Quasonix

ISO 9001:2015 Certified

Quasonix Binary Protocol for Transmitters

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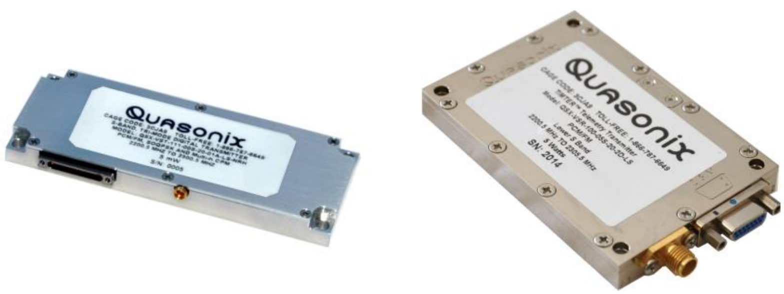

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Specifications subject to change without notice.

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1 Binary Transmitter Serial Protocol

1.1 Binary Serial Protocol

The binary serial protocol is designed to facilitate efficient machine to machine communication. The following defines the binary protocol version 1.009. Legacy binary protocol information is located in Appendix A – Legacy Binary Transmitter Serial Protocol.

Note: There is no released manual for binary protocol version 1.006 or 1.007. Version 1.006 is the same as 1.007 except for the following additions for 1.007: ASCII pass through Enable GET/SET, with the associated messages, and the BP_GET_DRAIN_V_AND_I message to read the PA drain voltage and current, where possible. Version 1.008 adds a well defined ACK for Set commands.

1.1.1 Binary Protocol Packet Definition

The binary protocol specifies the format of all packets sent or received. A binary packet is identified by the starting byte—Start of Header (SOH)— which has a value of 0x01 Hexadecimal (Hex). The general format of the packet is as follows.

Table 1: Packet Format

Byte #	Start of Header (SOH)	Description
0x00	0x01	Binary communication indicator
0x01	0x53	Device Signature (Refer to Appendix B)
0x02	0xnn	MSB payload size
0x03	0xnn	LSB payload size
0x04	Tag MSB	Binary Protocol Tag
0x05	Tag LSB	Binary Protocol Tag
0x06	Tag Length	
: :	Tag Data	Data bytes
	0xnn	MSB 16 Bit Checksum
	0xnn	LSB 16 Bit Checksum

Packet consists of:

- **Binary Start of Message**: One (1) byte used to tell the device this is the start of a binary message; SOH = 0x01 Hex
- **Device Identifier**: One (1) byte used to selectively isolate commands not intended for the device. For Quasonix transmitters, this is always 0x53.
- **Payload Size**: Two (2) bytes, MSB then LSB. The payload size is a count in bytes of the following data, which includes the two byte checksum.

- **Tag** - Tag consists of two bytes and forms the command
- **Tag Length** - Length is one byte. The length indicates how many bytes will be used for the Tag data, with a maximum size of 255 bytes.
- **Tag Data** - Data is the tag specific data, 0-255 bytes.

  Tag, **Tag Length**, and **Tag Data** may have multiple occurrences
- **Checksum**: The binary protocol uses a two (2) byte checksum. The checksum is calculated by adding each byte of the Payload Data. When calculating the Payload Checksum in software, an unsigned 16 bit variable should be used. This allows for the rollover of the variable when the calculation exceeds its maximum 0xFFFF value.

  Note: This calculation includes everything after the payload length bytes, except the final two bytes which ARE this checksum.

1.1.2 Binary Packet Errors

Errors that are detected by the protocol are Timeout, Bad Checksum, Bad Tag, Bad Tag Data, etc.

Communication with the device is done on a master / slave basis. The transmitter is the slave to any requests sent to it. After sending a binary packet to the transmitter, a binary packet response should always be received. Not receiving a response after an expected time period constitutes a communications timeout and possible loss of connection from the device. This timeout may be caused by incorrect serial communications settings and/or cabling problems. It is up to the master (system requesting data from the device) to handle any timeout conditions.

1.1.3 Sending and Receiving Multiple TLV Commands

Multiple tags can be sent together in one packet, as shown in the previous sections. The transmitter response contains corresponding tag responses. Single tags are generally simpler to work with.

Binary Packet Example: Set CS to 1.

Table 2: Binary Packet Example, Set Clock Source to Internal

Position	Byte Value	Description
0x00	0x01	SOH byte = 01h
0x01	0x53	Transmitter Device Signature
0x02	0x00	MSB payload size
0x03	0x06	LSB payload size
0x04	0x50	Tag Command MSB; Set clock source
0x05	0x09	Tag Command LSB; Set clock source
0x06	0X01	Tag Data Length
0x07	0x01	Tag Data (0 for Clock invert Off, 1 for On)
0x08	0x00	Checksum MSB
0x09	0x5B	Checksum LSB

1.2 Information Response Tags

1.2.1 BP NAK: Tag 0x0001

The BP_NAK tag response indicates that the device received a corrupt message or timed out. The received tags could not be processed by the device. This message has a zero tag data length.

Example: Checksum should be 00 44, but transmitter received 00 43

Sent BP Message: 01 53 00 05 44 00 00 00 43 (force bad checksum to see error)

Received BP Message: 01 53 00 05 00 01 00 00 01

1.2.2 BP NAK Bad ID: Tag 0x0002

The BP_NAK_BAD_ID response indicates that the device ID does not match the transmitter ID. The message is ignored and NAK Bad ID is returned. This message has a zero tag data length.

Example:

Sent BP Message: 01 54 00 05 44 00 00 00 44

Received BP Message: 01 53 00 05 00 02 00 00 02

1.2.3 BP ACK: Tag 0x0003

The BP_ACK response is not currently in use.

1.2.4 BP Unknown TAG: Tag 0x0004

The BP_UNKNOWN_TAG response indicates that the device received an unknown tag. Older devices may not support the given tag and this response will be returned. If more than one tag was sent to the device, then the remaining tags will be processed. This message has a zero tag data length.

Example:

Sent BP Message: 01 53 00 05 FF 00 01 FE

Received BP Message: 01 53 00 05 00 04 00 00 04

1.2.5 BP Invalid TAG: Tag 0x0005

The BP_INVALID_TAG response indicates that the device understood the tag but found that it was not valid for the active mode or device itself. This is the response to a command tag which is not allowed, but is known, such as DE in PCM/FM mode. This message has a zero tag data length.

1.2.6 BP Invalid TAG Data: Tag 0x0006

The BP_INVALID_TAG_DATA response indicates that the device understood the tag but found that the data was not valid for the given tag. This message has a zero tag data length. For example, command CS expects a 0 or 1. If the data is 7, this is bad tag data.

Example:

Sent BP Message: 01 53 00 06 50 09 01 07 01 61

Received BP Message: 01 53 00 05 00 06 00 00 06

1.2.7 BP Missing Option: Tag 0x0008

The BP_MISSING_OPTION response indicates that the tag requires an option that the transmitter does not have.

Example: Tried to send a SET CF (clock free) command with no CF option on the transmitter

Sent BP Message: 01 53 00 06 52 51 01 01 00 A5

Received BP Message: 01 53 00 05 00 08 00 00 08

2 Transmitter Save and Recall Command Tag Definitions

2.1 BP Save Command: Tag 0x5000

Tag BP_SAVE_CMD takes a one byte preset number to save the configuration setup. Quasonix transmitters have 16 save profile settings. Preset 0 is used for the default startup configuration.

Valid range is 0-15

Example: Save setup to preset 4

Sent Message: 01 53 00 06 50 00 01 04 00 55

Received Message: 01 53 00 06 50 00 01 04 00

2.2 BP Recall Command: Tag 0x5100

Tag BP_RECALL_CMD response has a one byte recall location. Transmitter devices have up to 15 recall profile settings. Save profile 0 is used to save the profile that the device configures to after a power cycle.

Value range is 0-15

Example: Recall setup profile 13

(Get Message) Sent Message: 01 53 00 06 51 00 01 0D 00 5F

(Get Response) Received Message: 01 53 00 06 51 00 01 0D 00 5F

Setup Profile = 13

Table 3: Transmitter Save/Recall Commands

Command	Protocol Defines	Description
BP_SAVE_CMD	0x5000	1 byte save location (0-15)
BP_RECALL_CMD	0x5100	1 byte recall location (0-15)

3 Transmitter Set Command Tag Definitions

3.1 Set Commands

This section provides all of the tag definitions for the transmitter Set commands.

The set command acknowledgement is defined as the set command tag with a tag length of 1 and a data value of 0 for success, or a non-zero value if there was any error that did NOT cause an error tag to replace the set tag.

3.1.1 BP Set Mode: Tag 0x5001

Tag BP_SET_MODE has a length of 1 byte. Table 4 lists valid modes. Note that Mode is sent as one byte, in hexadecimal, so Mode 1 is 0x01, Mode 6 is 0x06, and Mode 13 is 0x0D.

Example: Send a Set command to change mode to PCM/FM (0)

(Set Message) Sent BP Message: 01 53 00 06 50 01 01 00 00 52

(Set Response) Received BP Message: 01 53 00 06 50 01 01 00 00 52 (Ack, no error)

Table 4: Set Mode Descriptions

Mode	Waveform/Mode	Mode	Waveform/Mode
0	PCMFM	8	UQPSK
1	SOQPSK	9	AUQPSK
2	MHCPM	10	STDN
3	BPSK	11	SQPN
4	QPSK	12	AFM
5	AQPSK	13	STC (Dual Transmitter Only
6	Carrier Only	14	DPM
7	OQPSK		

3.1.2 BP Set Clock-free Bit Rate: Tag 0x5002

Tag BP_SET_CF_BR has a length of five bytes, in hexadecimal: one byte is N (for normal) or A (for auto), and four bytes for the bit rate. The byte value is in bps.

Example: Set Clock-free Bit Rate to 7.5 Mbps (Normal) = 7500000 bps = 00 72 70 e0h

(Set Message) Sent BP Message: 01 53 00 0A 50 02 05 4E 00 72 70 E0 02 67

(Set Response) Received BP Message: 01 53 00 06 50 02 01 00 00 53 (Ack, no error)

3.1.3 BP Set Data Polarity: Tag 0x5003

Tag BP_SET_DATA_POL has a length of one byte.

- A value of 0 sets normal data polarity.
- A value of 1 sets inverted data polarity.

Example: Set Data Polarity to inverted

(Set Message) Sent BP Message: 01 53 00 06 50 03 01 01 00 55

(Set Response) Received BP Message: 01 53 00 06 50 03 01 00 00 54 (Ack, no error)

3.1.4 BP Set Clock Polarity: Tag 0x5004

Tag BP_SET_CLOCK_POL has a length of one byte. Not valid on a Dual Transmitter; clock polarity is always Auto

- A value of 0 sets normal clock polarity.
- A value of 1 sets inverted clock polarity.
- A value of A sets clock polarity to automatic. If automatic, the software selects the most reliable clock edge. Letter A = 41h

Example: Set Clock Polarity to automatic

(Set Message) Sent BP Message: 01 53 00 06 50 04 01 41 00 96

(Set Response) Received BP Message: 01 53 00 06 50 04 01 00 00 55 (Ack, no error)

3.1.5 BP Set Frequency: Tag 0x5005

Tag BP_SET_FREQ has a length of 5 bytes. The frequency is defined in Hz.

Example: Set the frequency to 2200.5 MHz = 2200500000 Hz = 00 8328 F720h

(Set Message) Sent BP Message: 01 53 00 0A 50 05 05 00 83 28 F7 20 02 1C

(Set Response) Received BP Message: 01 53 00 06 50 05 01 00 00 56 (Ack, no error)

3.1.6 BP Set Randomizer On: Tag 0x5506

Tag BP_SET_RAND_On has a length of one byte.

- A value of 0 sets randomizer Off.
- A value of 1 sets IRIG-106 randomizer On.
- A value of 2 sets CCSDS randomizer On. (Only valid when LDPC is enabled)

Example: Set IRIG-106 randomizer On

(Set Message) Sent BP Message: 01 53 00 06 50 06 01 01 00 58

(Set Response) Received BP Message: 01 53 00 06 50 06 01 00 00 57 (Ack, no error)

3.1.7 BP Set Differential Encoding: Tag 0x5007

Tag BP_SET_DIFF_ENCODE has a length of one byte. If the mode does not support Differential Encoding, Bad Tag Data is returned.

- A value of 0 sets differential Off.
- A value of 1 set differential On.

Example: Set Differential Encoding On

(Set Message) Sent BP Message: 01 53 00 06 50 07 01 01 00 59

(Set Response) Received BP Message: 01 53 00 06 50 07 01 00 00 58 (Ack, no error)

3.1.8 BP Set RF On: Tag 0x5008

Tag BP_SET_RF_ON has a length of one byte.

- A value of 0 sets RF output Off.
- A value of 1 sets RF output On.

Example: Set RF to Off

(Set Message) Sent BP Message: 01 53 00 06 50 08 01 00 00 59

(Set Response) Received BP Message: 01 53 00 06 50 08 01 00 00 59 (Ack, no error)

3.1.9 BP Set Clock Source: Tag 0x5009

Tag BP_SET_CLOCK_SOURCE has a length of one byte.

- A value of 0 sets clock source to external.
- A value of 1 sets clock source to internal.

Example: Set Clock Source to internal (1)

(Set Message) Sent BP Message: 01 53 00 06 50 09 01 01 00 5B

(Set Response) Received BP Message: 01 53 00 06 50 09 01 00 00 5A (Ack, no error)

3.1.10 BP Set Internal Clock: Tag 0x500A

Tag BP_SET_INT_CLOCK has a length of 4 bytes. The internal bit rate is defined in bits per second (bps).

Valid range is 0.002 MHz – 46.000 MHz

Example: Set Internal Clock to 8.13 MHz = 8130000 Hz = 007C 0DD0h

(Set Message) Sent BP Message: 01 53 00 09 50 0A 04 00 7C 0D D0 01 B7

(Set Response) Received BP Message: 01 53 00 06 50 0A 01 00 00 5B (Ack, no error)

3.1.11 BP Set Data Source: Tag 0x500B

Tag BP_SET_DATA_SOURCE has a length of one byte. This command is not supported by Dual Transmitters. When Clock Source is set, Data Source is automatically set on a Dual Transmitter.

