DS X <CR>" where X corresponds to a 0 or 1. If the command is accepted, an "OK <CR>" is issued as a response.

    b.   Query Data Source - "DS <CR>" queries the currently set data source and returns "DS X <CR>" where integer X is represented in the example below.

Examples:

DS   Displays current data source

DS 0   Sets data source to external

DS 1   Sets data source to internal (type of internal data is set by ID command)

This command is not valid or needed when using Dual Transmitters. Use CS with a dual transmitter.

4.2.10 Differential Encoding

The DE command reports or sets differential encoding for SOQPSK-TG mode.

DE is automatically turned OFF if mode is SOQPSK and LDPC is turned ON or if mode is STC.

For additional information, the reader is referred to IRIG 106-13 Chapter 2 (paragraph 4.3.1.1) and Appendix M.

    a. Set Differential Encoding - Use "DE X <CR>" where X corresponds to a 1 or 0. If the command is accepted, an "OK <CR>" is issued as a response.

    b. Query Differential Encoding - "DE <CR>" queries the currently set differential encoding state and returns "DE X <CR>" where integer X is represented in the example below.

    c. Default - When switching modulation modes the differential encoding shall be switched appropriately. For example, when switching from SOQPSK-TG to PCM/FM, the differential encoding will be set to Off, DE 0.

    d. Manual Control - For the PCM/FM and ARTM-CPM modulation modes differential encoding will always be disabled (Off). However, the user can be given manual control of differential encoding when using SOQPSK-TG modulation.

Examples:

DE   Report the differential encoding setting

DE 1

DE 0   Set differential encoding OFF

OK DE 0

DE 1   Set differential encoding ON

OK DE 1

DE 8   Invalid command

ERR DE Cmd needs 0 or 1

4.2.11 Forward Error Correction Code

The FE command enables and sets the legacy Turbo code FEC.

This command is functionally obsolete.

- This command is left in to support legacy transmitters which still have FEC boards and turbo code FEC options. New transmitters do not support this command. Use LD for Low Density Parity Check encoding on new transmitters.

- For modern forward error correction, use the LD (LDPC) command.

a. Set Forward Error Correction - Use "FE X <CR>" where X corresponds to a 0 or 1. If the command is accepted, an "OK <CR>" is issued as a response.

b. Query Forward Error Correction - "FE <CR>" queries the currently set forward error correction state and returns "FE X <CR>" where integer X is represented in the example below.

Examples

FE   Report state

FE   On new transmitters

Command invalid

4.2.12 Frequency

The FR command reports or sets the SEAT frequency. The argument specifies the frequency in MHz in 0.5 MHz steps.

- If the command is entered with a '?', then the allowed frequency ranges for this unit display.

- If the frequency is outside of the allowed range for the unit, the transmitter will NOT retune but will report an error (ERR) to the user.

a. Set Frequency - Use "FR X <CR>" where X corresponds to a specific frequency. If the command is accepted, an "OK <CR>" is issued as a response.

b. Query Frequency - "FR <CR>" queries the currently set frequency and returns "FR X <CR>" where integer X is represented in the example below.

Examples:

FR   Display the current frequency

FR 2200.5 MHz

FR ?   Display allowed frequency ranges

Allowed Frequency ranges are:

Lower S band: 2200.50 to 2300.50 MHz

Upper S band: 2300.50 to 2394.50 MHz

C band: 4400.00 to 4950.00 MHz

FR 2221.5   Set frequency to 2221.5 MHz

OK FR 2221.5 MHz

FR 12   Invalid command

ERR FR Freq out of range, freq NOT changed

4.2.13 Frequency Step

The FS command reports or sets the frequency step.

If an argument is passed, it sets the frequency step size, which is activated by the left and right square bracket keys. The argument specifies the frequency step in MHz, with 0.5 MHz being the smallest available step.

    a.   Set Frequency Step - Use "FS X <CR>" where X corresponds to a specific frequency. If the command is accepted, an "OK <CR>" is issued as a response.

    b.   Query Frequency Step - "FS <CR>" queries the currently set frequency and returns "FS X <CR>" where integer X is represented in the example below.

