

Black Cat ALE
Version 1.0.1b1
February 6, 2022

WARNING! Depending on the number of decoders enabled and the decoding settings, the program can be extremely CPU intensive! To the point of effectively making your computer non-functional. Start with one decoder with a selected sound input device when changing the other settings, especially the integration step, then enable additional decoders one by one, by selecting a sound input device, while watching the CPU usage in the Task Manager (Windows) or Activity Monitor (macOS).

Known issues:

If you don't see any sound devices, quit and run again.

Requirements:

Windows 8/10

macOS 10.10.5 or later

Introduction

Black Cat ALE is a multi-channel ALE decoder. Up to 4 decoders can run at the same time, up to 24 when in high performance mode. See the section further down in the documentation.

Each decoder can be connected to its own audio input source (a virtual audio cable - VAC, or physical sound input device).

Purchase and licensing:

You can, and should, fully test this program prior to purchase. Other than some usage time restrictions, it is fully functional. If something “doesn’t seem to work”, or work the way you want it to, in trial mode, it’s probably not going to work differently once you have paid. So be sure to address any issues prior to purchase, as refunds are not available.

Two Black Cat ALE license codes are available. The regular license code allows for up to 3 decoders running at the same time, the Pro up to 24. Updates from the former to the latter are also available. A license code will work with the current release version at the time of purchase as well as any updates released over the next year. Use of updates past then will require a renewal of your license code. Of course your license code will continue to work with the previous versions, should you not wish to renew.

Note that until you purchase a Pro license code for high performance mode, your usage of the program will be restricted in high performance mode to several hours at a time, requiring a restart of the program to continue. This provides ample opportunity to evaluate the program. Also note that in trial mode without any license code, your usage may also be limited (but again you can restart the program to continue using it).

Visit the Black Cat ALE program page to purchase your license code, when you are ready: https://blackcatsystems.com/software/black_cat_ale_decoder.html

Basic operation:

The program defaults to one decoder. It's recommended to get some experience in single decoder mode first, before enabling additional decoders.

Select the sound input device from the popup menu. In most cases, you can ignore the Left/Right channel selection unless your sound input device supports different audio feeds on each channel.

You should start to see activity in the spectrum and volume displays, once you start feeding audio from a radio into that audio channel. The gain slider can be used in some cases to adjust the input level, but note that not all sound devices support this capability. If you don't see activity, troubleshoot your audio connection/settings. Tick the graph checkbox and a graphical display of the audio volume over time will appear and update.

The receiver frequency can be entered into the Frequency text box, optionally with the mode (USB or LSB). This information will be added to displayed ALE decodes.

Assuming you're tuned to a frequency with ALE transmissions, you should eventually start to see some decodes appear. If you have audio recordings (WAVE file format) of ALE signals, you can also feed them into the decoder, see the section further down in the documentation on this feature.

Most ALE transmissions are in USB mode, and on integer kHz frequencies, such as 6850.0 kHz, etc. A lesser number of transmissions are on half kHz steps, such as 6873.5 kHz. A smaller number of ALE transmissions are in LSB mode, and an even smaller number are on other fractional frequencies, such as 8476.1 kHz.

Setup:

The program defaults to one decoder. Select Settings from the Edit menu to change the

number of decoders as well as other settings.

NOTE: You must close this window after making changes, for those changes to take effect!

NOTE: If you wish to use more than 3 decoders, you will need to enable high performance mode. If you change the number of decoders, you must quit and restart the program for that change to take effect.

