

Host Interface Spec for the ARDOP TNC (preliminary)

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1.0 Scope

This is the Host interface specification for those wishing to use an ARDOP compatible TNC (virtual Software TNC or hardware/firmware TNC) in host applications. The ARDOP protocol specification document should be used in conjunction with this host specification.

2.0 Protocol Name and Purpose

The protocol name is ARDOP (Amateur Radio Digital Open Protocol). This document details how a host program (e.g. a radio client or server) can interface to an ARDOP modem. The details in this document cover the ARDOP Windows virtual TNC but should also be pretty close for other modems which could be either a pure software implementation (a virtual TNC) or a physical hardware/DSP firmware implementation that implements the ARDOP protocol

3.0 Initialization

The host program would normally use some initialization file (e.g. "ARDOP TNC.ini") that resides with the host program. That file should contain the minimum information to allow the host program to start the ARDOP TNC automatically. This includes:

TCP IP Control Port number used for both command and data (one port) and the Address for that port (e.g. 127.0.0.1 if on the same computer)

Or

Serial COM Port and baud rate if using Serial interface

Or

Bluetooth interface details for pairing if the Bluetooth interface to the TNC is used.

If the ARDOP TNC is a virtual TNC (software + sound card implementation) it can be launched from a command line with the above necessary parameters which are sufficient to initialize the Host <> Virtual TNC link.

e.g. for TCPIP connection from Host to Virtual TNC:

```
Shell("ARDOP_Win.exe TCPIP 8515 127.0.0.1")
```

Would start the ARDOP_Win virtual TNC using a TCPIP port listening on port 8515 of address 127.0.0.1

e.g. for Serial (RS232 or USB) connection from Host to Virtual TNC:

```
Shell("ARDOP_Win.exe SERIAL COM5 38400")
```

Would start the ARDOP_Win virtual TNC using a serial port listening on COM5 baud rate of 38400.

e.g. for BlueTooth connection from Host to Virtual TNC: (*preliminary*)

```
Shell("ARDOP_Win.exe BLUETOOTH ARDOPWINTNC")
```

Would start the ARDOP_Win virtual TNC using a BlueToothl port pairing to “ARDOPWINTNC”.

All remaining property values and setting may be supplied using the commands list or in some cases may use a separate ini file for ARDOP virtual TNC

4.0 ARDOP TNC User Interface (preliminary)

The host program normally would include a parameter setup menu for the ARDOP Win TNC. The ARDOP Win TNC’s setup menu (and resulting .ini file) will however allow setup of all parameters and host interface options and this is often helpful during initial testing and TNC/Host integration. The ARDOP Win TNC also includes a “virtual panel” which may be made visible or hidden by the host application. It is intended to provide the user with entertainment, information and real time status of the ARDOP TNC and status of any existing connections but is *not required* for operation. The following is a screen capture of the ARDOP Win virtual TNC. The virtual TNC interface is optional and may be eliminated for example if a hardware/firmware DSP implementation provides necessary status information.

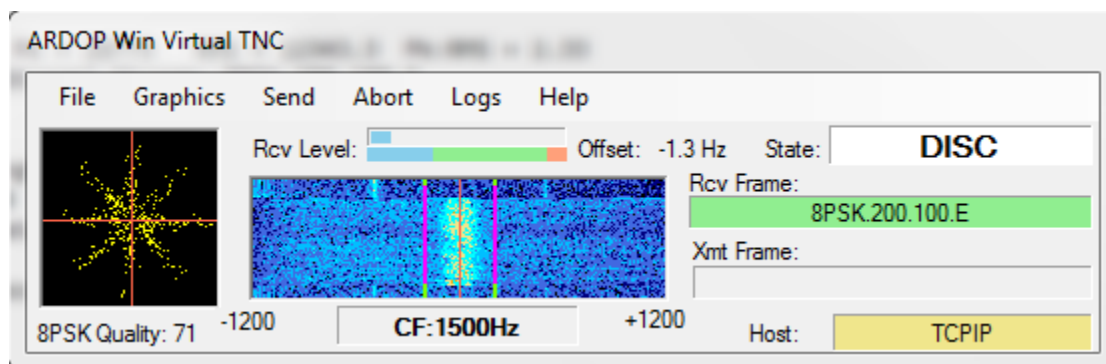


Fig 4-1 ARDOP Win TNC User Interface “Virtual Panel”

