

**Amateur Station Control Protocol
(ASCP)**

Ver. 0.17

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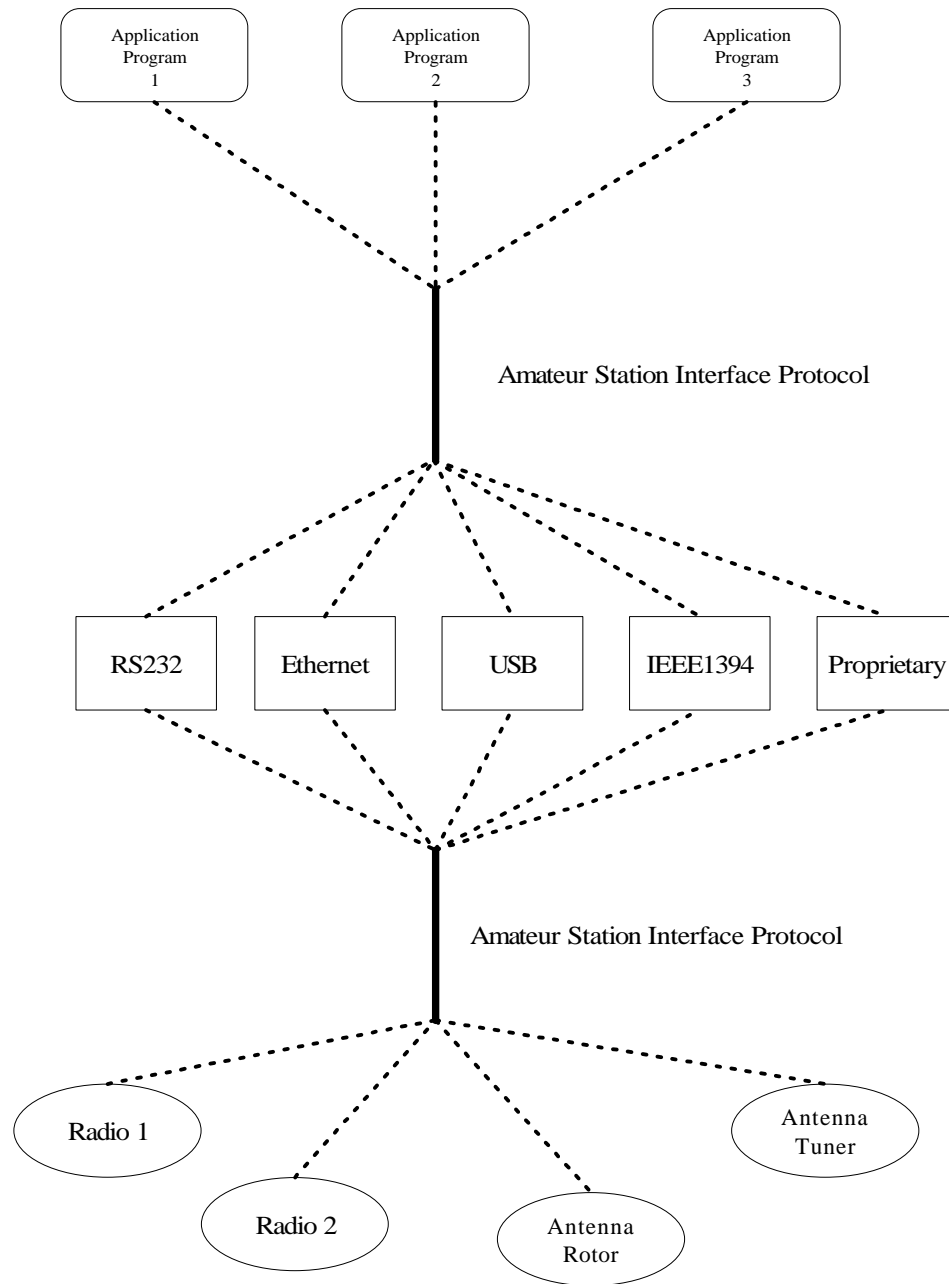
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1. Purpose

This specification addresses the need for a common, generic way to control and monitor an amateur radio station remotely using a standardized protocol. The protocol is operating system and hardware neutral in that it only defines a set of byte blocks that can be received and transmitted through any existing physical medium such as Ethernet, USB, IEEE1394, RS232, or other byte oriented scheme. There are no operating system specific functions or methods so it can be used with any OS.

In addition to control functionality, the protocol allows for the exchange of raw data over the same link such as digitized audio, I/Q signals, AX25 packet data, etc.



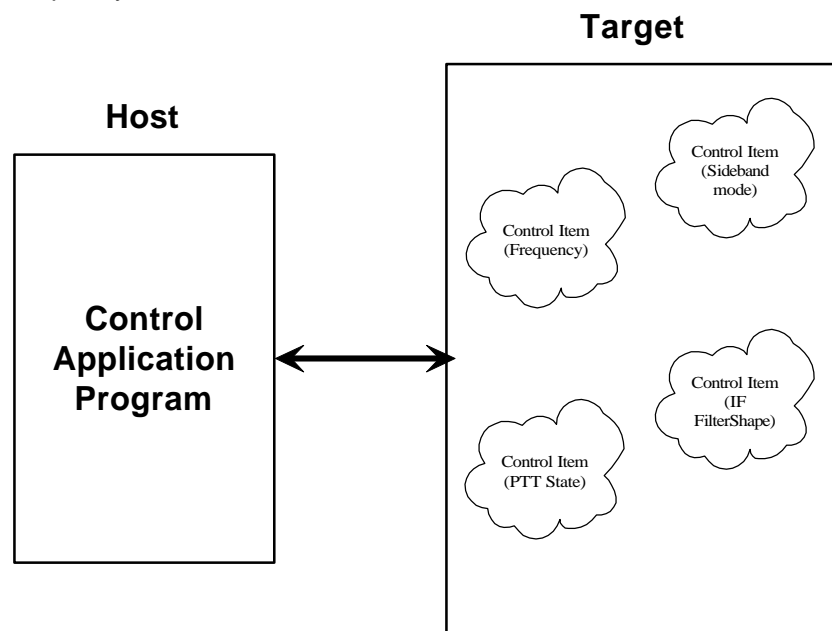
2. Basic Protocol Concepts

Definitions used in this specification:

Host == The main initiator of communications. Typically would be a PC or other computer system such as a custom user interface controller.

Target == The device that is to be controlled or monitored by the Host.

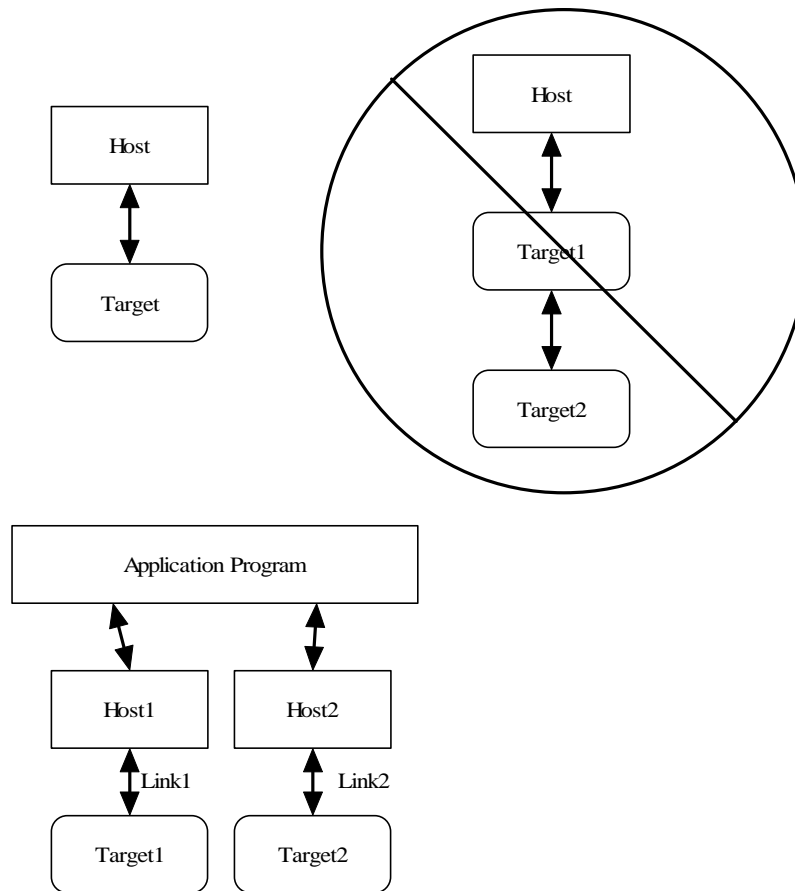
Control Item == The value, setting, or state of the target that is to be controlled or monitored by the Host. For example Frequency, Antenna direction, modulation mode, transmitter state, etc.



Data Item == Digital data associated with the received or transmitted signal. This could be digitized audio, IF, frequency domain data(FFT), information data such as text or AX25 data, etc.