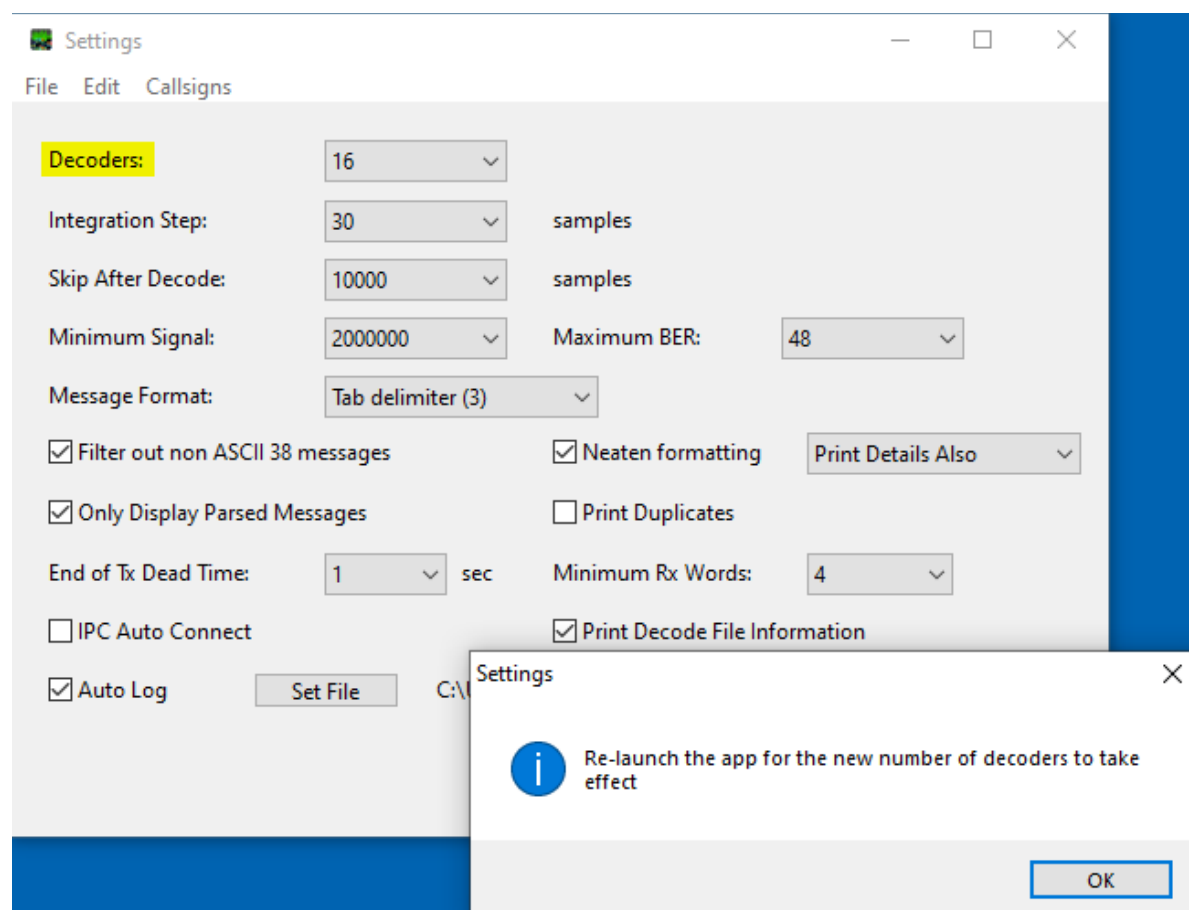


Figure 1: Select the number of Decoders/VACs 1 ... 24 from the dropdown menu "Decoders" in the Settings tab. Re-launch the app.

There are also some additional settings:

Integration Step: How closely Black Cat ALE looks for signals. The smaller the number, the more closely, but also the more processing time required. Experimentation has shown that a value of 30 is generally quite adequate, and even 70 or 100 works well for most cases. Very small numbers can help extract weak signals out of the noise, at the expense of more CPU use.

Skip After Decode: After a valid message is found, how many sound samples skipped (ignored) until decoding starts again. This should generally be left to the default value.

Minimum Signal: The required minimum strength of the demodulated audio to trigger a decode. This should generally be left to the default value.

