UZ7HO Soundmodem
Sound Card Modem
Setup Guide

Applicable to Soundmodem version 1.14

Complied by Jon Eyes, G7OMN, revised by Scott Currie, NS7C Document Revision 2.1

Contents

Features

The UZ7HO's sound card modem has the following features:

1. Supports up to 2400 bps AFSK and up to 4800 bps PSK packet operation, using AX.25 protocol, configurable by port (compatible with Direwolf PSK modes)
2. Supports internal Soundcards or external USB sound cards like Signalink, DRA Series adapters, Rim and Rim Lite, and radios with built-in sound cards
3. Runs under Windows 7+, without any need for installation
4. Uses Windows preinstalled device driver files for soundcards
5. Emulates SV2AGW packet engine, in TCP mode and can be used as a direct replacement
6. Emulates a KISS TNC in TCP mode
7. Dual Channel operation, for unprotocol (UI) traffic
8. Supports multiple decoder pairs per channel
9. Supports COM port, parallel port, CAT commands, and External devices for PTT triggering
9. Supports combined or multiple PTT triggering
10. Calibration function for setting TX levels
11. Supports VOX (in the case of Signalink Modems)
12. Supports Single Channel Output (dual port Tx on Signalink)
13. AX.25 digipeater operation
14. Supports FX.25 operation
15. Supports Correction factors to accurately calibrate sound card operation
16. Menu configuration for basic settings
17. ini file for extended options

About Andrei

The "Soundcard modem" was developed to provide an AX.25 modem devoid of the shortcomings of previous software products. When I started to work in Packet-Radio I had a choice between hardware and software products. At that time, I tried a lot of software TNCs, but each had its own flaw. I started with software TNCs using the Baycom modem design, but most all of them worked only under DOS. Now it is the 21st century, and DOS is obsolete, as are the machines where it was used. Windows gives more opportunities, but also limits some operations. Baycom modems, that worked well under DOS, cannot run under Windows. Sound card devices can solve this problem, and with DSP, make excellent modems.

After deliberation, I made a preliminary action plan and set targets. First, the modem should be compatible with modern software applications, using TCP/IP technology. George Rossopoulos (SV2AGW) has developed a great API interface, that allows connection to a modem, even on a remote host. Next, the modem must have excellent sensitivity since it has been developed for HF. The L2 protocol is compatible with modern TNCs. It also includes many adaptive functions, such as "Collector of frames" etc. Since the modem can be used on HF, I have provided additional narrow filtering of the transmitted signal to reduce out of band splatters.

The stable core of the program was written in Delphi. In May of 2010, with help from Sergei and Yuri UT1HZM RA9SJI, we started experiments on HF, which allowed me to more quickly find faults. At that

time, I couldn't do all testing by himself, so the guys really helped me. In the Spring of 2011, I began the first experiments by myself on the NET14 group frequency. I periodically ran my APRS digipeater, and reviews of the members of the NET14 groups indicated it worked excellent. The modem continues development from that time...
I very much hope that this product will find its admirers. With Packet-Radio in limited use due to the Internet and mobile communications, perhaps this new program will add new users. I want to believe it will.

See you on the air!

Andrei, UZ7HO

About the Application:

The software is in continuous support with new versions being added on a regular basis.

Installation

The application is provided as a zipped single executable, which when extracted and placed in a folder, can be run. It needs no "installation" and creates the soundmodem.ini file when the application is run for the first time. The soundmodem.ini file stores the operating parameters, to ensure the application restarts "as it was left". Any operational changes to the application are stored to the soundmodem.ini file when the application is closed.

Operation

To launch Soundmodem, simply double click the soundmodem.exe application from within the working folder. For ease of use, you may create a Windows shortcut in the normal way and store it on your desktop or start menu. The application can be configured to run in single or dual channel mode. Either channel or waterfall can be disabled if not required. Disabling unused channels or waterfalls will reduce CPU load.

Multiple Decoders

By default, each channel is configured to use a single decoder, however, the number of decoders can be increased in pairs either side of the "standard" decoder (subject to CPU "horsepower", the more enabled, the more resources used). This allows parallel decoding of "off frequency" transmissions either side of the center spot frequency. The default step, at the moment, is 30Hz per decoder pair and it is possible to add up to 16 additional decoders per channel (8 either side of the center decoder, giving approximately ±270Hz decoding bandwidth per channel on Rx (Similar effect to the SCS tracker modems) of strong signals. The decoder pairs are enabled in multiples of 2, i.e. one pair either side of the center pair.
Note: *Enabling more decoders than the CPU can handle will cause instability, this will exhibit itself as random locks of the s/w, and horizontal bars in the "quiet" areas of the waterfall*.
If parallel decoding is to be used, it is better to increase the number of decoders a step at a time, to ensure reliable operation.
DCD only works on the center decoder pair.