- A value of 0 indicates data source is external.
- A value of 1 indicates data source is internal.

Example: Set Data Source to internal (1)

(Set Message) Sent BP Message: 01 53 00 06 50 0B 01 01 00 5D

(Set Response) Received BP Message: 01 53 00 06 50 0B 01 00 00 5C (Ack, no error)

3.1.12 BP Set Internal Data: Tag 0x500C

Tag BP_SET_INT_DATA has a length of six bytes. The first byte indicates one of the standard Dual Transmitter pattern codes shown in Table 5, followed by four bytes for the pattern, then one byte for the length of the pattern, in bits. Table 6 shows the single transmitter pattern codes.

Table 5: Dual TX Set Internal Data Pattern Bit Descriptions

Bit Command Name	Protocol Defines
BP_USER_PATTERN (1 to 32 bits)	0x00
BP_MARK_PATTERN	0x01
BP_SPACE_PATTERN	0x02
BP_ALT01_PATTERN	0x03
BP_PN6_PATTERN	0x04
BP_PN9_PATTERN	0x05
BP_PN11_PATTERN	0x06
BP_PN15_PATTERN	0x07
BP_PN17_PATTERN	0x08
BP_PN20_PATTERN	0x09
BP_PN23_PATTERN	0x0A
BP_PN31_PATTERN	0x0B

Table 6: Single TX Set Internal Data Pattern Bit Descriptions

Bit Command Name	Protocol Defines
BP_PN6_PATTERN	0x00
BP_PN06_PATTERN	0x01
BP_PN11_PATTERN	0x02
BP_PN15_PATTERN	0x03
BP_PN23_PATTERN	0x04
BP_USER_PATTERN (16 bits)	0x05

Example: Set Internal Data Pattern to PN23 using 32 for the bit length (even though fixed patterns don't use it)

(Set Message) Sent BP Message: 01 53 00 0B 50 0C 06 0C 00 00 00 00 20 00 8E

(Set Response) Received BP Message: 01 53 00 06 50 0C 01 00 00 5D (Ack, no error)

3.1.13 BP Set Frequency Step: Tag 0x500D

Tag BP_SET_FREQSTEP has a length of five bytes, in hexadecimal. The frequency is defined in Hz.

Example: Set the Frequency Step to 7.5 MHz = 7500000 Hz = 00 0072 70E0h

(Set Message) Sent BP Message: 01 53 00 0A 50 0D 05 00 00 72 70 E0 02 24

(Set Response) Received BP Message: 01 53 00 06 50 0D 01 00 00 5E (Ack, no error)

3.1.14 BP Set Variable Power New: Tag 0x500F

Tag BP_SET_VAR_POWER has a length of three bytes, in ASCII, with implied decimal, XX.X. Valid range is 0 to 31 in 1 dB steps, or 31.5 in 0.5 dB steps, depending on the transmitter.

Example: Set Variable Power New to 27.5 dB

(Set Message) Sent BP Message: 01 53 00 08 50 0F 03 32 37 35 01 00

(Set Response) Received BP Message: 01 53 00 06 50 0F 01 00 00 60 (Ack, no error)

3.1.15 BP Set High Power Level: Tag 0x5010

Tag BP_SET_HP_LEVEL has a length of three bytes, in ASCII, with implied decimal, XX.X. Valid range is 0 to 31 in 1 dB steps, or 31.5 in 0.5 dB steps, depending on the transmitter.

Example: Set High Power Level to 13 dB

(Set Message) Sent BP Message: 01 53 00 08 50 10 03 31 33 30 00 F7

(Set Response) Received BP Message: 01 53 00 06 50 10 01 00 00 61 (Ack, no error)

3.1.16 BP Set Low Power Level: Tag 0x5011

Tag BP_SET_LP_LEVEL has a length of three bytes, in ASCII, with implied decimal, XX.X. Valid range is 0 to 31 in 1 dB steps, or 31.5 in 0.5 dB steps, depending on the transmitter.

Example: Set Low Power Level to 4.5 dB

(Set Message) Sent BP Message: 01 53 00 08 50 11 03 30 34 35 00 FD

(Set Response) Received BP Message: 01 53 00 06 50 11 01 00 00 62 (Ack, no error)

3.1.17 BP Set Low Density Parity Check State: Tag 0x5012

Tag BP_SET_LDPC_STATE has a length of two bytes. The first byte indicates the enable (one) or disable (zero) state. The second byte is the LDPC code. Valid code range is 0 through 5, as shown in Table 7.

Example: Set LDPC to On with LDPC code 4 (4096 4/5)

(Set Message) Sent BP Message: 01 53 00 07 50 12 02 01 04 00 69

(Set Response) Received BP Message: 01 53 00 06 50 12 01 00 00 63 (Ack, no error)

Table 7: LDPC Codes

LD6 Code	Block Size and Code Rate
0	k=4096, r=1/2
1	k=1024, r=1/2
2	k=4096, r=2/3
3	k=1024, r=2/3
4	k=4096, r=4/5

LD6 Code	Block Size and Code Rate
5	k=1024, r=4/5

3.1.18 BP Set Convolutional Encoding State: Tag 0x5013

Tag BP_SET_CC_STATE has a length of one byte.

- A value of 0 disables convolutional encoding.
- A value of 1 enables convolutional encoding.

Example: Set Convolutional Encoding to enabled (1)

(Set Message) Sent BP Message: 01 53 00 06 50 13 01 01 00 65

(Set Response) Received BP Message: 01 53 00 06 50 13 01 00 00 64 (Ack, no error)

3.1.19 BP Set NRZ-M Encoding State: Tag 0x5014

Tag BP_SET_MC_STATE has a length of one byte.

- A value of 0 disables NRZ encoding.
- A value of 1 enables NRZ encoding.

Example: Set NRZ encoding to disabled (0)

(Set Message) Sent BP Message: 01 53 00 06 50 14 01 00 00 65

(Set Response) Received BP Message: 01 53 00 06 50 14 01 00 00 65 (Ack, no error)

3.1.20 BP Set Channel Delay Enable State: Tag 0x5015

Tag BP_SET_CDE_STATE has a length of one byte. This command is valid on Dual Transmitters only.

- A value of 0 indicates channel delay is disabled.
- A value of 1 indicates channel delay is enabled.

Example: Set Channel Delay to enabled (1)

(Set Message) Sent BP Message: 01 53 00 06 50 15 01 01 00 67

(Set Response) Received BP Message: 01 53 00 06 50 15 01 00 00 66 (Ack, no error)

3.1.21 BP Set Channel Delay Value: Tag 0x5016

Tag BP_SET_CD_VALUE has a length of three bytes in 0.01 nanosecond or hundredths of nanoseconds. This command is valid on Dual Transmitters only.

Valid range is 0 to 5000.00 ns.

Example: Set Channel Delay Value to 42.00 ns = 4200 hundredths of nanoseconds = 00 1068h

(Set Message) Sent BP Message: 01 53 00 08 50 16 03 00 10 68 00 E1

(Set Response) Received BP Message: 01 53 00 06 50 16 01 00 00 67 (Ack, no error)

3.1.22 BP Set Modulation Scaling Value: Tag 0x5017

Tag BP_SET_MS_VALUE has a length of five bytes, in ASCII, with implied decimal, XXX.XX. Valid range is 0.09 to 128.01.

Example: Set Modulation Scaling to 21 = 021.00 (implied decimal) = 30 32 31 30 30

(Set Message) Sent BP Message: 01 53 00 0A 50 17 05 30 32 31 30 30 01 5F

(Set Response) Received BP Message: 01 53 00 06 50 17 01 00 00 68 (Ack

3.1.23 BP Set Automatic Carrier Output Enable: Tag 0x5250

Tag BP_SET_AC_ENABLE has a length of one byte.

- A value of 0 indicates automatic carrier output is Off/disabled.
- A value of 1 indicates automatic carrier output is On/enabled.

Example: Set Automatic Carrier Output to On/enabled (1)

(Set Message) Sent BP Message: 01 53 00 06 52 50 01 01 00 A4

(Set Response) Received BP Message: 01 53 00 06 52 50 01 00 00 A3 (Ack, no error)

3.1.24 BP Set Clock Free Disable: Tag 0x5251

Tag BP_SET_CF_DISABLE has a length of one byte.

- A value of 0 indicates clock free operation is enabled (uses the internal bit sync)
- A value of 1 indicates clock free operation is disabled; normal operation with an external clock

Example: Set Clock Free operation to disabled (1)

(Set Message) Sent BP Message: 01 53 00 06 52 51 01 01 00 A5

(Set Response) Received BP Message: 01 53 00 06 52 51 01 00 00 A4 (Ack, no error)

3.1.25 BP Set RF On/Off Pin Polarity State: Tag 0x5252

Tag BP_SET_RZ_STATE has a length of one byte.

- A value of 0 indicates RF On when pin is low.
- A value of 1 indicates RF On when pin is high or left unconnected.

Example: Set RF On/Off Pin value to 1 (high)

(Set Message) Sent BP Message: 01 53 00 06 52 52 01 01 00 A6

(Set Response) Received BP Message: 01 53 00 06 52 52 01 00 00 A5 (Ack, no error)

3.1.26 BP Set Overtemperature Control State: Tag 0x5253

Tag BP_SET_OC_STATE has a length of one byte.

- A value of 0 indicates overtemperature control is Off/disabled.
- A value of 1 indicates overtemperature control is On/enabled.

Example: Set the Overtemperature Control to On/enabled (1)

(Set Message) Sent BP Message: 01 53 00 06 52 53 01 01 00 A7

(Set Response) Received BP Message: 01 53 00 06 52 53 01 00 00 A6 (Ack, no error)

3.1.27 BP Set ASCII Passthrough Enable: Tag 0x5254

Tag BP_SET_BP_PASSTHRU_ENABLE has a length of one byte. All subsequent terminal output messages are encapsulated in binary protocol packets and sent to the "master," until an Escape is entered at the terminal, or Asc Passthru is set to (0) Off/disabled.

- A value of 0 indicates binary protocol passthrough is Off/disabled.
- A value of 1 indicates binary protocol passthrough is On/enabled.

Example: Set the binary protocol passthrough to enabled (1)

(Set Message) Sent BP Message: 01 53 00 06 52 54 01 01 00 A8

(Set Response) Received BP Message: 01 53 00 06 52 54 01 00 00 A7 (Ack, no error)

3.1.28 BP Set Dual Transmitter Channel: Tag 0x5400

Tag BP_DTX_SET_CHANNEL has a length of one byte. This command is valid on Dual Transmitters only.

- A value of 1 indicates channel 1.
- A value of 2 indicates channel 2.
- A value of 3 indicates channel 1 and channel 2.

Example: Set dual transmitter channel to 2

(Set Message) Sent BP Message: 01 53 00 06 54 00 01 02 00 57

(Set Response) Received BP Message: 01 53 00 06 54 00 01 00 00 55 (Ack, no error)

3.1.29 BP Send ASCII Passthrough Message: Tag 0x5401

Tag BP_SEND_ASCII_PASSTHRU_MSG has a length dependent on the ASCII command being sent. Requires ASCII Passthru set to enabled (1) or the command is ignored.

Example: Send FR command (not case sensitive) = Length 4, Data = f r CR LF

(Set Message) Sent BP Message: 01 53 00 09 54 01 04 66 72 0D 0A 01 48

(Set Response) Received BP Message: 01 53 00 05 54 01 00 00 55 (Ack, no error)

3.1.30 BP ASCII Passthrough Message: Tag 0x5402

The BP_ASCII_PASSTHRU_MSG tag is sent by the transmitter for any message that would normally display in a Transmitter Terminal screen. Since ASCII Passthrough is enabled, it is a binary protocol encapsulated response.

This is an ASCII passthrough message.

Example: Response to ASCII Send in section 3.1.29 of FR <CR>

(Set Response) Received BP Message (for the first line displayed): 01 53 00 27 54 02 22 43 68 61 6E 20 32 20 46 72 65 71 20 63 75 72 72 65 6E 74 6C 79 20 34 34 34 33 2E 30 20 4D 48 7A 0A 0D 0A 8D

Chan 2 Freq currently 4443.0 MHz <LF><CR>

(Set Response) Received BP Message (for the second line displayed): 01 53 00 0E 54 02 09 32 5F 53 4F 51 50 53 4B 3E 03 0F

2_SOQPSK>

3.2 Set Command Summary

The transmitter information responses are described in Table 23.

Table 8: Transmitter Information Responses

Response Codes	Protocol Defines	Description
BP_NAK	0x0001	Corrupt Message (Bad Checksum or Timeout)
BP_NAK_BAD_ID	0x0002	Bad Device ID
BP_ACK	0x0003	Not Currently Used
BP_UNKNOWN_TAG	0x0004	Unknown TAG in tag field
BP_INVALID_TAG	0x0005	TAG not valid for this mode or device
BP_INVALID_TAG_DATA	0x0006	Data was not valid for this TAG
BP_MISSING_OPTION	0x0008	Tag requires option the unit doesn't have

The transmitter SET commands are summarized in Table 24.