Filter out non ASCII 38 messages: Don't display messages with characters outside of the ALE specified ASCII 38 character set. This should generally be left to the default value.

Message Format: Controls the format of a displayed message:

Space Delimiter, a message looks like this:

```
[01 6907 USB 2021-10-13 22:20:55 24] TO EWD | KA=1 MP=7  
SINAD=31 BER=31 | TIS 4BUAAR
```

Tab Delimiter (1), a message looks like this:

```
01 6907 USB 2021-10-13 22:20:55 24 TO EWD |  
KA=1 MP=7 SINAD=31 BER=31 | TIS 4BUAAR
```

Tab Delimiter (2), a message looks like this:

```
01 6907 USB 2021-10-13 22:20:55 24 TO EWD KA=1  
MP=7 SINAD=31 BER=31 TIS 4BUAAR
```

Tab Delimiter (3), tabs between all fields. A message looks like this:

```
01 6973.0 USB 2021-10-17 08:43:51 0 TO ZEN TIS  
CM2
```

UDXF, formatted for posting logs to the UDXF mailing list. A message looks like this:

```
06950.0 69PMSANMIGUEL: TWAS ALE/USB (14OCT21 0536) (MD)
```

```
Space Delimiter:  
[01.5905.5.USB.2021-11-05.09:08:37.17].TO.J10.|.TIS.LNT  
  
Tab Delimiter (1):  
01→5905.5.USB→2021-11-05→09:10:46→0→TO.J10|.TIS.LNT  
  
Tab Delimiter (2):  
01→5905.5.USB→2021-11-05→09:12:03→23→TO.J10→TIS.LNT  
  
Tab Delimiter (3):  
01→5905.5.USB→2021-11-05→09:13:05→19→TO→J10.TIS.LNT  
  
UDXF:  
05905.5.LNT:TO.J10.TIS.ALE/USB.(05NOV21.0915).(W3HFU)  
  
UDXF, Neaten formatting, Print Details Also:  
05905.5.LNT:TO.J10.DHS.COTHEN/USCG-MH-60J.#6010.USA-USCG.Chesapeake.[on.COTHEN].Chesapeake>USA.TIS.ALE/USB.(05NOV21.0919).(W3HFU)
```

Figure 2: Six variations of the same message but with different message formats.

Maximum BER: Maximum allowed Bit Error Rate. Compares the number of bit errors between three successive ALE words. 48 would ignore all bit errors, 0 means the word must be received with no bit errors.

Neaten formatting: always prints frequencies with tenth kHz, and pads spaces in front of the kHz, for a uniform width.

Only Display Parsed Messages: Don't display the raw ALE words. Most users will want to select this.

Print Duplicates: When displaying raw ALE words, duplicate words (same word and timestamp) will be displayed. Duplicate parsed messages will also be dropped.

These two settings result in four possible ways of controlling what is displayed:

Only Display Parsed Messages ON, Print Duplicates OFF: The least output, only fully formed messages will be displayed, no duplicates.

Only Display Parsed Messages ON, Print Duplicates ON: Only fully formed messages will be displayed, with duplicates.

Only Display Parsed Messages OFF, Print Duplicates OFF: Fully formed messages will be displayed, along with raw ALE words.

Only Display Parsed Messages OFF, Print Duplicates ON: Fully formed messages will be displayed, along with raw ALE words, with duplicates of each. Will produce a lot of output. But this can be useful if you are decoding very weak signals, when not all of the ALE words may be received, resulting in only partial display of messages, or none at all in some cases.

Callsign information popup menu: controls whether or not details for a callsign are displayed, values are: No Callsign Info, Print Organization, Print Details Also. See the section further down regarding the next file necessary for this feature.

End of Tx Dead Time: Used to decide when an ALE transmission has ended, and display any remaining buffered message. I suggest 3 seconds for now as a value, but you can experiment.

IPC Auto Connect: For future use.

