

# **FAQ**

**Frequently Asked Questions  
regarding  
FreeDV plus Video (FreeDV+)**

**by Rick Peterson, WA6NUT**

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## FreeDV+ FAQ

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## **FreeDV+ FAQ**

### **FAQ: Frequently Asked Questions regarding FreeDV plus Video (FreeDV+)**

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#### **Q1: "What is FreeDV plus Video?"**

**FreeDV plus Video (FreeDV+) is a multimedia soundcard mode providing video conferencing over HF. It combines digital voice with low resolution (36 lines), low frame rate (1 FPS) video. It uses FreeDV digital voice software (by VK5DGR) and video software (by ZL2AFP). ZL2AFP's software has been modified (by WA6NUT) for compatibility with FreeDV. FreeDV+ is compatible with the "1600" and "700D" FreeDV modes.**

#### **Q2: "Are there any special requirements for the HF transceiver when operating FreeDV+?"**

**Frequency stability: Direct Digital Synthesis (DDS) required (no analog VFO). A master oscillator locked to a TCXO or GPSDO is preferred.**

**Frequency resolution: 1 Hz**

**Independent TX and RX tuning: split capability**

**Bandwidth (TX and RX): 3.5 kHz minimum**

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**Q3: "Is any other special hardware required?"**

No, all hardware is readily available:

**Laptop PC:** A higher-performance PC is recommended – the author uses an HP8540w laptop – otherwise, 2 PC's can be used.

**USB sound card:** The author uses a Manhattan 151429 unit.

**USB webcam:** Or the laptop's webcam can be used.

**Amplified speakers**

**Computer mic (electret)**

**Audio cables, stereo, 3.5 mm**

**Sound card interface:** VOX-operated PTT cannot be used, but VOX PTT can be bypassed with a USB-to-Serial adapter cable. The setup can be further simplified if the sound card interface includes a built-in sound card (such as the MFJ-1204). A document on the FreeDV+ Publications page

<https://www.qsl.net/wa6nut/WA6NUTpublications.html>

shows how to modify the MFJ-1204 for FreeDV+.

**Q4: "Is a mode like FreeDV+, with simultaneous voice and video, permitted on HF?"**

Part 97 of the FCC Rules, para. 97.307(f)(2) allows the same bandwidth as A3E (4-5 kHz) for "a multiplexed image and phone emission."

Consideration for the other operator requires that a wider bandwidth mode such as FreeDV+ should be used only when it will not cause interference.

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**Q5: "How does propagation affect the FreeDV+ signal?"**

A study, using the PathSim simulation software, shows that FreeDV+ is fairly robust, except for trans-Polar (high latitude paths). This study can be downloaded from the Publications page on the FreeDV+ website.

The author has extensively tested FreeDV+ with his signal received at WebSDRs at distances up to 1,600 miles. The video component is less robust than the FreeDV component when there is rapid selective fading with doppler shift.

**Q6: "What is the most difficult thing about operating FreeDV+?"**

Once you've established the correct sound card settings, the most difficult (more annoying than difficult) thing is keeping the transceiver RX frequency tuned for best received video quality (but frequency drift is not a problem after the transceivers warm up). There is no problem with transceivers using TCXO- or GPSDO-locked master oscillators.

**Q7: "How is WinWarbler (PSK31 software) used to tune the received video signal?"**

The FreeDV+ video RX application (RXfftDIFF7L), unlike the FreeDV application, has no AFC to maintain correct tuning. But WinWarbler's AFC can be locked to one of the video subcarriers (B58) and the transceiver RX tuning can be adjusted to maintain a 2.175 kHz indication on the WinWarbler AFC readout.

**Q8: "Are there any other issues to consider with FreeDV+?"**

There are two issues that relate to setting the TX power level:

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1. **PAPR (Peak-to-Average Power Ratio):** For the FreeDV+ signal, the signal peaks are about 6X the average power level. So, to avoid clipping the signal peaks, a 100W transceiver should be operated at 15-20W maximum average output (or a 600W amplifier should be operated at 100W maximum average output).
2. **Linearity:** The FreeDV+ signal is composed of 66 subcarriers spaced 75 Hz intervals (digital voice) and 37.5 Hz intervals (video). In a nonlinear system (and all systems are nonlinear to some extent), the subcarriers interact with each other, forming intermodulation (IM) products. IM products produce vertical noise lines on received video and degrade the FreeDV SNR.

Fortunately, issues 1 and 2 have a common solution: run all amplifier stages (transceiver and external amplifier) well below rated output power. Ideally, Class A amplifiers would be used. But even Class AB2 amplifiers (such as the AL-811) can run close to Class A if the drive level is kept low enough. An even better solution is to run FreeDV+ using an SDR transceiver with adaptive predistortion (APD, called "Pure-Signal" in Apache Labs products). PureSignal assures a signal with minimum intermodulation products. Flex Radio will soon introduce APD in their SDR products (6000 series). And Elecraft plans to add APD in their K4 transceiver.

**Q9:** "I'm running FreeDV+, but other stations report that my video has intermittent vertical noise lines. Is there an adjustment for this problem?"

Yes, there is an adjustment for that! The problem is likely caused by the video subcarrier level set too low w.r.t. the FreeDV subcarrier level. Two sound card level sliders can be used for this adjustment, called "TX LEVEL 1" and "TX LEVEL 2" in the FreeDV+ documentation. While monitoring your transmitted FreeDV+ spectrum (on a monitor receiver or as monitored by another station), set the TX LEVEL 1 slider so that the video subcarriers are at the same level as the FreeDV subcarriers. Some additional

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spectrum (on a monitor receiver or as monitored by another station), set the TX LEVEL 1 slider so that the video subcarriers are at the same level as the FreeDV subcarriers. Some additional adjustment might be required to obtain acceptable video quality with FreeDV SNR readings of 10-12 or better.

**Q10: "I have FreeDV+ set up, and I'm ready to transmit with this mode. But I need to find another station similarly equipped to monitor my voice and video. How do I do this?"**

For testing, you can receive your FreeDV+ signal on a distant WebSDR receiver. Just open the FreeDV, WinWarbler and RXfftDIFF7L apps on your PC while you're monitoring the WebSDR or KiwiSDR receiver you choose (instructions are found in the "Using a Distant Web-Hosted SDR . . ." PDF document on the Publications page of the FreeDV+ website). The author has monitored his FreeDV+ signal on WebSDR's at distances up to 1,600 miles. Hint: If your transceiver master oscillator is locked to a GPSDO, choose a KiwiSDR receiver also locked to a GPSDO – it will simplify tuning the video signal.

Also, the author streams audio and video from his FreeDV+ receiver setup in Buena Vista, Colorado. Contact him (e-mail address is good on QRZ.COM) and set up a schedule. You'll be able to see and hear your own signal as received on 14236 kHz, as band conditions (QRM and propagation) allow. WA6NUT occasionally streams while testing his FreeDV+ setup. Check his stream at:

<https://batc.org.uk/live/wa6nut>

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