Table 9: Transmitter SET Commands

SET Command	Protocol Defines	Description
BP_SET_MODE	0x5001	1 byte mode number
BP_SET_CF_BR	0x5002	1 byte N or A (normal or auto), plus 4 bytes hex, in bps
BP_SET_DATA_POL	0x5003	1 byte binary (0 or 1)
BP_SET_CLOCK_POL	0x5004	1 byte binary (0 or 1 or A); Not valid in Dual Transmitter
BP_SET_FREQ	0x5005	5 bytes hex, in Hz
BP_SET_RAND_On	0x5006	1 byte binary (0, 1, or 2)
BP_SET_DIFF_ENCODE	0x5007	1 byte binary (0 or 1)
BP_SET_RF_On	0x5008	1 byte binary (0 or 1)
BP_SET_CLOCK_SOURCE	0x5009	1 byte binary (0 or 1)
BP_SET_INT_CLOCK	0x500A	4 bytes hex, in bps
BP_SET_DATA_SOURCE	0x500B	1 byte binary (0 or 1); Not valid on Dual Transmitter

SET Command	Protocol Defines	Description
BP_SET_INT_DATA	0x500C	1 byte pattern code, plus 4 hex bytes pattern, plus 1 byte user pattern length in bits
BP_SET_FREQSTEP	0x500D	5 bytes hex, in Hz
BP_SET_VAR_POWER_NEW	0x500F	3 bytes ASCII with implied decimal, XX.X
BP_SET_HP_LEVEL	0x5010	3 bytes ASCII with implied decimal, XX.X
BP_SET_LP_LEVEL	0x5011	3 bytes ASCII with implied decimal, XX.X
BP_SET_LDPC_STATE	0x5012	2 bytes: 1 byte state, 1 byte code
BP_SET_CC_STATE	0x5013	1 byte binary (0 or 1)
BP_SET_MC_STATE	0x5014	1 byte binary (0 or 1)
BP_SET_CDE_STATE	0x5015	1 byte binary (0 or 1); Valid on Dual Transmitters only
BP_SET_CD_VALUE	0x5016	3 hex bytes in 0.01 ns units; Dual Transmitters only
BP_SET_MS_VALUE	0x5017	5 bytes ASCII with implied decimal, XXX.XX
BP_SET_AC_ENABLE	0x5250	1 byte binary (0 or 1)
BP_SET_CF_DISABLE	0x5251	1 byte binary (0 or 1)
BP_SET_RZ_STATE	0x5252	1 byte binary (0 or 1)
BP_SET_OC_STATE	0x5253	1 byte binary (0 or 1)
BP_DTX_SET_CHANNEL	0x5400	1 byte binary (1, 2, or 3); Dual Transmitters only

4 Transmitter Get Command Tag Definitions

4.1 Get Commands

This section provides all of the tag definitions for the transmitter Get commands.

Get Tag messages sent to the transmitter ALL have a length of zero (0). The following sections describe the Get Responses, which are NOT zero.

4.1.1 BP Get Binary Protocol Version: Tag 0x4000

Tag BP_GET_BP_VERSION response has a length of four bytes, in ASCII, with an implied decimal, X.XXXX.

Example:

(Get Message) Sent Message: 01 53 00 05 40 00 00 00 40

(Get Response) Received Message: 01 53 00 09 40 00 04 31 30 30 36 01 0B

Binary Protocol Version = 1.006

4.1.2 BP Get Device Model Number: Tag 0x4001

Tag BP_GET_DEVICE_MODELNUM response returns the model number as it is stored on the transmitter. The length may vary, but is always in the Tag length byte (as shown underlined in the response below). This is the Quasonix internal model number, not the customer part number. Use ASCII Passthru to display the customer part number.

Example:

(Get Message) Sent Message: 01 53 00 05 40 01 00 00 41

(Get Response) Received Message: 01 53 00 2A 40 01 25 51 53 58 2D 56 45 52 2D 31 31 31 2D 31 30 53 2D 32 30 2D 50 4B 47 2D 56 50 2D 53 54 43 2D 53 42 53 2D 4C 44 36 09 AD

Model Number = QSX-VER-111-10S-20-PKG-VP-STC-SBS-LD6

4.1.3 BP Get Device Serial Number: Tag 0x4002

Tag BP_GET_DEVICE_SERNUM response returns the serial number as it is stored on the transmitter. The length may vary, but is always in the Tag length byte (as shown underlined in the response below).

Example:

(Get Message) Sent Message: 01 53 00 05 40 02 00 00 42

(Get Response) Received Message: 01 53 00 0B 40 02 06 31 30 30 31 0A 0D 01 21

Serial Number = 1001 <LF> <CR>

4.1.4 BP Get Software Version: Tag 0x4003

Tag BP_GET_SOFTWARE_VER response has a variable length of ASCII bytes based on the length of the software version.

Example:

(Get Message) Sent Message: 01 53 00 05 40 03 00 00 43

(Get Response) Received Message: 01 53 00 30 40 03 2B 44 75 61 6C 20 54 58 20 46 69 72 6D 77 61 72 65 20 52 65 76 3A 20 44 54 58 20 56 31 2E 32 30 34 20 20 31 2F 31 30 2F 32 30 31 39 0C 1B

Software Version = Dual TX Firmware Rev: DTX V1.204 1/10/2019

4.1.5 BP Get FPGA Version: Tag 0x4004

Tag BP_GET_FPGA_VER response returns the FPGA version as it is stored on the transmitter. The length may vary, but is always in the Tag length byte (as shown underlined in the response below).

Example:

(Get Message) Sent Message: 01 53 00 05 40 04 00 00 44

(Get Response) Received Message: 01 53 00 1C 40 04 17 44 54 58 20 46 50 47 41 20 52 65 76 3A 20 30 30 30 68 20 30 31 31 68 06 42

FPGA Version = DTX FPGA Rev: 000h 011h

4.1.6 BP Get Available Modes: Tag 0x4100

Tag BP_GET_AVAIL_MODES response has a length of two bytes, in binary. Each valid mode is one bit, as shown in Table 26.

Example:

(Get Message) Sent Message: 01 53 00 05 41 00 00 00 41

(Get Response) Received Message: 01 53 00 07 41 00 02 20 47 00 AA

Available Modes = 0 1 2 6 13

Table 10: BP Get Available Modes Bit Definitions

Bit Command Name	Protocol Defines	Waveform (Mode) Description
BP_PCMFM_MODE_BIT	0x0001	PCMFM
BP_SOQPSK_MODE_BIT	0x0002	SOQPSK
BP_MHCPM_MODE_BIT	0x0004	MHCPM
BP_BPSK_MODE_BIT	0x0008	BPSK
BP_QPSK_MODE_BIT	0x0010	QPSK
BP_AQPSK_MODE_BIT	0x0020	AQPSK
BP_CARRIER_ONLY_MODE_BIT	0x0040	Carrier only
BP_OQPSK_MODE_BIT	0x0080	OQPSK

Bit Command Name	Protocol Defines	Waveform (Mode) Description
BP_UQPSK_MODE_BIT	0x0100	UQPSK
BP_AUQPSK_MODE_BIT	0x0200	AUQPSK
BP_STDN_MODE_BIT	0x0400	Spacecraft Tracking and Data Network or PM/BPSK
BP_SQPN_MODE_BIT	0x0800	Staggered Quadrature Pseudo-random Noise
BP_AFM_MODE_BIT	0x1000	Analog FM
BP_STC_MODE_BIT	0x2000	Space Time Coding (STC) (Dual Transmitter Only)
BP_DPM_MODE_BIT	0x4000	Digital Phase Modulation (DPM)

4.1.7 BP Get Bit Rate Range: Tag 0x4101

Tag BP_GET_BITRATE_RANGE response has a length of eight bytes, in hexadecimal. The first four bytes are the minimum bit rate, and the second four bytes are the maximum bit rate. The bit rate is in bits per second (bps).

Example: With Mode set to 1 (SOQPSK), a GET Bit Rate Range command was sent:

(Get Message) Sent Message: 01 53 00 05 41 01 00 00 42

(Get Response) Received Message: 01 53 00 0D 41 01 08 00 01 24 F8 03 04 18 40 01 C6

Allowed Bit Rate Range (in bps): Bit Rate Minimum = 0.075, Bit Rate Maximum = 50.600

0.075 Mbps = 75000 bps = 000124F8h
50.6 Mbps = 50,600,000 bps = 03041840h

4.1.8 BP Get Frequency Bands: Tag 0x4104

Tag BP_GET_FREQ_BANDS response has a length of two bytes, in hexadecimal. The frequency bands are defined by their associated band letter. Each band is one bit, as shown in Table 11.

Example:

(Get Message) Sent Message: 01 53 00 05 41 04 00 00 45

(Get Response) Received Message: 01 53 00 07 41 04 02 00 7B 00 C2

Frequency Bands Allowed = L U LS US C MC

Table 11: BP Get Frequency Bands Bit Descriptions

Command	Protocol Defines
BP_L_BAND_BIT	0x0001
BP_U_BAND_BIT	0x0002
BP_M_BAND_BIT	0x0004

Command	Protocol Defines
BP_LS_BAND_BIT	0x0008
BP_US_BAND_BIT	0x0010
BP_C_BAND_BIT	0x0020
BP_MC_BAND_BIT	0x0040
BP_EX_BAND_BIT	0x0080

4.1.9 BP Get L Band Range: Tag 0x4105

Tag BP_GET_L_BAND_RANGE response has a length of ten (10) bytes, in hexadecimal. The first five bytes are the minimum band frequency, and the second five bytes are the maximum band frequency. The frequency is defined in Hz.

Example:

(Get Message) Sent Message: 01 53 00 05 41 05 00 00 46

(Get Response) Received Message: 01 53 00 0F 41 05 0A 00 55 8F FD E0 00 5B 76 9C A0 05 1E

L Band Range: Frequency Minimum 00 55 8F FD E0 = 1435500000 Hz = 1435.500 MHz

Frequency Maximum 00 5B 76 9C A0 = 1534500000 Hz = 1534.500 MHz

4.1.10 BP Get U Band Range: Tag 0x4106

Tag BP_GET_U_BAND_RANGE response has a length of ten (10) bytes, in hexadecimal. The first five bytes are the minimum band frequency, and the second five bytes are the maximum band frequency. The frequency is defined in Hz.

Example:

(Get Message) Sent Message: 01 53 00 05 41 06 00 00 47

(Get Response) Received Message: 01 53 00 0F 41 06 0A 00 68 4E E1 80 00 6E 91 0D C0 04 34

U Band (Upper L) Range: Frequency Minimum 00 68 4E E1 80 = 175000000 Hz = 1750.000 MHz

Frequency Maximum 00 6E 91 0D C0 = 1855000000 Hz = 1855.000 MHz

4.1.11 BP Get M Band Range: Tag 0x4107

Tag BP_GET_M_BAND_RANGE response has a length of ten (10) bytes, in hexadecimal. The first five bytes are the minimum band frequency, and the second five bytes are the maximum band frequency. The frequency is defined in Hz.

Example:

(Get Message) Sent Message: 01 53 00 05 41 07 00 00 48

(Get Response) Received Message: 01 53 00 0F 41 07 0A 00 78 B3 0C 40 00 7D C4 0B 80 03 95

M Band Range: Frequency Minimum 00 78 B3 0C 40 = 2025000000 Hz = 2025.000 MHz

Frequency Maximum 00 7D C4 0B 80 = 2100000000 Hz = 2110.000 MHz

4.1.12 BP Get LS Band Range: Tag 0x4108

Tag BP_GET_LS_BAND_RANGE response has a length of ten (10) bytes, in hexadecimal. The first five bytes are the minimum band frequency, and the second five bytes are the maximum band frequency. The frequency is defined in Hz.

Example:

(Get Message) Sent Message: 01 53 00 05 41 08 00 00 49

(Get Response) Received Message: 01 53 00 0F 41 08 0A 00 83 28 F7 20 00 89 1E D8 20 03 B4

LS Band (Lower S) Range: Frequency Minimum 00 83 28 F7 20 = 2200500000 Hz = 2200.500 MHz

Frequency Maximum 00 89 1E D8 20 = 2300500000 Hz = 2300.500 MHz

4.1.13 BP Get US Band Range: Tag 0x4109

Tag BP_GET_US_BAND_RANGE response has a length of ten (10) bytes, in hexadecimal. The first five bytes are the minimum band frequency, and the second five bytes are the maximum band frequency. The frequency is defined in Hz.

Example:

(Get Message) Sent Message: 01 53 00 05 41 09 00 00 4A

(Get Response) Received Message: 01 53 00 0F 41 09 0A 00 89 1E D8 20 00 8E B9 2B A0 04 05

US Band (Upper S) Range: Frequency Minimum 00 89 1E D8 20 = 2300500000 Hz = 2300.500 MHz

Frequency Maximum 00 8E B9 2B A0 = 2394500000 Hz = 2394.500 MHz

4.1.14 BP Get C Band Range: Tag 0x410A

Tag BP_GET_C_BAND_RANGE response has a length of ten (10) bytes, in hexadecimal. The first five bytes are the minimum band frequency, and the second five bytes are the maximum band frequency. The frequency is defined in Hz.

Example:

(Get Message) Sent Message: 01 53 00 05 41 0A 00 00 4B

(Get Response) Received Message: 01 53 00 0F 41 0A 01 06 42 AC 00 01 27 0B 01 80 01 FE

C Band Range: Frequency Minimum = 4400000000 Hz = 4400.000 MHz

Frequency Maximum = 4950000000 Hz = 4950.000 MHz

4.1.15 BP Get MC Band Range: Tag 0x410B

Tag BP_GET_MC_BAND_RANGE response has a length of ten (10) bytes, in hexadecimal. The first five bytes are the minimum band frequency, and the second five bytes are the maximum band frequency. The frequency is defined in Hz.

Example:

(Get Message) Sent Message: 01 53 00 05 41 0B 00 00 4C

(Get Response) Received Message: 01 53 00 0F 41 0B 0A 01 2F 72 7E C0 01 32 F6 C3 80 04 A2

MC Band (Mid-C) Range: Frequency Minimum 01 2F 72 7E C0 = 5091000000 Hz = 5091.000 MHz

Frequency Maximum 01 32 F6 C3 80 = 5150000000 Hz = 5150.000 MHz

4.1.16 BP Get EX Band Range: Tag 0x410C

Tag BP_GET_EX_BAND_RANGE response has a length of ten (10) bytes, in hexadecimal. The first five bytes are the minimum band frequency, and the second five bytes are the maximum band frequency. The frequency is defined in Hz.

Example:

(Get Message) Sent Message: 01 53 00 05 41 0C 00 00 4D

(Get Response) Received Message: 01 53 00 0F 41 0C 0A 01 32 F6 C3 80 01 38 EC A4 80 05 0C

EX Band (Extended/Euro Mid-C) Range: Frequency Minimum 01 32 F6 C3 80 = 5150000000 Hz = 5150.000 MHz
Frequency Maximum 01 38 EC A4 80 = 5250000000 = 5250.000

4.1.17 BP Get Mode: Tag 0x4201

Tag BP_GET_MODE response has a one byte mode number. The available Quasonix modes are listed in Table 12.

