

Some FTDX10 Issues and Solutions

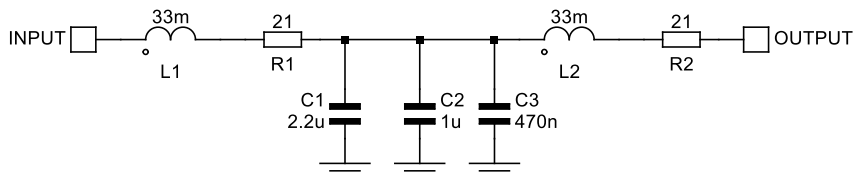
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Hiss when using Headphones on CW

Some of us find the amount of high frequency hiss on our headphones when operating on CW with narrow filters (500 Hz or less bandwidth) to be annoying. You may also notice clicks in the headphones when switching between transmit and receive. This is highly subjective, and depends on your high frequency hearing, the sensitivity of your headphones and what other gear you are accustomed to using. For some, the solution is just to add some attenuation to the headphones. F5PBG suggested a plug-in in-line volume control. I find I need more, and have been using a homebrew audio filter that I built for another purpose. But it needs to be switched out for SSB/AM/FM reception. W1SRD decided that having to carry an extra outboard gadget was unacceptable for DXpedition purposes.

Here is the schematic of the filter I used. The input is connected to just one side of the headphone jack and the output feeds both sides of the headphones. R1 and R2 represent the DC resistance of the two 33 mH inductors, L1 and L2. Three capacitors (not electrolytics) were used in parallel to tune the filter so it sounded good to my ears on CW signals.



Computer Transmits CW Even with BK-IN OFF

BK-IN OFF normally prevents transmission using a key plugged directly into the key jack on the rig. If you have a computer connected via the USB port for sending CW (so far, all the cases I have heard about are using N1MM+ contest software), sending from the computer will cause the FTDX10 to transmit, even if BK-IN is set to OFF. This is not helpful when trying to test the software or set up recorded messages. PA2ST suggested that you just have to tune outside the ham bands when you want to do this. The FTDX10 will not transmit at all there (unless you have modified it to do so!).

Band and Mode Selection Screens Disappear Quickly

Many operators find the time allowed for changing bands (including band stack operations) and modes too short. The December 2021 software update has addressed this, by roughly doubling the time that these screens remain available.

Audio Harmonics in WSJT-X and Related Digital Modes

Many FTDX10 operators have reported high levels of harmonics of their FT8 or JS8CALL transmit audio signal. These can be seen in both the spectrum scope and the AF-FFT display, when transmitting with the audio input via the USB port. The fundamental problem appears to be a combination of two design issues:

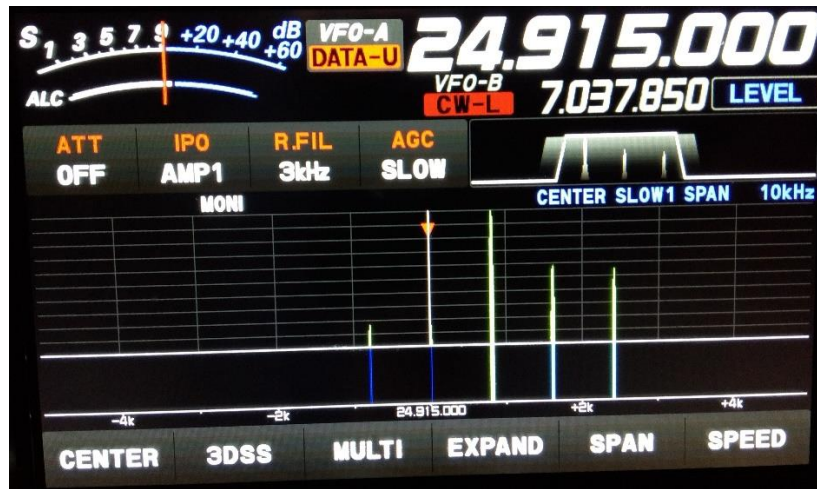
- (1) The output of the USB CODEC (transmit direction) appears to go into the low-level audio input stages of the transmitter without any attenuation (as would normally be needed if an analog audio interface was used). This means that these input stages will overload at quite a low signal level, far below the maximum that the CODEC can put out. Overloading is the cause of harmonics, the same as in all rigs.
- (2) The PRESET function sets a default value of RPORT GAIN of 10 (out of a possible 100). This is the gain control between the USB CODEC and the transmit modulator (as far as I can tell). This low value means that the audio level at the computer must be set quite high to get very much power from the transmitter.

The distortion resulting can also badly affect the wider band mode MSK144, used for meteor scatter on 6 metres.

