FlexRadio Systems®
Software Defined Radios

How To Guide

FreeDV Mode in SmartSDR

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For SmartSDR v1.6.17 and greater

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Introduction

This document is intended as a how-to for users that already have some familiarity with FreeDV and is not intended as a complete manual on the FreeDV protocol nor how to operate all the intricacies of the mode. For more in depth information please visit the links in the **For More Information** section at the end of this document.

The first Waveform Module being provided for the FLEX-6000 is the FreeDV/CODEC2 module. FreeDV is a free, open source, digital voice communications system for HF amateur radio, which uses the CODEC2 low bit rate VOCODER (Voice Coder Decoder) developed by David Rowe, VK5DGR.

A FreeDV signal only occupies one-half the bandwidth of a normal SSB signal. It may be installed in any FLEX-6000 Signature Series radio by using the instructions below. Once installed, the ability to transmit and receive using FreeDV/CODEC2 is added to the FLEX-6000 radio, and a new mode button named **FDV** appears alongside USB, LSB, FM, etc. If you press this button, the radio talks and listens in this new narrowband digital voice mode.

In general, CODEC2 is a low bit rate vocoder, which takes human voice and encodes it into a bit stream at 1400 bits per second. FreeDV is an application wrapper that adds an HF Modem (audio tone modulator/demodulator) and a GUI (Graphical User Interface) to the vocoder to provide a communication system for HF communications. When used for HF communications, the FreeDV system occupies less than one-half the bandwidth of a conventional SSB voice signal. The signal also includes a text stream that is used for call sign, name, location and grid-square information.

Requirements

- SmartSDR v1.6.17 or higher
- SmartSDR Waveform Installer V1.0.5.32 or higher

Restrictions

A few restrictions apply to using FreeDV with your radio. Please read these carefully to avoid confusion or problems while operating.

1. FDV Mode can only be selected on **one** Slice at a time. (Although the software will allow you to select it on multiple Slices this will interfere with proper decode and transmit).
2. Currently FreeDV will only operate on upper sideband. It is traditional to run lower sideband on frequencies below 10 MHz, i.e. 160, 80 and 40 Meter bands. Future versions will add this capability.
3. Power Output: The FreeDV modem signal is a 17-tone subcarrier system, where the sub-carriers are PSK and QPSK modulated. As a result, FreeDV has an effective Peak to Average Ratio (PAR) of 6 dB. This means that a signal with a peak power of 100 Watts (the peak power rating of the FLEX-6000) will have an average power of 25 Watts. The transmit levels inside the FreeDV module have been adjusted, so that a maximum setting of the Transmit Power Control Slider will result in a Peak power output of 100 Watts which corresponds to an average power output

of 25 Watts. The power meter on the transmit display of the FLEX-6000 during transmit will typically bounce rapidly and continuously between the peak and the average values. This is normal.

Installing the FreeDV Waveform

NOTE: There are two steps in the installation process. The first, which is steps 1 and 2, install the Window's client for the FreeDV Waveform. The second, which is steps 3 through 6, install the waveform on the FLEX-6000 so that the new FDV mode is available.

1. Run **SmartSDR_FreeDV _Waveform_Installer.exe** by double-clicking the file or by right-clicking and selecting **Open** from the menu that is displayed.
2. Follow instructions to install the FreeDV Waveform on your computer. The installer will create a new shortcut on your Desktop and launch the SmartSDR FreeDV Waveform. (Note: This application is explained in detail later in this document.)
3. In SmartSDR, click **File->Waveforms** in the top menu bar. A dialog (Waveform Manager) will appear that shows all currently installed waveforms and two buttons to Install and Uninstall waveforms.
4. Click **Install** in the Waveform Manager. In the dialog that opens, select a file named **FreeDV.ssdr_waveform** and press Enter or click Open. After a few seconds, a new waveform name will appear in the Waveform Manager labeled **FreeDV vA.B.C** where A.B.C is the version number.
5. In the Slice mode list, you should now be able to select **FDV** as a mode. You are now ready to begin using FreeDV with your Flex 6000 Series radio.
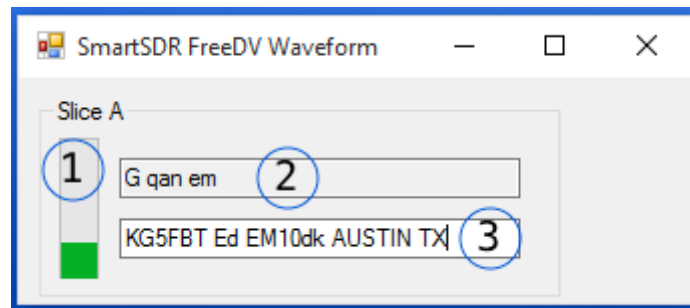
SmartSDR FreeDV Waveform Client

Figure 1

The SmartSDR FreeDV Waveform client is shown in Figure 1. This application runs on a Windows PC and enables extra features found in FreeDV besides voice transmission. The main components are labeled in Figure 1 and are as follows:

1. SNR Meter Bar: This is intended to provide the SNR of the incoming transmission. In the current FreeDV Waveform this functionality is not supported and the meter will be stationary.