Message Block == A contiguous block of bytes comprising a single Control Item or Data Item transfer from target to host or host to target.

To simplify the protocol, the link can only comprise one host and one target. The Host is the only one that can set or request Control items. This means a Target device cannot connect to another target device or daisy chain to other targets. The Host can control multiple Targets by utilizing multiple links such as USB endpoints or multiple TCP/IP Sockets.



The protocol allows a Target to send unsolicited Control Item messages to the Host. This is desirable for updating the Host when a something changes in the Target without the need for polling by the Host. An example would be when a user changes the frequency of the radio using the radio's frequency knob. The target can send the updated frequency as it occurs without requiring the Host to ask for it.

Message blocks contain the block length in the message header. This is useful to aid in decoding messages as well as being able to support variable length Control Items. For example, a Control Item containing the text string for the Target's manufacturer and model number can be different lengths.

The protocol contains a mechanism for obtaining information about the range and resolution of a Control Item. This allows the Host to obtain the limits of Control Items for the particular target device. For example, the frequency ranges of the target as well as the frequency step size can be obtained without any knowledge of the model or manufacturer of the radio. This capability is key in being able to write a generic application interface program without having to maintain a list of all possible radios and devices that may be connected.

Target devices are not required to implement all the functionality of the protocol. A simple Target device that turns on and off a light need only implement the single Control Item message associated with it. This allows micro controllers with limited capability to be used.

The Data Item message blocks allow various raw data blocks to be sent and received along with the Control Items over the same physical link. The Header type allows up to 5 logical channels of data to be specified in each direction. This permits sending digitized audio, digitized I/Q IF data, etc. to and from a target over the same physical connection.

Note that there is no synchronization or error handling mechanism in this protocol. This layer of protocol assumes that the block synchronization and error handling is done at a lower level. This is a reasonable assumption since Ethernet, USB, IEEE 1394, and most other modern physical links provide robust error recovery. The exception is RS232 serial links. This protocol will work over it as-is but if any data corruption is anticipated, then some simple method such as "SLIP" should be used to frame the data bytes and perhaps add error detection as well. A little "sanity" checking of message block parameters can be used as a simple error detection scheme and allow the RS232 system to eventually sync back up. Since RS232 serial links are being phased out, it doesn't make sense to burden a protocol to handle such a legacy physical link.

3. Message Block Format

The basic message structure starts with a 16 bit header that contains the length of the block in bytes and also a 3 bit type field. If the message is a Control Item, then a 16 bit Control Item code follows the header and contains the code describing the object of the message block. This is followed by an optional number of parameter or data bytes associated with this message. The byte order for all fields greater than 8 bits is "Little Endian" or least significant byte first.

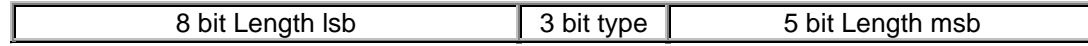
Control Item Message block format:



Data Item Message block format:



The 16 bit header is defined as follows:



The 13 bit Length parameter value is the total number of bytes in the message including this header. The range of the message Length is 0 to 8192 bytes.

A special case for Data Items is that a message length of Zero is used to specify an actual message length of 8194 bytes. This allows data blocks of a power of 2 to be used which is useful in dealing with FFT data.

A 16 bit header containing no Control Item or parameters is a special case and is called a NAK message.

The message type field is used by the receiving side to determine how to process this message block. It has a different meaning depending upon whether the message is from the Host or Target.

3 bit Msg Type field	Message Source	Message Type
000	Host	Set Control Item
001	Host	Request Current Control Item
010	Host	Request Control Item Range
011	Host	Host Data Item 0
100	Host	Host Data Item 1
101	Host	Host Data Item 2
110	Host	Host Data Item 3
111	Host	Host Data Item 4
000	Target	Response to Set or Request Current Control Item
001	Target	Unsolicited Control Item
010	Target	Response to Request Control Item Range
011	Target	Target Data Item 0
100	Target	Target Data Item 1
101	Target	Target Data Item 2
110	Target	Target Data Item 3
111	Target	Target Data Item 4

3.1. Detailed Description of the Message Block Types and Their Purpose

3.1.1 Set Control Item

This Message type is sent from the Host to the Target requesting that the Target change the specified Control Item to the new value supplied in this message. A request to change to a new frequency would be an example of this type of message. The Target must respond to this message.

3.1.2 Request Control Item

This Message type is sent from the Host to the Target requesting that the Target respond with its current state or value of the specified Control Item of this message. A request to get the current S-meter reading would be an example of this message type. The Target must respond to this message.

3.1.3 Request Control Item Range

This Message type is sent from the Host to the Target requesting that the Target respond with the acceptable range of values of the Control Item supplied in this message. A request for the targets frequency range(s) and step sizes would be an example of this message type. The Target must respond to this message.

3.1.4 Response to Set or Request Current Control Item

This Message type is sent from the Target to the Host in response to a request from the Host to either set or just return the current value of the Control Item supplied in this message. This message contains the current value of the Control Item. It is sent in response to either the "Set Control Item" or "Request Control Item" message.

3.1.5 Unsolicited Control Item

This Message type can be sent from the Target to the Host without any request from the Host. It contains the current value of the Control Item supplied in this message. This message can be sent at any time to the Host. It can be used to update the Host to any changes that have occurred in the Target Control Items. An example would be if the user changed frequency using the Targets frequency knob, then the Target could send the new Control Item value to the Host without having to wait for the Host to ask for it. There is no response back from the Host when this message is received.

3.1.6 Response to Request Control Item Range

This Message is sent from the Target to the Host in response to a "Request Control Item Range" message from the Host. It contains the allowable range and step size of the Control Item supplied in this message.

3.1.7 Data Item Messages

Data Item message allow data messages to be allocated to different logical "channels". Different types of data blocks may be interleaved together and this mechanism allows each end to keep the data separated. For example, Data Item 5 blocks may be digitized audio from a Target receiver that needs to be processed and sent to a soundcard speaker. Data Item 6 Blocks may be spectral data from an FFT inside the Target receiver that needs to be sent to the Host applications display screen.

The current scheme allows up to five different logical channels for each data direction.

3.2. The NAK Message and its Purpose

A "NAK" message is a 16 bit header without a Control Item or parameters (Message length of 2). When the NAK message block is returned by the Target, it indicates that the specified Control Item is not supported. This allows a target to implement only the Control Items it actually needs. Any Host message requesting an unimplemented Control Item will be returned the NAK message. The Host can then exclude this Control Item from its list of Items to control or monitor.

As an example, suppose a Host requests the elevation setting from a rotor Target controller that only supports azimuth readings. The Target controller would just return the NAK header.

Implementation on the Target side is easily done by simply decoding only the Control Item messages that it supports and returning the NAK for all others.

On the Host side, one could initially poll the Target for all the Control Items it may use and then tag the ones that return NAK for exclusion.

This dynamically allocated feature set allows application software to determine on the fly what capabilities are available without any prior knowledge of the Target device.

The "NAK" message could also be used with Data Items and perhaps redefined as an ACK for data messages. This issue remains undetermined at this time.

4. Control Item Definitions

All examples use hexadecimal notation within brackets [] for the individual byte values.

4.1. General Control Items

4.1.1 Interface Name

Purpose: Contains an ASCII string describing the Host or Target device. This could be the manufacturer and model or a description of the device.

Control Item Code: 0x0001

Control Item Parameter Format: The data is a NULL(zero) terminated character byte string.

Example, to request the target name, the host sends:

[04][20] [01][00]

The Target responds with "DSP-10" :

[0B][00] [01][00] [44][53][50][2D]31][30][00]

Example, to Send the Host name "WinPSK" to the target device, the host sends:

[0B][00] [01][00] [57][69][6E][50][53][4B][00]

The Target responds with " WinPSK " :

[0B][00] [01][00] [57][69][6E][50][53][4B][00]

Control Item Range: N.A.

4.1.2 Interface Version

Purpose: Contains the version number of the Host or Targets implemented Interface. This allows the Host or Target to display or adapt to different versions of the interface.

Control Item Code: 0x0002

Control Item Parameter Format: The data is a 2 byte 16 bit unsigned variable equal to the version times 100. For example the value 123 would be version 1.23.

Example, to request the target interface version(5.29) the host sends:

[04][20] [02][00]

The Target responds with:

[06][00] [02][00] [11][02]

Example, to Send the Host's interface version(1.00) to the target, the host sends:

[06][00] [02][00] [64][00]

The Target responds with:

[06][00] [02][00] [64][00]

Control Item Range: N.A.

4.1.3 Error Code

Purpose: Contains the Error Status code(s) of the Target. This item is used to notify the Host of any error or problem using a list of code values. Once the error code(s) are obtained, the host can interrogate the Target "Error String" Control Item to obtain a description string of the error(s).

Control Item Code: 0x0003

Control Item Parameter Format: The data is a list of 1 byte unsigned variable equal to the error number associated with a particular error. There can be multiple error codes returned by the Target.