The above panel shows the reception of a single carrier (200 Hz bandwidth) 8PSK, 100 baud frame with a successful decode and a decoded quality value (0-100) of 71. The channel was multipath poor at 0 dB S/N. The virtual TNC is using a TCPIP Host<> TNC interface. The Rcv and Xmt frame labels indicate the frame being received or transmitted. State information is also shown which matches the state diagrams in the ARDOP protocol specification. The Green or Magenta tuning lines in the waterfall indicate the detection of a signal with the TNCs busy detector (Green = NOT BUSY, Magenta = BUSY)

5.0 Command Interface

The command interface is via ASCII commands sent to the TCPIP address/port, the serial port or to the Bluetooth paired device identified in the host .ini file. It is designed for a

computerized host interface (not keyboard commands as in 1980 type Packet TNCs). For robustness all commands and data are protected by a 16 bit CRC. All commands are plain (readable) text. Command sent from the host begin with “C:” and terminate with a <Cr> followed by a 2 byte CRC check. No command name or parameter may include a “C:”, or <Cr> character. Commands that do not include parameters will cause an “echo back” of the current parameters as described below. Upon initial connection to the TCP port at the TCP Address, the COM port or the Bluetooth paired device in the .ini file the host connect request will be accepted and the following response issued: “c:RDY<Cr>+2 byte CRC”. Commands or replies from the TNC always begin with “c:” and end with a “<Cr>+2 byte CRC”. After *completing* execution of a command the virtual TNC will respond with: “c:RDY<Cr>” indicating it is available for the next command. Commands *must* be sequenced using this RDY response. Note some commands may take a few seconds to execute.

If a command or data from the host is received and has a CRC failure the Virtual TNC will reply with “c:CRCAFAULT<CR>+ 2byte CRC”. The host should then repeat the command or data transfer.

If a command from the host is received with improper syntax or parameter values the Virtual TNC will reply with “c:FAULT <fault description + Echo back of command><CR>+2 byte CRC”.

If debug logging is enabled and Enable Command Trace is enabled each command will be logged as received and each response will be logged as sent. This is helpful in initial debugging the host application interface.

The following is the current list of commands with Explanation. What is between the “< >” are the command options separated by “|” or the response given in the reply to the command.

Items marked in **blue** text are anticipated but not yet implemented.

ARQBW <200MAX|500MAX|1000MAX|2000MAX|200FORCED|500FORCED|1000FORCED|2000FORCED>

Set/gets the bandwidth for ARQ mode. This sets the maximum negotiated bandwidth or sets the forced bandwidth to a specific value. Attempting to change bandwidth while a connection is in process will generate a FAULT. If no parameter is given will return the current bandwidth setting. This bandwidth setting applies to all call signs used (MYCALL plus optional MYAUX)

AUTOBREAK <False|True>

Disables/enables automatic link turnover (BREAK) by IRS when IRS has outbound data pending and receives an IDLE frame from ISS indicating its’ outbound queue is empty. Default is True.

BREAK

Initiates a BREAK (link turnover request to ISS) if in IRS state otherwise no effect. Forces ISS to clear its outbound queue and acknowledge. Normally not required if AUTOBREAK is enabled.

BUFFER

Gets the current outbound data buffer size in bytes. BUFFER is also sent asynchronously whenever there is a change in the outbound buffer size.

BUSYLOCK <False|True>

Disable/Enable Busy channel blocking. Busy lock will block a connection request unless there have been T_{quiet} ms of non busy status preceding the connect request. (See appendix B) Default = False

CAPTURE <device name>

Sets desired sound card capture device. If no device name will reply with the current assigned capture device.

CAPTUREDEVICES

Returns a comma delimited list of all currently installed capture devices.

CLOSE

Provides an orderly shutdown of all connections, release of all sound card resources and closes the Virtual TNC Program or hardware.

CODEC <False|True>

Start the Codec with True, Stop with False. No parameter will return the Codec state.

CONNECT <remote Call,Bandwidth>

Initiates connect request cycle to <remote Call> at Bandwidth (200, 500, 1000, 2000) Normal response is

“CONNECT IN PROCESS”. Failure response is “FAULT Connect Failure”. During the connect process the TNC will compute the measured Transmit to Receive (T>R) latency. Latency < 250 ms is acceptable with normal timing parameters.