Examples:

FS   Display the current frequency step

FS 10.000000 MHz

FS 1   Sets Frequency step = 1 MHz

OK FS 1.000000 MHz

FS G   Invalid command

ERR FS Bad FS step or value out of range

4.2.14 Frequency Step Down

The designated Frequency Step Down key stroke tunes the transmitter to the next lower frequency, as determined by the frequency step (FS) parameter. No carriage return (Enter key) is required.

    a.   Step Down Frequency - Use "[" where the left square bracket corresponds to a frequency one step lower than was specified with the FS command.

    b.   The immediate response is the new frequency, in MHz.

For a dual transmitter, the current channel (1, 2, or 3) determines which frequency(s) is stepped.

When a user presses "]" on a blank line:

```
3> Chan 1 freq stepped up to 2210.5 MHz
3> Chan 2 freq stepped up to 2210.5 MHz

3> CH 1

1>
```

When a user presses "[" on a blank line now:

```
1> Chan 1 freq stepped down to 2200.5 MHz

1> CH 3

3>FR

CH1 FR 2200.5 MHz
CH2 FR 2210.5 MHz

3>
```

4.2.15 Frequency Step Up

The designated Frequency Step Up key stroke tunes the transmitter to the next higher frequency, as determined by the frequency step (FS) parameter. No carriage return (Enter key) is required.

    a.   Step Up Frequency - Use "]" where the right square bracket corresponds to a frequency one step higher than was specified with the FS command.

    b.   The immediate response is the new frequency, in MHz.

For a dual transmitter, the current channel (1, 2, or 3) determines which frequency(s) is stepped. Refer to 4.2.14 Frequency Step Down for examples.

4.2.16 Help

The HE command displays a list of available commands.

4.2.17 Internal Data Pattern

The internal data pattern is set or queried with the "ID(IDP)" mnemonic. This setting is used if the Data Source is set to internal (DS 1). Typically, CS should also be set to 1. On a Dual Transmitter, the CS command sets both clock and data sources.

    a.   Set Internal Data Pattern - Use "ID X" where X corresponds to the internal PN data pattern. If the command is accepted, an "OK ID PNxx <CR>" is issued as a response.

    b.   Example Internal Data Patterns - Example patterns are shown in Table 2.

Table 2: Internal Data Pattern

Command	Pattern	
ID(IDP) 6	2^6-1	(63 bits)
ID(IDP) 9	2^9-1	(511 bits)
ID(IDP) 11	2^{11}-1	(2047 bits)
ID(IDP) 15	2^{15}-1	(32767 bits)
ID(IDP) 17	2^{17}-1	(131071 bits)
ID(IDP) 20	2^{20}-1	(1048575 bits)
ID(IDP) 23	2^{23}-1	(8388607 bits)
ID(IDP) 31	2^{31}-1	(1073741823 bits)
ID(IDP) xXXXXXXXX nn	0xXXXXXXXX	nn bit fixed pattern repeating

    Selection of which patterns to implement is left up to the manufacturer. If an error occurs, the transmitter will return "ERR ID cause of error <CR>" to indicate the error. A query can be used to see the current setting.

    c.   Query Internal Data Pattern - "ID(IDP) <CR>" queries the currently set internal data pattern and returns "ID(IDP) X <CR>" where integer X is represented in Table 2.

d. Example Command Use - This feature can be used for system characterization and troubleshooting. A known bit pattern can be used to test and characterize telemetry systems end-to-end or isolate baseband signal problems to the transmitter.

Quasonix Note: When setting the data, the argument must be "6" (or 9, 11, 15, 17, 20, 23, 31), or a valid hexadecimal value (of 1 to 8 digits) prefixed by "x" (such as x55AA0011 or xAA), possibly followed by a decimal number of bits from 2 to 32. If no bit length is entered, 32 bits will be assumed.

Examples:

ID   Report the internal data pattern

ID PN15

ID 15   Set internal data pattern to PN15

OK ID PN15

ID xAA55   Set internal data pattern to 0xAA55 using 32 bits

OK ID 0000AA55h 32

ID xAA55 16   Set internal data pattern to 0xAA55 using 16 bits

OK ID 0000AA55h 16

ID x0098 47   Invalid command

ERR ID Bad pattern len: 'ID [xXXXXXXXX [len]]' (len = 2-32 bits)

ID 8   Invalid command

ERR ID Bad PN number: use 6,9,11,15,17,20,23 or 31

In SOQPSK-TG mode, ID 55555555 or ID AAAAAAAA will result in an unmodulated carrier, at the nominal carrier frequency.