0x00 = No Errors

0x01 to 0x3F = Range of minor errors not requiring any user actions.

0x40 to 0x7F = Range of errors that can be fixed by some user action.

0x80 to 0xBF = Range of fatal errors that cannot be fixed by any user action.

0xC0 to 0xFF = Undefined.

Example, suppose a Target transmitter device overheats and shuts down. It could send an unsolicited Response message to the host as follows where code 0x42 is it's code for overheating:
[05][20] [03][00] [42]

No response is required from host. The host can act on it, ignore it, or request more details by requesting the "Error String" Control Item from the Target device.

Control Item Range: N.A.

4.1.4 Error String

Purpose: Contains the Error Status text strings describing the current error state of the target device.

Control Item Code: 0x0004

Control Item Request Parameter Format: The data is a 1 byte unsigned variable that specifies the error number of the desired error string. This allows the Host to obtain an information text string from the Target device about any of the targets error codes.

Control Item Response Parameter Format: The data is a NULL(zero) terminated character byte string.

Example, a Host wants to obtain the text string associated with the error code (0x42) returned by the target in the Error Code Control Item example.

The Host would send:

[05][20] [04][00] [42]

The Target would respond with a text string such as " Overheated"

[0F][00] [04][00] [4F][76][65][72][68][65][61][74][65][64][00]

Control Item Range: N.A.

4.2. Receiver Control Items

4.2.1 Receiver Channels

Purpose: Controls which channel(s) are concurrently available in the receiver. This allows for receivers that may have multiple channels that can be active at the same time such as a priority channel or possibly a telemetry receiver running in parallel with an SSB voice receiver or a television receiver that can receive data from the horizontal blanking interval, etc. All the control items related to a receiver have a channel selection parameter in order to independently control each channel.

Control Item Code: 0x0010

Control Item Parameter Format:

A list of one byte channel ID's that are to be made available.

A channel ID is a one byte value(0 to 255)

Example, a Host wants to make channel 0 and 3 available:

The Host would send:

[06][00] [10][00] [00][03]

The Target would respond

[06][00] [10][00] [00][03]

Example, a Host wants to request the available receiver channels:

The Host would send:

[04][20] [10][00]

The Target would respond

[06][00] [10][00] [00][03]

or it could use the request range to get the same information.

Control Item Range: Returns list of implemented channels.

Example, suppose a receiver has two channels(0 and 3) that can be active concurrently.
The host sends:
[04][40] [10][00]
The Target would reply with the following byte string:
[06][40] [10][00] [00][03]

4.2.2 Receiver State

Purpose: Controls the power or state of the receiver channel.

Control Item Code: 0x0018

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

The second parameter is a 1 byte value defined as:

0x00 = Power OFF

0x01 = Power ON Idle

0x02 = Power ON Active.

Example, request to set the target receiver channel 0 to active state.

The host sends:

[06][00] [18][00] [00] [02]

The Target responds with:

[06][00] [18][00] [00] [02]

Example, request the current target receiver channel 0 's state.

The host sends:

[05][20] [18][00] [00]

The Target responds with:

[06][00] [18][00] [00] [02]

Control Item Range: Returns list of implemented states for the specified channel ID.

Example, suppose a receiver allows an idle and active state but not a power off state on channel 3.

The host sends:

[05][40] [18][00] [03]

The Target would reply with the following byte string:

[07][40] [18][00] [03] [01] [02]

4.2.3 Receiver Frequency

Purpose: Controls the receiver center frequency.

Control Item Code: 0x0020

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 4 byte frequency value in Hz(32 bit unsigned integer LSB first)

Followed by a 1 byte(8 bit unsigned integer) multiplier value. The multiplier will typically be 1 except when the frequency exceeds the range of a 32 bit integer(4.29496GHz). Example for 7.123 MHz the control value is [38][B0][6C][00] [01] in Hex.

Example, To set a target receiver channel 0 to 146.32MHz.

The host sends this:

[0A][00] [20][00] [00] [80][AA][B8][08] [01]

The Target responds with:

[0A][00] [20][00] [00] [80][AA][B8][08] [01]

Example, To get the current target receiver channel 0's frequency.

The host sends this:

[05][20] [20][00] [00]

The Target responds with:

[0A][00] [20][00] [00] [80][AA][B8][08] [01]

Control Item Range: List of supported frequency ranges and minimum step sizes.

The format for each range is

{ Beginning Freq(5 bytes) }{ Ending Freq(5 bytes) }{ Minimum Step size(2 byte) }

The frequency format is the same as the Control Item, 4 byte frequency and 1 byte multiplier.

The Step size is a two byte 16 bit unsigned integer value LSB first in Hz.

Example, suppose a target receivers channel 0 covers 40 and 80 meters with a 100Hz step size.

The host sends this to request the valid band ranges and step sizes:

[05][40] [20][00] [00]

The Target responds with:

[1D][40] [20][00] [00] [E0][67][35][00] [01] [00][09][3D][00] [01] [64][00]
[C0][CF][6A][00] [01] [A0][63][6F][00] [01] [64][00]

4.2.4 Signal Demodulation Type

Purpose: Controls the receivers demodulator type.

Control Item Code: 0x0028

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 1 byte mode value.

Mode values:

0x00 = Baseband Double Sideband(AM)

0x01 = Baseband Upper Sideband (USB)

0x02 = Baseband Lower Sideband (LSB)

0x03 = Offset Upper Sideband (USB CW with BFO Offset)

0x04 = Offset Lower Sideband (LSB CW with BFO Offset)

0x05 = FM

Example, request to set the target receiver channel 0 to USB mode.

The host sends:

[06][00] [28][00] [00][01]

The Target responds with:

[06][00] [28][00] [00][01]

Example, request current setting of the target receiver channel 0's mode.

The host sends:

[05][20] [28][00] [00]

The Target responds with:

[06][00] [28][00] [00][01]

Control Item Range: List of supported Demodulator types for the specified channel.

Example: The host sends this to request the valid demodulator types for channel 1:

[05][40] [28][00] [01]

If the Target only supports FM it responds with:

[06][40] [28][00] [01][05]

4.2.5 Data Decoder Settings

Purpose: Controls the receivers data decoder Settings.

Control Item Code: 0x0030

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 2 byte decoder type.

Type values will be enumerated in a supplementary document due to the large number of data decoder types
examples: CW, RTTY, PSK31, 1200Baud Packet, SSTV, etc

4.2.6 RF Gain

Purpose: Controls the Level of RF gain(or attenuation) of the receiver.

Control Item Code: 0x0038

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 1 byte signed variable(-128 to +127 dB).

Example, to set the receiver channel 0 RF Gain to +10 dB.

The host sends this:

[06][00] [38][00] [00] [0A]

The Target responds with:

[06][00] [38][00] [00] [0A]

The host sends this to request the current RF Gain setting of channel 0:

[05][20] [38][00] [00]

The Target responds with:

[06][00] [38][00] [00] [0A]

Control Item Range: Returns range and step size in dB.

The format for each range is

{ Start Value(1 bytes) }{ Ending Value(1 bytes) }{ Step size(1 byte) }

Example, suppose a target receivers channel 2 RF gain ranges from -25 to +30 dB in 6 dB steps.

The host sends this to request the valid gain range and step size:

[04][40] [38][00] [02]

The Target responds with:

[07][40] [38][00] [02] [E7] [1E] [06]

4.2.7 IF Gain

Purpose: Controls the Level of IF gain(or attenuation) of the receiver.

Control Item Code: 0x0040

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 1 byte signed variable(-128 to +127 dB).

Example, to set the receiver channel 0 IF Gain to +10 dB.

The host sends this:

[06][00] [40][00] [00] [0A]

The Target responds with:

[06][00] [40][00] [00] [0A]

The host sends this to get the current Channel 0's IF Gain Setting:

[05][20] [40][00] [00]

The Target responds with:

[06][00] [40][00] [00] [0A]

Control Item Range: Returns range and step size in dB.

The format for each range is

{ Start Value(1 bytes) }{ Ending Value(1 bytes) }{ Step size(1 byte) }

Example, suppose a target receivers channel 2 IF gain ranges from -25 to +30 dB in 6 dB steps.
The host sends this to request the valid gain range and step size:
[04][40] [40][00] [02]
The Target responds with:
[07][40] [40][00] [02] [E7] [1E] [06]

4.2.8 AF Gain

Purpose: Controls the Level of AF gain(or attenuation) of the receiver.
Control Item Code: 0x0048
Control Item Parameter Format:
The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 1 byte signed variable(-128 to +127 dB).
Example, to set the receiver channel 0 AF Gain to +10 dB.
The host sends this:
[06][00] [48][00] [00] [0A]
The Target responds with:
[06][00] [48][00] [00] [0A]
The host sends this to get the current Channel 0's AF Gain Setting:
[05][20] [48][00] [00]
The Target responds with:
[06][00] [48][00] [00] [0A]

Control Item Range: Returns range and step size in dB.
The format for each range is
{ Start Value(1 bytes) }{ Ending Value(1 bytes) }{ Step size(1 byte) }

Example, suppose a target receivers channel 2 AF gain ranges from -25 to +30 dB in 6 dB steps.
The host sends this to request the valid gain range and step size:
[04][40] [48][00] [02]
The Target responds with:
[07][40] [48][00] [02] [E7] [1E] [06]

4.2.9 AGC Setting

Purpose: Controls the AGC settings of the specified receiver channel.
Control Item Code: 0x0050
Control Item Parameter Format:
The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 2 byte unsigned signed variable(0 to 65535 milliSeconds) for the AGC Attack time.
Followed by a 2 byte unsigned signed variable(0 to 65535 milliSeconds) for the AGC Decay time.