There are a number of internet videos and sets of instructions which show how to set the FTDX10 up for FT8 which do not take these points into consideration. With great care, following their approaches can give an acceptable signal without too high harmonics, but it is quite difficult. One Spanish language instructional video even clearly showed the harmonics on the spectrum displays! As for other rigs, using the split options "Fake It" or "Rig Split" in WSJT-X can help minimize the harmonics, especially in combination with a narrow transmit bandwidth.

However, there does appear to be a better solution. This is to use a higher setting of RPORT GAIN, and a lower transmit audio level setting at the computer. Users employing this approach have reported success with RPORT GAIN between 30 and 70 – in other words not too far from the general (non-PRESET) default of 50. Enough total gain to get some ALC action improves the stability (over audio frequency) and setability of the output power and can be done without introducing audio harmonics. Then using Fake It or Rig Split and a narrow transmit bandwidth can be used to produce a really clean signal. The higher RPORT GAIN does not appear, at this point, to introduce excess noise into the transmit signal. ALC readings above zero may not be usable with other digital modes with non-constant amplitude such as PSK31 – I have not tried them.

Fortunately, the FTDX10 has the test equipment needed to make sure your signal is harmonic-free, built-in to the rig. If you set the spectrum scope LEVEL (while transmitting) so that the main signal just touches the top of the scale, you can see how far down the harmonics are. Here are some examples, using an 800 Hz transmit audio frequency and Split Operation = None on the Radio Settings tab of WSJT-X. First, an example with bad harmonics and even a signal on the wrong sideband, generated by using too high an audio level from the computer through the USB interface.



The screen should look more like the following one, where the audio level at the computer is increased only up to the point where the RF power output does not increase any further – in this case the ALC reading is near the middle of the white part of the meter scale.



The following settings work for me for FT8/FT4/MSK144 and produce a clean signal (Note 6).

Windows 10

Sounds/Playback/USB AUDIO CODEC/Properties/Levels = 29 (See Note 5)

Sounds/Playback/USB AUDIO CODEC/Properties/Enhancements:
“Disable all enhancements” box checked

Sounds/Playback/USB AUDIO CODEC/Properties/Advanced:
16 bit 48000 bps (DVD Quality) selected
Exclusive mode: both boxes checked

Sounds/Playback/USB AUDIO CODEC/Properties/Spatial Sound = Off

Sounds/Recording/USB AUDIO CODEC/Properties/Levels = 47

Sounds/Recording/USB AUDIO CODEC/Properties/Advanced:
16 bit 48000 bps (DVD Quality) selected (as recommended in WSJT-X manual)
Exclusive mode: both boxes checked
Enable audio enhancements box checked

WSJT-X v.2.5.4

Settings/Radio:

Rig: FTDX-10
Poll Interval: 1s
Baud Rate: 38400
Data Bits: Default
Stop Bits: Default
Handshake: Default
Force Control Lines: nothing selected
PTT Method: RTS
Port: COM5 (this is what Windows assigned for the USB audio)
Transmit Audio Source: nothing selected, or even selectable
Mode: None
Split Operation: Fake It (but None also works, haven't experimented with Rig option)

Settings/Audio:

Input: Line (USB AUDIO CODEC) – Mono
Output: Speakers (USB AUDIO CODEC) – Mono

Pwr Slider: -32.0 dB (See Notes 4 & 5)

FTDx10

EXTENSION SETTING

MAIN: V01-08 or V01-09
DISPLAY: V01-03
DSP: V01-01
SDR: V01-00
AF: V01-00

OPERATION SETTING

GENERAL

CAT RATE: 38400 bps
CAT RTS: OFF

TX AUDIO

AMC RELEASE TIME: MID

RADIO SETTING

MODE PSK/DATA

AF TREBLE GAIN: 0
AF MIDDLE TONE GAIN: 0
AF BASS GAIN: 0
DATA SHIFT (SSB): 1500 Hz
LCUT FREQ: OFF
HCUT FREQ: OFF
DATA OUT LEVEL: 0
TX BPF SEL: 50-3050Hz (see note 1)
DATA MOD SOURCE: REAR
REAR SELECT: USB
RPORT GAIN: 70 (see note 2)
RPTT SELECT: RTS

MODE: DATA-U (PRESET not used) (see Note 3)

R.FIL: 3kHz

WIDTH: 3000

DNR: OFF

NB: OFF

SHIFT: 0

NOTCH: OFF

CONT/APF: OFF

AMC LEVEL: 55

DNF: OFF

Notes:

- (1) I use FT8/FT4 and also MSK144, which is a wideband mode that will work better with the maximum transmitter bandwidth setting. However, if you only use FT4/FT8 (with Fake It or Rig split), then the audio frequency will always fall between 1.5 and 2 kHz and using a transmit bandwidth of 400-2600Hz will give more attenuation of the second harmonic of the audio frequency, resulting in a cleaner signal and more margin for setting the audio levels too high while still transmitting a clean signal. If you use Split Operation = None and must cover the full WSJT-X frequency range, then you should probably use 50-3050 Hz bandwidth, but you may need to be more careful in setting the audio levels to avoid generating audio harmonics.
- (2) Others have reported successfully using values of RPORT GAIN as low as 30, with clean signals. I believe you can probably use a value in the lower end of the 30-70 range if you use low transmitter bandwidth and Fake It or Rig split. A value in the higher end of this range appears to be less prone to creating audio harmonic signals, but does appear to increase the level of additional possible spurious signals at 1.0 and 2.0 kHz.
- (3) DO1YHJ reports that to use Split Operation = Rig in WSJT-X, you must set the mode on both VFO A and VFO B to DATA-U before starting WSJT-X if you use Mode=None on the WSJT-X Settings Radio tab.
- (4) WSJT-X Pwr Slider is adjusted to give the power output set on the FTDX10, with ALC meter reading more than zero, but well within the white segment of the scale. Around "S5" works, but isn't too critical.
- (5) Initial indications are that using other combinations of Windows Playback Level and WSJT-X Pwr slider settings that result in the same audio level being sent to the FTDX10 does not result in major changes in signal purity and quality. The spectrum shown on the FTDX10 scope (with Split Operation = None) looks very similar for Windows Playback Level = 5 and WSJT-X Pwr Slider = -10 dB, as compared with the settings in the list above, for example. If the Windows Level is displayed in dB, then I have found the sum of Windows and WSJT-X levels should be around -50 dB.
- (6) Using the FTDX10's spectrum scope, all spurious signals appear to be below -50 dB with respect to the main signal in WSJT-X Tune mode, at any power level between 5 and 100 watts, when adjusted according to Note 4.

Acknowledgements:

Discussions with W5AJ, DO1YHD, AC6BW and W9RTB have been helpful in preparing this list.

Unstable Power Output in FT4/FT8

When driving an amplifier, it is usually necessary to have a well-controlled drive power. Some operators have found that the FTDX10 output power varies drastically as one changes the transmit audio frequency in use in FT4 or FT8 modes. This is apparently due to the variation over frequency of the loss in the transmit audio section of the rig. There are two approaches to improving this situation:

- (1) Use Fake It or Rig Split modes in WSJT-X. These restrict the actual audio frequencies used to a small range, over which there will be a small loss variation in the filtering.
- (2) Operate with some ALC action, to provide feedback to control power output (despite what some on-line advice suggests). I have seen no evidence yet that operating with some ALC meter movement is problematical for these modes.

I believe that both these techniques can be employed together without compromising signal quality.

Lack of Low Power “Tune” Function for Adjusting External ATU

The FTDX10 does not provide a single button which results in a low power continuous carrier being transmitted, so one can adjust an external manual antenna tuner. So far there does not seem to be a good simple answer useful on all modes. I find it is helpful to assign the RF Power Output control to the outer ring of the Tuning knob (MPVD) as it operates much more smoothly than the FUNC knob, and is easier than going into menus to adjust power. I just crank it down to 5 W to tune my antenna tuner.

If you operate only SSB, with no key plugged in, then holding down the MOX button apparently should transmit a carrier at the power you have set. It doesn't seem to work on all units, including mine.

If you operate SSB and CW with a straight key, external keyer (with straight key in parallel) or bug, with KEYSER set to OFF, then you can set AUTO CW to ON and BK-IN to ON and then just press the key in SSB or CW modes. This transmits a carrier at the power level you have set.

On WSJT-X modes, you can use the WSJT-X Tune button to transmit a tone at the audio frequency set in WSJT-X and the power level you have set in the FTDX10 (assuming you use my settings above, or similar, so that the power setting in the rig actually controls the output power).

In AM or FM, pressing the PTT button on the microphone transmits a carrier at the power you have set.

If you are operating on CW using the internal keyer, there doesn't seem to be a good solution yet.

If you are using a computer to generate CW (for example with a contest logging program) via the USB CAT interface, you can consider turning the KEYSER setting to OFF, so you can use a straight key (or one side of your paddles) to send a carrier at the power level you have set.

There may be some ways to implement a proper low power “tune” button externally. Use of the TX REQ and ALC inputs deserves investigation, as does a box that sends a series of commands on the RS-232 or USB interface.