Minimum RX Words: Sets the minimum number of ALE words that must be received for

a parsed message to be displayed. The decoding routines in Black Cat ALE are extremely sensitive and intensive, and try to find any possible ALE signal. Sometimes noise can fool the routines. This can help filter out extraneous random decodes from noise, caused by the high sensitivity of the decoder. It does not stop the printing of raw ALE words. A value of 2 or 3 will probably be sufficient, but the user can experiment.

Print file decode information: Adds the name of the WAVE file to the decoded text

Auto Log: Check the box and Set the name of the log file, and it will automatically be opened at program launch, so you don't have to do this manually each time you run it.

Decoders:

Each decoder appears in its own tab in the main window. There is also a tab named "Combined" on the far right, this displays the text from all decoders in one easy to read display.

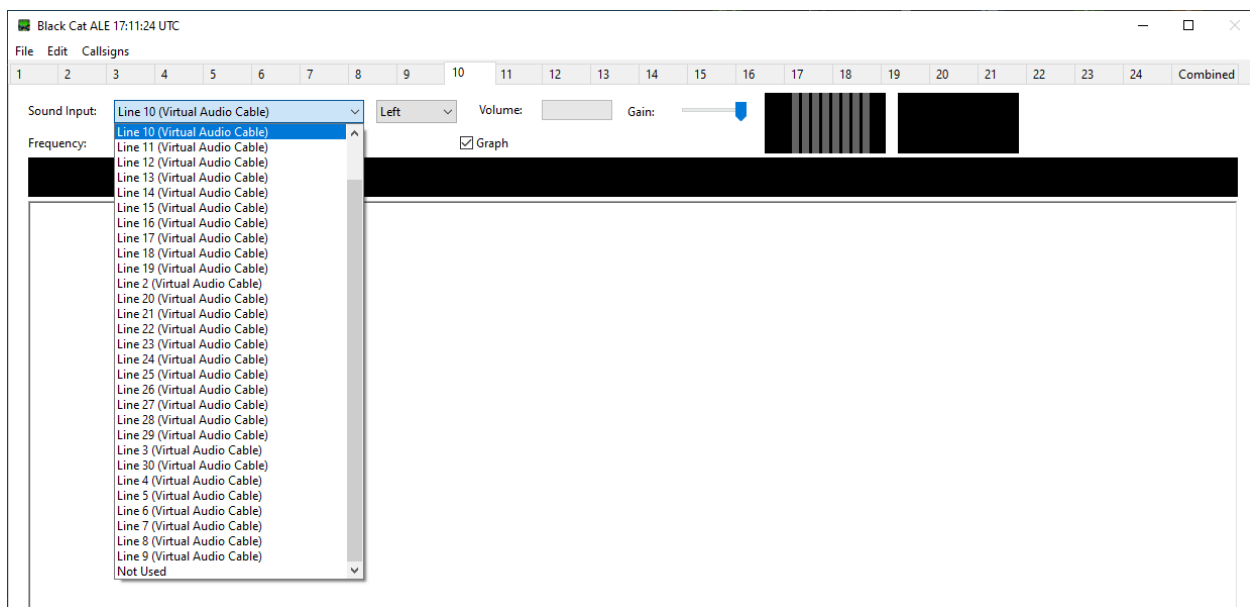


Figure 3: Up to 24 decoders can be set. It is a good idea to match the decoder number (1 ...24) to the VAC number (VAC1 ...VAC24).

For each decoder, there are several settings:

Sound Input: The device (physical or VAC) to use, along with which sound channel (left or right) to use. The latter can sometimes be used to double the effective number of VACs on your system, if your SDR or other software can feed audio to just a single channel, vs stereo.

Gain: The gain setting for an audio input. Not all devices support changing the gain, so it may do nothing on your setup.

Frequency: This is a text field for your own personal use. When ALE messages are displayed, the frequency is included, this is useful when looking at the combined display, or logging files, so you know what you're looking at. The decoder makes no additional use of this value.