A value of zero for both Attack and Decay time would disable the AGC function.

Example, to set the receiver channel 3 AGC for a 25 mSec attack and 500 mSec Decay time
The host sends this:
[09][00] [50][00] [03] [19][00] [F4][01]
The Target responds with:
[09][00] [50][00] [03] [19][00] [F4][01]

The host sends this to get channel 3's current AGC Setting:

[05][20] [50][00] [03]
The Target responds with:
[09][00] [50][00] [03] [19][00] [F4][01]

Control Item Range: Returns the supported range for the attack and decay times.

The format for each range is

{ Min Attack Time(2 bytes) } { Max Attack Time(2 bytes) } { Min Step Size(1 byte) }
{ Min Decay Time(2 bytes) } { Max Decay Time(2 bytes) } { Min Step Size(1 byte) }

Example, suppose a target receivers channel 1 AGC attack time is fixed at 25mSec and the Decay Time is adjustable from 100 to 1000mSec in steps of 10mSecs..

The host sends this to request the valid AGC ranges and step size:

[05][40] [50][00] [01]

The Target responds with:

[0F][40] [50][00] [01] [19][00] [19][00] [00] [64][00] [E8][03] [0A]

4.2.10 IF Filter BW

Purpose: Controls the IF Filter bandwidth of the specified receiver channel.

Control Item Code: 0x0058

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 4 byte unsigned signed variable of the Filter pass bandwidth in Hz.

Example, to select the receiver channel 1's 3KHz wide IF Filter.

The host sends this:

[09][00] [58][00] [01] [B8][0B][00][00]

The Target responds with:

[09][00] [58][00] [01] [B8][0B][00][00]

The host sends this to get the channel 1's current Filter Bandwidth:

[05][20] [58][00] [01]

The Target responds with:

[09][00] [58][00] [01] [B8][0B][00][00]

Control Item Range: Returns the supported IF Filter bandwidths available.

Example, a receivers channel 2 has two available IF filter bandwidths, a 2KHz and a 300Hz filter:

The host sends this:

[05][40] [58][00] [02]

The Target responds with:

[0D][40] [58][00] [02] [D0][07][00] [00] [2C][01][00][00]

4.2.11 LMS Noise Reduction Filter

Purpose: Controls the LMS NR Filter of the specified receiver channel.

Control Item Code: 0x0060

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

tbd

Control Item Range:

tbd.

4.2.12 Notch Filter

Purpose: Controls the Notch Filter of the specified receiver channel.

Control Item Code: 0x0068

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

tbd

Control Item Range:

tbd.

4.2.13 Impulse Noise Blanker

Purpose: Controls the Impulse Noise blanker Filter of the specified receiver channel.

Control Item Code: 0x0070

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

tbd

Control Item Range:

tbd.

4.2.14 AFC Setting

Purpose: Controls the Automatic Frequency Control of the specified receiver channel.

Control Item Code: 0x0078

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

tbd

Control Item Range:

tbd.

4.2.15 Squelch Threshold

Purpose: Controls the Squelch Threshold Setting of the specified receiver channel.

Control Item Code: 0x0080

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 1 byte unsigned value for the squelch threshold

Example, to set the receiver channel 1's squelch to 25.

The host sends this:

[06][00] [80][00] [01] [19]

The Target responds with:

[06][00] [80][00] [01] [19]

The host sends this to get channel 1's current squelch threshold:

[05][20] [80][00] [01]

The Target responds with:

[06][00] [80][00] [01] [19]

Control Item Range: Returns the supported squelch threshold range for the specified channel.
{ min value(1 byte) max value(1 byte) }

Example, a receivers channel 2 has a squelch range of 0 to 100:

The host sends this:

[05][40] [80][00] [02]

The Target responds with:

[07][40] [80][00] [02] [00] [64]

4.2.16 CW BFO Pitch Offset

Purpose: Controls the CW BFO Pitch Offset of the specified receiver channel.

Control Item Code: 0x0088

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 2 byte unsigned value for the BFO Pitch offset of the CW signal in Hz.

Example, to set the receiver channel 1's CW pitch to 700Hz.

The host sends this:

[07][00] [88][00] [01] [BC][02]

The Target responds with:

[07][00] [88][00] [01] [BC][02]

The host sends this to get channel 1's current CW pitch offset:

[05][20] [88][00] [01]

The Target responds with:

[07][00] [88][00] [01] [BC][02]

Control Item Range: Returns the supported CW pitch offsets for the specified channel.
{ min value(2 byte) max value(2 byte) min step size in Hz(1byte) }

Example, a receivers channel 2 has a CW pitch offset range of 200 to 1000Hz with a 10Hz step size:

The host sends this:

[05][40] [88][00] [02]

The Target responds with:

[0A][40] [88][00] [02] [C8][00] [E8][03] [0A]

4.2.17 Signal Level

Purpose: Controls the receiver signal level.

Control Item Code: 0x0090

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

The following byte represents a signal strength value.

Example, Host requests the current receiver channel 5's Signal Level:

The host sends this:

[05][20] [90][00] [05]

The Target responds with a level of 50:

[06][00] [90][00] [05] [32]

Example, a Target receivers channel 2 changes to a Signal Level of 10 so can send the following unsolicited message:

[06][20] [90][00] [02] [0A]
There is no response from the Host.

Control Item Range: Returns the supported Signal Strength range for the specified channel.
{ min value(1 byte) max value(1 byte min step size(1byte) }

Example, a receivers channel 2 has a Signal Level range of 0 to 100 with a step size of 5:

The host sends this:
[05][40] [90][00] [02]
The Target responds with:
[09][00] [90][00] [02] [00][64] [05]

4.2.18 Spectral Display Settings

Purpose: Controls the receiver Spectral Display Parameters.

Control Item Code: 0x0098

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 1 byte parameter specifying which target message data item to use in sending the spectral display data back to the host:

0x00 = Data Item 0
0x01 = Data Item 1
0x02 = Data Item 2
0x03 = Data Item 3
0x04 = Data Item 4

Followed by a 1 byte data type parameter with the following possible values

0x00 = Linear
0x01 = Log

Followed by the 2 byte number of data points.

Followed by the 2 byte minimum amplitude

Followed by the 2 byte maximum amplitude

Followed by the 4 byte starting frequency in Hz

Followed by the 4 byte ending frequency in Hz

Example, Host sets receiver channel 0's Spectral Display Parameters for a 1000 Point log frequency display with a range of -100dB to +100dB and a frequency range of 14.000 MHz to 14.001 MHz coming from the Target's message data item 2:

The host sends this:

[14][00] [98][00] [02] [01] [E8][03] [9C][FF] [64][00] [80][9F][D5][00] [68][A3] [D5][00]

The Target responds with:

[14][00] [98][00] [02] [01] [E8][03] [9C][FF] [64][00] [80][9F][D5][00] [68][A3] [D5][00]

Example, Host requests current receiver channel 0's Spectral Display Parameters:

The host sends this:

[05][20] [98][00] [00]

The Target responds with:

[14][00] [98][00] [02] [01] [E8][03] [9C][FF] [64][00] [80][9F][D5][00] [68][A3] [D5][00]

4.2.19 Receiver Signal Input Source

Purpose: Controls the receiver signal input source.

Control Item Code: 0x00A0

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 1 byte source value:

0x00 = No Source Attached

0x01 = Antenna 1

0x02 = Antenna 2

...

...

0x10 = Antenna 16

0x11 = Dual Diversity Antenna or I/Q Input 1

0x12 = Dual Diversity Antenna or I/Q Input 2

...

...

0x20 = Dual Diversity Antenna or I/Q Input16

0x21 = Internally Generated Signal 1 (test or calibration signal)

0x22 = Internally Generated Signal 2 (test or calibration signal)

0x23 = Internally Generated Signal 3 (test or calibration signal)

...

...