Main Screen Layout

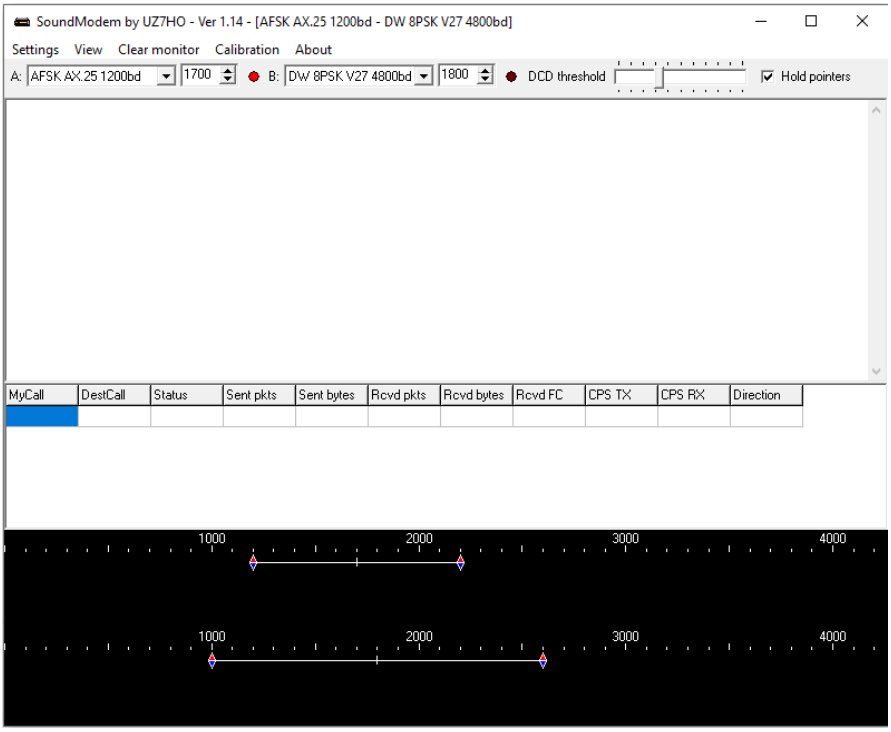


Figure 1 The Main Screen

In Figure 1 above, the window is split into 5 sections:

1. Menu Bar
   Provides access to configuration and settings
2. Decoder Settings: Current decoder center frequencies, DCD indicators, Hold Pointer (Decoder Frequency slider lock) and DCD threshold (It should not be necessary to adjust the DCD threshold).
3. Monitor Window
   Shows Tx packets and Decoded Rx frames. Each displayed frame is prefixed with the applicable channel number
4. Status Window
   (This only works on connected nets)
5. Waterfalls
   Channel 1 at the top, Channel 2 below.

Once run, the application creates an ini file in the same folder, which allows some tweaking of the settings. However, the basic default settings that are created will serve most people and the settings menu provides access to the general settings to configure the application.

Configuration

Menu Bar - Settings:

The Settings Menu provides access to the following:

1. Output volume* sets the TX output level.
2. Input Volume* sets the RX input level. Adjust for moderate density of monochrome waterfall. If using color waterfalls, you should set for green with some yellow patterning in receive state and red when data is detected.
3. Devices
4. Modems

*Not supported in newer versions of Windows, use the Windows Sounds settings instead.

Device Menu

The Devices menu offers the following:

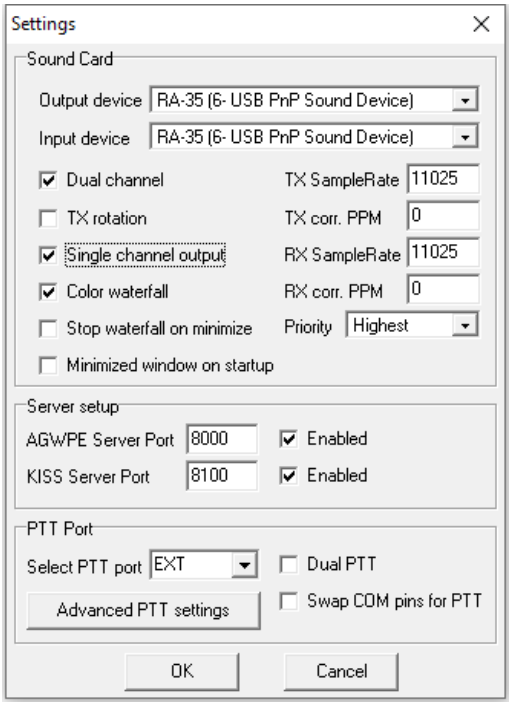


Figure 2 The Settings Menu

Input/Output Devices - Select the appropriate I/O device from the drop-down list to use the relevant sound card as a modem.

Dual channel - Select if two port operation is required (a "stereo" sound card is required).

Sampling rates- this sets the sampling rate of signals and these may be left at their defaults for typical operation. If 11025 is not supported, try 12000 instead. The sampling rates are limited to a range of 10KHz to 13KHz. It is possible to amend these values to calibrated values for your soundcard. See *Soundcard Calibration*

Tx Rotation – this prohibits the sending of multiple transmissions on the same channel (i.e both ports transmitting together), and forces packets to be sent sequentially. This is mostly for older soundcards or when using Single Channel output. Enable this option when using ***Single channel output.***

Single channel output – this is used when the sound card in use only supports "mono" output to the transceiver, it will force the transmitted audio for either port to use the left audio channel. Use this to enable full dual channel Tx with Signalink type modems.

Color Waterfall – check this box for a color waterfall display.