2. Decode Text: This is text decoded from other FreeDV users when their signal is received. Currently, FreeDV does not include error detection/correction on this text stream, so it may have some gibberish in the receive window when listening to noise. The decode information will slowly scroll through the window as it is received.
3. Transmit Text Message Entry Box: This box provides the ability to add your call sign, name and location to an embedded transmit text stream. This is the counterpart to #2 as other FreeDV users will be able to decode your transmitted text.

Operating Example

The most commonly used FreeDV frequency is 14.236. Look there first for activity. There is also a **QSO Finder** web site (http://qso.k7ve.org/) that can be used to see who is currently active, on what frequencies around the world.

For this example, we assume you are operating on Slice A.

1. Launch the SmartSDR FreeDV Waveform client by double clicking its icon on your desktop or right clicking the icon and selecting **Open.** The window shown in Figure 1 will appear with a message that says **No FDV Slice**.
2. Set Slice A to FDV mode. The RX filters will change and should be centered around 1500 Hz and the SmartSDR FreeDV Waveform client will show the SNR Meter Bar and the two text boxes shown in Figure 1.
3. Tune Slice A to 14.236 MHz
4. If there is a station talking on 14.236 you will now hear their audio and begin decoding the text string in the Decode Text Box (#2 in Figure 1). If the FreeDV demodulator is not receiving a FreeDV signal, or cannot sync to what is on the channel, the receiver will be in USB (Upper Sideband) mode on the designated frequency, so that the operator can listen to the noise floor or non-FreeDV signals on the channel. As soon as the demodulator can sync to an incoming FreeDV signal, the receiver will automatically switch to decoding and receiving FreeDV.
5. To transmit, enter your message in the Transmit Text message Entry Box (#3 in Figure 1) and key the radio. You will see the multi-toned transmission in the panadapter.

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Uninstalling FreeDV Waveform

NOTE: There are two steps in uninstalling the FreeDV waveform. The first, which is steps 1 and 2, uninstall the Window's client for the FreeDV Waveform from your PC. The second, which is steps 3 through 4, uninstall the FreeDV waveform from the FLEX-6000.

1. Uninstall the FreeDV Waveform application by opening the Remove Program Windows Control Panel and clicking on the "SmartSDR FreeDV Waveform a.b.c.d".   Click on the **Uninstall** button as shown below.
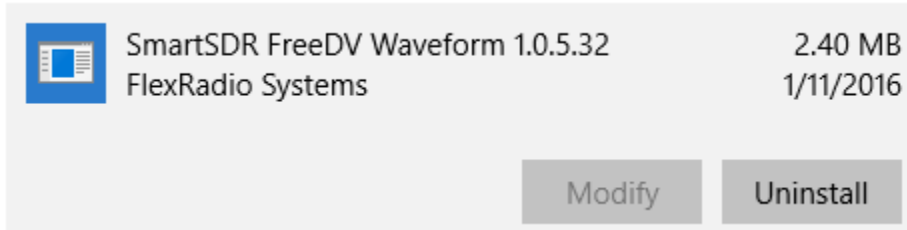
2. Follow the prompts to uninstall the FreeDV Waveform on your computer.
3. In SmartSDR, click **File->Waveforms** in the top menu bar. A dialog (Waveform Manager) will appear that shows all currently installed waveforms and two buttons to Install and Uninstall waveforms.
4. Click **Uninstall** in the Waveform Manager. In the dialog that opens, select the installed waveform named **FreeDV Va.b.c** and press **Uninstall** button at the top of the screen. After a moment, the FreeDV waveform name will disappear in the Waveform Manager, indicating the waveform has been uninstalled from the radio.

FOR MORE INFORMATION

1. FreeDV Home Page
   http://freedv.org/tiki-index.php
2. FreeDV Quick Start Guide
   http://files.freedv.org/Documents/FreeDV_QSG_v0_2.pdf
3. Codec 2 Introduction
   http://www.rowetel.com/blog/?page_id=452
4. FDMDV Modem
   http://www.rowetel.com/blog/?page_id=2458
5. Digital Voice Forum
   https://groups.google.com/forum/#!forum/digitalvoice/home/
6. FreeDV QSO Finder
   http://qso.k7ve.org/

For more information visit www.flexradio.com or call 512-535-4713.