0x60 = Internally Generated Signal 64 (test or calibration signal)

0x61 = Real Data From Data Item 0 (Digital data from host using Data Item 0)

0x62 = Real Data From Data Item 1 (Digital data from host using Data Item 1)

0x63 = Real Data From Data Item 2 (Digital data from host using Data Item 2)

0x64 = Real Data From Data Item 3 (Digital data from host using Data Item 3)

0x65 = Real Data From Data Item 4 (Digital data from host using Data Item 4)

0x66 = I/Q Data From Data Item 0 (Digital data from host using Data Item 0)

0x67 = I/Q Data From Data Item 1 (Digital data from host using Data Item 1)

0x68 = I/Q Data From Data Item 2 (Digital data from host using Data Item 2)

0x69 = I/Q Data From Data Item 3 (Digital data from host using Data Item 3)

0x6A = I/Q Data From Data Item 4 (Digital data from host using Data Item 4)

0x71 = External Real Data File 1

0x72 = External Real Data File 2

...

...

0x80 = External Real Data File 16

0x81 = External I/Q Complex Data File 1

0x82 = External I/Q Complex Data File 2

...

...

0x90 = External I/Q Complex Data File 16

0x91 to 0xFF = undefined

Example, request to set the target receiver channel 4's signal source to Antenna number 3.
The host sends:

[06][00] [A0][00] [04] [03]
The Target responds with:
[06][00] [A0][00] [04] [03]

The host sends this to get receiver channel 4's current source:
[05][20] [A0][00] [04]
The Target responds with:
[06][00] [A0][00] [04] [03]

Control Item Range: Returns list of implemented input sources.
Example, suppose a receiver channel 0 supports one antenna and an external I/Q Data File only.

The host sends:
[05][40] [A0][00] [00]
The Target would reply with the following byte string:
[07][40] [A0][00] [00] [01] [81]

4.2.20 Receiver Demodulator Output Destination

Purpose: Controls the receiver demodulator output destination.

Control Item Code: 0x00A8

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

The following 1 byte parameters specify the output destination or destinations. Multiple destinations are possible by listing all destinations in the parameter field.

Destination values:

0x00 = No destination Attached

0x01 = Internal Speaker

0x02 = External Speaker

0x03 = Headphones

0x04 = Binaural Internal Speakers

0x05 = Binaural External Speakers

0x06 = Binaural Headphones

0x11 = Aux Output 1

0x12 = Aux Output 2

...

...

0x20 = Aux Output 16

0x21 = I/Q or Binaural Aux Output 1

0x22 = I/Q or Binaural Aux Output 2

...

...

0x30 = I/Q or Binaural Aux Output 16

0x31 = Real Data to Data Item 0(Digital data sent to host using Data Item 0)

0x32 = Real Data to Data Item 1(Digital data sent to host using Data Item 1)

0x33 = Real Data to Data Item 2(Digital data sent to host using Data Item 2)

0x34 = Real Data to Data Item 3(Digital data sent to host using Data Item 3)

0x35 = Real Data to Data Item 4(Digital data sent to host using Data Item 4)

0x36 = I/Q Data to Data Item 0(Digital data sent to host using Data Item 0)

0x37 = I/Q Data to Data Item 1(Digital data sent to host using Data Item 1)

0x38 = I/Q Data to Data Item 2(Digital data sent to host using Data Item 2)
0x39 = I/Q Data to Data Item 3(Digital data sent to host using Data Item 3)
0x3A = I/Q Data to Data Item 4(Digital data sent to host using Data Item 4)

0x41 = External Real Data File 1
0x42 = External Real Data File 2
...
...
0x50 = External Real Data File 16

0x51 = External I/Q Data File 1
0x52 = External I/Q Data File 2
...
...
0x60 = External I/Q Data File 16

0x61 to 0xFF = undefined

Example, request to set the target receiver channel 4's signal destination to Binaural Headphones and an External I/Q Data File:

The host sends:
[07][00] [A8][00] [04] [06] [51]
The Target responds with:
[07][00] [A8][00] [04] [06] [51]

The host sends this to get receiver channel 4's current destination(s):
[05][20] [A8][00] [04]
The Target responds with:
[07][00] [A8][00] [04] [06] [51]

Control Item Range: Returns list of implemented input sources.

Example, suppose a receiver channel 0 supports an internal speaker and an Auxiliary Output only.

The host sends:
[05][40] [A8][00] [00]
The Target would reply with the following byte string:
[07][40] [A8][00] [00] [01] [11]

4.2.21 Receiver Input Sample Rate

Purpose: Controls the receiver input sample rate if it supports a digital data input.

Control Item Code: B0

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

The following 4 byte parameter specifies the input source sample rate in Hz.

Example, suppose a receiver's channel 0 is set to an input sample rate of 25MHz.

The host sends:
[05][20] [B0][00] [00]
The Target would reply with the following byte string:
[09][40] [B0][00] [00] [40][78][7D][01]

Example, to set a receiver channel 2's input sample rate to 48000 Hz.

The host sends:
[09][00] [B0][00] [02] [80][BB][00][00]
The Target would reply with the following byte string:

[09][00] [B0][00] [02] [80][BB][00][00]

Control Item Range: Returns range of implemented input sample rates and minimum step resolution size.

{4 bytes unsigned Min sample rate}{4 bytes unsigned Max sample rate}{2 byte step size(Hz) }

Example, suppose a receiver channel 0 input supports a range of 48000 to 25MHz sample rate with a minimum resolution of 1000 Hz.

The host sends:

[05][40] [B0][00] [00]

The Target would reply with the following byte string:

[0F][40] [B0][00] [00] [80][BB][00][00] [40][78][7D][01] [E8][03]

4.2.22 Receiver Output Sample Rate

Purpose: Controls the receiver output sample rate if it supports a digital output.

Control Item Code: 0x00B8

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

The following 4 byte parameter specifies the output destination sample rate in Hz.

Example, suppose a receiver's channel 0 is set to an output sample rate of 8000 Hz.

The host sends:

[05][20] [B8][00] [00]

The Target would reply with the following byte string:

[09][40] [B8][00] [00] [40][1F][00][00]

Example, to Set a receiver channel 2's output sample rate to 44100 Hz.

The host sends:

[09][00] [B8][00] [02] [44][AC][00][00]

The Target would reply with the following byte string:

[09][00] [B8][00] [02] [44][AC][00][00]

Control Item Range: Returns range of implemented output sample rates and minimum step resolution size.

{4 bytes unsigned Min sample rate}{4 bytes unsigned Max sample rate}{2 byte step size(Hz) }

Example, suppose a receiver channel 0 output supports a range of 8000 to 32000 Hz sample rate with a minimum resolution of 100 Hz.

The host sends:

[05][40] [B8][00] [00]

The Target would reply with the following byte string:

[0F][40] [B8][00] [00] [40][1F][00][00] [00][7D][00][00] [64][00]

4.2.23 Receiver Input Data File Parameters

Purpose: Controls the receiver input data file parameters.

Control Item Code: 0x00C0

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

The following 4 byte parameter specifies the input file offset in number of samples.

Followed by a variable length NULL(zero) terminated character string representing the Input File path name. (The format will depend on the operating system)

Example, suppose a receiver's channel 2's Input file is set to start at a 0 sample offset and has a pathname of "c:\in.wav".

The host sends:

[05][20] [C0][00] [02]

The Target would reply with the following byte string:

[13][40] [C0][00] [02] [00][00][00][00] [63][3A][5C][69][6E][2E][77][61][76][00]

Example, to set a receiver channel 2's input file parameters to a starting offset of 5000 samples and a path name of "c:\in.wav".

The host sends:

[13][40] [C0][00] [02] [13][88][00][00] [63][3A][5C][69][6E][2E][77][61][76][00]

The Target would reply with the following byte string:

[13][40] [C0][00] [02] [13][88][00][00] [63][3A][5C][69][6E][2E][77][61][76][00]

Control Item Range: NA

4.2.24 Receiver Output Data File Parameters

Purpose: Controls the receiver output data file parameters.

Control Item Code: 0x00C8

Control Item Parameter Format:

The first parameter is a 1 byte receiver channel ID (0 to 255).

Followed by a 1 byte parameter specifying the output file write characteristics.

0x00 = Overwrite an existing file.

0x01 = Append to the end of an existing file.

Followed by a 4 byte parameter specifies the output file size limit in number of Samples.

Followed by a variable length NULL(zero) terminated character string representing the Output File path name. (The format will depend on the operating system)

Example, suppose a receiver's channel 2's Output file is set to overwrite with a sample limit of 2MegaSamples and has a pathname of "c:\out.wav".

The host sends:

[05][20] [C8][00] [02]

The Target would reply with the following byte string:

[15][00] [C8][00] [02] [00] [80][84][1E][00] [63][3A][5C][6F][75][74][2E][77][61][76][00]

Example, to set a receiver's channel 1's Output file to append with a sample limit of 2MegaSamples and a pathname of "c:\out.wav".

The host sends:

[15][00] [C8][00] [01] [01] [80][84][1E][00] [63][3A][5C][6F][75][74][2E][77][61][76][00]

The Target would reply with the following byte string:

[15][00] [C8][00] [01] [01] [80][84][1E][00] [63][3A][5C][6F][75][74][2E][77][61][76][00]

Control Item Range: NA

4.3. Transmitter Control Items

4.3.1 Transmitter Channels

Purpose: Controls which channel(s) are concurrently available in the transmitter. This allows for transmitters that may have transmit on multiple channels at the same time. All the control items related to a transmitter have a channel selection parameter in order to independently control each channel.