Graph: Enables/disables the moving display of sound data. You can turn this off to use a little less CPU time, as well as gain a little more decode text space.

There's also a volume indicator as well as a simple audio spectrum display, for diagnostic/tuning purposes.

You can right click in the decoded text area to select all the text, copy text, or clear the text.

Each line of a fully parsed message contains this information:

Decoder number

Frequency (with mode if you have entered it)

Date

Time

Worst BER for any ALE word in the message

ALE message, optionally with callsign information

Decoding from audio files:

You can decode a WAVE audio file. Go to one of the decoders, and select Decode Audio File from the File menu. It will be decoded into the selected decoder display. Only WAVE files can be decoded. Not mp3 or any other format.

Multiple files can be selected, they will decode one after another. Don't change the decoder tab while files are decoding.

Decoding of WAVE files is much faster than real time decoding, limited by the speed of your computer, often 10x real time processing.

If the files are long, they will be read in chunks of approximately one hour's worth of data each.

Internally, sound is processed at a 44.1 kHz rate, monophonic, 16 bits. If the sound file is different from this, it will be converted internally to this format. As this takes some time, the fastest processing will occur if the sound file is already in this format.

The file name is parsed for the frequency and time/date/mode information. If it is found, it will be used when decoding messages, so they get timestamp corresponding to their actual time. Otherwise the current time/date is used. "

As of now, two formats are supported:

1. That when you download an audio file from a KiwiSDR receiver in your web browser:
sdr.hfunderground.com_2021-10-19T18_09_09Z_10242.00_usb.wav

2. Files from my SDR playback program mySdrPlayback:

Frequency(kHz) [space] Mode(LSB/USB) [space] day-Month-Year [space]
hour.minute.second.wav

For example:

6950.0 USB 14-Oct-2021 05.36.27.wav

Any deviation from this format will cause it to not be parsed.

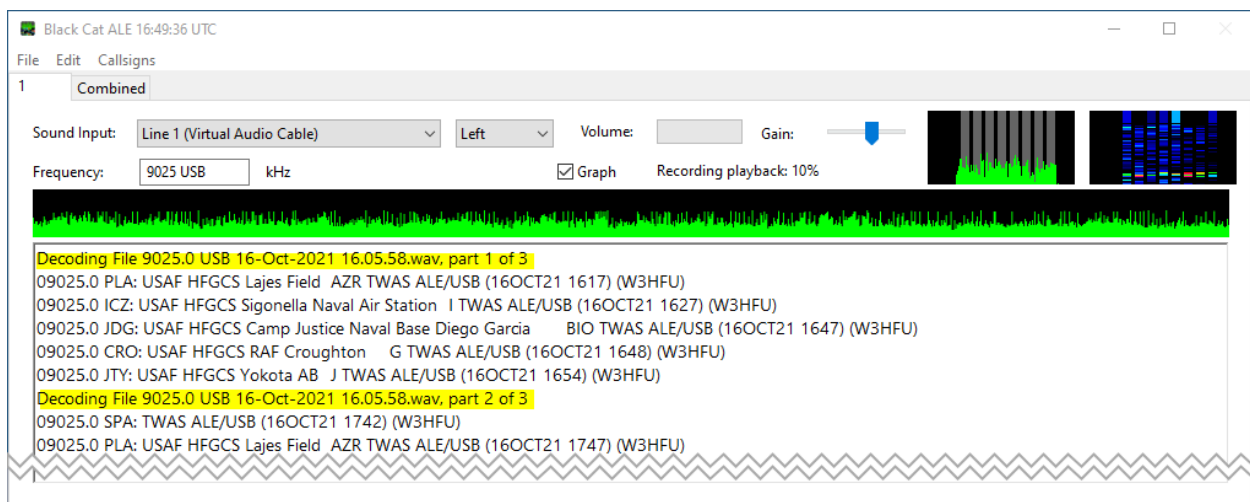


Figure 4: Decoding from an audio file. With a proper named file (marked), the decoder automatically timestamps each decode at the matching (original) time. Larger files are also automatically divided into pieces of one hour each.

