

MFJ-1204 USB Radio Interface

Mods for FreeDV+

by Rick Peterson, WA6NUT

April, 2019

MFJ-1204 Mods for FreeDV+

Table of Contents

1.	Introduction	3
2.	Parts List	4
3.	Mechanical modification	4
4.	Wiring the perfboard	5
5.	Configuring the software and testing	6
6.	FreeDV plus Video Website	9

Figures

1.	Wiring Diagram for PTT Circuit	10
2.	Photo of Modified MFJ-1204	11
3.	FreeDV plus Video PC Connections	12
4.	Software Flow Diagram: Video TX/FreeDV	13
5.	Software Flow Diagram: Video RX	14

Appendix

Configuring MFJ-1204 for ANAN-10E Transceiver

1.	Introduction	15
2.	Configuring the MFJ-1204 DIP header and wiring to board	15
3.	Installing the 3.5 mm plugs on the RJ45 cable	16
4.	Configuring the ANAN-10E Hermes J16 Breakout Board	17

MFJ-1204 Mods for FreeDV+

MFJ-1204 USB Radio Interface

Mods for FreeDV+

1. Introduction

This document describes how to use the MFJ-1204 USB Radio Interface with FreeDV plus Video (FreeDV+). FreeDV+ is a multimedia mode combining digital voice and narrow band TV.

NOTES:

1. The mods described in this document will void any manufacturer's warranty.
2. The mods described can be adapted for other USB interfaces, such as the SignalLink™ USB.

The MFJ-1204 USB Radio Interface has received wide usage on the amateur digital modes. Its “PTT Detector” (“Auto-PTT™” on the SignalLink™ USB unit) provides automatic PTT operation (similar to VOX), switching the transceiver to transmit whenever the software generates a transmit signal waveform.

However, the software for some digital modes (such as FreeDV+) continuously generates an audio transmit signal waveform, and the audio signal is not turned off by the software PTT control. Thus, in order to use the MFJ-1204 with FreeDV+, the automatic PTT function on the sound card interface hardware must be bypassed.

This document describes how to modify your MFJ-1204 to bypass the “PTT Detector” feature. This mod is based on an article by W1ZE in the *Yavapai Signal* newsletter (pp. 10-11), at:

<http://www.rahughes.net/signal/wp-content/uploads/2015/10/May07.pdf>

MFJ-1204 Mods for FreeDV+

The MFJ-1204 Instruction Manual and schematic diagram can be downloaded from:

<http://www.mfjenterprises.com/support.php?productid=MFJ-1204UT>

2. Parts List (order online at: <https://jameco.com>)

Designation	Qty.	Description	Jameco P/N
D1-D4	4 ea.	Diode, 1N4148	36038
R1	1 ea.	Resistor, 2K	690937
Q1	1 ea.	Transistor, NPN 2N2222A	38236
J1	1 ea.	DB9 connector, female	15771
Perfboard	1 ea.	4.5 in. x 6.0 in.	616690
Mounting Kit	1 ea.	0.375 in., 4-40	106551
Cable	1 ea.	USB-to-Serial DB9 male, 3.5 ft.	387954

3. Mechanical modification

1. Make a cutout in the rear panel of the MFJ-1204 for the DB9 connector, above the RJ45 connector (the author drills multiple holes along the inside of the cutout, then cleans up the cutout with flat and round files).
2. Drill two holes for the DB9 mounting screws, with 0.98 in. spacing.

MFJ-1204 Mods for FreeDV+

IMPORTANT: All work should be done with the cover off and the unit upside-down, so that no metal particles can fall onto the circuit board. Masking tape on the opposite side can catch particles.

3. Use a small saw to cut out a 0.75 in. x 2.0 in. perfboard, and drill holes at each end, spaced 0.98 in.
4. The screws mounting the DB9 connector on the rear panel are threaded into the standoffs. On the inside of the MFJ-1204, the 0.75 in. x 2.0 in. perfboard will be mounted on the standoffs with the other two screws.

4. Wiring the perfboard (See Figures 1-2, pp. 10-11)

1. On the perfboard, install and connect D1-D4, R1 and Q1 per the schematic on p. 10 of the W1ZE article (see link p. 3).

