

# **FreeDV+ PowerPoint Presentation Narration**

**by Rick Peterson, WA6NUT**

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## FreeDV+ Presentation Narration

Comments to accompany FreeDV plus Video presentation

by Rick Peterson, WA6NUT

You can download the FreeDV+ PowerPoint presentation (along with these notes) from this link:

<https://www.qsl.net/wa6nut/FreeDV+ Presentation.zip>

Slide	Comments
1.	<b>Title Slide</b>
2.	<b>Why FreeDV plus Video?</b> Note that the FreeDV+ image quality cannot be compared to the resolution and frame rate of Facetime and Skype
3.	<b>Background: Prior work by others.</b> “ISB” stands for Independent Sideband, where LSB and USB are transmitted independently, each carrying different information (one is voice, the other is the image). Another way is to use analog filtering to separate voice and video, but voice restricted to lower frequencies has a muffled sound.
4.	<b>Background: Prior work by WA6NUT.</b> My ISB system was too complex (hardware and software), but it worked. FDMDV plus Video was the first software-based scheme – the audio quality was good.
5.	<b>What is FreeDV+?</b> An ATV mode for HF?

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6.	<b>Screenshot.</b> SDR receiver waterfall, at end of FreeDV+ QSO (waterfall ID is same as used with EasyPal). Note the details of the FreeDV+ signal: 13 chroma subcarriers at left, the FreeDV digital voice subcarriers, and 4 of the 36 luminance subcarriers just barely visible. Received near Edmonton, Alberta.
7.	<b>Introduction.</b> Con Wassilieff graciously allowed me to modify his NBTv software (written in PowerBasic).
8.	<b>Introduction (cont.).</b> FreeDV is the digital voice mode you'll hear at 14236 kHz (if you have the software to decode it).
9.	<b>Introduction (cont.).</b> Since only the video component is recorded, playback at 10 FPS is video only, without sound.
10.	<b>The FreeDV plus Video Signal.</b> The FreeDV+ signal is composed of 66 subcarriers, with the digital voice component sandwiched between the 13 video chroma and 36 video luminance subcarriers.
11.	<b>Diagram: FreeDV plus Video Baseband Spectrum.</b> Note the “B58” subcarrier at 2175 Hz. It's the subcarrier we'll use to tune the transceiver's receiver for best video quality. The video subcarrier spacing is 37.5 Hz and FreeDV subcarrier spacing is 75 Hz (“1600” mode).

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12. **Hardware Requirements.** Note the bandwidth and IMD requirements. The author uses an Apache Labs ANAN-10E SDR transceiver with an Ameritron AL-811 amplifier. His PC is an HP 8540w laptop, with a quad core processor. Also note the soundcard interface requirement: The video component is not controlled by the PTT, so a non-VOX interface is required, or the interface VOX function must be bypassed.
13. **Hardware Requirements (cont.).** The requirements for the Video TX/FreeDV functions. Only one USB soundcard is required (in addition to the PC's motherboard soundcard).
14. **Diagram: FreeDV plus Video PC Connections.** Note that a USB-to-Serial Cable is used between the PC and soundcard interface, unless the PC has a serial COM port.
15. **Software Requirements (Video RX):** WinWarbler is a PSK app repurposed for tuning the received FreeDV+ video signal. Its AFC readout is used to accurately measure the baseband frequency of one of the luminance subcarriers. RXfftDIFF7L.exe is the video receive app.