Example:

(Get Message) Sent Message: 01 53 00 05 42 01 00 00 43

(Get Response) Received Message: 01 53 00 06 42 01 01 01 00 45

Current Mode = 1

Table 12: Quasonix TX Mode Descriptions

Mode	Waveform/Mode
0	PCMFM
1	SOQPSK
2	MHCPM
3	BPSK
4	QPSK
5	AQPSK
6	Carrier Only
7	OQPSK
8	UQPSK

Mode	Waveform/Mode
9	AUQPSK
10	STDN
11	SQPN
12	AFM
13	STC
14	DPM

4.1.18 BP Get Clock Free Bit Rate: Tag 0x4202

Tag BP_GET_CF_BR response has a length of five (5) bytes, in hexadecimal: one byte is N (for normal) or A (for auto), and four bytes for the bit rate in bits per second (bps).

Example:

(Get Message) Sent Message: 01 53 00 05 42 02 00 00 44

(Get Response) Received Message: 01 53 00 0A 42 02 05 4E 00 4C 4B 40 01 6E

Clock Free Bit Rate (Br) = 00 4C 4B 40 = 5000000 bps = 5.000 Mbps (Normal)

4.1.19 BP Get Data Polarity: Tag 0x4203

Tag BP_GET_DATA_POL response has a length of one byte.

- A value of 0 indicates normal data polarity.
- A value of 1 indicates inverted data polarity.

Example:

(Get Message) Sent Message: 01 53 00 05 42 03 00 00 45

(Get Response) Received Message: 01 53 00 06 42 03 01 00 00 46

Data Polarity = 0 (Normal)

4.1.20 BP Get Clock Polarity: Tag 0x4204

Tag BP_GET_CLOCK_POL response has a length of one byte, in binary. (This command is not supported by Dual Transmitters. Clock Polarity is always set to Automatic on Dual Transmitters.) If clock polarity was set to automatic, the software selects the most reliable clock edge.

- A value of 0 indicates normal clock polarity.
- A value of 1 indicates inverted clock polarity.
- A value of A sets clock polarity to automatic. If automatic, the software selects the most reliable clock edge. Letter A = 41h

Example:

(Get Message) Sent Command: 01 53 00 05 42 04 00 00 46

(Get Response) Received Command: 01 53 00 06 42 04 01 00 00 47

Clock Polarity = 0 (Normal)

4.1.21 BP Get Frequency: Tag 0x4205

Tag BP_GET_FREQ response has a length of five (5) bytes, in hexadecimal. The frequency is defined in Hz.

Example:

(Get Message) Sent Command: 01 53 00 05 42 05 00 00 47

(Get Response) Received Command: 01 53 00 0A 42 05 05 00 87 A1 5F E0 02 B3

Frequency 00 87 A1 5F E0 = 2275500000 Hz = 2275.500 MHz

4.1.22 BP Get Randomizer On: Tag 0x4206

Tag BP_GET_RAND_On response has a length of one byte, in binary.

- A value of 0 indicates randomizer Off.
- A value of 1 indicates IRIG-106 randomizer On.
- A value of 2 indicates CCSDS randomizer On.

Example:

(Get Message) Sent Command: 01 53 00 05 42 06 00 00 48

(Get Response) Received Command: 01 53 00 06 42 06 01 00 00 49

Randomizer = 0 (Off)

4.1.23 BP Get Differential Encoding: Tag 0x4207

Tag BP_GET_DIFF_ENCODE response has a length of one byte, in binary.

- A value of 0 indicates differential Off.
- A value of 1 indicates differential On.

Example:

(Get Message) Sent Command: 01 53 00 05 42 07 00 00 49

(Get Response) Received Command: 01 53 00 06 42 07 01 01 00 4B

Differential Encoding = 1 (On)

4.1.24 BP Get RF State: Tag 0x4208

Tag BP_GET_RF_STATE response has a length of two bytes. One byte is for the RF setting, and the other byte is the actual RF state.

- A value of 0 indicates RF output Off/disabled.
- A value of 1 indicates RF output On/enabled.

Example:

(Get Message) Sent Message: 01 53 00 05 42 08 00 00 4A

(Get Response) Received Message: 01 53 00 07 42 08 02 00 00 00 4C

RF On State = 0 (Off), Actual RF = Off

4.1.25 BP Get Clock Source: Tag 0x4209

Tag BP_GET_CLOCK_SOURCE response has a length of one byte, in binary.

- A value of 0 indicates clock source is external.
- A value of 1 indicates clock source is internal.

Example:

(Get Message) Sent Message: 01 53 00 05 42 09 00 00 4B

(Get Response) Received Message: 01 53 00 06 42 09 01 00 00 4C

Clock Source = 0 (External)

4.1.26 BP Get Internal Clock: Tag 0x420A

Tag BP_GET_INT_CLOCK response has a length of four bytes, in hexadecimal. The returned internal bit rate is in bits per second.

Example:

(Get Message) Sent Message: 01 53 00 05 42 0A 00 00 4C

(Get Response) Received Message: 01 53 00 09 42 0A 04 00 4C 4B 40 01 27

Internal Clock = 00 4C 4B 40 = 5000000 bps = 5.000 MHz

4.1.27 BP Get Data Source: Tag 0x420B

Tag BP_GET_DATA_SOURCE response has a length of one byte, in binary. This command is not supported by Dual Transmitters.

- A value of 0 indicates data source is external.
- A value of 1 indicates data source is internal.

Example:

(Get Message) Sent Message: 01 53 00 05 42 0B 00 00 4D

(Get Response) Received Message: 01 53 00 06 42 0B 01 00 00 4E

Data Source = 0 (External)

4.1.28 BP Get Internal Data: Tag 0x420C

Tag BP_GET_INT_DATA response has a length of six bytes, in hexadecimal. The first byte indicates one of the standard Dual Transmitter pattern codes shown in Table 13, followed by four bytes for the pattern, then one byte for the length of the user pattern, in bits. Table 14 shows the single transmitter pattern codes.

Table 13: Dual TX Set Internal Data Pattern Bit Descriptions	
Bit Command Name	**Protocol Defines**
BP_USER_PATTERN (1 to 32 bits)	0x00
BP_MARK_PATTERN	0x01
BP_SPACE_PATTERN	0x02
BP_ALT01_PATTERN	0x03
BP_PN6_PATTERN	0x04
BP_PN9_PATTERN	0x05
BP_PN11_PATTERN	0x06
BP_PN15_PATTERN	0x07
BP_PN17_PATTERN	0x08
BP_PN20_PATTERN	0x09
BP_PN23_PATTERN	0x0A
BP_PN31_PATTERN	0x0B

Table 14: Single TX Set Internal Data Pattern Bit Descriptions	
Bit Command Name	**Protocol Defines**
BP_PN6_PATTERN	0x00
BP_PN06_PATTERN	0x01
BP_PN11_PATTERN	0x02
BP_PN15_PATTERN	0x03
BP_PN23_PATTERN	0x04
BP_USER_PATTERN (16 bits)	0x05

Example:

(Get Message) Sent Message: 01 53 00 05 42 0C 00 00 4E

(Get Response) Received Message: 01 53 00 0B 42 0C 06 03 00 00 AA 10 01 BB

Code = 03 = PN15 (from Single Tx table)

User Data Pattern = 00 00 AA = AAAAh

Bits = 10h = 16 (This is always 16 bits for a single user data pattern length.)

4.1.29 BP Get Frequency Step: Tag 0x420D

Tag BP_GET_FREQSTEP response has a length of five (5) bytes, in hexadecimal, with implied decimal XX.X. The frequency is in Hz.

Example:

(Get Message) Sent Message: 01 53 00 05 42 0D 00 00 4F

(Get Response) Received Message: 01 53 00 0A 42 0D 05 00 00 98 96 80 02 02

Frequency Step = 00 00 98 96 80 = 10000000 Hz = 10.0 MHz

4.1.30 BP Get Variable Power New: Tag 0x420F

Tag BP_GET_VAR_POWER_NEW response has a length of three (3) bytes, in ASCII, with implied decimal, XX.X. Valid range is 0 to 31 in 1.0 dB steps, or 31.5 in 0.5 dB steps, depending on the transmitter.

Example:

(Get Message) Sent Message: 01 53 00 05 42 0F 00 00 51

(Get Response) Received Message: 01 53 00 08 42 0F 03 31 37 35 00 F1

Variable Power New = 17.5 dB

4.1.31 BP Get High Power Level: Tag 0x4210

Tag BP_GET_HP_LEVEL response has a length of three (3) bytes, in ASCII, with implied decimal, XX.X. Valid range is 0 to 31 in 1.0 dB steps, or 31.5 in 0.5 dB steps, depending on the transmitter.

Example:

(Get Message) Sent Message: 01 53 00 05 42 10 00 00 52

(Get Response) Received Message: 01 53 00 08 42 10 03 33 31 35 00 EE

High Power Level = 31.5 dB

4.1.32 BP Get Low Power Level: Tag 0x4211

Tag BP_GET_LP_LEVEL response has a length of three (3) bytes, in ASCII, with implied decimal, XX.X. Valid range is 0 to 31 in 1.0 dB steps, or 31.5 in 0.5 dB steps, depending on the transmitter.

Example:

(Get Message) Sent Message: 01 53 00 05 42 11 00 00 53

(Get Response) Received Message: 01 53 00 08 42 11 03 30 31 30 00 E7

Low Power Level = 01.0 dB

4.1.33 BP Get LDPC State: Tag 0x4212

Tag BP_GET_LDPC_STATE response has a length of two bytes. The first byte indicates the enable (one) or disable (zero) state. The second byte is the LDPC code. Valid code range is 0 through 5.

Example:

(Get Message) Sent Message: 01 53 00 05 42 12 00 00 54

(Get Response) Received Message: 01 53 00 07 42 12 02 00 02 00 58

LDPC State: LD = 0 (disabled), Code = 2 (4096 2/3)

Table 15: LDPC Codes

LD6 Code	Block Size and Code Rate
0	k=4096, r=1/2

LD6 Code	Block Size and Code Rate
1	k=1024, r=1/2
2	k=4096, r=2/3
3	k=1024, r=2/3
4	k=4096, r=4/5
5	k=1024, r=4/5

4.1.34 BP Get Convolutional Encoding State: Tag 0x4213

Tag BP_GET_CC_STATE response has a length of one byte, in binary.

- A value of 0 indicates convolutional encoding is disabled.
- A value of 1 indicates convolutional encoding is enabled.

Example:

(Get Message) Sent Message: 01 53 00 05 42 13 00 00 55

(Get Response) Received Message: 01 53 00 06 42 13 01 01 00 57

Convolutional Encoding State = 1 (Enabled)

4.1.35 BP Get NRZ-M Encoding State: Tag 0x4214

Tag BP_GET_MC_STATE response has a length of one byte, in binary.

- A value of 0 indicates NRZ encoding is not disabled.
- A value of 1 indicates NRZ encoding is enabled.

Example:

(Get Message) Sent Message: 01 53 00 05 42 14 00 00 56

(Get Response) Received Message: 01 53 00 06 42 14 01 01 00 58

NRZ-M Encoding State = 1 (Enabled)

4.1.36 BP Get Channel Delay Enable State: Tag 0x4215

Tag BP_GET_CDE_STATE response has a length of one byte, in binary.

- A value of 0 indicates channel delay is disabled.
- A value of 1 indicates channel delay is enabled.

Example:

(Get Message) Sent Message: 01 53 00 05 42 15 00 00 57

(Get Response) Received Message: 01 53 00 06 42 15 01 01 00 59

Channel Delay Enable State = 1 (Enabled)

4.1.37 BP Get Channel Delay Value: Tag 0x4216

Tag BP_GET_CD_VALUE response has a length of three (3) bytes, in hexadecimal, in 0.01 nanosecond (ns) units.

Valid range is 0 to 5000.00 ns.

Example:

(Get Message) Sent Message: 01 53 00 05 42 16 00 00 58

(Get Response) Received Message: 01 53 00 08 42 16 03 00 10 68 00 D3

Channel Delay Value = 00 10 68 = 4200 dns = 42.00ns

4.1.38 BP Get Modulation Scaling Value: Tag 0x4217

Tag BP_GET_MS_VALUE response has a length of five (5) bytes, in ASCII, with implied decimal, XXX.XX. Valid range is 0.09 to 128.01.

Example:

(Get Message) Sent Message: 01 53 00 05 42 17 00 00 59

(Get Response) Received Message: 01 53 00 0A 42 17 05 30 30 31 30 30 01 4F

Modulation Scaling Value = 1.00

4.1.39 BP Get Automatic Carrier Output Enable: Tag 0x4250

Tag BP_GET_AC_ENABLE response has a length of one byte, in binary.

- A value of 0 indicates automatic carrier output is Off/disabled.
- A value of 1 indicates automatic carrier output is On/enabled.

Example:

(Get Message) Sent Message: 01 53 00 05 42 50 00 00 92

(Get Response) Received Message: 01 53 00 06 42 50 01 00 00 93

Automatic Carrier Output Enable = 0 (Disabled)

4.1.40 BP Get Clock Free Disable: Tag 0x4251

Tag BP_GET_CF_DISABLE response has a length of one byte, in binary.

- A value of 0 indicates clock free operation is enabled.
- A value of 1 indicates operation with an external clock (clock free is disabled and normal).

Example:

(Get Message) Sent Message: 01 53 00 05 42 51 00 00 93

(Get Response) Received Message: 01 53 00 06 42 51 01 01 00 95

Clock Free Disable = 1 (Normal operation with external clock)

4.1.41 BP Get RF On/Off Pin Polarity State: Tag 0x4252

Tag BP_GET_RZ_STATE response has a length of one byte, in binary.

- A value of 0 indicates RF On when RF On/Off pin is low.
- A value of 1 indicates RF On when RF On/Off pin is high.

Example:

(Get Message) Sent Message: 01 53 00 05 42 52 00 00 94

(Get Response) Received Message: 01 53 00 06 42 52 01 01 00 96

RF On/Off Pin Polarity State (RZ) = 1 (RF On when RF On/Off pin is high)

4.1.42 BP Get Overtemperature Control State: Tag 0x4253

Tag BP_GET_OC_STATE response has a length of one byte, in binary.