2. Solder three wires between the perfboard and the DB9 connector J1:

DB9-4 to D1-A

DB9-7 to D2-A

DB9-5 to "PTT Ground"

3. On the DIP header, remove the jumper connected between the "PTT" DIP header socket and an opposite socket (this opposite socket connects to the radio, so we'll call it socket "R"). Note the location of socket "R" (should be the same as shown for your radio on pp. 6-9 of the MFJ-1204 Instruction Manual).
4. Connect two wires between the perfboard and the DIP header:
Solder a #24 tinned solid wire from "PTT Ground" on the perfboard to the midpoint of one of the jumpers connected between GND and an opposite socket .

Solder a #24 tinned solid wire at the perfboard Q1 collector connection and insert the the other end into socket "R".

MFJ-1204 Mods for FreeDV+

5. Install the assembled perfboard on the standoffs using the mounting screws. Make sure that no wiring is in contact with the screws or standoffs (use washers for added spacing between the perfboard and DB9 connector as required).

5. Configuring Software and Testing (see Figures 3-5 pp.12-14)

1. After checking (and double-checking) your work, connect the MFJ-1204 to a USB port on your PC and connect the USB-to-Serial cable between the new MFJ-1204 DB9 connector and another USB port on your PC. Connect the MFJ-1204 to your transceiver. From the MFJ-1204 Instruction Manual, p. 3:

Important Note: Do not connect the MFJ-1204 to your computer until the prescribed set of jumper wires are installed, the computer is turned on, and its operating system has fully booted up. Also, close any applications that are open and running before plugging in the interface.

2. When your PC boots up, Windows will detect the new device (the USB-to-Serial cable), and locate and install the driver.

NOTE: The names for the MFJ-1204 (“USB Audio Device”) and the motherboard sound card (“High Definition Audio Device”) in the author's setup are used in the following procedure. Substitute the names corresponding to your setup.

3. Open the Windows Sound Playback and Record as follows:
Control Panel --> Hardware and Sound --> Sound

Playback: Set “Voicemeeter Input” as the Default output (no change). Note that the “USB Audio Device” level control (together with the MFJ-1204 front panel “Transmit Audio Level” control) will set the FreeDV+ transmit signal level (TX LEVEL 3). Make sure the “Default Format” under the “Advanced” tab is set to a format with a 44100 Hz sampling rate.

MFJ-1204 Mods for FreeDV+

Record: Set “USB Audio Device” as the Default input. This level control (together with the MFJ-1204 front panel “Receive Audio Level” control) will set the level to the FreeDV decoder, video receive app and WinWarbler.

4. Open the FreeDV app, and set the “Audio Config” configuration (under the “Tools” tab) as follows:

Receive

From Radio:	Sample Rate
Microphone (USB Audio Device)	48000
MME	

To Speaker/Headphones:	Sample Rate
Speakers (High Definition Audio Device) MME	48000

Transmit

From Microphone:	Sample Rate
Microphone (High Definition Audio Device) MME	48000

To Radio:	Sample Rate
Speakers (USB Audio Device) MME	48000

5. Set the “PTT Config” configuration (under the “Tools” tab) as follows:

Hardware PTT Settings:

Use Serial Port PTT --> COM7 (select the COM port indicated by Windows Device Manager for the USB-to-Serial cable:
Control Panel --> Hardware and Sound --> Device Manager --> Ports (COM & LPT) --> USB-to-Serial Cable)

MFJ-1204 Mods for FreeDV+

Signal Polarity:

Use RTS --> RTS = +V

6. **Open Voicemeeter and configure the Voicemeeter settings as follows:**

Inputs/Output	Select from dropdown	Comment
Hardware Input 1	MME: Microphone (USB Audio Device)	Monitor RX audio level
Hardware Input 2	MME: Microphone (High Definition Audio Device)	Monitor TX mic audio level
Virtual Input	N/A	Monitor and control video TX signal level (TX LEVEL 1)
Hardware Out	MME: Speakers (USB Audio Device)	Monitor and control video TX signal level (TX LEVEL 2)