Control Item Code: 0x0100

Control Item Parameter Format:

A list of one byte channel ID's that are to be made available.
A channel ID is a one byte value(0 to 255)

Example, a Host wants to make channel 0 and 3 available:

The Host would send:

[06][00] [00][01] [00][03]

The Target would respond

[06][00] [00][01] [00][03]

Example, a Host wants to request the available transmitter channels:

The Host would send:

[04][20] [00][01]

The Target would respond

[06][00] [00][01] [00][03]

or it could use the request range to get the same information.

Control Item Range: Returns list of implemented channels.

Example, suppose a transmitter has two channels(0 and 3) that can be active concurrently.

The host sends:

[04][40] [00][01]

The Target would reply with the following byte string:

[06][40] [00][01] [00][03]

4.3.2 Transmitter State

Purpose: Controls the power or state of the transmitter channel.

Control Item Code: 0x0108

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

The second parameter is a 1 byte value defined as:

0x00 = Power OFF

0x01 = Power ON Idle

0x02 = Power ON Active.

Example, request to set the target transmitter channel 0 to active state.

The host sends:

[06][00] [08][01] [00] [02]

The Target responds with:

[06][00] [08][01] [00] [02]

Example, request the current target transmitter channel 0 's state.

The host sends:

[05][20] [08][01] [00]

The Target responds with:

[06][00] [08][01] [00] [02]

Control Item Range: Returns list of implemented states for the specified channel ID.

Example, a transmitter allows an idle and active state but not a power off state on channel 3.

The host sends:

[05][40] [08][01] [03]

The Target would reply with the following byte string:

[07][40] [08][01] [03] [01] [02]

4.3.3 CW Key State

Purpose Indicates the state of the CW key switch input.

Control Item Code: 0x0110

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte CW Key State variable:

0x00 = Key OFF

0x01 = Key ON

Example, request the target transmitter's Channel 0 CW key state.

The host sends:

[05][20] [10][01] [00]

The Target responds with:

[06][00] [10][01] [00] [01] if key is on.

Example, if target channel 2's transmitter's CW key is pressed then it can send this unsolicited message.

[06][20] [10][01] [02] [01] when key is pressed.

[06][20] [10][01] [02] [00] when key is released.

4.3.4 PTT Switch State

Purpose: Indicates the state of the transmitter PTT switch.

Control Item Code: 0x0118

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte PTT Switch State variable:

0x00 = PTT switch OFF

0x01 = PTT switch ON

Example, request the target transmitter channel 0's Microphone PTT state.

The host sends:

[05][20] [18][01] [00]

The Target responds with:

[06][00] [18][01] [00] [01] if switch is on.

Example, request to set the target transmitter channel 0's PTT state to ON.

The host sends:

[06][00] [18][01] [00] [01]

The Target responds with:

[05][00] [18][01] [00] [01]

Example, if target transmitter channel 0's Microphone PTT key is pressed then it can send this unsolicited message.

[06][20] [18][01] [00][01] when switch is pressed.

[06][20] [18][01] [00][00] when switch is released.

4.3.5 Transmitter Frequency

Purpose: Controls the transmitter center frequency.

Control Item Code: 0x0120

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 4 byte frequency value in Hz(32 bit unsigned integer LSB first)

Followed by a 1 byte(8 bit unsigned integer) multiplier value. The multiplier will typically be 1 except when the frequency exceeds the range of a 32 bit integer(4.29496GHz). Example for 7.123 MHz the control value is [38][B0][6C][00] [01] in Hex.

Example, to set a target transmitter channel 0 to 146.32MHz.

The host sends this:

[0A][00] [20][01] [00] [80][AA][B8][08] [01]

The Target responds with:

[0A][00] [20][01] [00] [80][AA][B8][08] [01]

Example, to get the current target transmitter channel 0's frequency.

The host sends this:

[05][20] [20][01] [00]

The Target responds with:

[0A][00] [20][01] [00] [80][AA][B8][08] [01]

Control Item Range: List of supported frequency ranges and minimum step sizes.

The format for each range is

{ Beginning Freq(5 bytes) }{ Ending Freq(5 bytes) }{ Minimum Step size(2 byte)

The frequency format is the same as the Control Item, 4 byte frequency and 1 byte multiplier.

The Step size is a two byte 16 bit unsigned integer value LSB first in Hz.

Example, suppose a target transmitter's channel 0 covers 40 and 80 meters with a 100Hz step size.

The host sends this to request the valid band ranges and step sizes:

[05][40] [20][01] [00]

The Target responds with:

[1D][40] [20][01] [00] [E0][67][35][00] [01] [00][09][3D][00] [01] [64][00]
[C0][CF][6A][00] [01] [A0][63][6F][00] [01] [64][00]

4.3.6 Modulation Types

Purpose: Controls the transmitter modulation types.

Control Item Code: 0x0128

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte value.

Type values:

0x00 = Un-modulated Carrier(Tune up mode)

0x01 = On/Off Keyed Carrier(CW)

0x02 = Upper Sideband (USB)

0x03 = Lower Sideband (LSB)

0x04 = FM

Example, request to set the target transmitter channel 0 to USB mode.

The host sends:

[06][00] [28][01] [00][02]

The Target responds with:

[06][00] [28][01] [00][02]

Example, request current setting of the target transmitter channel 0's modulation mode.

The host sends:

[05][20] [28][01] [00]

The Target responds with:

[06][00] [28][01] [00] [01]

Control Item Range: List of supported modulator types for the specified channel.

Example: The host sends this to request the valid modulator types for channel 1:

[05][40] [28][01] [01]

If the Target supports FM and CW, it responds with:

[07][40] [28][01] [01] [01][04]

4.3.7 Data Encoder Settings

Purpose: Controls the transmitter data decoder Settings.

Control Item Code: 0x0130

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 2 byte encoder type.

Type values will be enumerated in a supplementary document due to the large number of data decoder types

examples: CW, RTTY, PSK31, 1200Baud Packet, SSTV, etc

4.3.8 Power Control

Purpose: Controls the transmitter power output.

Control Item Code: 0x0138

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1byte mode value.

Mode values:

0x00 = Linear Power in milliwatts

0x01 = Linear Power in watts

0x02 = Log Power in dBm

0x03 = Linear Voltage in millivolts

0x04 = Linear Voltage in volts

0x05 = Un-calibrated Value

Followed by a 2 byte signed value that is in milliwatts, watts, etc. depending on the Mode parameter

Example, request to set the target transmitter channel 0 to 1 Watt.

The host sends:

[06][00] [38][01] [00] [01] [01][00]

The Target responds with:

[06][00] [38][01] [00] [01] [01][00]

Example, request current setting of the target transmitter channel 0's power that is -10 dBm.

The host sends:

[05][20] [38][01] [00]

The Target responds with:

[08][00] [38][01] [00] [02] [F6][FF]

Control Item Range: Range and step size for the transmitter power Control Item.

{1 byte mode}{ 2 byte min value}{ 2 byte Max value}{2 byte step value}

Example: The host sends this to request the valid power range for channel 1:

[05][40] [38][01] [01]
If the Target channel 1 supports an Un-calibrated range of 0 to 1000 with a step resolution of 100, it responds with:
[0C][40] [38][01] [01] [05] [00][00] [E8][03] [64][00]

4.3.9 Microphone Gain

Purpose: Controls the Level of Microphone audio gain(or attenuation) of the transmitter.

Control Item Code: 0x0140

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte signed variable(-128 to +127 dB).

Example, to set the transmitter channel 0 Microphone Gain to +10 dB.

The host sends this:

[06][00] [40][01] [00] [0A]

The Target responds with:

[06][00] [40][01] [00] [0A]

The host sends this to get the current Channel 0's Microphone Gain Setting:

[05][20] [40][01] [00]

The Target responds with:

[06][00] [40][01] [00] [0A]

Control Item Range: Returns range and step size in dB.

The format for each range is

{ Start Value(1 bytes) }{ Ending Value(1 bytes) }{ Step size(1 byte) }

Example, suppose a target transmitters channel 2 Microphone gain ranges from -25 to +30 dB in 6 dB steps.

The host sends this to request the valid gain range and step size:

[04][40] [40][01] [02]

The Target responds with:

[07][40] [40][01] [02][ED][1E][06]

4.3.10 Compression Level

Purpose: Controls the Level of audio compression of the transmitter.

Control Item Code: 0x0148

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte signed variable(-128 to +127 dB).

Example, to set the transmitter channel 0 Audio Compression to +10 dB.

The host sends this:

[06][00] [48][01] [00] [0A]

The Target responds with:

[06][00] [48][01] [00] [0A]

The host sends this to get the current Channel 0's Audio Compression Setting:

[05][20] [48][01] [00]

The Target responds with:

[06][00] [48][01] [00] [0A]

Control Item Range: Returns range and step size in dB.