- A value of 0 indicates overtemperature control is Off/disabled.
- A value of 1 indicates overtemperature control is On/enabled.

Example:

(Get Message) Sent Message: 01 53 00 05 42 53 00 00 95

(Get Response) Received Message: 01 53 00 06 42 53 01 01 00 97

Overtemperature Control State = 1 (Enabled)

4.1.43 BP Get ASCII Passthrough Enable: Tag 0x4254

Tag BP_GET_BP_PASSTHRU_ENABLE response has a length of one byte, in binary.

- A value of 0 indicates binary protocol passthrough is Off/disabled.
- A value of 1 indicates binary protocol passthrough is On/enabled.

Example:

(Get Message) Sent Message: 01 53 00 05 42 54 00 00 96

(Get Response) Received Message: 01 53 00 06 42 54 01 00 00 97

Binary Protocol Passthrough = 0 (Disabled)

4.1.44 BP Get Temperature: Tag 0x4300

Tag BP_GET_TEMP response has a length of five bytes for single transmitters, or ten bytes for Dual Transmitters, in ASCII, with implied decimal, XXX.XX. The temperature is in degrees Centigrade.

Example:

(Get Message) Sent Message: 01 53 00 05 43 00 00 00 43

(Get Response) Received Message: 01 53 00 0F 43 00 0A 30 33 39 32 30 30 33 35 30 30 02 43

PA 1 Temperature = 39.20, PA 2 Temperature = 35.00 (Dual Transmitter)

4.1.45 BP Get Status 1: Tag 0x4301

Tag BP_GET_STATUS_1 response returns a 19 byte (38 byte for Dual Transmitters) status message. The status format is as follows:

Byte 0 = 1 byte mode number

Byte 1 and 2 = CS, DS, DP, DE, RN (2 bits), CC, MC, and RF as 1 bit each, followed by Actual RF, CF, AC, LD State (1 bit), and LD Code (3 bits), as defined in Figure 1.

Bytes 3-5 = VP as three bytes with an implied decimal

Bytes 6-10 = FR as five bytes, in hexadecimal, defined in Hz

Bytes 11-14 = Detected baseband bit rate as four bytes, in hexadecimal, defined in bps

Bytes 15-18 = Detected Over the Air bit rate as four bytes, in hexadecimal, defined in bps

This format repeats (Bytes 19 through 38) for Channel 2 values on a Dual Transmitter.

Example:

(Get Message) Sent Message: 01 53 00 05 43 01 00 00 44

(Get Response) Received Message: 01 53 00 2B 43 01 26 01 44 C8 31 37 35 00 87 A1 5F E0 00 00 00 00 00 00 00 00 01 44 C8 31 37 35 00 87 A1 5F E0 00 00 00 00 00 00 00 00 08 8C

Get Status 1 = Mode 1, (Refer to Figure 1 for Status Bits) VP 17.5, FR 2275.5, Detected 0.000, OTA 0.000

```
Get Status 1 message

received bytes: 01 53 00 2B 43 01 26 01 44 C8 ...

         Bit                               Bit
         15     12  11     8  7     4  3     0
          |      |   |     |  |     |  |     |
44 C8   = 0 1 0 0   0 1 0 0   1 1 0 0   1 0 0 0
          | | | |   | | | |   | | | |   | | | |___  CS = 0 = external
          | | | |   | | | |   | | | |   | | |_____  DS = 0 = external
          | | | |   | | | |   | | | |   | |_______  DP = 0 = not inverted
          | | | |   | | | |   | | | |   |_________  DE = 1 = enabled
          | | | |   | | | |   | | | |____________  RA0 = 0
          | | | |   | | | |   | | |______________  RA1 = 0
          | | | |   | | | |   | |________________  CC = 1 = enabled
          | | | |   | | | |   |__________________  MC = 1 = enabled
          | | | |   | | | |_____________________  RF = 0 = off
          | | | |   | | |_______________________  Actual RF = 0 = off
          | | | |   | |_________________________  CF = 1 = Clock free Disabled
          | | | |   |___________________________  AC = 0 = Auto Carrier disabled
          | | | |_______________________________  LD = 0 = LPDC disabled
          | | |_________________________________  LD_Code_0 = 0
          | |___________________________________  LD_Code_1 = 1
          |_____________________________________  LD_Code_2 = 0


         LD_Code bits   | Code                RA Bits   | Randomizer
          2  1  0       |                      1    0   |
         ---------------------               -----------------------
          0  0  0       |  0                   0    0   |   Off
          0  0  1       |  1                   0    1   |   Irig On
          0  1  0       |  2                   1    0   |   CCSDS On
          0  1  1       |  3                   1    1   |   invalid
          1  0  0       |  4
          1  0  1       |  5
          1  1  0       | invalid
          1  1  1       | invalid
```

Figure 1: Status 1 Message Bits Example

4.1.46 BP Get Detected Bit Rate: Tag 0x4302

Tag BP_GET_DETECTED_BITRATE response has a length of eight (8) bytes for single channel transmitters, or 16 bytes for Dual Transmitters, in hexadecimal. The first four bytes are the baseband bit rate in bps. The second four bytes are the Over the Air bit rate in bps.

Example:

(Get Message) Sent Message: 01 53 00 05 43 02 00 00 45

(Get Response) Received Message: 01 53 00 0D 43 02 08 <u>00 4C 4B 4A 00 98 96 95</u> 02 F1

Detected Bit Rate <u>00 4C 4B 4A</u> = 5000000 bps = 5.000 Mbps

Over the Air Bit Rate = <u>00 98 96 95</u> = 10000000 bps = 10.000 Mbps

4.1.47 BP Get PA Drain Voltage and Current: Tag 0x4303

Tag BP_GET_DRAIN_V_AND_I response has a length of four bytes for single transmitters, or eight bytes for Dual Transmitters. The first two bytes are the PA drain voltage in mV. The second two bytes are the current in mA.

Example: (using a Dual Transmitter with two channels active)

(Get Message) Sent Message: 01 53 00 05 43 03 00 00 46

(Get Response) Received Message: 01 53 00 0D 43 03 08 28 24 00 1C 26 F0 00 1C 01 E8

PA Drain Voltage, Channel 1 = 10.276 mV, Channel 2 = 9.968 mV;

Current Channel 1 = 0.028 mA, Channel 2 = 0.028 mA

4.1.48 BP Get DTX Channel: Tag 0x4400

Tag BP_DTX_GET_CHANNEL has a length of one byte.

- A value of 0 indicates not a dual transmitter.
- A value of 1 indicates channel 1.
- A value of 2 indicates channel 2.
- A value of 3 indicates channel 1 and channel 2.

Example:

(Get Message) Sent Message: 01 53 00 05 44 00 00 00 44

(Get Response) Received Message: 01 53 00 06 44 00 01 03 00 48

Dual Transmitter Channel = 3

4.2 Get Command Summary

The transmitter information responses are described in Table 30.

Table 16: Transmitter Information Responses

Response Codes	Protocol Defines	Description
BP_NAK	0x0001	Corrupt Message (Bad Checksum)
BP_NAK_BAD_ID	0x0002	Bad Device ID
BP_ACK	0x0003	Not Currently Used
BP_UNKNOWN_TAG	0x0004	Unknown TAG in tag field
BP_INVALID_TAG	0x0005	TAG not valid for this mode or device
BP_INVALID_TAG_DATA	0x0006	Data was not valid for this TAG
BP_TAG_LIMIT_EXCEEDED	0x0007	Too many tags in one message

Response Codes	Protocol Defines	Description
BP_MISSING_OPTION	0x0008	Tag requires option the unit doesn't have

The transmitter GET commands are summarized in Table 31.

Table 17: Transmitter GET Commands

GET Command	Protocol Defines	Description
BP_GET_BP_VERSION	0x4000	4 bytes ASCII with implied decimal, X.XXX
BP_GET_DEVICE_MODELNUM	0x4001	bytes ASCII (model as it comes)
BP_GET_DEVICE_SERNUM	0x4002	bytes ASCII (number as it comes)
BP_GET_SOFTWARE_VER	0x4003	ASCII (version as it comes)
BP_GET_FPGA_VER	0x4004	ASCII (FPGA version as it comes)
BP_GET_AVAIL_MODES	0x4100	2 bytes binary (one bit per valid mode)
BP_GET_BITRATE_RANGE	0x4101	4 bytes hex min, then max, in bps
BP_GET_FREQ_BANDS	0x4104	2 bytes, 1 bit per band
BP_GET_L_BAND_RANGE	0x4105	5 bytes hex min, then max, in Hz
BP_GET_U_BAND_RANGE	0x4106	5 bytes hex min, then max, in Hz
BP_GET_M_BAND_RANGE	0x4107	5 bytes hex min, then max, in Hz
BP_GET_LS_BAND_RANGE	0x4108	5 bytes hex min, then max, in Hz
BP_GET_US_BAND_RANGE	0x4109	5 bytes hex min, then max, in Hz
BP_GET_C_BAND_RANGE	0x410A	5 bytes hex min, then max, in Hz
BP_GET_MC_BAND_RANGE	0x410B	5 bytes hex min, then max, in Hz
BP_GET_EX_BAND_RANGE	0x410C	5 bytes hex min, then max, in Hz
BP_GET_MODE	0x4201	1 byte mode number
BP_GET_CF_BR	0x4202	1 byte N or A (normal or auto), plus 4 bytes hex, in bps
BP_GET_DATA_POL	0x4203	1 byte binary (0 or 1)
BP_GET_CLOCK_POL	0x4204	1 byte binary (0, 1, or A (41h))
BP_GET_FREQ	0x4205	5 bytes hex, in Hz

GET Command	Protocol Defines	Description
BP_GET_RAND_On	0x4206	1 byte binary (0, 1, or 2)
BP_GET_DIFF_ENCODE	0x4207	1 byte binary (0 or 1)
BP_GET_RF_STATE	0x4208	2 bytes: 1 byte setting (0 or 1), 1 byte actual
BP_GET_CLOCK_SOURCE	0x4209	1 byte binary (0 or 1)
BP_GET_INT_CLOCK	0x420A	4 bytes hex, in bps
BP_GET_DATA_SOURCE	0x420B	1 byte binary (0 or 1) (Not valid for Dual Transmitters)
BP_GET_INT_DATA	0x420C	1 byte pattern code, plus 4 hex bytes pattern, plus 1 byte length in bits
BP_GET_FREQSTEP	0x420D	5 bytes hex, in Hz
BP_GET_VAR_POWER_NEW	0x420F	3 bytes ASCII with implied decimal, XX.X
BP_GET_HP_LEVEL	0x4210	3 bytes ASCII with implied decimal, XX.X
BP_GET_LP_LEVEL	0x4211	3 bytes ASCII with implied decimal, XX.X
BP_GET_LDPC_STATE	0x4212	2 bytes: 1 byte state, 1 byte code
BP_GET_CC_STATE	0x4213	1 byte binary
BP_GET_MC_STATE	0x4214	1 byte binary
BP_GET_CDE_STATE	0x4215	1 byte binary
BP_GET_CD_VALUE	0x4216	3 hex bytes in 0.01ns units
BP_GET_MS_VALUE	0x4217	5 bytes ASCII with implied decimal, XXX.XX
BP_GET_AC_ENABLE	0x4250	1 byte binary
BP_GET_CF_DISABLE	0x4251	1 byte binary
BP_GET_RZ_STATE	0x4252	1 byte binary
BP_GET_OC_STATE	0x4253	1 byte binary
BP_GET_TEMP	0x4300	5 bytes ASCII with implied decimal, XXX.XX (10 bytes for DTX)
BP_GET_STATUS_1	0x4301	19 byte status message (38 bytes for DTX)
BP_GET_DETECTED_RATE	0x4302	8 bytes hex, in bps (16 bytes for DTX)
BP_DTX_GET_CHANNEL	0x4400	1 byte

5 Proposed New Binary Protocol Tags

The binary protocol tags described in Table 18 are placeholders for new functionality to support fully independent channel operation. This functionality is not currently implemented.

Table 18: Proposed Transmitter GET/SET Commands

SET Command	Protocol Defines	Description
BP_GET_D2	TBD	TBD
BP_GET_IND_MODE	TBD	TBD
BP_GET_EVTM_TDD_STATUS	TBD	TBD
BP_GET_XDC	TBD	TBD
BP_GET_XDF	TBD	TBD
BP_GET_XDP	TBD	TBD
BP_GET_D2	TBD	TBD
BP_SET_D2	TBD	TBD
BP_SET_IND_MODE	TBD	TBD
BP_SET_EVTM_TDD_ENABLE	TBD	TBD
BP_SET_EVTM_TDD_SD	TBD	TBD
BP_SET_XDC	TBD	TBD
BP_SET_XDF	TBD	TBD
BP_SET_XDP	TBD	TBD

6 Appendix A – Legacy Binary Transmitter Serial Protocol

The Legacy binary protocol is deprecated. These tags should NOT be used for new interface code.

6.1 Legacy Binary Serial Protocol

The binary serial protocol is designed to facilitate efficient machine to machine communication. The following defines the binary serial packet protocol version 1.005 or earlier.

6.1.1 Legacy Packet Format Definition

The binary protocol specifies the format of all packets sent or received. A binary packet is identified by the starting byte which has a value of 0x01 Hexadecimal (Hex). The general format of the packet bytes are as follows.

Table 19: Packet Format

Position	Description
0x00	Binary communication indicator
0x01	Device Signature (Refer to section 6.8)
0x02	MSB payload size
0x03	LSB payload size
0x04 +	TLV(s)

END	MSB 16Bit Checksum
END+1	LSB 16Bit Checksum

6.1.2 Legacy Binary Packet Formation

Figure 1 illustrates the construction of the binary packet.