CWID <False|True>

Disable/Enable the CWID option

DATATOSEND <0>

If sent with the parameter 0 (zero) it will clear the TNC's data to send Queue. If sent without a parameter will return the current number of data to send bytes queued.

DEBUGLOG <False|True>

Enable/disable the debug log.

DIRTYDISCONNECT

Initiates an immediate disconnect and return to the DISCONNECTED state. Normally should not be used or required. Works only ARQ mode. Use FECSSEND<False> to abort a FEC transmission.

DISCONNECT

Initiates a normal disconnect cycle for an ARQ connection. If not connected command is ignored.

DISPLAY<Frequency in KHz>

Sets the Dial frequency display of the Waterfall or Spectrum display. If sent without parameters will return the current Dial frequency display.

DRIVELEVEL <0-100>

Set Drive level. Default = 100 (max)

FECID<False|True>

Disable/Enable ID (with optional grid square) at beginning of FEC transmissions

FECMODE<4FSK.200.50S|4FSK.200.50,4PSK.200.100S|4PSK.200.100|8PSK.200.100|4FSK.500.100S|4FSK.500.100|4PSK.500.100|8PSK.500.100|4PSK.500.167|8PSK.500.167|4FSK.1000.100|4PSK.1000.100|8PSK.1000.100|4PSK.1000.167|8PSK.1000.167|4FSK.2000.100|4PSK.2000.100|8PSK.2000.100|4PSK.2000.167|8PSK.2000.167|>

Sets the modulation mode and bandwidth for FEC (multicast) transmission. Details on the specific frame types can be found in the ARDOP frame type spreadsheet. In general the first component of the frame ID is the modulation type e.g. 4FSK, 8PSK etc. The second is the bandwidth (@-26 dB). The third is the baud rate. Some modes also allow a shortened frame designated by a trailing "S". The above are in order of robustness for most channel types.

FECSEND <True, False>

Start/Stop FEC broadcast (multicast) mode for specific FECMODE. FECSEND

<False> will abort a FEC broadcast and send an ID frame.

FECREPEATS <0-5> Sets the number of times a frame is repeated in FEC (multicast) mode. Higher number of repeats increases good copy probability under marginal conditions but reduces net throughput.

GRIDSQUARE <4 or 6 character grid square>

Sets or retrieves the 4 or 6 character grid square (used in ID Frames)

LEADER<100-2000>

Get/Set the leader length in ms. (Default is 160 ms). Rounded to the nearest 10 ms. Normally not required but may be used for some experimental work such as repeaters.

LISTEN <False|True>

Enables/disables server's response to an ARQ connect request. Default = True

MAXCONREQ <limit>

Get/Set the limit of connect request cycles (2-15). Default limit = 10 (about 25 seconds) An ID frame with optional CW ID is sent following the last Connect Request.

MYAUX <aux call sign1, aux call sign2, ... aux call sign10>

Sets up to 10 auxiliary call signs that will answer connect requests. Call signs must be valid radio call signs and separated by commas. If sent with an illegal call sign (e.g. "MYAUX x" it will clear the MYAUX list. If sent without a parameter will return a comma delimited string of current MYAUX call signs. Legitimate call signs include from 3 to 7 ASCII characters (A-Z, 0-9) followed by an optional "-" and a single ASCII character (A-Z, 0-9) SSID.

MYCALL <call sign>

Sets current call sign. If not a valid call generates a FAULT. See CODEC True command. Legitimate call signs include from 3 to 7 ASCII characters (A-Z, 0-9) followed by an optional "-" and a single ASCII character (1-9 or A-Z) SSID.

OVER

If IRS initiates a BREAK. If ISS clears the outbound Queue. Then ISS repeats an OVER Command until a BREAK is received from IRS.

PLAYBACK <device name>

Sets desired sound card playback device. If no device name will reply with the current assigned playback device.

PLAYBACKDEVICES

Returns a comma delimited list of all currently installed playback devices.

The following RADIO commands support optional radio control that may be used in some applications (e.g. Virtual TNC is running on a remote computer located with the radio)

RADIO<Radio Model> If radio control is enabled accepts the radio model. If sent without a parameter returns a comma delimited list of supported radio models. If radio control is not enabled or Radio Model is not supported will return a FAULT.