4.2.18 Internal Temperature

The TE (or QT) command reports the internal temperature in degrees Celsius.

This command may report both digital board and PA board temperatures. In the case of a dual transmitter, it may report two PA temperatures since there are two PAs.

Query Internal Temperature – "TE <CR>" will query the current internal temperature of the transmitter and returns "TE xxx.xx" where xxx.xx is the current internal Celsius temperature of the transmitter.

```
3>QT        Get board temperatures for both channels

3>CH1 TE 24.00
3>CH2 TE 26.50

3>CH 1
```

```
OK CH 1

1>TE

1>TE 24.00
```

4.2.19 Internal Clock Rate

The IC command reports or sets the internal clock rate.

This rate is used if the clock source is set to internal (CS 1). It should not be confused with "BR", which sets the rate of the internal bit sync, which phase locks to the externally applied data, if and only if the unit has the -CF option and the CF command is set to 0 (use clock free mode.)

- If no argument is passed, the unit reports the clock frequency.

- If a valid frequency is given, the internal clock frequency is set.

- The frequency is in MHz

a. Set Internal Clock Rate - Use "IC(ICR) XX.XXX <CR>" where XX.XXX corresponds to the clock frequency in MHz. Actual range for the clock frequency is left to the manufacturer but should correspond to the specified useable input clock frequency range. Resolution should be +/-1 kHz. Accuracy for the internal clock is left to the manufacturer but should correspond to internal values for the transmitter. If the command is accepted, an "OK IC XX.XXX<CR>" is issued as a response.

b. Query Internal Clock Rate -"IC(ICR) <CR>" queries the currently set internal clock rate and returns "IC(ICR) XX.XXX" where XX.XXX is the current set internal clock rate in MHz.

Examples:

IC   Display current internal clock rate

IC 5.000 MHz

IC 4.95   Set internal clock rate to 4.95 MHz

OK IC 4.950 MHz

IC 88   Invalid command

ERR IC Bad input or value out of range

The valid range depends on transmitter options, but is nominally from 0.002 MHz – 28.0 MHz.

4.2.20 List Configurations

The LC command lists the stored configurations on the unit.

LC is not currently defined in Appendix N. The response is fairly long in both versions, so they are not listed here.

If a configuration number is supplied, then the saved parameters for that configuration are displayed.

Examples:

LC   List all internal saved configurations

LC 7   Show configuration 7 details

The SEAT shall support a minimum of 10 configurations.

4.2.21 Set LDPC Code

The LD command reports or sets the LDPC coding selection. This command enables or disables the LDPC coding and selects the block size and code rate. If no argument is supplied, the unit reports the current LDPC setting.

LDPC cmd syntax is:

> LD [?/enable [code]]

> > where

> > > '?' displays this syntax and code list

> > > enable is 0 to disable or 1 to enable with current code

> > > code is

> > > > 0 blk size k=4096 code rate r=1/2

> > > > 1 blk size k=1024 code rate r=1/2

> > > > 2 blk size k=4096 code rate r=2/3 (default)

> > > > 3 blk size k=1024 code rate r=2/3

> > > > 4 blk size k=4096 code rate r=4/5

> > > > 5 blk size k=1024 code rate r=4/5

Examples with LD option but without LD6 option:

LD 0   Turns LDPC OFF

OK LD 0

LD 1   Sets LDPC ON with current code

OK LD 1

LD 1 4   Trying to use extended option

ERR LD The LD6 option is required to select other LDPC codes

Examples with LD6 option:

LD 1 4   Sets LDPC ON with code 4 (blk4096, rate 4/5)

OK LD 1 4

LD 0   Turn off LDPC

OK LD 0 4

LD 8   Invalid command

ERR LD Code is 0 thru 5 (use 'LD ?' for syntax and list)

4.2.22 Modulation

Modulation mode is set or queried with the "MO(MOD)" mnemonic.

a. Set Modulation Mode - Use "MO(MOD) X <CR>" where X corresponds to the modulation mode. If the command is accepted, an "OK <CR>" is issued as a response.