Binary Identifier 0x01	Device Identifier 0xNN	Payload Size 0xNNNN	Payload Data 4bytes to device limited payload bytes	Payload Checksum 0xNNNN

Figure 2: Legacy Binary Packet Example

Packet formation consists of:

- **Binary Identifier**: One (1) byte used to tell the device this is a binary packet
- **Device Identifier**: One (1) byte used to selectively isolate commands not intended for the device. Refer to section 6.8 for a current list of available devices. Although serial communications are normally on a single channel interface to the device this identifier allows for any future serial communications that may be single channel to multiple devices.
- **Payload Size**: Two (2) bytes represented as MSB then LSB. The payload size is a count in bytes of the payload data plus the two byte checksum. Remember to subtract two bytes from the Payload Size (16 bit checksum) when removing the payload data from the packet. The minimum payload size will be at least

four (4) bytes. This minimum is determined by the smallest TLV command size. The maximum payload size is limited by the device.

- **Payload Data**: Payload data is one or more TLV commands of variable length. The smallest Payload Data size will be at least one TLV command or four (4) bytes.
- **Payload Checksum**: Two (2) bytes represent the Payload Checksum. The Payload Checksum is calculated by adding the actual value of each byte of the Payload Data. When calculating the Payload Checksum in software an unsigned 16 bit variable should be used. This allows for the rollover of the variable when the calculation exceeds its maximum 0xFFFF value.

  Note: This calculation includes the Payload Data only.

6.1.3 Receiving a Legacy Binary Packet from the Device

To receive binary serial packets on a single threaded operating system, it is recommended that an interrupt driven serial routine be used. For multitasking operating systems, a blocking thread is recommended.

The interrupt or blocking thread should wait for received data on the serial port. When the first byte of data begins to be received on the serial port, the software should start a binary packet watchdog timer. With the watchdog timer started, the data buffer may be polled to see if more than four bytes have been received (the minimum packet size to acquire the payload size). After a minimum of four bytes have been received, the packet may be parsed for the payload size. With the payload size parsed, the software may continue to poll until the actual payload received matches the reported Payload Size. In time critical systems, the polling can be adjusted based on the baud and reported payload size. For most cases, a simple polling until the received payload matches the reported payload works fine. The watchdog timer should go off if the expected binary packet has not been received in an expected timeframe. The watchdog should have enough time to receive the entire packet plus some extra time for any possible transmission delays from the device.

6.1.4 Legacy Binary Packet Errors

There are two conditions in which the binary packet may be checked for errors.

- The first condition is a mismatch of the actual received payload size with the Payload Size reported in the packet. If these two sizes do not match and the binary packet watchdog has waited for enough time to receive the reported size of the packet, then the packet should be considered corrupt and a retry or a timeout condition should be considered.
- The second condition is the Payload Checksum. If the calculated Payload Checksum does not match the received Payload Checksum, then the packet should be considered corrupt and a retry or a timeout condition should be considered.

6.1.5 Legacy TLV Commands - Payload Data

6.1.5.1 Legacy TLV Data Information

TLV is an acronym for: Tag, Length, and Variable.

- Tag - Tag consists of two bytes and forms the command. (65535 or 0xFFFF Hex possible TAG commands)
- Length - Length consists of one byte. The length indicates how many bytes will be used for the Tag command data variable with a maximum variable size of 255 or 0xFF Hex bytes.
- Variable - Variable is the actual data associated with the Tag. Depending on the Tag, the variable may be binary data that forms an ASCII string or the actual binary value which represents the tags value.

6.1.6 Legacy Set and Get Command Operations

6.1.6.1 Legacy SET Command

Tags defined with the SET notation in the Tag definition table (refer to section 6.7) are expected to have actual variable data associated with them for changing a value on the device. These SET values are used to force a change to occur on the device and then return the result of that change. For example, when setting the bit rate to the device the device will attempt to set the bit rate and return its result as the new bit rate. Comparing the values sent with the values received will ensure that the changes on the device were successful.

6.1.6.2 Legacy GET Command

Tags defined with a GET notation in the Tag definition table (refer to section 6.7) are not expected to have actual variable data associated with them when they are sent to the device. These GET tags can accept any data with them; however, it is recommended to simply send a length as 1 and the variable as 0 so as to form a complete TLV entry. The GET tag will return with the requested data as noted in the Tag definition table (refer to section 6.7).

6.1.7 Handshake Events

Communication with the device is done on a master / slave relationship. The device is the slave to any requests sent to it. After sending a binary packet to the device, a binary packet response should always be received. Not receiving a response after an expected time period constitutes a communications timeout and possible loss of connection from the device. This timeout may be caused by incorrect baud, stop-bits, or other serial communications settings and/or cabling problems. It is up to the master (system requesting data from the device) to handle any timeout conditions.

6.1.8 Sending and Receiving Multiple Legacy TLV Commands

TLV commands should be queued together when sending more than one command to the device. Append all of the TLV commands to be sent to the device as the payload and the device will respond with the appropriate TLV commands.

6.1.9 Legacy Binary Packet Formation Samples

A basic binary packet with TLV payload example is shown in Table 20.

- Packet Example sending a single TLV (Set Clock Invert)
- Clock Invert value: True

Table 20: Binary Packet Example, Single TLV with Clock Invert

Position	Byte Value	Description
0x00	0x01	Binary indicator
0x01	0x53	Transmitter Device Signature
0x02	0x00	MSB payload size
0x03	0x06	LSB payload size
0x04	0x00	Tag Command MSB; Set clock polarity
0x05	0x13	Tag Command LSB; Set clock polarity
0x06	0X01	Length
0x07	0x01	Variable (0 for Clock invert Off, 1 for On)

Position	Byte Value	Description
0x08	0x00	Checksum MSB
0x09	0x15	Checksum LSB

A packet example sending a single TLV command with multiple data bytes represented as ASCII data (Set Freq) is shown in Table 21.

- Frequency Value: 2200.5 MHz

Table 21: Binary Packet Example, Single TLV, Multiple Bytes as ASCII Data

Position	Byte Value	Description
0x00	0x01	Binary Start of Message indicator
0x01	0x53	Transmitter Device Signature
0x02	0x00	MSB payload size
0x03	0x10	LSB payload size
0x04	0x00	Tag Command MSB; Set frequency
0x05	0x17	Tag Command LSB; Set frequency
0x06	0X0B	Length
0x07	0x32	Variable data. “2”
0x08	0x32	Variable data. “2”
0x09	0x30	Variable data. “0”
0x0A	0x30	Variable data. “0”
0x0B	0x2E	Variable data. “.”
0x0C	0x35	Variable data. “5”
0x0D	0x30	Variable data. “0”
0x0E	0x30	Variable data. “0”
0x0F	0x30	Variable data. “0”
0x10	0x30	Variable data. “0”
0x11	0x30	Variable data. “0”
0x12	0x02	Checksum MSB
0x13	0x39	Checksum LSB

6.2 Legacy Information Response Tags

6.2.1 NAK: Tag 0x0001

This response indicates that the device received a corrupt message or timed out. None of the received tags could be processed by the device.

```
NAK = 0x0001; // (L)= 0 bytes(V)=0x00~0x00 (Binary)
```

6.2.2 NAK Bad ID: Tag 0x0002

This response indicates that the device ID does not match the device. None of the received tags could be processed by the device.

```
NAK_BAD_ID = 0x0002; // (L)= 0 bytes(V)=0x00~0x00 (Binary)
```

6.2.3 ACK: Tag 0x0003

This response is not currently in use.

```
ACK = 0x0003; // (L)= 0 bytes(V)=0x00~0x00 (Binary)
```

6.2.4 Unknown TAG: Tag 0x0004

This response indicates that the device received an unknown tag. Older devices may not support the given tag and this response will be returned. If more than one tag was sent to the device, then the remaining tags will be processed. Unknown Tag will also return with two bytes that contain the tag that was not known.

```
UNKNOWN_TAG = 0x0004; // (L)= 2 bytes(V)=0x00~0xFF (Binary)
```

6.2.5 Invalid TAG: Tag 0x0005

This response indicates that the device understood the tag but found that it was not valid for the active mode or device itself. This message may be a common response if you decide to always send a set of commands to the device regardless of the mode the device is set to. An example of this is setting differential encoding while the device is in PCMFM since differential encoding is only valid for SOQPSK. If more than one tag was sent to the device, then the remaining tags will be processed. Invalid Tag will also return with two bytes that contain the tag that the device found to be invalid.

```
INVALID_TAG = 0x0005; // (L)= 2 bytes(V)=0x00~0xFF (Binary)
```

6.2.6 Invalid TAG Data: Tag 0x0006

This response indicates that the device understood the tag but found that the data was not valid for the given tag. This error may occur if a tag that was supposed to have a data length of 1 byte received 2 bytes for the tag variable. If more than one tag was sent to the device then the remaining tags will be processed. Invalid Tag data will also return with two bytes that contain the tag that had bad data.

```
INVALID_TAG_DATA = 0x0006; // (L)= 2 bytes(V)=0x00~0xFF (Binary)
```

6.2.7 Tag Limit Exceeded: Tag 0x0007

This response indicates that the device exceeded its capacity to process any more tags. Tags up to this tag on a response were processed; any additional tags were not.

```
TAG_LIMIT_EXCEEDED = 0x0007; // (L)= 0 bytes(V)=0x00~0x00 (Binary)
```

6.3 Legacy Transmitter Set Command Tag Definitions

This section provides all of the tag definitions for the legacy transmitter Set commands.

6.3.1 TX Set Mode: Tag 0x0010

Set Mode has a variable length of two binary bytes or 16 bits. The byte order is MSB to LSB.

```
TX_SET_MODE = 0x0010; // (L)= 2 bytes(V)=0x00~0xFF (Binary)
```

Each bit in Table 22 represents a mode.

Table 22: Example - Setting SOQPSK 0x00 0x02

Bit	Waveform	Bit Range	Bytes
0	PCMFM	00000000 00000001	0x00 0x01
1	SOQPSK	00000000 00000010	0x00 0x02
2	MHCPM	00000000 00000100	0x00 0x04
3	BPSK	00000000 00001000	0x00 0x08
4	QPSK	00000000 00010000	0x00 0x10
5	Reserved	00000000 00100000	0x00 0x20
6	Carrier Only	00000000 01000000	0x00 0x40
7	Reserved	00000000 10000000	0x00 0x80
8	Reserved	00000001 00000000	0x01 0x00
9	Reserved	00000010 00000000	0x02 0x00

6.3.2 TX Set Data Polarity: Tag 0x0012

Set Data Polarity has a variable length of one binary byte.

- A value of 0 sets normal data polarity.
- A value of 1 sets inverted data polarity.

```
TX_SET_DATA_POL = 0x0012; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.3.3 TX Set Clock Polarity: Tag 0x0013

Set Clock Polarity has a variable length of one binary byte.

- A value of 0 sets normal clock polarity.
- A value of 1 sets inverted clock polarity.

```
TX_SET_CLOCK_POL = 0x0013; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.3.4 TX Set Frequency: Tag 0x0017

Set Frequency has a variable length of up to 11 ASCII bytes. The frequency is defined in MHz.

Example: 1450.0

```
TX_SET_FREQ = 0x0017; // (L)= 11 bytes(V)=0x00~0xFF (ASCII)
```

6.3.5 TX Set Randomizer: Tag 0x2015

Set Randomizer has a variable length of one binary byte.

- A value of 0 sets randomizer Off.
- A value of 1 sets randomizer On.

```
TX_SET_RAND_On = 0x2015; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.3.6 TX Set Differential Encoding: Tag 0x0019

Set Differential Encoding has a variable length of one binary byte and only applies to SOQPSK mode. On is the default setting for differential encoding when in SOQPSK mode.

- A value of 0 sets differential Off.
- A value of 1 set differential On.

```
TX_SET_DIFF_ENCODE = 0x0019; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.3.7 TX Set RF On: Tag 0x2018

Set RF On has a variable length of one binary byte.

- A value of 0 sets RF output Off.
- A value of 1 sets RF output On.

```
TX_SET_RF_On = 0x2018; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.3.8 TX Set Clock Source: Tag 0x2019

Set Clock Source has a variable length of one binary byte.

- A value of 0 sets clock source to external.
- A value of 1 sets clock source to internal.

```
TX_SET_CLOCK_SOURCE = 0x2019; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.3.9 TX Set Internal Clock: Tag 0x201A

Set Internal Clock has a variable length of up to 11 ASCII bytes. The frequency is defined in MHz. Specified clock rates are rounded to the nearest integer multiple of 93.333 / 65536 MHz (approximately 1424.15 Hz).

Example: 4.95

- Valid range is 0.150 MHz – 22.0 MHz

```
TX_SET_INT_CLOCK = 0x201A; // (L)= 11 bytes(V)=0x00~0xFF (ASCII) MHz
```

6.3.10 TX Set Data Source: Tag 0x201B

Set Data Source has a variable length of one binary byte.

- A value of 0 indicates data source is external.
- A value of 1 indicates data source is internal.

```
TX_SET_DATA_SOURCE = 0x201B; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.3.11 TX Set Internal Data: Tag 0x201C

Set Internal Data has a variable length of three binary bytes MSB to LSB. The first byte (MSB) indicates one of the following standard patterns:

```
PN6_PATTERN  = 0x00;
PN06_PATTERN = 0x01;
PN11_PATTERN = 0x02;
PN15_PATTERN = 0x03;
PN23_PATTERN = 0x04;
USER_PATTERN = 0x05;
```

The last two bytes indicate a custom user pattern.

Example: 0x05 0xAA 0x55

Sets custom user pattern to 0xaa55

```
TX_SET_INT_DATA = 0x201C; // (L)= 3 bytes as pattern code or value (Binary)
```

6.3.12 TX Set Variable Power: Tag 0x201D

Set Variable Power has a variable length of one binary byte. Not all devices support this tag.

- Valid ranges are from 0x00 to 0x1F.

```
TX_SET_VAR_POWER = 0x201D; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.3.13 TX Set Variable Power New: Tag 0x201E

Set Variable Power New has a variable length of four binary bytes. Not all devices support this tag.

- Valid ranges are from 00.0 to 31.5.

```
TX_SET_VAR_POWER_NEW = 0x201E; // (L)= 4 bytes (V)=0x00~0x01??? (ASCII)
```

6.3.14 TX Save Command: Tag 0x0040

TX Save has a variable length of one binary byte. Transmitter devices have up to eight save profile settings. Save profile 0 is used to save the profile that the device will configure to after a power cycle.

```
TX_SAVE_CMD = 0x0040; // (L)= 1 byte (V)=0x00~0x08 (Binary)
```

6.4 Legacy Set Command Summary

The legacy transmitter information responses are described in Table 23.