Stop waterfall on minimize – check this box to disable waterfall operation when the application is minimized. This frees up CPU cycles on slower computers.

PTT Port – sets the port to be used for PTT switching. Set to COM for serial port, LPT for parallel port, None for VOX (e.g.Signalink), CAT for CAT control, or EXT for external options using the PTT-dll (see ***Advanced PTT Settings*** below).

If using serial ports, RTS is used for Channel 1, DTR is used for Channel 2

If using parallel ports, Pins 2 & 3 are used for Channel 1 and 8 & 9 are used for Channel 2.

Advanced PTT Settings – these settings are used for CAT control of PTT, or PTT control of other devices like AllStar repeater interfaces (C-Media based sound card interfaces like the RA series, Rim Lite, etc.). Support is provided by an external driver available on the website (ptt-dll.zip).

Dual PTT – this option sets dual channel PTT operation from the COM or LPT port. Each port will operate its "TX pin" independently. This allows a full stereo soundcard to operate two different transceivers independently of each other. If you are using a single transceiver with a single PTT line, you can leave this box unchecked and sending data on either port will cause the transceiver to transmit. (A good example of this is using one HF transceiver to transmit/receive 300bps and 1200bps data within the same pass band).

Swap COM Pins for PTT – this option swaps the PTT lines between channels.

Modems Menu

The Modems Menu offers the following:

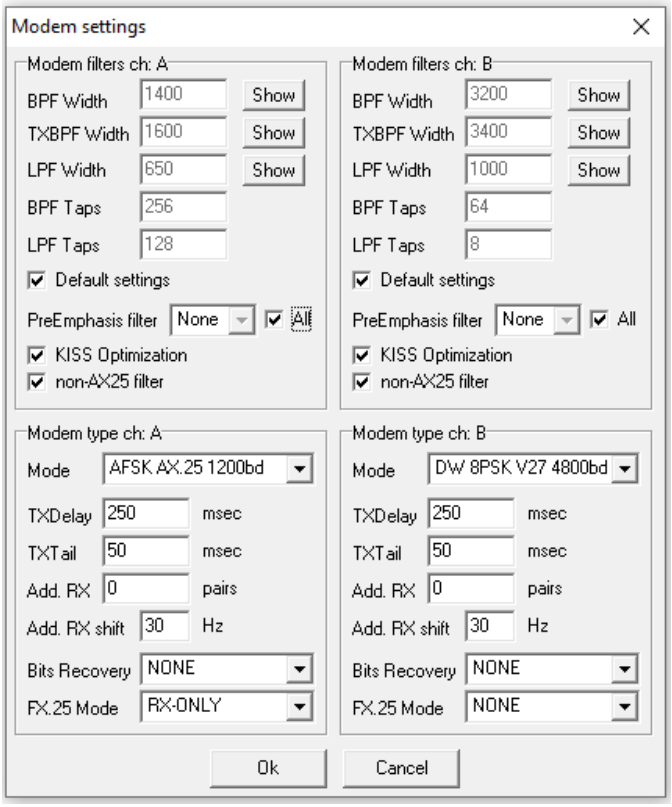


Figure 3 Modem Settings

Each modem can be configured individually and quickly from this window.

To change any feature from default, uncheck the box first.

Feature definitions are as follows:

I. BPF Width*

This sets the width of the receive Bandpass filter in Hertz

II. TXBPF Width*

This sets the width of the transmit Bandpass filter in Hertz

III. LPF Width*

This sets the post detector bit stream filter, (Always AFSK Baud rate/2).

IV. BPF Taps*

Band Pass Filter quality – increase/decrease in steps of 2. Increasing this will increase CPU load but improve Q of filter. If this is reduced, the BPF value should also be reduced.

V. LPF Taps*

Post detector bit stream filter quality – increase/decrease steps of 2. Increasing this will increase CPU load but improve Q of filter.

VI. Pre-Emphasis filter

This is a receive high pass filter that applies either 6dB or 12dB gain per octave to the high frequencies, to compensate for receivers that do not have a flat passband. Check All to apply all pre-emphasis filters.

VII. Modem Type

This sets the modem type (300-2400bd AFSK, 300-4800bd PSK).

VIII. TXDelay

Sets the length of the lead in tones before the main packet of data is sent. Defaults should work, but can be fined tuned to allow for radios that have a longer or shorter delay when switching to TX mode.

IX. TXTail

Sets the hold time after the packet is sent before the radio switches back to receive. The default value for this should be ok.

X. Add. Rx

Additional decoder pairs that are added either side of the initial decoder. 0 = No additional pairs. 1= 1 additional pair (3 decoders total). A maximum of 8 additional decoder pairs can be added bringing the total to 17 per channel. ***Use this with caution – as it is very processor intensive.***

XI. Add. Rx Shift

This sets the shift from the adjacent "inner" decoder pair center frequency for each additional decoder pair enabled and is configured per channel.

XII. Bits Recovery

This option sets bit recovery to none or single. When set to single, Soundmodem will attempt to recover single bit errors by bit flipping until the CRC check is met. Use this option with caution as it may cause data corruption on receive.

XIII. FX.25 Mode

This option enables FX.25 operation for receive only or both receive and transmit. FX.25 adds FEC to the standard AX.25 frame.