Monitoring a directory for new audio files to decode:

Black Cat ALE can monitor a specific directory, looking for new WAVE files, and decode them automatically as they appear.

Select Set Directory To Monitor For New Files from the File menu, and choose the directory in which sdrRewind will store demodulated WAVE files. (Create one if you

need to)

Select Monitor File Directory from the File menu. Black Cat ALE will start looking in this directory for new WAVE files. The name of these files must end in ".wav" or ".WAV". It will ignore any files that already exist in this directory.

There is an option in Settings which allows for the automatic deletion of processed WAVE files, to save disk space.

Printing additional information about callsigns:

Black Cat ALE can use one or more text files to provide additional information about callsigns.

You need to create a directory to store these callsigns. One suggestion is to create one called "ale_callsigns" in the Documents directory for your user account.

From the Callsigns menu, pick Set Callsigns Directory... and then select the directory you created.

When you use the Save/Load Decoder Configuration options, this directory will be saved and loaded. So you could have a different directory, and set of callsign text files, for each configuration.

You can put one or more PLAIN TEXT files into this directory, the program will look for them when it is opened.

The first line of each text file should contain this text on the first line: CALLSIGN_FILE

These files should be a tab delimited list of callsigns, along with two or more descriptive fields (one for the organization and one for more details), with another tab between each. So:

callsign [tab] organization [tab] details [return]

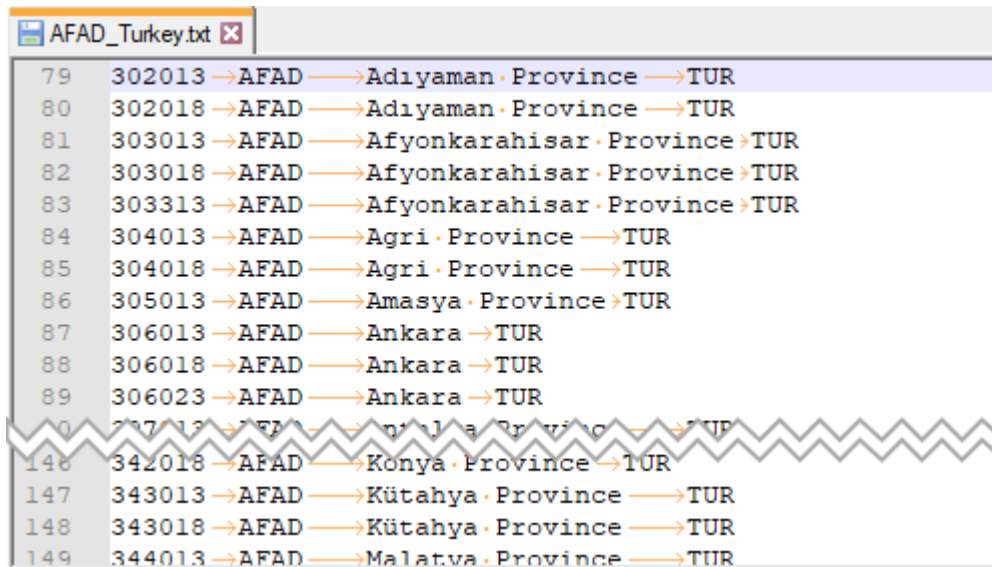
Any deviation from this format will cause it to not be parsed.

When a callsign matches an entry in the list, the organization and/or details will be displayed after it, in curly braces { }. This functionality is controlled in the settings.

If there are two or more callsigns with the same name, then information will not be printed for that callsign, instead "Ambiguous - multiple entries" will be printed.