Table 3: Modulation Mode

Command	Modulation Type
MO(MOD) 0	PCM/FM
MO(MOD) 1	SOQPSK-TG
MO(MOD) 2	ARTM-CPM
MO(MOD) 6	Modulation Off (carrier only) This mode is present on all transmitters.
MO(MOD) 13	STC (if STC option is enabled)

The "MO(MOD) 6" command turns off the modulation for carrier only mode. Modulation will return upon a new commanded modulation mode.

b. Query Modulation Mode - "MO(MOD) <CR>" queries the currently set modulation mode and returns "MO(MOD) X <CR>" where the integer X is represented in Table 3.

Examples:

MO   Report the modulation setting

MO 1 (SOQPSK)

MO 0   Set modulation to PCM/FM

OK MO 0 (PCMFM)

MO 23   Invalid mode

ERR MO Invalid mode entered

4.2.23 Modulation Scaling

The MS command scales the deviation (modulation index) of the transmitted signal relative to the Standard default deviation.

MS is not currently defined in Appendix N.

a. Set Modulation Scaling - Use "MS X <CR>" where X corresponds to a specific decimal value. If the command is accepted, an "OK <CR>" is issued as a response.

b. Query Modulation Scaling - "MS <CR>" queries the currently set modulation scaling state and returns "MS X <CR>" where integer X is represented in the example below.

Examples:

If option is not enabled:

ERR MS –MS Option not enabled

If option is enabled:

MS   Reports the current modulation scaling state (which includes spectral inversion state)

MS 1.000000

SI 0 (Normal)

MS 2.0   Scales modulation scaling to twice normal level

OK MS 2.000000

OK SI 0 (Normal)

MS 129   Invalid command

ERR MS Mod Scale Factor is 0.090000 to 128.010000

4.2.24 Overtemperature Control

The OC command reports or enables/disables the Overtemperature Control. When enabled, the transmitter automatically reduces output power incrementally (2 dB at a time up to 6 dB total) to mitigate the Overtemperature state.

OC is not currently defined in Appendix N

a. Set Overtemperature Control - Use "OC X <CR>" where X is 0 or 1. If the command is accepted, an "OK OC X<CR>" is issued as a response.

b. Query Overtemperature Control - "OC <CR>" queries the currently set overtemperature control state and returns "OC X <CR>" where integer X is represented in the example below.

Examples:

OC   Report current Overtemperature Control state and current OT value (factory set)

OC 1 (Enabled)

OT 96.0

OC 0   Disable Overtemperature Control

OK OC 0 (Disabled)

OC 1   Enable Overtemperature Control

OK OC 1 (Enabled)

OK OT 96.0

OC K   Invalid command

ERR OC Cmd needs 0 or 1

4.2.25 Current Preset Read

The CR command reports the currently selected software preset as selected by the preset inputs on power up or by the last RC command. To view the current preset input settings, use the ZX command.

    a.   Query Current Preset Read - "CR <CR>" queries the currently set software preset state and returns "CR X <CR>" where integer X is represented in the example below.

Example:

CR   Report current selected software preset

CR 0

4.2.26 Step Down Power

The Step Down Power command incrementally steps down the output power level, from a maximum level down to 0.

One step per key stroke. No carriage return (Enter key) is required.

The Step Down Power command is the '<' (shift comma) key. On a dual transmitter, the command acts on the current channel. If the prompt shows 1, then only channel 1 steps down. If the prompt shows 3, then BOTH channels are stepped together.

    a.   Step Down Power - Use "<" to decrease the power level by one step from the current level.

    b.   The immediate response is the new power level.

Dual channel example of step down when '<' is entered:

```
3>Chan 1 power level decremented to 30.5
3>Chan 2 power level decremented to 30.5
3>
```

4.2.27 Step Up Power

The Step Up Power command incrementally steps up the output power level, from 0 to a maximum level.

The Step Up Power command is the '>' (shift period) key. On a dual transmitter, the command acts on the current channel. If the prompt shows 1, then only channel 1 steps up. If the prompt shows 3, then BOTH channels are stepped together.

    a.   Step Up Power - Use ">" to increase the power level by one step from the current level.

    b.   The immediate response is the new power level.