* These settings are automatically set to their optimal settings for the baud rate if the "Default settings" box is checked

Menu Bar – View:

This allows monitoring windows, status windows, status table and waterfalls to be toggled on or off. By default, all are on. Font adjustments is also available from this menu.

Menu Bar – Clear Monitor

This clears the monitor window of received and transmitted data.

About:

General "About" details – this shows the version number of the application

Figure 4 The About Window

The Soundmodem ini file:

This file is created when the application is run for the first time and updated when the application is closed.

A sample ini file is listed below, with explanations in red. ini file notes:

1. Set from Devices drop down window
2. Set in Modems drop down window
3. These items only appear *if* default boxes are unchecked and changes to the modem configurations have been saved.
4. Enabled or disabled in the View window
5. Amended in the main window

Note that some of the settings apply for "connected" communications, which do not apply for APRS (which uses unnumbered frames).

Note: If you need to amend any settings in the soundmodem.ini file, you must close the soundmodem application before editing the ini file, as the application reads the file at start up only.

Sample .ini file:

[Init]

Priority=2	Application process priority
UTCTime=0	When set to 0 the monitor window shows local time, setting to 1 enables the display of UTC time.
NRMonitorLines=500	Sets the number of lines in the receive window buffer, values are 10 to 65535
PTT=NONE	Selected PTT port[1]
DispMode=1	Waterfall colour, 0= Mono, 1= Colour[1]
StopWF=0	Enable/Disable waterfall on application minimize
StatLog=0	Enables a log file for connections. n/a for unproto modes like APRS[1]
SndRXDevice=4	ID of sound card used for Rx[1]
SndTXDevice=2	ID of sound card used for Tx[1]
SndRXDeviceName=	Sound card device name for Rx
SndTXDeviceName=	Sound card device name for Tx
RXSampleRate=11025	RX sample rate [1]
TXSampleRate=11025	TX sample rate [1]
RX_corr_PPM=0	RX sample rate correction figure in Parts per Million [1]
TX_corr_PPM=0	TX sample rate correction figure in Parts per Million [1]
DisableUnit=0	Used debug, disables various modules of the program. Leave @ 0
TXRotate=0	Prevents tones being Tx'd from both encoders at the same time. Set to 1 to enable serial transmission[1]
DualChan=0	Single channel mode=0, Dual channel mode=1[1]
DualPTT=0	Dual PTT 0=Disabled. 1= Enabled[1]
SCO=0	Single Channel Output. 0=Disabled 1=Enabled[1]

TXBufNumber=32	Buffers allocated to Tx 16~64
RXBufNumber=32	Buffers allocated to Rx 16~64
UseStandardTones=1	Enable/Disable standard frequency preset (e.g. AFSK1200 = 1700Hz)
[AX25_A]	***(Modem 1, Standard AX25 settings, specific to the windows API – these generally should not need adjustment.)***
Maxframe=3	Max number of frames transmitted at once
Retries=15	Maximum retries of frame sending
FrackTime=5	Interval between retries (in seconds)
IdleTime=180	Time (seconds) a link will remain idle before auto disconnect (Connected Net)
SlotTime=100	Milliseconds, reset time for Persist timer.
Persist=128	Tx Probability, A larger number will increase probability, assuming DCD doesn't detect a signal If a signal is present, the Modem waits slottime before restarting the persist timer. Values = 32~255. 64 is a good value for a digi
RespTime=1500	Wait time for an ACK (Connected State)
TXFrmMode=1	Transmission Frame Mode, 1=repeat only one frame on each REJ received, improves performance under poor conditions (HF) if the other does have "frame collector". 0=always repeat the block of frames, improves efficiency under good conditions if the other end does not have "frame collector"
FrameCollector=6	Received frames buffer, sets the number of received frames that are buffered to compensate for frames received out of sequence – due to QSB or QRM
ExcludeCallsigns=	Provides the option to filter out packets from specific callsigns and prevent them being passed to the host program, separate each callsign with a comma, excluded callsigns are displayed in GREEN in the monitor window.Use this option with caution to prevent upsetting other hams. *See Exclusion Syntax for use examples*
ExcludeAPRSFrmType=	Provides the option to filter out packets of specific frame types and prevent them being passed to the host program, enter corresponding ASCII codes separated by commas. Excluded frames are displayed in GREEN in the monitor window. See APRS Data Type Identifiers Exclusion syntax sections for examples
KISSOptimization=1	Enable/Disable KISS Optimization, removes unnecessary supervisor and duplicate frames.
DynamicFrack=0	Enable/Disable Dynamic Frack timer. (increases Frack time)
BitRecovery=0	Attempt recovery of single bit errors (0=no recovery, 1=single bit)
NonAX25Frm=0	Ignore non-AX.25 formatted frames (1=ignore)
MEMRecovery=200	Number of frames in corrupted frames buffer to assemble a good frame during bit recovery
IPOLL=80	PACLEN limit for Idle poll frames
MyDigiCall=	Digipeater call sign for this modem, leave blank for no digi