RADIOANT<1|2> Selects the radio antenna 1 or 2 for those radios that support antenna switching. If sent without a parameter will return 1 or 2. If RADIOCONTROL Is false or RADIOMODEL has not been set will return FAULT

RADIOCONTROL<True|False> Enables/disables the radio control capability of the ARDOP_Win TNC. If sent without a parameter will return the current value of RADIOCONTROL enable.

RADIOFILTER<Bandwidth in Hz> This sets (for selected radios) the bandwidth of the desired IF filter. Filters are centered on 1500 Hz. If not supported by the radio will return FAULT.

RADIOFREQUENCY<Frequency in KHz> If Radio Control is enabled in the ARDOP_Win TNC sets the Dial frequency of the radio and the display of the Waterfall or Spectrum display. If sent without parameters will return the current Dial frequency of the radio. If radio control is not enabled will return a FAULT. For radios with frequency readback will also be sent asynchronously when the radio frequency is changed (manual dial change or band change).

RADIOMODE<USB,USBD, FM> Sets the radio modulation mode to USB, USB Digital (some radios) or FM. If sent without a parameter will return the current value of RADIOMODE. If Radio control is not enabled or model is not set or mode is not supported will return FAULT.

SENDID <delay in seconds>

This will send an ID frame and if CWID above is enabled also a CW ID after delay seconds. Delay must be an integer in the range 0 – 15.

SQUELCH <1-10>

Returns or sets the current squelch value (default = 5). The default value should be sufficient for most installations. Squelch affects the sensitivity of the busy detector and leader detector (low values = higher sensitivity).

STATE

Gets the current ARDOP protocol state

<OFFLINE|DISC|ISS|IRS|IDLE|FECSend|FECRecv> Every State change is also reported asynchronously with the NEWSTATE reply below.

SUFFIX <CW ID suffix>

This sets the optional CW ID suffix. It is sent after the normal CW ID for MYC with a separating slash e.g. DE W4ABC/XE2 if the "/" is omitted it will be inserted automatically.

TWOTONETEST

Send 5 second two-tone burst at the normal leader amplitude. May be used in adjusting drive level to the radio. If sent while in any state except DISC will result in a fault "not from state"

VERSION

Returns the name and version of the ARDOP TNC program or hardware implementation.

6.0 Asynchronous Responses

The ARDOP TNC codec will respond on the command port with possible asynchronous responses. All asynchronous responses begin with "**c: and terminate in <Cr> + 2 Byte CRC**". The host should acknowledge an asynchronous response with a **RDY** or a **CRCFAULT** response

This is the list of the current responses:

BLOCKED

Connect request blocked due to busy channel

BUFFER

Reply format is:

BUFFER <data out queued>

Value is in integer bytes. BUFFER may also be polled using the BUFFER command with no parameters.

BUSY FALSE

Clear channel detected

BUSY TRUE

Busy channel detected

CONNECTED <remote Call>

A connection has been established. <remote Call> contains the connected call sign.

This immediately follows the TARGET <target call sign> asynchronous response

DISCONNECTED

An existing link has been disconnected or a pending connect was not for this call sign or not decoded.

FAULT <description>

A program fault or error condition.

MODE (TBD)

MODE may also be polled using the MODE command without parameters.

MONCALL <Call sign (grid square)>

Non connected monitor data includes call sign and optional grid square in parenthesis

NEWSTATE reports any protocol state change.

Reply options: < OFFLINE|DISC|ISS|IRS|IDLE|FECSend|FECCv>

OFFSET <Remote station offset in HZ>

Indicates the remote station offset. Positive values indicate the remote station is higher in frequency. Reported on every decoded frame but only updated when connected.

PTT <True|False>

Indicates to the host application to key the PTT on (PTT True) or off (PTT False)
To operate correctly the transmitter PTT should be activated within 50 ms of receipt of this response. Excessive delay in PTT application or removal may cause a failure in ARQ modes if measured latency exceeds 250 ms.

RADIOFREQUENCY<Frequency in KHz> If Radio Control is enabled will return the new radio frequency when the radio frequency is manually changed (dial change, band change or waterfall/spectrum click...see TUNE below). Does *not* return the new frequency when the command RADIOFREQUENCY is sent to the modem.