Dual channel example of step down when '>' is entered:

```
3>Chan 1 power level incremented to 31.5
3>Chan 2 power level incremented to 31.5
3>
```

4.2.28 Query All

The "query all" command, executed with the "QA(QALL)" mnemonic, displays all device settings in one display.

    a.   Query Transmitter Configuration - The command "QA(QALL) <CR>" requests the current setting of all basic commands. The transmitter response will contain, as a minimum, the following, in this order:

           (1) Carrier Frequency   [FR(FREQ) XXXX.X]<CR>

           (2) Modulation Mode   [MO(MOD) X] <CR>

           (3) Differential Encoding setting   [DE X] <CR>

           (4) Randomization setting   [RA(RAND) X] <CR>

           (5) RF Output setting   [RF X] <CR>

                                    OK<CR>

                                      >

    b.   Status of Other Commands - If other commands are implemented in the transmitter beyond the basic set, a complete status should be given for each implemented command.

Example output:

A dual transmitter will contain temperature outputs from the DTX digital board, the DTX interface board, and both PAs, in addition to the normal query data:

Dig brd Temp(C): 31.00

DTXIB Temp(C): 34.25

Chan 1 PA Temp(C): 27.50

Chan 2 PA Temp(C): 24.00

4.2.29 Randomizer

Report or set the Randomizer output state using the "RA(RAND)" mnemonic. For additional information, refer to IRIG 106-13 Chapter 2, paragraph 2.4.3.4, and Appendix D, Figure D-2.

    a.   Set Data Randomization - Use "RA(RAND) X <CR>" where X corresponds to a 1 or 0. If the command is accepted, an "OK <CR>" is issued as a response.

Table 4: Data Randomization

Command	Randomization
RA(RAND) 0	Off
RA(RAND) 1	Standard IRIG Randomizer On
RA(RAND) 2	CCSDS Randomizer On (only allowed if LDPC is enabled)

b. Query Randomization Mode - "RA(RAND) <CR>" queries the currently set randomization and returns "RA(RAND) X <CR>" where integer X is represented in Table 4.

Examples:

RA   Report the randomizer state

RA 0

RA 1   Set randomizer ON using std IRIG randomizer

OK RA 1

RA 2   Set randomizer ON using CCSDS randomizer. Note this option is only valid if the current mode supports LDPC encoding AND LDPC is currently enabled.

OK RA 2

RA 0   Set randomizer OFF

OK RA 0

RA 3   Invalid command

ERR RA Cmd needs 0, 1, or 2

4.2.30 Recall Configuration

The recall command is executed with the RL(RCLL) mnemonic. It loads a saved configuration into the active configuration if the configuration number entered is valid.

For "Recall Transmitter Set-up", "RL(RCLL) X<CR>" retrieves and restores the transmitter set-up from preset location "X" in nonvolatile memory within the transmitter. Values of "X" start at 0 (zero). The 0 (zero) location is the default set-up. The default set-up is the memory location that is loaded during power-up when hardware presets are not enabled.

The command "RL(RCLL) <CR> will recall from the default location 0 (zero).

If the selected configuration is not valid, then the unit is restored to defaults and that data is saved for the preset.

RC with no value is the same as RC 0 (or RL 0) (restore the default configuration).

As a Fail Safe, RECALL always defaults to CS 0 and DS 0 (external) unless the transmitter has the ID option. In that case, the stored CS and DS values are restored as is.

Example:

RL   Load configuration 0 (default setup)

RL 3   Load configuration 3

4.2.31 Restore Defaults

The "RE(RES)" mnemonic restores factory default parameters for the transmitter.

*   All settings are restored to factory defaults

- The transmitter will use the following basic settings as a base configuration unless they are not valid. For instance, if the transmitter does not support PCM/FM, then it will default to the next mode which it DOES support (SOQPSK in this case).