HiToneRaise=0	High Tone amplitude correction in dB, for AFSK 1200/2400 only
FX25=1	FX.25 mode, 0=disabled, 1=RX Only, 2=RX and TX
FX25TagCorr=1	FX.25 Tag Correlator adjustment (block size and parity size) The default setting is optimal
[AX25_B]	***(Modem 2 settings., Same definitions as listed under AX25_A)***
[Modem]	
RawPktMinLen=17	Minimum length of raw packet, default is 17 for AX.25 mode
SwapPTTPins=0	Swap PTT COM port pins (DTR and RTS)
InvPTTPins=0	Invert state of PTT COM port pins
PreEmphasisDB1=1	Pre-emphasis filter preset on port 1 (0=0dB,1=+6dB,2=+12dB)
PreEmphasisDB2=1	Pre-emphasis filter preset on port 2 (0=0dB,1=+6dB,2=+12dB)
PreEmphasisAll1=1	Enable/Disable all pre-emphasis filter on port 1 parallel decoders
PreEmphasisAll2=1	Enable/Disable all pre-emphasis filter on port 2 parallel decoders
Default1=0	Modem 1 running in custom settings[2]
Default 2=1	Modem 2 running in default settings[2]
DCDThreshold=32	This should not need adjustment, (set on Main Screen Slider)[5]
HoldPnt=1	Lock frequency sliders, 0 = unlocked, 1= locked, set in main screen check box
RXFreq1=1700	Channel 1 spot frequency (set by slider). Set at 1700 for KAM tones and use published dial frequencies. [5]
RXFreq2=1700	Channel 2 spot frequency (set by slider) [5]
AFC=32	AFC for bit generator – do not adjust
TxDelay1=250	Set Modem 1 transmit lead in time in mS[2]
TxDelay2=250	Set Modem 2 transmit lead in time in mS[2]
TxTail1=50	Set Modem 1 transmit lead out time in mS[2]
TxTail2=50	Set Modem 2 transmit lead out time in mS[2]
Diddles=0	Default is 0. Do not adjust.
NRRcvrPairs1=0	Sets the number of additional decoders in use on Channel 1. 0=1 central decoder, 1=3 decoders (center plus one either side of center), 2 = 5 decoders, 3=7 decoders, 4=9 decoders up to 8=17 decoders. ***Use this setting with caution!*** [2]
NRRcvrPairs2=3	As above, for Channel 2[2]
RcvrShift1=30	Sets the shift from the adjacent “inner” decoder pair center frequency for each additional decoder pair enabled for channel 1[2]
RcvrShift2=30	Sets the shift from the adjacent “inner” decoder pair center frequency for each additional decoder pair enabled for channel 2[2]
ModemType1=0	Set Modem 1 Type. 0-8[2]
ModemType2=0	Set Modem 2 Type. 0-8[2]
BPF1=500	Modem 1 Rx Band Pass setting in Hz (set in Modems Menu)[2,3]
TXBPF1=450	Modem 1 TX Band Pass Filter [2,3]

LPF1=150	Modem 1 Post detector bit stream filter, AFSK Baud rate/2 [2,3]
BPFTap1=256	Modem 1 Band Pass Filter quality – increase/decrease in steps of 2 [2,3]
LPFTap1=128	Modem 1 Post detector bit stream filter quality – increase/decrease steps of 2. Increasing this will increase CPU load but improve Q of filter. [2,3]
BPF2=500	Modem 2 Rx Band Pass setting in Hz [2,3]
TXBPF2=450	Modem 2 TX Band Pass Filter [2,3]
LPF2=150	Modem 2 Post detector bit stream filter, AFSK Baud rate/2 [2,3]
BPFTap2=256	Modem 2 Band Pass Filter quality – increase/decrease in steps of 2 [2,3]
LPFTap2=128	Modem 2 Post detector bit stream filter quality – increase/decrease steps of 2. Increasing this will increase CPU load but improve Q of filter. [2,3]
[AGWHost]	
Server=1	Enables AGW host mode (0=disabled)
Port=8000	TCP port used for the AGW server.
[KISSHost]	
Server=1	Enables KISS host mode (0=disabled)
Port=8100	TCP port used for the KISS server.
[Window]	
Top=404	Vertical position of the top edge of the window
Left=225	Horizontal position of the left edge of the window
Height=543	Window Height
Width=668	Window Width
Waterfall1=1	Channel 1 waterfall, 1=enable, 0=disable[4]
Waterfall2=1	Channel 2 waterfall, 1=enable, 0=disable[4]
StatTable=1	Show stat table, 1=enable, 0=disable[4]
Monitor=1	Show Monitor Window, 1=enable, 0=disable[4]
MinimizedOnStartup=0	Start application minimized
[Font]	
Size=8	Font Size
Name=MS Sans Serif	Font Name
Style=0	Font Style
TXTextColor=125	TX Text Color (dec)
RXTextColor=0	RX Text Color (dec)
ExcludedTextColor=32768	Excluded Text Color (dec)