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| 16.   | <b>Diagram: FreeDV plus Video Video RX Setup.</b> Here's a software signal flow diagram. The USB soundcard input (Recording in Windows Control Panel Sound) is designated as the default input.   |
| 17.   | <b>Software Requirements (Video TX/FreeDV):</b><br>Voicemeeter is an app permitting the adjustment of the video subcarriers with respect to the FreeDV subcarriers. TXfftCO5L.exe is the video transmit app.  |
| 18.   | <b>Diagram: FreeDV plus Video TX/FreeDV Setup.</b> Another software signal flow diagram. Note the mixing (summing) of the video (with level set by the Voicemeeter TX LEVEL 1 & 2 controls) and FreeDV subcarriers, with the level of the composite signal set by the Windows Control Panel Sound Playback TX LEVEL 3 control. The Voicemeeter virtual input is designated as the default output. |
| 19.   | <b>Screenshot: the FreeDV+ apps.</b> All the apps are opened on the PC's screen by clicking an icon on the desktop. It's done with a simple batch file (instructions for creating the batch file are given on the FreeDV+ website). We'll add audio and motion to this slide at the end of this presentation.   |
| 20.   | <b>Transmitting FreeDV+.</b> Factors important for a clean FreeDV+ signal.  |

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21.	<b>Intermodulation Distortion (IMD).</b> What causes IMD and what the effects of IMD are.
22.	<b>Screenshot. Shows the effects of IMD.</b> This signal would produce significant splatter on adjacent frequencies – enough to earn a pink slip from an OO!
23.	<b>Intermodulation Distortion. How to correct IMD.</b> Methods for correcting IMD.
24.	<b>Screenshot. IMD corrected with adaptive predistortion.</b> Note the “shoulders” well below the subcarrier levels. Adaptive predistortion is not yet available in FlexRadio SDR transceivers.
25.	<b>Diagram. Signal Switching for Adaptive Predistortion (PureSignal).</b> Used for Apache Labs ANAN-10E only. The switching circuit is included as internal circuitry in more recent SDR transceivers from Apache Labs.
26.	<b>Photo. Setup at WA6NUT, while transmitting FreeDV+.</b> Equipment is an older configuration, with one laptop (at top left) running Video RX and the other (at right) running Video TX/FreeDV. The middle laptop is dedicated to the ANAN-10E SDR transceiver (note the clean spectrum of the transmitted FreeDV+ signal). The current configuration requires only one laptop to run both Video RX and Video TX/FreeDV functions.

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27. **Photo. Another view of the WA6NUT setup.** The PC at the left is monitoring the transmitted FreeDV+ video and audio, as received by the Ten Tec Omni VII.
28. **Photo. A view of the amplifiers at WA6NUT.** The HF Packer and Ameritron AL-811 boost the ANAN-10E output to about 40 watts average power output. The antenna is a Cushcraft MA5B mini-beam at 30 ft.
29. **DX worked using NBTv and FreeDV.** Starting with monochrome NBTv back in 2005, to a recent contact using FreeDV+, with voice and full-color video.
30. **Screenshot. FreeDV+ DX from WA6NUT.** WA6NUT is transmitting voice with a “twirling license plate” video clip, with the signal received at the W3PIE/WA3MJY KiwiSDR receiver at Hopwood, PA.
31. **References.** There's lots of FreeDV+ information and useful links at the FreeDV+ website. BATC membership is very inexpensive, and includes the digital edition of CQ-TV, a fine magazine devoted to ATV.
32. **References (cont.).** You're invited to join the Groups.io FreeDV plus Video Group, at:

<https://groups.io/g/FreeDVplusVideo>

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### Slide

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33. This slide is deleted for the .ppt version of the slide show. The slide is a 127 sec. video clip in the .odp (Open Office Impress) version.

**Screen capture of FreeDV+ received from WA6NUT. (127 sec.)** Note that the “1600” mode of FreeDV is being used. The “700D” mode has poorer voice quality, but operates well at lower SNR levels. Also note the “ghosting” in the received video as the op (WA6NUT) moves about. The “ghosting” is an artifact of the noise filter in the RXfftDIFF7L.exe app. Without noise filtering, the image is sharper, but noisier. Note that the “twirling license plate” video in Slide 30 was obtained with noise filtering OFF (the receiver's “S” meter reading was S8).

### QUESTIONS?

Last revised: 6/2/20