Table 5: Reset Transmitter

Transmitter Setting	Command	Result
Carrier Frequency	[FR(FREQ)]	Lowest valid frequency within the tuning range
Modulation Mode	[MO(MOD)]	MO(MOD) 0, PCM/FM
Randomization	[RA(RAND) X]	RA(RAND) 0, Randomization Off
RF Output	[RF X]	RF 0, RF Output Off

4.2.32 RF Output

The RF command reports or sets the RF Output Control state.

a. Set RF Output - Use "RF X <CR>" where X corresponds to a 1 or 0. If the command is accepted, an "OK RF X<CR>" is issued as a response.

b. Query RF Output - "RF <CR>" queries the currently set RF output and returns "RF X <CR>" where 0 is OFF and 1 is ON.

Examples:

RF　　　　　　　　Report the RF output state

RF 1

RF 0　　　　　　　Set RF output OFF

OK RF 0

RF 1　　　　　　　Set RF output ON

OK RF 1

RF 8　　　　　　　Invalid command

ERR RF Cmd needs 0 or 1

4.2.33 RF On/Off Pin Polarity

The RZ command sets or shows the polarity of the RF On/Off pin, which is pulled high internally to 3.3 VDC.

RZ is not currently defined in Appendix N.

a. Set RF On/Off Pin Polarity - Use "RZ X <CR>" where X corresponds to a 1 or 0. If the command is accepted, an "OK RZ X<CR>" is issued as a response.

b. Query RF On/Off Pin Polarity - "RZ <CR>" queries the currently set RF On/Off Pin Polarity state and returns "RZ X <CR>" where X represented in the example below.

Examples:

RZ   Show the current RF On/Off polarity

RZ 1 (high = RF on)

RZ 0   Set RF On/Off polarity to "pin low = ON"

OK RZ 0 (low = RF on)

RZ 1   Set RF On/Off polarity to "pin high = ON" (this includes the case where the pin is floating since
                                the transmitter contains an internal pullup on this line.)

OK RZ 1 (high = RF on)

RZ 4   Invalid command

ERR RZ Cmd needs 0 or 1

4.2.34 Save Configuration

The SV command is executed with the "SV(SAVE)" mnemonic. It saves the current transmitter configuration to a user-selected preset number, from 0 to 6 (7 presets is a threshold, 15 is an objective) where 0 is the power-on default unless hardware presets are enabled.

The Save command also allows the user to assign and store a name and description for the desired preset (this is an objective).

As a Fail Safe, CS 1 and DS 1 (internal) settings are never restored (always default to zero) unless the unit has the ID option.

- "SV(SAVE) X<CR>" saves the current settings of the transmitter to preset "X" in nonvolatile memory within the transmitter. If only one location is available, the value of "X" is 0 (zero). There are up to 16 presets within the transmitter.

  The command "SV(SAVE) <CR> with no value is the same as SV 0.

Examples:

SV 1   Save current configuration to preset 1

SV 7 abc SOQPSK 4Mbit FR 2200.5   Save current configuration to preset 7 and assign name "abc SOQPSK
                                                4Mbit FR 2200.5" which will display in the LC command listing

Example for a dual transmitter (with channel number in prompt):

```
3>SV 7 ABC SOQPSK 4 MBIT FR 2200.5

User entered name: 'ABC SOQPSK 4 MBIT FR 2200.5' entered
Do NOT turn off power until you see Setup Written response.

OK SV Setup 7 written.

3>LC
Setup 0:     Name: Setup 0, mode: SOQPSK
Setup 1:     Name: Setup 0, mode: PCMFM
Setup 2:     Name: Setup 0, mode: PCMFM
Setup 3:     Name: Setup 0, mode: PCMFM
Setup 4:     Name: Setup 0, mode: PCMFM
```

```
Setup 5:      Name: Setup 0, mode: PCMFM
Setup 6:      Name: Setup 0, mode: PCMFM
Setup 7:      Name: ABC SOQPSK 4 MBIT FR 2200.5
Setup 8:      Name: Setup 0, mode: PCMFM
Setup 9:      Name: Setup 0, mode: PCMFM
Setup 10:     Name: Setup 0, mode: PCMFM
Setup 11:     Name: Setup 0, mode: PCMFM
Setup 12:     Name: Setup 0, mode: PCMFM
Setup 13:     Name: Setup 0, mode: PCMFM
Setup 14:     Name: Setup 0, mode: PCMFM
Setup 15:     Name: Setup 0, mode: PCMFM
3>
```