The format for each range is

{ Start Value(1 bytes) }{ Ending Value(1 bytes) }{ Step size(1 byte) }

Example, suppose a target transmitters channel 2 audio compression ranges from -25 to +30 dB in 6 dB steps.

The host sends this to request the valid gain range and step size:

[05][40] [48][01] [02]

The Target responds with:

[08][40] [48][01] [02] [E7] [1E] [06]

4.3.11 CW Side Tone Pitch

Purpose: Controls the CW Side Tone Pitch of the specified transmitter channel.

Control Item Code: 0x0150

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 2 byte unsigned value for the Side tone Pitch signal in Hz.

Example, to set the transmitter channel 1's Side tone pitch to 700Hz.

The host sends this:

[07][00] [50][01] [01] [BC][02]

The Target responds with:

[07][00] [50][01] [01] [BC][02]

The host sends this to get channel 1's current CW side tone pitch:

[05][20] [50][01] [01]

The Target responds with:

[07][00] [50][01] [01] [BC][02]

Control Item Range: Returns the supported CW Side tone pitch frequencies for specified channel.

{ min value(2 byte) max value(2 byte) min step size in Hz(1byte) }

Example, a transmitters channel 2 has a Side tone pitch range of 200 to 1000Hz with a 10Hz step size:

The host sends this:

[05][40] [50][01] [02]

The Target responds with:

[0A][40] [50][01] [02] [C8][00] [E8][03] [0A]

4.3.12 CW Side Tone Amplitude

Purpose: Controls the CW Side Tone Amplitude of the specified transmitter channel.

Control Item Code: 0x0158

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte unsigned value for the Side tone Amplitude signal.

Example, to set the transmitter channel 1's Side tone amplitude to 50.

The host sends this:

[06][00] [58][01] [01] [32]

The Target responds with:

[06][00] [58][01] [01] [32]

The host sends this to get channel 1's current CW side amplitude pitch:

[05][20] [58][01] [01]

The Target responds with:

[06][00] [58][01] [01] [32]

Control Item Range: Returns the supported CW Side tone amplitude range for specified channel.
{ min value(1 byte)} { max value(1byte) }{ min step size (1byte) }

Example, a transmitters channel 2 has a Side tone amplitude range of 0 to 10 with a step size of 1:

The host sends this:

[05][40] [58][01] [02]

The Target responds with:

[08][40] [58][01] [02] [00] [0A] [01]

4.3.13 CW Keyer Settings

Purpose: Controls the CW Keyer Settings of the specified transmitter channel.

Control Item Code: 0x0160

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte unsigned value for the CW letter speed in WPM.

Followed by a 1 byte unsigned value for the CW word speed in WPM.

Example, to set the transmitter channel 1's CW keyer to 10wpm overall word speed using 18 WPM characters.

The host sends this:

[06][00] [60][01] [01] [0A][12]

The Target responds with:

[06][00] [60][01] [01] [0A][12]

The host sends this to get channel 1's current CW keyer settings:

[05][20] [60][01] [01]

The Target responds with:

[06][00] [60][01] [01] [0A][12]

Control Item Range: Returns the supported CW Keyer settings for specified channel.
{ min word value(1 byte)} { max word value(1byte) }{ min word step size (1byte) }
{ min char value(1 byte)} { max char value(1byte) }{ min char step size (1byte) }

Example, a transmitters channel 2 has a Keyer word rate range of 5 to 40 WPM with a step size of 1 and a character rate of 1 to 40 WPM with a step size of 1:

The host sends this:

[05][40] [60][01] [02]

The Target responds with:

[0C][40] [60][01] [02] [00] [05] [28] [01] [05] [28] [01]

4.3.14 VOX Settings

Purpose: Controls the Voice Operated PTT Settings of the transmitter.

Control Item Code: 0x0168

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte unsigned value for the VOX threshold.

Followed by a 2 byte unsigned value for the VOX Hang-time in milliseconds.

Example, to set the transmitter channel 1's VOX threshold to 50 with a hang time of 500 milliseconds.

The host sends this:
[06][00] [68][01] [01] [32] [F4][01]
The Target responds with:
[06][00] [68][01] [01] [32] [F4][01]

The host sends this to get channel 1's current VOX settings:
[05][20] [68][01] [01]
The Target responds with:
[06][00] [68][01] [01] [32] [F4][01]

Control Item Range: Returns the supported CW Side tone amplitude range for specified channel.
{ min value(1 byte)} { max value(1 byte) } { min step size (1 byte) }
{ min value(2 byte)} { max value(2 byte) } { min step size (2 byte) }

Example, a transmitters channel 2 has a VOX threshold range of 0 to 10 with a step size of 1 and a hang time range of 100 to 2000 milliseconds with a 100millisecond step size:

The host sends this:
[05][40] [68][01] [02]
The Target responds with:
[0E][40] [68][01] [02] [00] [0A] [01] [64][00] [D0][07] [64][00]

4.3.15 SWR Measurement

Purpose: Controls the Antenna SWR value of the transmitter.

Control Item Code: 0x0170

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 2 byte unsigned value representing the SWR value times 100.

Example, to read the transmitter channel 0's SWR value that is 1.52 : 1

The host sends this:
[06][20] [70][01] [00]
The Target responds with:
[07][00] [70][01] [00] [98][00]

The target may also send as an un-solicited message its current Channel 0's SWR value:

The Target sends if its SWR changes to 1.2 : 1:

[07][00] [70][01] [00] [78][00]

No response from the host to this message.

Control Item Range: Returns range and step size in dB.

The format for each range is

{ Start Value(2 bytes) } { Ending Value(2 bytes) } { Step size(2 byte) }

Example, suppose a target transmitters channel 2 SWR ranges from 1:1 to 5:1 in .1 steps.

The host sends this to request the valid gain range and step size:

[05][40] [70][01] [02]
The Target responds with:
[0B][40] [70][01] [02] [64][00] [F4][01] [64][00]

4.3.16 Spectral Display Settings

Purpose: Controls the transmitter Spectral Display Parameters.

Control Item Code: 0x0178

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte parameter specifying which target message data item to use in sending the spectral display data back to the host:

0x00 = Data Item 0
0x01 = Data Item 1
0x02 = Data Item 2
0x03 = Data Item 3
0x04 = Data Item 4

Followed by a 1 byte data type parameter with the following possible values

0x00 = Linear
0x01 = Log

Followed by the 2 byte number of data points.

Followed by the 2 byte minimum amplitude

Followed by the 2 byte maximum amplitude

Followed by the 4 byte starting frequency in Hz

Followed by the 4 byte ending frequency in Hz

Example, Host sets transmitter channel 0's Spectral Display Parameters for a 1000 Point log frequency display with a range of -100dB to +100dB and a frequency range of 14.000 MHz to 14.001 MHz coming from the Target's message data item 2:

The host sends this:

[14][00] [78][01] [02] [01] [E8][03] [9C][FF] [64][00] [80][9F][D5][00] [68][A3] [D5][00]

The Target responds with:

[14][00] [78][01] [02] [01] [E8][03] [9C][FF] [64][00] [80][9F][D5][00] [68][A3] [D5][00]

Example, Host requests current transmitter channel 0's Spectral Display Parameters:

The host sends this:

[05][20] [78][01] [00]

The Target responds with:

[14][00] [78][01] [02] [01] [E8][03] [9C][FF] [64][00] [80][9F][D5][00] [68][A3] [D5][00]

4.3.17 Transmitter Modulation Input Source

Purpose: Controls the transmitter modulation signal input source.

Control Item Code: 0x0180

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte source value:

0x00 = No source Attached

0x01 = Internal Microphone

0x02 = External Microphone

0x03 = Internal Binaural Microphone

0x04 = External Binaural Microphone

0x11 = Aux Input 1

0x12 = Aux Input 2
 ...
 ...
 0x20 = Aux Input 16

 0x21 = I/Q or Binaural Aux Input 1
 0x22 = I/Q or Binaural Aux Input 2
 ...
 ...
 0x30 = I/Q or Binaural Aux Input 16

 0x31 = Internally Generated Signal 1 (test or calibration signal)
 0x32 = Internally Generated Signal 2 (test or calibration signal)
 0x33 = Internally Generated Signal 3 (test or calibration signal)
 ...
 ...
 0x70 = Internally Generated Signal 64 (test or calibration signal)

 0x71 = Real Data from Data Item 0(Digital data sent to target using Data Item 0)
 0x72 = Real Data from Data Item 1(Digital data sent to target using Data Item 1)
 0x73 = Real Data from Data Item 2(Digital data sent to target using Data Item 2)
 0x74 = Real Data from Data Item 3(Digital data sent to target using Data Item 3)
 0x75 = Real Data from Data Item 4(Digital data sent to target using Data Item 4)

 0x76 = I/Q Data from Data Item 0(Digital data sent to target using Data Item 0)
 0x77 = I/Q Data from Data Item 1(Digital data sent to target using Data Item 1)
 0x78 = I/Q Data from Data Item 2(Digital data sent to target using Data Item 2)
 0x79 = I/Q Data from Data Item 3(Digital data sent to target using Data Item 3)
 0x7A = I/Q Data from Data Item 4(Digital data sent to target using Data Item 4)

 0x81 = External Real Data File 1
 0x82 = External Real Data File 2
 ...
 ...
 0x90 = External Real Data File 16

 0x91 = External I/Q Data File 1
 0x92 = External I/Q Data File 2
 ...
 ...
 0xA0 = External I/Q Data File 16

 0xA1 to 0xFF = undefined

Example, request to set the target transmitter channel 4's modulation source to an external Microphone.