7. **Open WinWarbler and configure the sound card options: Config --> Soundcard: Check the “Microphone (USB Audio Device)” and “Speakers (USB Audio Device)” radio buttons.**
8. **The microphone and the amplified speaker connections are now to/from the motherboard sound card (“High Definition Audio Device” in the author's setup), with levels set by the corresponding Windows Sound Record and Playback controls.**
9. **Restart your PC, start the FreeDV app and verify that the FreeDV “PTT” button controls the transceiver transmit and receive functions (FreeDV+ uses the FreeDV “PTT” button).**

MFJ-1204 Mods for FreeDV+

10. Settings to maintain linear operation in the MFJ-1204 sound card output:

- a. Windows Control panel --> Hardware and Sound --> Sound --> Playback --> USB Audio Device --> Properties --> Levels

Using the Level slider control, set level to 0.

- b. On the MFJ-1204, set the Transmit control full clockwise.
- c. While transmitting your FreeDV+ signal and monitoring your output power, gradually increase the Level slider control setting until the desired transmit power is obtained (this will usually be the maximum power at which PureSignal maintains a clean signal – 40 W for the author's setup).

The MFJ-1204 Transmit control will be left at its full clockwise setting, unless you wish to reduce your transmit power.

Using a remote SDR receiver (KiwiSDR or WebSDR), check your transmitted signal on the SDR waterfall after adjusting the controls per steps a-c above. There should be no faint “subcarriers” below the lowest chrominance subcarrier at 375 Hz.

Steps a-c ensure that signal levels in the MFJ-1204 sound card output circuit are kept low enough to prevent intermodulation products at its output.

6. FreeDV plus Video Website

For more information on FreeDV+, please visit the website at:

<https://www.qsl.net/wa6nut/FreeDVplusVideo>

MFJ-1204 Mods for FreeDV+

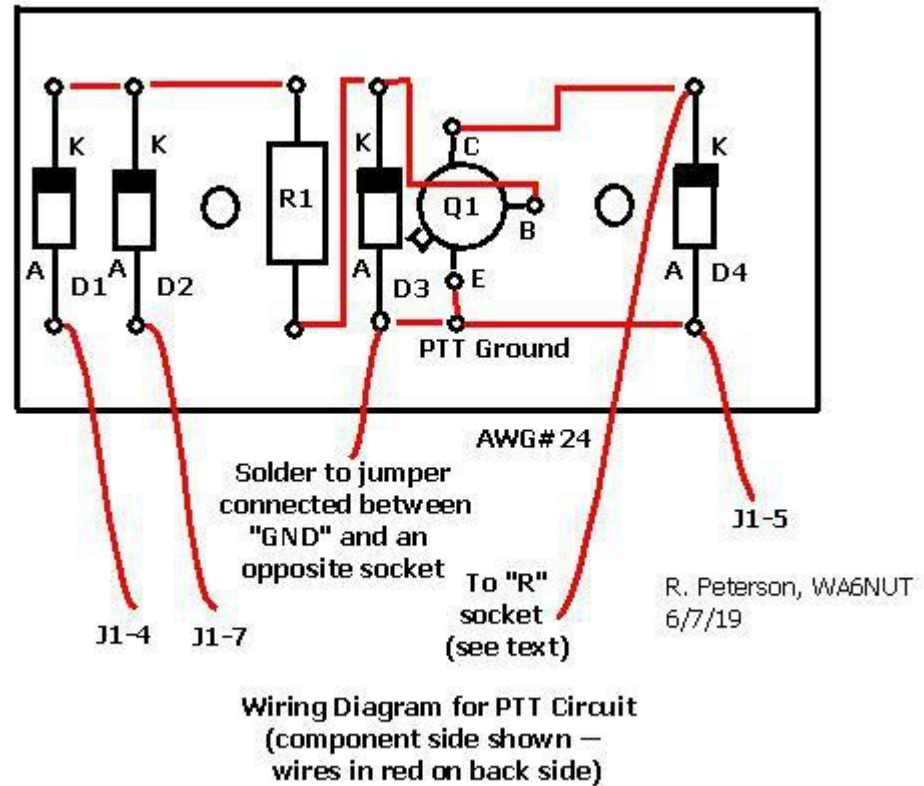


Figure 1: Wiring Diagram for PTT Circuit

MFJ-1204 Mods for FreeDV+

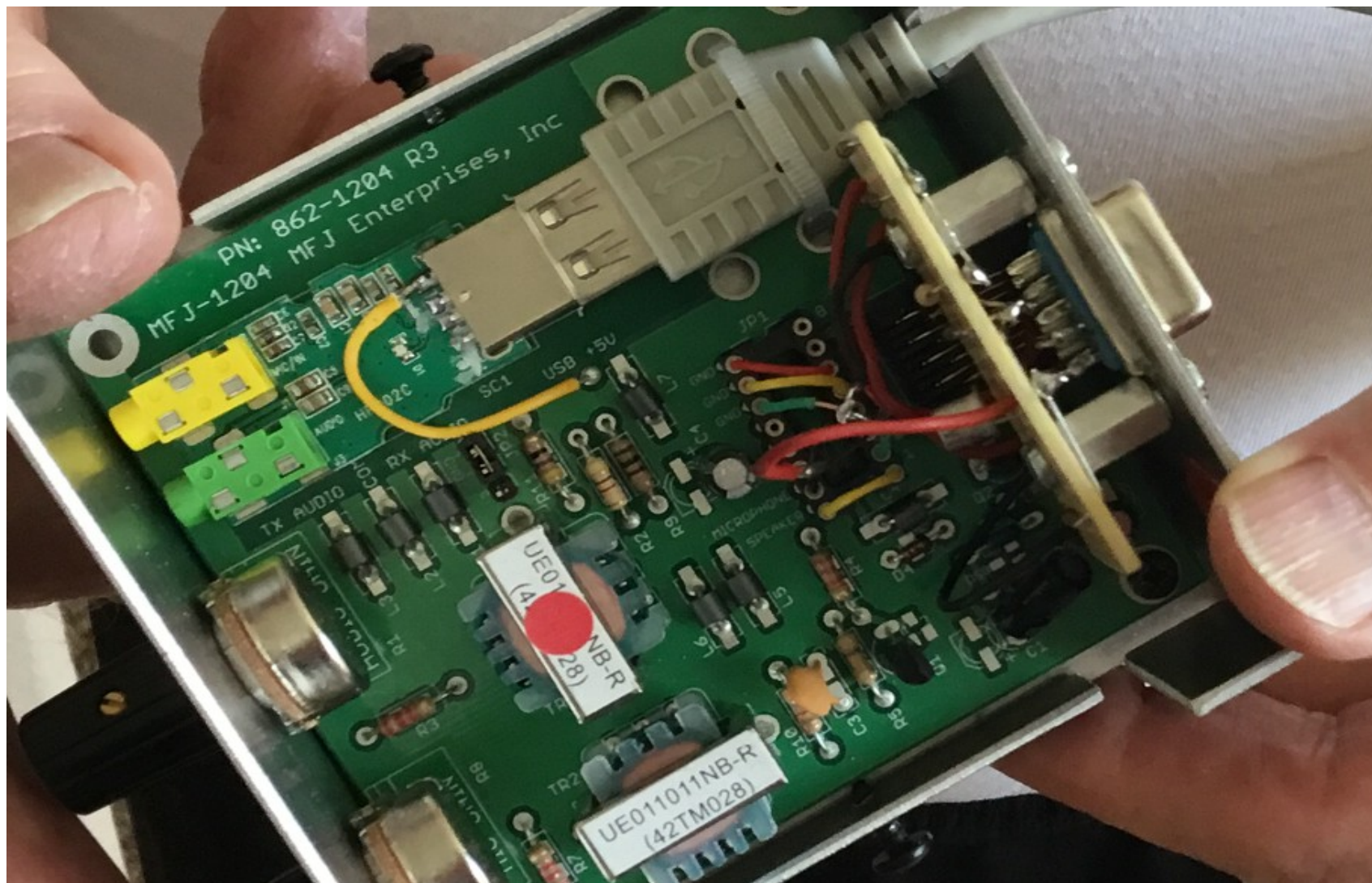