Soundcard Calibration

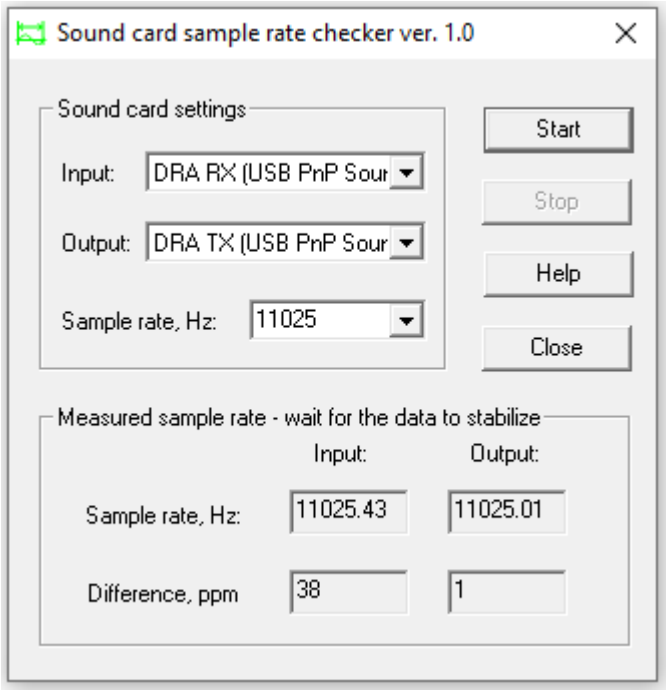


Figure 5 CheckSR.exe Application

If you wish to calibrate your sound card, you can use the NBEMS/FLDIGI calibration utility, CheckSR.exe (above) which can be downloaded from: http://wa8lmf.net/miscinfo/
Follow the instructions on the linked page to find the delta values in ppm.
Once the stable values are obtained, enter the "Input" value under the Rx corr. PPM box in the Settings Window, as shown in *Figure 2 The Settings Menu*. The "Output" value should be entered in the Tx corr. PPM box. Remember the "-" if you have a negative value.

Appendix A - APRS Data Type Identifiers

Ident	Data Type	Ascii Code	Ident	Data Type	Ascii Code
0x1c	Current Mic-E Data (rev 0 beta)	n/a	<	Station Capabilities	60
0x1d	Old Mic-E Data (rev 0 beta)	n/a	>	Status	62
!	Position without timestamp (No APRS messaging), or Ultimeter 200 WX Station.	33	=	Position without timestamp (with APRS messaging) **Beacons**	61
“	[Unused]	34	?	Query	63
#	Peet Bros U-II Weather Station	35	@	Position with timestamp (with APRS	64
$	Raw GPS data or Ultimeter 2000	36	A-S	messaging)[Do not use]	65-83
%	Agrelo DFJn / MicroFinder	37	T	Telemetry data	84
&	[Reserved - Map Feature]	38	U-Z	[Do not use]	85-90
‘	Old Mic-E Data (but Current data for TM-D700)	39	[	Maidenhead grid locator beacon (obsolete)	91
(	[Unused]	40	\	[Unused]	92
)	Item	41	]	[Unused]	93
*	Peet Bros U-II Weather Station	42	^	[Unused]	94
+	[Reserved - Shelter data with time]	43	_	Weather Report (without position)	95
,	Invalid data or test dat	44	`	Current Mic-E Data (not used in TM-D700)	96
-	[Unused]	45	a-z	[Do not use]	97-122
.	[Reserved - Space weather]	46	{	User-Defined APRS packet format	123
/	Position with time stamp (no APRS messaging)	47	|	[Do not use, TNC stream switch character]	124
0-9	[Do not use]	48-57	}	Third-party traffic **IGated traffic**	125
:	Message	58	~	[Do not use, TNC stream switch character]	126
;	Object	59	~	**Also used for UI-View messages**	126

Identifier Overview

The APRS Data Type Identifier is the first character in the second line of the transmitted frame. In the example below it is ":" indicating a message. So, identify the character in the offending frame and use the table above to ascertain the ASCII code to be inserted in the filter. The green entries are added notes.

07:34:13T MB7UXN-14>APU25N,WIDE2-2 <UI C Len=33>: :K1CKK-14
:This is a test msg{47

Exclusion Syntax

Exclude Callsigns:

ExcludeCallsigns=TCPIP,IGATE,G9XYZ

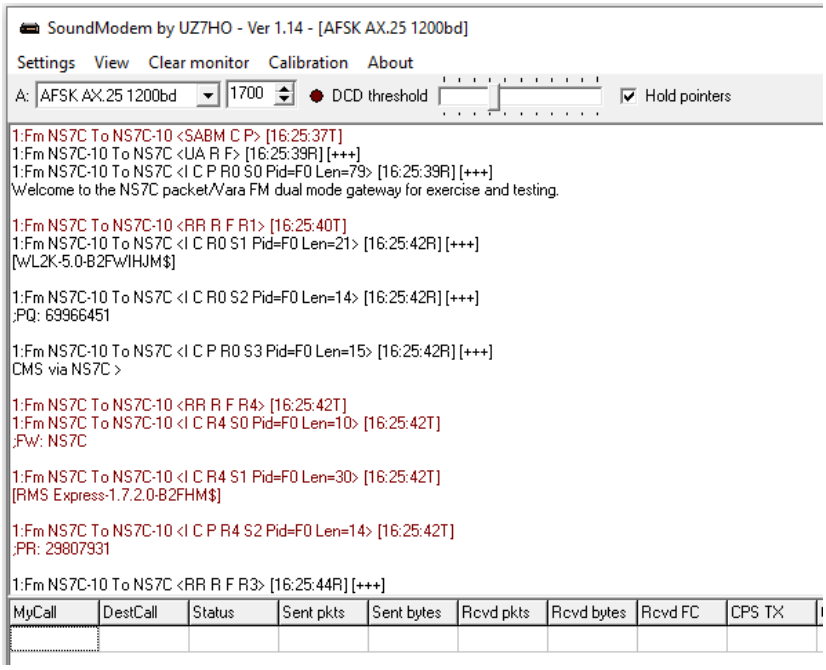
Exclude Frame Types:

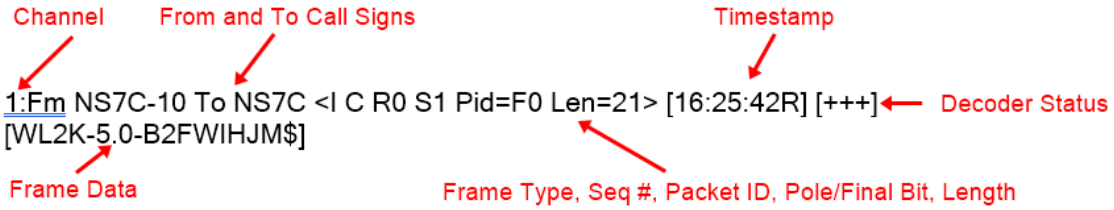
ExcludeAPRSFrmType=59,125

In this example, “Objects” and “I-Gated” traffic would be excluded from being passed to the Host Program

Monitor Window Example

The Monitor Window shows both received and transmitted packet frames. The Monitor Window buffer size can be adjusted in the ini file if more history is needed. By default, transmitted frames use red text and received frames use black text, but this can be changed in the ini file as well. The Monitor Window supports the standard “copy to clipboard” (Ctrl-C) function for capturing data that can then be pasted into another application for review. Knowledge of the AX.25 protocol is required to decode the frames, but a basic breakdown is presented below.





Status	Meaning
-	Frame was not decoded
+	Frame was decoded successfully
$	Single bit error correction
#	Frame was recovered using parts of previous frames based on similar size, CRC, etc.
F	FX.25 Frame

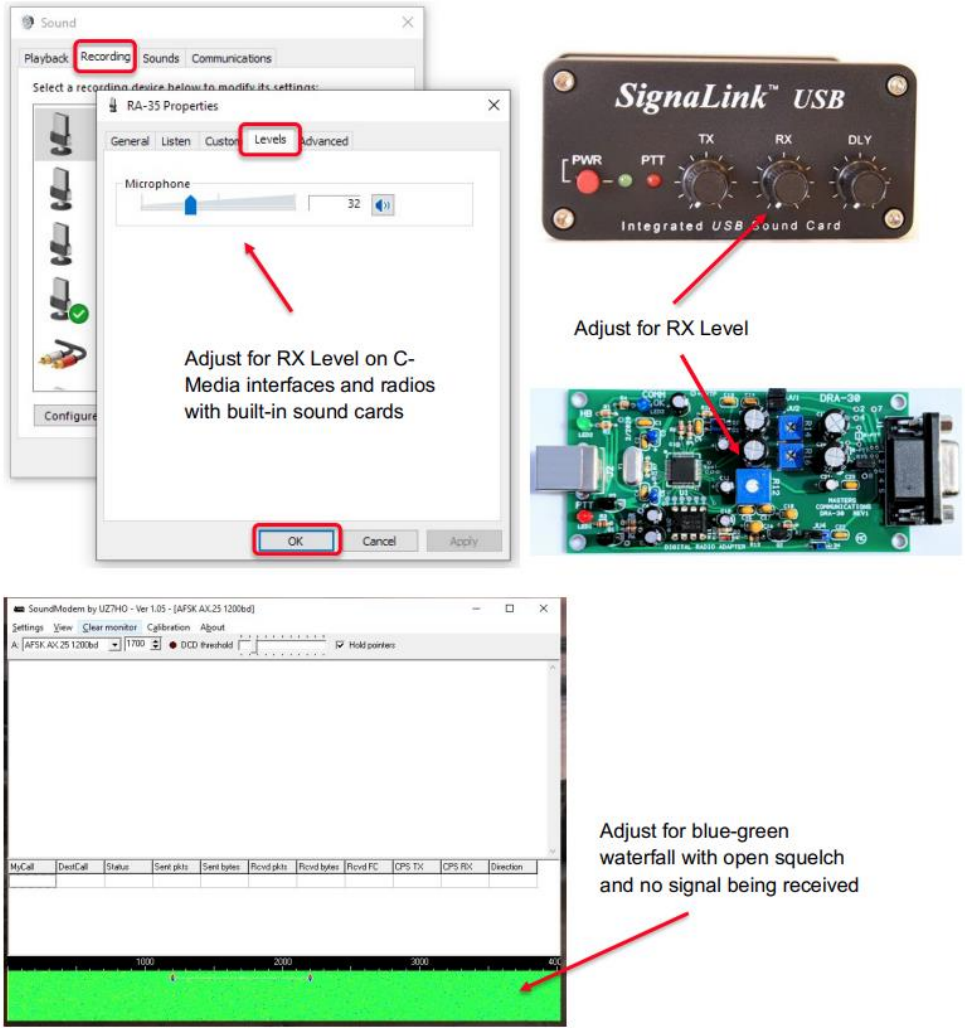
Figure 6 Parallel Decode Status Characters

Transmit and Receive Level Setting (FM Radios)

Adjusting these levels properly is essential for maximum data throughput. A poorly adjusted system will result in multiple retransmissions of packets that were not decoded properly. TX and RX levels can be adjusted by the Windows Sound settings, hardware controls on your sound card interface (if so equipped) and possibly radio menu settings. All three can change the levels. You should document all these levels once they are set. Always use open squelch for data operations.