TARGET <target call>

Identifies the target call sign of the connect request. The target call will be either MYC or one of the MYAUX call signs. This command immediately precedes the CONNECTED <remote Call> asynchronous response.

TUNE <Tuning offset in integer Hz> Sent when the waterfall or spectrum is clicked and can be used by the host to adjust radio settings. This is bounded to approx. +/- 1200 Hz. If radio control is enabled will also tune the radio to the new frequency.

7.0 Data transfer:

Data is transferred on the same TCP address/port, Serial COM port or Bluetooth pairing as commands using binary byte transfers with a specific header defined below.

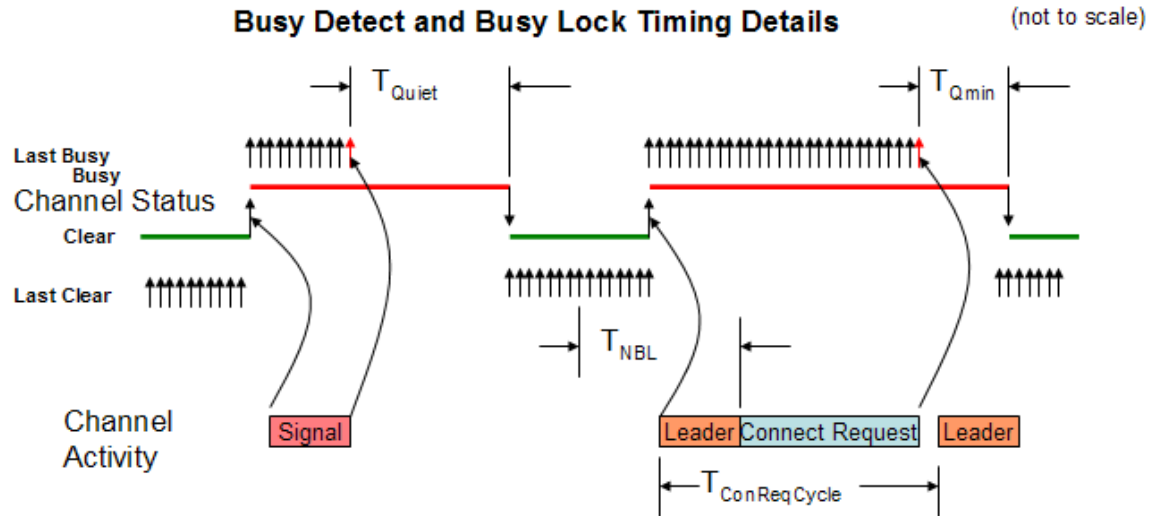
The format for data going from the Host to the TNC is:

“D: 2 byte count (Hex 0001 – FFFF most significant byte first), binary data, +2 Byte CRC”. The **“D:”** identifies this as a data frame from the Host. If the TNC received the data correctly it replies with **“c:RDY<Cr> + 2 byte CRC”** or if a CRC failure **“c:CRCFail<Cr> + 2 byte CRC”**. The TNC will buffer this data in its outbound queue until transmitted.

The format for data going from the TNC to the Host is:

“d:ARQ|FEC|ERR|, 2 byte count (Hex 0001 – FFFF most significant byte first), binary data, +2 Byte CRC”. The **“d:”** identifies this as a data frame from the TNC. **ARQ** indicates this is data received from a connected (ARQ) session and should be error free. **FEC** indicates this is data received from an unconnected session (a monitored FEC or ARQ frame) and should be error free. **ERR** indicates this is Data received from an unconnected session which failed CRC check of the received frame . It can be masked or ignored by the Host if desired.
If the Host received the data correctly it replies with **“C:RDY<Cr> + 2 byte CRC”** or if a CRC failure **“C:CRCFail<Cr> + 2 byte CRC”**. The TNC will then respond with the next data frame or a repeat of the failed data frame.

Appendix B: ARDOP Channel Busy and Busy Lock Details (place holder....current diagram for WINMOR)



Nominal Values:

$T_{Quiet} = 2000$ ms, (time of no signal before reporting clear channel)

$T_{Qmin} = 500$ ms (the temporary minimum quiet time after the receipt of a connect request frame. (insures non blocking of repeated connect frames).

$T_{NBL} = 500$ ms, (time before leader end which must be clear for no busy lock

$T_{ConReqCycle} = 4200$ ms (minimum repeat interval for Connect Request frame)