Table 23: Legacy Transmitter Information Responses

Response Codes	Protocol Defines	Description
NAK	0x0001	Corrupt Message (Bad Checksum)
NAK_BAD_ID	0x0002	Bad Device ID

Response Codes	Protocol Defines	Description
ACK	0x0003	Not Currently Used
UNKNOWN_TAG	0x0004	Unknown TAG in tag field
INVALID_TAG	0x0005	TAG not valid for this mode or device
INVALID_TAG_DATA	0x0006	Data was not valid for this TAG
TAG_LIMIT_EXCEEDED	0x0007	Too many tags in one message

The legacy transmitter SET commands are summarized in Table 24.

Table 24: Legacy Transmitter SET Commands

SET Command	Protocol Defines	Description
TX_SET_MODE	0x0010	2 bytes binary (one bit only set)
TX_SET_DATA_POL	0x0012	1 byte binary (0 or 1)
TX_SET_CLOCK_POL	0x0013	1 byte binary (0 or 1)
TX_SET_FREQ	0x0017	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_SET_RAND_On	0x2015	1 byte binary (0 or 1)
TX_SET_DIFF_ENCODE	0x0019	1 byte binary (0 or 1) (SOQPSK only)
TX_SET_RF_On	0x2018	1 byte binary (0 or 1)
TX_SET_CLOCK_SOURCE	0x2019	1 byte binary (0 or 1)
TX_SET_INT_CLOCK	0x201A	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_SET_DATA_SOURCE	0x201B	1 byte binary (0 or 1)
TX_SET_INT_DATA	0x201C	3 bytes as pattern code or value
TX_SET_VAR_POWER	0x201D	1 byte binary sets variable power 0-1F
TX_SET_VAR_POWER_NEW	0x201E	4 bytes ASCII (xx.x)
TX_SAVE_CMD	0x0040	No data required

6.5 Legacy Transmitter Get Command Tag Definitions

This section provides all of the tag definitions for the legacy transmitter Get commands.

6.5.1 TX Get Mode: Tag 0x0090

Get Mode has a variable length of two binary bytes or 16 bits. Each bit represents a mode, as described in Table 25. The byte order is MSB to LSB.

Example: Value returned is 0x00 0x02 (mode is SOQPSK).

```
TX_GET_MODE = 0x0090; // (L)= 2 bytes(V)=0x00~0xFF (Binary)
```

Table 25: TX Get Mode Bit Descriptions

Bit	Waveform	Bit Range	Bytes
0	PCMFM	(bits 00000000 00000001)	0x00 0x01
1	SOQPSK	(bits 00000000 00000010)	0x00 0x02
2	MHCPM	(bits 00000000 00000100)	0x00 0x04
3	BPSK	(bits 00000000 00001000)	0x00 0x08
4	QPSK	(bits 00000000 00010000)	0x00 0x10
5	Reserved	(bits 00000000 00100000)	0x00 0x20
6	Carrier Only	(bits 00000000 01000000)	0x00 0x40
7	Reserved	(bits 00000000 10000000)	0x00 0x80
8	Reserved	(bits 00000001 00000000)	0x01 0x00
9	Reserved	(bits 00000010 00000000)	0x02 0x00

6.5.2 TX_Get Data Polarity: Tag 0x0092

Get Data Polarity has a variable length of one binary byte.

- A value of 0 indicates normal data polarity.
- A value of 1 indicates inverted data polarity.

```
TX_GET_DATA_POL = 0x0092; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.5.3 TX_Get Clock Polarity: Tag 0x0093

Get Clock Polarity has a variable length of one binary byte.

- A value of 0 indicates normal clock polarity.
- A value of 1 indicates inverted clock polarity.

```
TX_GET_CLOCK_POL = 0x0093; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.5.4 TX Get Frequency: Tag 0x0097

Get Frequency has a variable length of up to 11 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
TX_GET_FREQ = 0x0097; // (L)= 11 bytes (V)=0x00~0xFF (ASCII)
```

6.5.5 TX Get Randomizer: Tag 0x2095

Get Randomizer has a variable length of one binary byte.

- A value of 0 indicates randomizer Off.
- A value of 1 indicates randomizer On.

```
TX_GET_RAND_On = 0x2095; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.5.6 TX Get RF On: Tag 0x2098

Get RF On has a variable length of one binary byte.

- A value of 0 indicates RF output Off.
- A value of 1 indicates RF output On.

```
TX_GET_RF_On = 0x2098; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.5.7 TX Get Differential Encoding: Tag 0x0099

Get Differential Encoding has a variable length of one binary byte. This command is dependent on get differential available. Refer to TX_GET_DIFFENC_AVAIL 0x0202.

- A value of 0 indicates differential Off.
- A value of 1 indicates differential On.

```
TX_GET_DIFF_ENCODE = 0x0099; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.5.8 TX Get Clock Source: Tag 0x2099

Get Clock Source has a variable length of one binary byte.

- A value of 0 indicates clock source is external.
- A value of 1 indicates clock source is internal.

```
TX_GET_CLOCK_SOURCE = 0x2099; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.5.9 TX Get Internal Clock: Tag 0x209A

Get Internal Clock has a variable length of up to 11 ASCII bytes. The frequency is defined in MHz. Specified clock rates are rounded to the nearest integer multiple of 93.333 / 65536 MHz (approximately 1424.15 Hz).

Example: Bytes returned (0x34 0x2E 0x39 0x35)

String Representation 4.95

- Valid range is 0.150 MHz – 22.0 MHz

```
TX_GET_INT_CLOCK = 0x209A; // (L)= 11 bytes(V)=0x00~0xFF (ASCII) MHz
```

6.5.10 TX Get Data Source: Tag 0x209B

Get Data Source has a variable length of one binary byte.

- A value of 0 indicates data source is external.

- A value of 1 indicates data source is internal.

```
TX_GET_DATA_SOURCE = 0x209B; // (L)=  1 byte (V)=0x00~0x01 (Binary)
```

6.5.11 TX Get Internal Data: Tag 0x209C

Get Internal Data has a variable length of three binary bytes, MSB to LSB. The first byte (MSB) indicates one of the following standard patterns:

```
PN6_PATTERN  = 0x00;
PN06_PATTERN = 0x01;
PN11_PATTERN = 0x02;
PN15_PATTERN = 0x03;
PN23_PATTERN = 0x04;
USER_PATTERN = 0x05;
```

The last two bytes indicate a custom user pattern.

```
TX_GET_INT_DATA = 0x209C; // (L)=  3 bytes as pattern code or value (Binary)
```

6.5.12 TX Get Temperature: Tag 0x009A

Get Temperature has a variable length of up to six ASCII bytes. The temperature is defined in degrees C. This variable is returned as an ASCII string stored in multiple bytes. The format is xxx.xx where the leading character is a space, - sign (negative), or a number.

Example: Bytes returned (0x20 0x33 0x37 0x2E 0x30 0x30)

String Representation: _37.00, -25.20, 112.10, _-9.10, _ _7.01

```
TX_GET_TEMP = 0x009A; // (L)=  6 bytes ASCII (xxx.xx in Deg C)
```

6.5.13 TX Get Variable Power: Tag 0x221D

Get Variable Power has a variable length of one binary byte.

- Valid ranges are from 0x00 to 0x1F.

```
TX_GET_VAR_POWER = 0x221D; // (L)=  1 byte (0 to 0x1F) (Binary)
```

6.5.14 TX Get Variable Power New: Tag 0x221E

Get Variable Power New has a length of four ASCII bytes.

```
TX_GET_VAR_POWER_NEW = 0x221E; // (L)=  4 bytes ASCII
```

6.5.15 TX Get Device Serial Number: Tag 0x0101

Get Device Serial Number has a length of ten ASCII bytes.

Example: "_ _ _ _ _ _1009"

```
TX_GET_DEVICE_SERNUM = 0x0101; // (L)= 10 bytes ASCII
```

6.5.16 TX Get Available Modes: Tag 0x0102

Get Available Modes has a variable length of two binary bytes. Each mode is one bit, as shown in Table 26.

```
TX_GET_AVAIL_MODES = 0x0102; // (L)=  2 bytes (V)
```

Table 26: TX Get Available Modes Bit Descriptions

Bit Command Name	Protocol Defines	Waveform (Mode) Description
BP_PCMFM_MODE_BIT	0x0001	PCMFM
BP_SOQPSK_MODE_BIT	0x0002	SOQPSK
BP_MHCPM_MODE_BIT	0x0004	MHCPM
BP_BPSK_MODE_BIT	0x0008	BPSK
BP_QPSK_MODE_BIT	0x0010	QPSK
BP_AQPSK_MODE_BIT	0x0020	AQSPK
BP_AUQPSK_MODE_BIT	0x0040	AUQPSK
BP_OQPSK_MODE_BIT	0x0080	OQPSK
BP_UQPSK_MODE_BIT	0x0100	UQPSK
BP_DPM_MODE_BIT	0x0200	Not used
BP_STDN_MODE_BIT	0x0400	Spacecraft Tracking and Data Network or PM/BPSK
BP_SQPN_MODE_BIT	0x0800	Staggered Quadrature Pseudo-random Noise
BP_CARRIER_ONLY_MODE_BIT	0x8000	Carrier only

6.5.17 TX Get Software Version: Tag 0x0107

Get Software Version has a length of 32 ASCII bytes. It displays the current firmware version up to 32 bytes.

```
TX_GET_SOFTWARE_VER = 0x0107; // (L)= 32 bytes ASCII
```

6.5.18 TX Get FPGA Version: Tag 0x0109

Get FPGA Version has a length of 32 ASCII bytes. It displays the current FPGA version.

```
TX_GET_FPGA_VER = 0x0109; // (L)= 32 bytes ASCII
```

6.5.19 TX Get Variable Power Available: Tag 0x2202

Get Variable Power Available has a variable length of one binary byte.

- A value of 0 indicates variable power is not available.
- A value of 1 indicates variable power is available.

```
TX_GET_VAR_POWER_AVAIL = 0x2202; // (L)=  1 byte (V)=0x00~0x01 (Binary)
```

6.5.20 TX Get New Variable Power Available: Tag 0x0206

Get New Variable Power Available has a variable length of one binary byte.

- A value of 0 indicates variable power is not available.
- A value of 1 indicates variable power is available.

```
TX_GET_NEW_VAR_POWER_AVAIL = 0x0206; // (L)=  1 byte (V)=0x00~0x01 (Binary)
```

6.5.21 TX Get Differential Encoding Available: Tag 0x0202

Get Differential Encoding Available has a variable length of one binary byte.

- A value of 0 indicates differential not available.
- A value of 1 indicates differential available.

```
TX_GET_DIFFENC_AVAIL = 0x0202; // (L)= 1 byte (V)=0x00~0x01 (Binary)
```

6.5.22 TX Get Internal Clock Maximum: Tag 0x209E

Get Internal Clock Maximum has a variable length of up to 11 ASCII bytes. The clock is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x32 0x2E 0x30 0x30)

String Representation 22.0000

```
TX_GET_INT_CLOCK_MAX = 0x209E; // (L)= 11 bytes ASCII (xxxx.xxxxxx) in MHz
```

6.5.23 TX Get Internal Clock Minimum: Tag 0x209F

Get Internal Clock Minimum has a variable length of up to 11 ASCII bytes. The clock is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x30 0x2E 0x31 0x35)

String Representation 0.15

```
TX_GET_INT_CLOCK_MIN = 0x209F; // (L)= 11 bytes ASCII (xxxx.xxxxxx) in MHz
```

6.5.24 TX Get Available Bands: Tag 0x0205

Get Available Bands has a variable length of one binary byte. Each band is one bit, as shown in Table 27.

- A value of 0 indicates band is not available.
- A value of 1 indicates band is available.

```
TX_GET_BANDS_AVAIL = 0x0205; // (L)=  1 byte (V)=0x00~0xFF (Binary)
```

Table 27: TX Get Available Bands Bit Descriptions

Command	Protocol Defines
BP_L_BAND_BIT	0x01
BP_U_BAND_BIT	0x02
BP_S_BAND_BIT	0x04
BP_C_BAND_BIT	0x08
BP_P_BAND_BIT	0x20

6.5.25 TX Get Configuration Status: Tag 0x2107

Get Configuration Status returns a packed status message. The status format includes 1 byte for the mode and additional bits as described in the table. A full message with this tag only requires 9 + 9 = 18 bytes.

```
TX_GET_CONFIG_STATUS = 0x2107; // (L)=  18 bytes
```

MO 1 byte

CS, DS, DP, DE, CC, MC, RF, RN 1 bit each as defined in Table 28.

Table 28: Get Configuration Status Format

Bit Command Name	Protocol Defines	Description
TX_STAT_CS_INT_BI	0x01	Clock source internal, if set
TX_STAT_DS_INT_BIT	0x02	Data source internal, if set
TX_STAT_DP_INV_BIT	0x04	Data polarity inverted, if set
TX_STAT_DE_ENA_BIT	0x08	Differential encoding enabled, if set
TX_STAT_RN_ENA_BIT	0x10	Randomizer enabled, if set
TX_STAT_CC_ENA_BIT	0x20	Convolutional encoding enabled, if set
TX_STAT_MC_ENA_BIT	0x40	NRZ encoding enabled, if set
TX_STAT_RF_ENA_BIT	0x80	RF enabled, if set

VP 1 byte

FR 6 bytes (2 bytes integer MHz + 4 bytes Hz) each MSB first

6.5.26 TX Get Power Status: Tag 0x2108

Get Power Status returns a packed status message. The status format is described in Table 29. A full message with this tag only requires 9 + 5 = 14 bytes.