You can select which file to use from the Callsigns menu in the program. You can select "Load All" to load all of the callsign files.

As each file is loaded, a line of text will be displaying indicating the number of callsigns in the file, the name of the file, and the total number of unique callsigns so far loaded into the program.



79	302013	-> AFAD	-> Adiyaman Province	-> TUR
80	302018	-> AFAD	-> Adiyaman Province	-> TUR
81	303013	-> AFAD	-> Afyonkarahisar Province	-> TUR
82	303018	-> AFAD	-> Afyonkarahisar Province	-> TUR
83	303313	-> AFAD	-> Afyonkarahisar Province	-> TUR
84	304013	-> AFAD	-> Agri Province	-> TUR
85	304018	-> AFAD	-> Agri Province	-> TUR
86	305013	-> AFAD	-> Amasya Province	-> TUR
87	306013	-> AFAD	-> Ankara	-> TUR
88	306018	-> AFAD	-> Ankara	-> TUR
89	306023	-> AFAD	-> Ankara	-> TUR
90	307013	-> AFAD	-> Antalya Province	-> TUR
146	342018	-> AFAD	-> Konya Province	-> TUR
147	343013	-> AFAD	-> Kütahya Province	-> TUR
148	343018	-> AFAD	-> Kütahya Province	-> TUR
149	344013	-> AFAD	-> Malatya Province	-> TUR

Figure 5: Such a look-up table makes identification and logging easy.

Logging:

Start and Stop Logging can be used to route all decoded messages to a text file. Note that when you start logging, any existing file will not actually be erased, but will be appended to.

Load/Save Decoder Configuration:

Loads and saves the current setup for all defined decoders. Handy if you want to have banks of decoder setups for FEMA, COTHEN, FAA, etc.

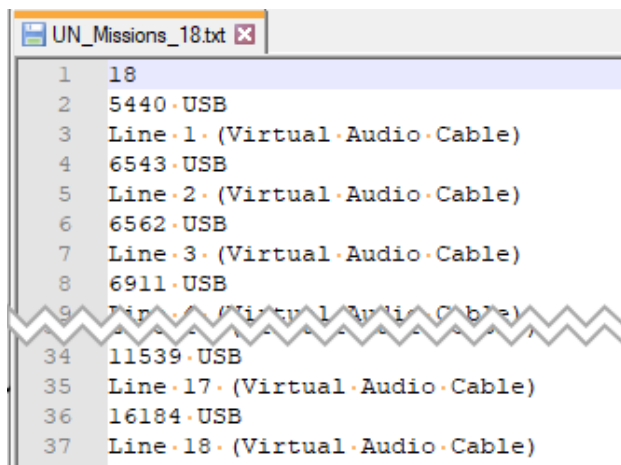


Figure 6: Here 18 frequencies, plus USB mode, of an UN mission's net are saved in a configuration file, named "UN_mission_18.txt".