RX Level

To set the Rx level, use the Windows Sound Record level, and/or your device controls, to achieve a clean waterfall with the radio squelch open, and no signal being received. If you selected color waterfall, this should be blue-green color. Received packet transmissions will be yellow with some red.

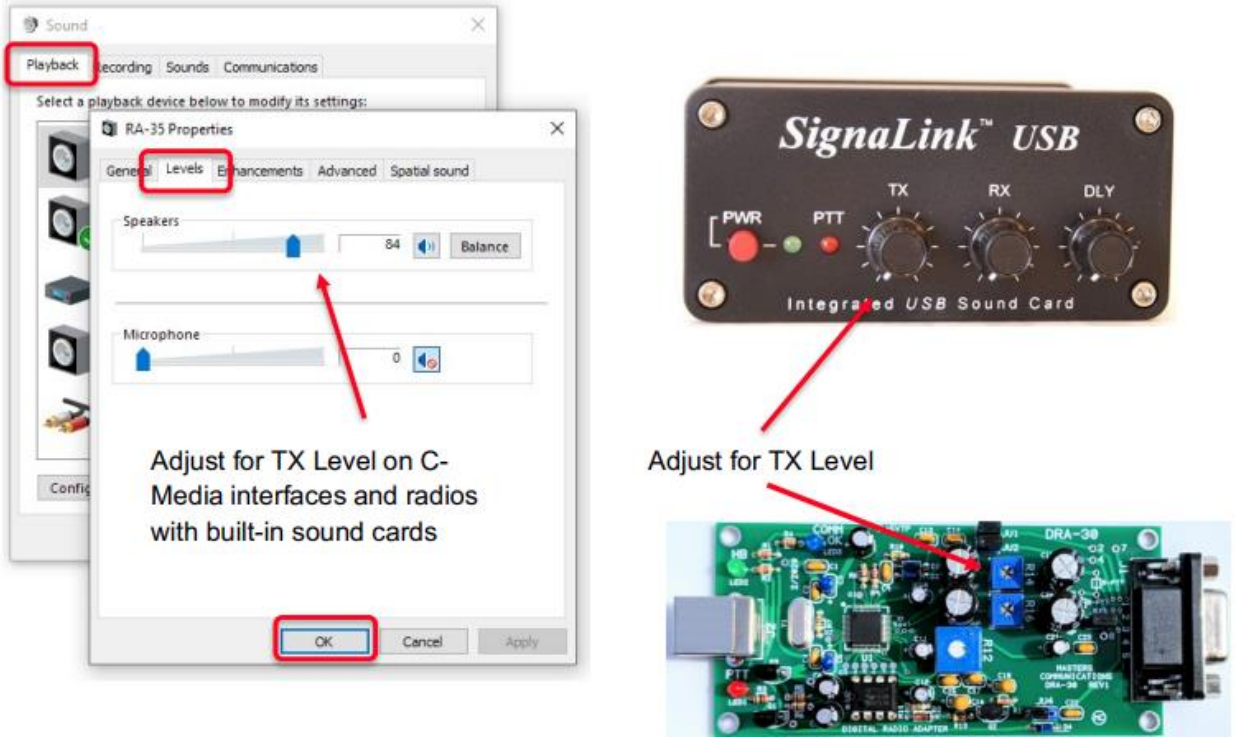


Note: Under Windows Sound Settings, be sure to disable AGC if present (under the Custom tab) and all other sound "enhancements" for both playback and recording for your sound card device.

TX Level

To set the TX level, use the Windows Sound “Playback” level, and/or your device controls, to achieve an undistorted transmission of about 3.2kHz deviation. If you have test equipment available, this can be easily set. If you do not have test equipment, you can approximate this level using the Calibration function in Soundmodem while monitoring your transmissions with another radio.

Set your monitor radio to the same channel and adjust the volume to a comfortable level. Set the Playback level, or TX control to a low setting. On the Soundmodem main panel, select Calibration. On the Calibration panel, click the High Tone button. Your radio should start transmitting and the 2200Hz tone may be heard on the monitor radio. Adjust the playback/TX level up slowly until you reach the point where further increases in this level do not increase the receive tone level on the monitor radio. From this point, adjust the level back down just until you perceive a noticeable drop in the receive tone level on the monitor radio. This should be close to 3kHz deviation. Click on the Stop TX button. Close the Calibration panel.



For HF operations, adjust the TX level while watching your ALC meter. Adjust for minimum ALC action.