```
TX_GET_POWER_STATUS = 0x2108; // (L)=  14 bytes
```

Table 29: Get Power Status Format

Option	Bit Description	Option Description	Examples
FP	2 bytes (signed int dB, unsigned fraction dB)	Forward power	31.52 dB = 0x1F 0x34 -10.01 dB = 0xF6 0x01
RP	2 bytes (signed int dB, unsigned fraction dB)	Reflected power	

Option	Bit Description	Option Description	Examples
QT	1 unsigned byte	Temperature in degrees C (-128 to +127 degrees)	-35 degrees 0xDD 47 degrees 0x2F

6.5.27 Get Frequency Bands: Tag 0x0210

Get Frequency Bands has a variable length of up to eight ASCII bytes. The frequency bands are defined by their associated band letter in hexadecimal. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x53 0x4C) where 53 is S-band, 4C is L-band

Other bands: U = 55 hex, C = 43 hex, and P = 50 hex

String Bands Representation SL

```
GET_FREQ_BANDS = 0x0210; // (L)=  1 or more bytes L U S C P (ASCII)
```

6.5.28 Get Frequency Band S Maximum: Tag 0x0211

Get Frequency Band S Maximum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_S_MAX = 0x0211; // (L)= 12 bytes (V)=0x00~0xFF (ASCII))
```

6.5.29 Get Frequency Band S Minimum: Tag 0x0212

Get Frequency Band S Minimum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_S_MIN = 0x0212; // (L)= 12 bytes (V)=0x00~0xFF (ASCII)
```

6.5.30 Get Frequency Band L Maximum: Tag 0x0213

Get Frequency Band L Maximum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_L_MAX = 0x0213; // (L)= 12 bytes (V)=0x00~0xFF (ASCII))
```

6.5.31 Get Frequency Band L Minimum: Tag 0x0214

Get Frequency Band L Minimum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_L_MIN = 0x0214; // (L)= 12 bytes (V)=0x00~0xFF (ASCII)
```

6.5.32 Get Frequency Band U Maximum: Tag 0x0215

Get Frequency Band U Maximum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_U_MAX = 0x0215; // (L)= 12 bytes (V)=0x00~0xFF (ASCII))
```

6.5.33 Get Frequency Band U Minimum: Tag 0x0216

Get Frequency Band U Minimum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_U_MIN = 0x0216; // (L)= 12 bytes (V)=0x00~0xFF (ASCII)
```

6.5.34 Get Frequency Band C Maximum: Tag 0x021A

Get Frequency Band C Maximum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_C_MAX = 0x021A; // (L)= 12 bytes (V)=0x00~0xFF (ASCII))
```

6.5.35 Get Frequency Band C Minimum: Tag 0x022B

Get Frequency Band C Minimum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_C_MIN = 0x022B; // (L)= 12 bytes (V)=0x00~0xFF (ASCII)
```

6.5.36 Get Frequency Band P Maximum: Tag 0x022C

Get Frequency Band P Maximum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_P_MAX = 0x022C; // (L)= 12 bytes (V)=0x00~0xFF (ASCII))
```

6.5.37 Get Frequency Band P Minimum: Tag 0x022D

Get Frequency Band P Minimum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_P_MIN = 0x022D; // (L)= 12 bytes (V)=0x00~0xFF (ASCII)
```

6.5.38 Get Frequency Band Mid-C Maximum: Tag 0x022E

Get Frequency Band Mid-C Maximum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_MID_C_MAX = 0x022E; // (L)= 12 bytes (V)=0x00~0xFF (ASCII))
```

6.5.39 Get Frequency Band Mid-C Minimum: Tag 0x022F

Get Frequency Band Mid-C Minimum has a variable length of up to 12 ASCII bytes. The frequency is defined in MHz. This variable is returned as an ASCII string stored in multiple bytes.

Example: Bytes returned (0x31 0x314 0x35 0x30 0x2E 0x30)

String Representation 1450.0

```
GET_FREQ_BAND_MID_C_MIN = 0x022F; // (L)= 12 bytes (V)=0x00~0xFF (ASCII)
```

6.6 Legacy Get Command Summary

The legacy transmitter information responses are described in Table 30.

Table 30: Legacy Transmitter Information Responses

Response Codes	Protocol Defines	Description
NAK	0x0001	Corrupt Message (Bad Checksum)
NAK_BAD_ID	0x0002	Bad Device ID
ACK	0x0003	Not Currently Used
UNKNOWN_TAG	0x0004	Unknown TAG in tag field
INVALID_TAG	0x0005	TAG not valid for this mode or device
INVALID_TAG_DATA	0x0006	Data was not valid for this TAG
TAG_LIMIT_EXCEEDED	0x0007	Too many tags in one message

The legacy transmitter GET commands are summarized in Table 31.

Table 31: Legacy Transmitter GET Commands

GET Command	Protocol Defines	Description
TX_GET_MODE	0x0090	2 bytes binary (one bit only set)
TX_GET_DATA_POL	0x0092	1 byte binary (0 or 1)
TX_GET_CLOCK_POL	0x0093	1 byte binary (0 or 1)
TX_GET_FREQ	0x0097	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_GET_RAND_On	0x2095	1 byte binary (0 or 1)
TX_GET_DIFF_ENCODE	0x0099	1 byte binary (0 or 1) (SOQPSK only)
TX_GET_RF_On	0x2098	1 byte binary (0 or 1)
TX_GET_CLOCK_SOURCE	0x2099	1 byte binary (0 or 1)
TX_GET_INT_CLOCK	0x209A	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_GET_DATA_SOURCE	0x209B	1 byte binary (0 or 1)
TX_GET_INT_DATA	0x209C	3 bytes as pattern code or value
TX_GET_TEMP	0x209D	6 bytes ASCII (xxx.xx in Deg C)
TX_GET_VAR_POWER	0x221D	1 byte binary sets variable power 0-1F
TX_GET_VAR_POWER_NEW	0x221E	4 bytes ASCII
TX_GET_NEW_VAR_POWER_AVAILABLE	0x0206	1 byte binary (0 or 1)
TX_GET_FEC_AVAIL	0x0203	1 byte binary (0 or 1)
TX_GET_DEVICE_SERNUM	0x0101	10 bytes ASCII
TX_GET_AVAIL_MODES	0x0102	2 bytes binary (one bit per valid mode)
TX_GET_SOFTWARE_VER	0x0107	32 bytes ASCII (version as it comes)
TX_GET_FPGA_VER	0x0109	32 bytes ASCII (FPGA version as it comes)
TX_GET_VAR_POWER_AVAIL	0x2202	1 byte binary (0 or 1)
TX_GET_DIFFENC_AVAIL	0x0202	1 byte binary (0 or 1) (SOQPSK only)
TX_GET_INT_CLOCK_MAX	0x209E	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_GET_INT_CLOCK_MIN	0x209F	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_GET_BANDS_AVAIL	0x0205	1 byte binary (1 bit per band)
TX_GET_CONFIG_STATUS	0x2107	Returns a packed status message

GET Command	Protocol Defines	Description
TX_GET_POWER_STATUS	0x2108	Returns a packed status message
GET_FREQ_BANDS	0x0210	1 or more ASCII letters; Returns bands S, L, U, C, and T or any unforeseen new bands
GET_FREQ_BAND_S_MAX	0x0211	12 bytes (ASCII)
GET_FREQ_BAND_S_MIN	0x0212	12 bytes (ASCII)
GET_FREQ_BAND_L_MAX	0x0213	12 bytes (ASCII)
GET_FREQ_BAND_L_MIN	0x0214	12 bytes (ASCII)
GET_FREQ_BAND_U_MAX	0x0215	12 bytes (ASCII)
GET_FREQ_BAND_U_MIN	0x0216	12 bytes (ASCII)
GET_FREQ_BAND_C_MAX	0x021A	12 bytes (ASCII)
GET_FREQ_BAND_C_MIN	0x022B	12 bytes (ASCII)
GET_FREQ_BAND_P_MAX	0x022C	12 bytes (ASCII)
GET_FREQ_BAND_P_MIN	0x022D	12 bytes (ASCII)
GET_FREQ_BAND_MID_C_MAX	0x022E	12 bytes (ASCII) (Mid-C band)
GET_FREQ_BAND_MID_C_MIN	0x022F	12 bytes (ASCII) (Mid-C band)

6.7 Legacy Transmitter GET, SET, and Response Codes

Table 32: Legacy Transmitter Information Responses

Response Codes	Protocol Defines	Description
NAK	0x0001	Corrupt Message (Bad Checksum)
NAK_BAD_ID	0x0002	Bad Device ID
ACK	0x0003	Not Currently Used
UNKNOWN_TAG	0x0004	Unknown TAG in tag field
INVALID_TAG	0x0005	TAG not valid for this mode or device
INVALID_TAG_DATA	0x0006	Data was not valid for this TAG
TAG_LIMIT_EXCEEDED	0x0007	Too many tags in one message

Table 33: Legacy Transmitter SET Commands

SET Command	Protocol Defines	Description
TX_SET_MODE	0x0010	2 bytes binary (one bit only set)
TX_SET_DATA_POL	0x0012	1 byte binary (0 or 1)
TX_SET_CLOCK_POL	0x0013	1 byte binary (0 or 1)
TX_SET_FREQ	0x0017	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_SET_RAND_On	0x2015	1 byte binary (0 or 1)
TX_SET_DIFF_ENCODE	0x0019	1 byte binary (0 or 1) (SOQPSK only)
TX_SET_RF_On	0x2018	1 byte binary (0 or 1)
TX_SET_CLOCK_SOURCE	0x2019	1 byte binary (0 or 1)
TX_SET_INT_CLOCK	0x201A	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_SET_DATA_SOURCE	0x201B	1 byte binary (0 or 1)
TX_SET_INT_DATA	0x201C	3 bytes as pattern code or value
TX_SET_VAR_POWER	0x201D	1 byte binary sets variable power 0-1F
TX_SET_VAR_POWER_NEW	0x201E	4 bytes ASCII (xx.x)
TX_SAVE_CMD	0x0040	No data required

Table 34: Legacy Transmitter GET Commands

GET Command	Protocol Defines	Description
TX_GET_MODE	0x0090	2 bytes binary (one bit only set)
TX_GET_DATA_POL	0x0092	1 byte binary (0 or 1)
TX_GET_CLOCK_POL	0x0093	1 byte binary (0 or 1)
TX_GET_FREQ	0x0097	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_GET_RAND_On	0x2095	1 byte binary (0 or 1)
TX_GET_DIFF_ENCODE	0x0099	1 byte binary (0 or 1) (SOQPSK only)
TX_GET_RF_On	0x2098	1 byte binary (0 or 1)
TX_GET_CLOCK_SOURCE	0x2099	1 byte binary (0 or 1)
TX_GET_INT_CLOCK	0x209A	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_GET_DATA_SOURCE	0x209B	1 byte binary (0 or 1)
TX_GET_INT_DATA	0x209C	3 bytes as pattern code or value
TX_GET_TEMP	0x209D	6 bytes ASCII (xxx.xx in Deg C)
TX_GET_VAR_POWER	0x221D	1 byte binary sets variable power 0-1F
TX_GET_VAR_POWER_NEW	0x221E	4 bytes ASCII
TX_GET_NEW_VAR_POWER_AVAILABLE	0x0206	1 byte binary (0 or 1)
TX_GET_FEC_AVAIL	0x0203	1 byte binary (0 or 1)
TX_GET_DEVICE_SERNUM	0x0101	10 bytes ASCII
TX_GET_AVAIL_MODES	0x0102	2 bytes binary (one bit per valid mode)
TX_GET_SOFTWARE_VER	0x0107	32 bytes ASCII (version as it comes)
TX_GET_FPGA_VER	0x0109	32 bytes ASCII (FPGA version as it comes)
TX_GET_VAR_POWER_AVAIL	0x2202	1 byte binary (0 or 1)
TX_GET_DIFFENC_AVAIL	0x0202	1 byte binary (0 or 1) (SOQPSK only)
TX_GET_INT_CLOCK_MAX	0x209E	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_GET_INT_CLOCK_MIN	0x209F	11 bytes ASCII (xxxx.xxxxxx) in MHz
TX_GET_BANDS_AVAIL	0x0205	1 byte binary (1 bit per band)
TX_GET_CONFIG_STATUS	0x2107	Returns a packed status message
TX_GET_POWER_STATUS	0x2108	Returns a packed status message
GET_FREQ_BANDS	0x0210	1 or more ASCII letters; Returns bands S, L, U, C, and T or any unforeseen new bands

GET Command	Protocol Defines	Description
GET_FREQ_BAND_S_MAX	0x0211	12 bytes (ASCII)
GET_FREQ_BAND_S_MIN	0x0212	12 bytes (ASCII)
GET_FREQ_BAND_L_MAX	0x0213	12 bytes (ASCII)
GET_FREQ_BAND_L_MIN	0x0214	12 bytes (ASCII)
GET_FREQ_BAND_U_MAX	0x0215	12 bytes (ASCII)
GET_FREQ_BAND_U_MIN	0x0216	12 bytes (ASCII)
GET_FREQ_BAND_C_MAX	0x021A	12 bytes (ASCII)
GET_FREQ_BAND_C_MIN	0x022B	12 bytes (ASCII)
GET_FREQ_BAND_P_MAX	0x022C	12 bytes (ASCII)
GET_FREQ_BAND_P_MIN	0x022D	12 bytes (ASCII)
GET_FREQ_BAND_MID_C_MAX	0x022E	12 bytes (ASCII) (Mid-C band)
GET_FREQ_BAND_MID_C_MIN	0x022F	12 bytes (ASCII) (Mid-C band)

6.8 Device Types

Device ID	Description
0x51 Hex	Demodulator
0x51 Hex	Receiver
0x53 Hex	Transmitter

7 Appendix B – Acronym List

Acronym	Description
AGC	Automatic Gain Control
AM	Amplitude Modulation
AQPSK	Variant of Quadrature Phase Shift Keying
ASCII	American Standard Code for Information Interchange
AUQPSK	Variant of Quadrature Phase Shift Keying
BPSK	Binary Phase Shift Keying
DPM	Digital Phase Modulation
FEC	Forward Error Correction
KHz	Kilohertz
LSB	Least Significant Bit
Mbps	Megabits per second
MHCPM	multi-h Continuous Phase Modulation
MHz	Megahertz
MSB	Most Significant Bit
NAK	Negative Acknowledgment
OQPSK	Offset Quadrature Phase Shift Keying
PCMFM	Pulse Code Modulation/Frequency Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
SOQPSK	Shaped Offset Quadrature Phase Shift Keying
TX	Transmit