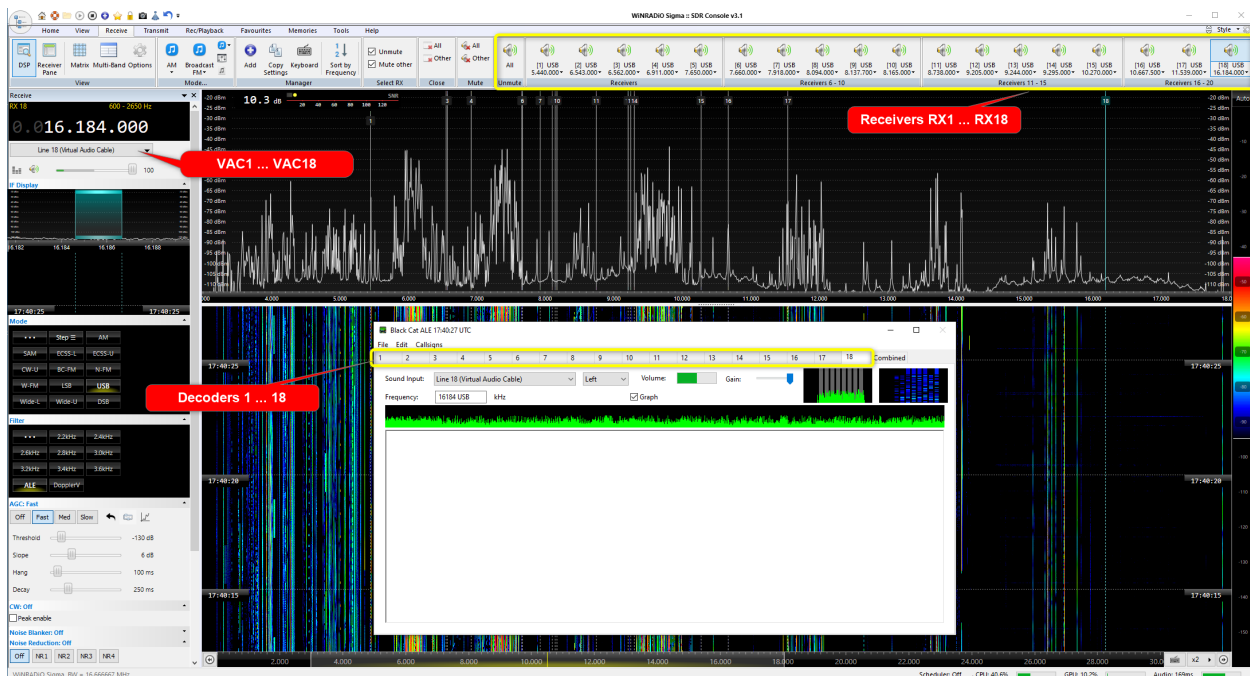


Figure 7: Be prepared – SDR software SDR# has been prepared for decoding all UN mission's channels. VAC1 ... VAC18 are designated to RX1 ... RX18 and activated ("All"). Black Cat Systems' ALE decoder mirrors that configuration. Now parallel decoding can start.

There is an option in Setup to specify an "Auto Log" file. When this is done, and the checkbox is ticked, this log file will be automatically opened and written to each time the program is launched, saving you from doing this manually.

Note that you must not have the log file you will be writing to open in any other program, or it will not be written to, and Black Cat ALE could misbehave/crash.

Edit Menu:

You can select the size, color, and font of the decode text here, plus enter your registration license code.

Some Caveats About ALE Decoding:

ALE transmissions are broken up into words, each of which contains up to three characters of a callsign, as well as the preamble type (TO, TIS, TWAS, etc). For callsigns of three (or fewer) characters, the entire callsign can be transmitted in a single word.

Callsigns longer than three characters must be broken up into two or more words, the additional characters are transmitted via a series of DATA/REP words. Up to a total of five words can be sent, allowing for callsigns up to 15 characters in length.

ALE words are sent several times, this redundancy helps, but does not eliminate, the chance of words being lost. It's entirely possible that no words representing a certain portion of a callsign will be received, especially when signals are weak. This can result in a portion of the callsign being missed. For example, if the callsign of a station is ABCDEF, it's possible that no words containing the DEF portion of the callsign will be received, resulting in the callsign ABC being displayed. So it's critical that the user carefully examines the callsigns of received messages, noting possible cases of this occurring. Once you know the general format of callsigns in a particular ALE network, this becomes fairly easy.

ALE words contain error detection/correction bits, this allows rejection in most cases of invalid words. But there is always the statistical chance that random noise will happen to produce an ALE word that passes these checks, especially in the case of very sensitive decoding software that is looking for weak signals down in the noise. It's a tradeoff.

There is an option in the settings that specifies the minimum number of valid ALE words that must be received for a message to be displayed. As this value is increased, the number of random decodes displayed is drastically reduced.

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