The host sends:
 [06][00] [80][01] [04] [02]
 The Target responds with:
 [06][00] [80][01] [04] [02]

The host sends this to get transmitter channel 4's current modulation source:
 [05][20] [80][01] [04]
 The Target responds with:
 [06][00] [80][01] [04] [02]

Control Item Range: Returns list of implemented modulation sources.

Example, suppose a transmitter channel 0 supports one internal microphone and an external I/Q Data File only.

The host sends:

[05][40] [80][01] [00]

The Target would reply with the following byte string:

[07][40] [80][01] [00] [01] [91]

4.3.18 Transmitter Output Destination

Purpose: Controls the transmitter output destination.

Control Item Code: 0x0188

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

The following 1byte parameter specifies the output destination or destinations. Multiple destinations are possible by listing all destinations in the parameter field.

Destination values:

0x00 = No Destination Attached

0x01 = Antenna 1

0x02 = Antenna 2

...

...

0x10 = Antenna 16

0x11 = Dual Antenna or I/Q Output 1

0x12 = Dual Antenna or I/Q Output 2

...

...

0x20 = Dual Antenna or I/Q Output 16

0x21 = Real Data To Data Item 0 (Digital data to host using Data Item 0)

0x22 = Real Data To Data Item 1 (Digital data to host using Data Item 1)

0x23 = Real Data To Data Item 2 (Digital data to host using Data Item 2)

0x24 = Real Data To Data Item 3 (Digital data to host using Data Item 3)

0x25 = Real Data To Data Item 4 (Digital data to host using Data Item 4)

0x26 = I/Q Data To Data Item 0 (Digital data to host using Data Item 0)

0x27 = I/Q Data To Data Item 1 (Digital data to host using Data Item 1)

0x28 = I/Q Data To Data Item 2 (Digital data to host using Data Item 2)

0x29 = I/Q Data To Data Item 3 (Digital data to host using Data Item 3)

0x2A = I/Q Data To Data Item 4 (Digital data to host using Data Item 4)

0x31 = External Real Data File 1

0x32 = External Real Data File 2

...

...

0x40 = External Real Data File 16

0x41 = External I/Q Complex Data File 1

0x42 = External I/Q Complex Data File 2

...

...

0x50 = External I/Q Complex Data File 16

0x51 to 0xFF = undefined

Example, request to set the target transmitter channel 4's signal destination to Antenna 1 and an External I/Q Data File:

The host sends:
[07][00] [88][01] [04] [01] [41]
The Target responds with:
[07][00] [88][01] [04] [01] [41]

The host sends this to get transmitter channel 4's current destination(s):
[05][20] [88][01] [04]
The Target responds with:
[07][00] [88][01] [04] [01] [41]

Control Item Range: Returns list of implemented transmitter output destinations.
Example, suppose a transmitter channel 0 supports antenna1 and antenna 2 only.
The host sends:
[05][40] [88][01] [00]
The Target would reply with the following byte string:
[07][40] [88][01] [00] [01] [02]

4.3.19 Transmitter Modulation Input Sample Rate

Purpose: Controls the Transmitter modulation input sample rate if it supports digital data input.
Control Item Code: 0x0190
Control Item Parameter Format:
The first parameter is a 1 byte transmitter channel ID (0 to 255).
The following 4 byte parameter specifies the input source sample rate in Hz.

Example, suppose a transmitter channel 0 is set to an input sample rate of 8000Hz.
The host sends:
[05][20] [90][01] [00]
The Target would reply with the following byte string:
[09][40] [90][01] [00] [40][1F][00][00]

Example, to set a transmitter channel 2's input sample rate to 48000 Hz.
The host sends:
[09][00] [90][01] [02] [80][BB][00][00]
The Target would reply with the following byte string:
[09][00] [90][01] [02] [80][BB][00][00]

Control Item Range: Returns range of implemented input sample rates and minimum step resolution size.
{4 bytes unsigned Min sample rate}{4 bytes unsigned Max sample rate}{2 byte step size(Hz) }

Example, suppose a transmitter channel 0 input supports a range of 48000 to 25MHz sample rate with a minimum resolution of 1000 Hz.
The host sends:
[05][40] [90][01] [00]
The Target would reply with the following byte string:
[0F][40] [90][01] [00] [80][BB][00][00] [40][78][7D][01] [E8][03]

4.3.20 Transmitter Output Sample Rate

Purpose: Controls the transmitter output sample rate if it supports a digital output.

Control Item Code: 0x0198

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

The following 4 byte parameter specifies the output destination sample rate in Hz.

Example, suppose a transmitter's channel 0 is set to an output sample rate of 25MHz.

The host sends:

[05][20] [98][01] [00]

The Target would reply with the following byte string:

[09][40] [98][01] [00] [40][78][7D][01]

Example, to Set a transmitter channel 2's output sample rate to 44100 Hz.

The host sends:

[09][00] [98][01] [02] [44][AC][00][00]

The Target would reply with the following byte string:

[09][00] [98][01] [02] [44][AC][00][00]

Control Item Range: Returns range of implemented output sample rates and minimum step resolution size.

{4 bytes unsigned Min sample rate}{4 bytes unsigned Max sample rate}{2 byte step size(Hz) }

Example, suppose a transmitter channel 0 output supports a range of 8000 to 32000 Hz sample rate with a minimum resolution of 100 Hz.

The host sends:

[05][40] [98][01] [00]

The Target would reply with the following byte string:

[0F][40] [98][01] [00] [40][1F][00][00] [00][7D][00][00] [64][00]

4.3.21 Transmitter Modulation Input Data File Parameters

Purpose: Controls the receiver input data file parameters.

Control Item Code: 0x01A0

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

The following 4 byte parameter specifies the input file offset in number of samples.

Followed by a variable length NULL(zero) terminated character string representing the Input File path name. (The format will depend on the operating system)

Example, suppose a transmitter's channel 2's Input file is set to start at a 0 sample offset and has a pathname of "c:\in.wav".

The host sends:

[05][20] [A0][01] [02]

The Target would reply with the following byte string:

[13][40] [A0][01] [02] [00][00][00][00] [63][3A][5C][69][6E][2E][77][61][76][00]

Example, to set a transmitter channel 2's input file parameters to a starting offset of 5000 samples and a path name of "c:\in.wav".

The host sends:

[13][40] [A0][01] [02] [13][88][00][00] [63][3A][5C][69][6E][2E][77][61][76][00]

The Target would reply with the following byte string:

[13][40] [A0][01] [02] [13][88][00][00] [63][3A][5C][69][6E][2E][77][61][76][00]

Control Item Range: NA

4.3.22 Transmitter Output Data File Parameters

Purpose: Controls the transmitter output data file parameters.

Control Item Code: 0x01A8

Control Item Parameter Format:

The first parameter is a 1 byte transmitter channel ID (0 to 255).

Followed by a 1 byte parameter specifying the output file write characteristics.

0x00 = Overwrite an existing file.

0x01 = Append to the end of an existing file.

Followed by a 4 byte parameter specifies the output file size limit in number of Samples.

Followed by a variable length NULL(zero) terminated character string representing the Output File path name. (The format will depend on the operating system)

Example, suppose a transmitter's channel 2's Output file is set to overwrite with a sample limit of 2MegaSamples and has a pathname of "c:\out.wav".

The host sends:

[05][20] [A8][01] [02]

The Target would reply with the following byte string:

[15][00] [A8][01] [02] [00] [80][84][1E][00] [63][3A][5C][6F][75][74][2E][77][61][76][00]

Example, to set a transmitter's channel 1's Output file to append with a sample limit of 2MegaSamples and a pathname of "c:\out.wav".

The host sends:

[15][00] [A8][01] [01] [01] [80][84][1E][00] [63][3A][5C][6F][75][74][2E][77][61][76][00]

The Target would reply with the following byte string:

[15][00] [A8][01] [01] [01] [80][84][1E][00] [63][3A][5C][6F][75][74][2E][77][61][76][00]

Control Item Range: NA

4.4. Antenna Control Items

4.4.1 Antenna Switching Control Item

4.4.2 Azimuth Control Item

4.4.3 Elevation Control Item

4.4.4 Polarity Control Item