4.2.35 Variable Power

The VP command reports or sets a variable power level. The transmitter can support user selectable output power levels using the VP XX<CR> mnemonic.

a. Set Variable Power Level - Use VP XX<CR> or VP X<CR> to set a range of RF output power levels available in discrete predefined steps. If the command is accepted, an "OK VP XX<CR>" is issued as a response.

b. Query Variable Power Level - "VP<CR>" queries the power mode setting and returns "VP XX<CR>" where integer XX is represented in Table 6.

c. Look Up Table - The actual value of output power that corresponds to "XX" is undefined. Each manufacturer will provide an equation or lookup table that defines the output power as a function of "XX".

Table 6: Variable Power RF Power Level

Command	RF Power Level
VP MAX	Full Power
VP 30	Max – 30 less than full power
VP 1	~1 dB more than low power
VP 0	Low Power

Valid range is MIN-MAX (providing 20 increments is a threshold). MAX and MIN may be used to specify the outer limits. Max may vary with transmitter and options, but is typically 31 or 31.5 (in the first case, 32 one dB steps are allowed; in the second case, 64 0.5 dB steps are allowed).

Examples:

VP   Report the variable power level

VP 31.5

VP 28.5   Set variable power to the level 28.5 (3 dB below max power)

OK VP 28.5

VP MAX   Set to max allowed power

OK VP 31.5

VP MIN   Set to min allowable value for the unit

OK VP 0.0

VP 88   Invalid command

ERR VP Out of Range: Power Level is 0.0 dB to 31.5 dB

4.2.36 Version

The Version command, executed with the "VE(VERS) <CR>" mnemonic, reports the serial number and part number for the transmitter.

a. Query Transmitter Version - "VE(VERS) <CR>" requests the current version of the transmitter. The response will contain (at a minimum) the following information about the transmitter:

(1) Manufacturer Name

(2) Model Number

(3) Serial Number

b. Formatting and Delimiting the Fields - It is left up to the transmitter manufacturer to format and delimit the above fields and, if chosen, add additional information to the response.

5   Non-Standard Commands

Note: This paragraph is reserved for transmitter commands that fall outside of the commands and command structure discussed above. Additions to this section will be made as non-standard commands are derived and found applicable to this standard.

6 Physical Layer(s)

The above command sets are independent of the physical layer over which the commands are transferred. The command set should be implemented in such a way that it can be translated over any physical layer interfacing with the transmitter.

6.1 Serial Interface

Should a three-wire serial interface be chosen, it should be implemented via a three wire serial interface compatible with EIA232 (http://www.eia.org/). The intent of this standard is not to force complete EIA-232 compliance; Rather, the intent is to establish a serial communication interface with the transmitter so that any terminal program, such as Windows® HyperTerminal, or Linux Minicom, can be used to communicate with the transmitter. A transmit (Tx) and receive (Rx) line will be supplied with an associated ground return; the choice of connector pin-out being left up to the manufacturer. The serial interface will operate at one of the common transfer rates. Typical baud rates are 9600, 19200, 38400, 57600, and 115200 baud. The default shall be 9600 baud. Should operation at another baud rate be desired, a command must be implemented to accommodate this capability. The command shall have the form TXBR as described below. Alternatively, an option can be provided to the transmitter which will override the default baud rate with another allowed rate. With the option, the unit will start up at the desired baud rate, with no command required. The baud rate command will still work to change the rate (for the duration of a session.)

    a.   Baud Rate. Serial communication baud rate shall be set with the "TXBR" mnemonic.

    b.   Set Baud Rate. Use "TXBR baudrate <CR>" where baudrate is the desired baud rate. If the command is accepted, the baud rate will change to the new baud rate and the user must change the terminal program to match it.

Table 7: Baud Rates

Command	Rate
TXBR 4800	4800
TXBR 9600	9600
TXBR 19200	19200
TXBR 38400	38400
TXBR 57600	57600
TXBR 115200	115200

Communication should be compatible with a terminal set-up consisting of one of the above baud rates with 8 data bits, 1 stop bit, 1 start bit, and no parity. ASCII characters will be transmitted and received. No hardware or software handshaking should be implemented and connector pin-out is left to the manufacturer.