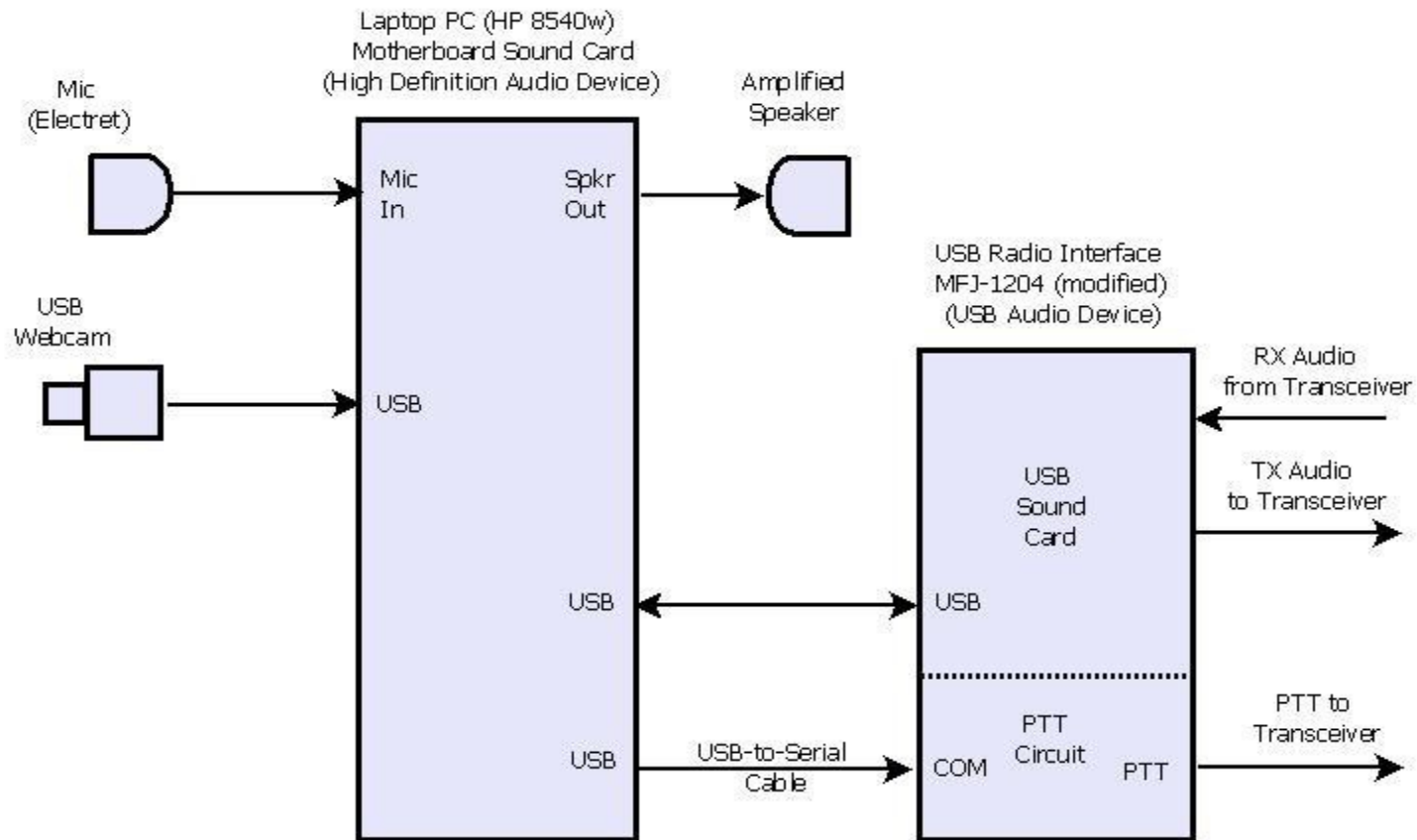


Figure 2: Photo of Modified MFJ-1204

MFJ-1204 Mods for FreeDV+



**FreeDV plus Video
PC Connections
(with modified MFJ-1204)**

R. Peterson, WA6NUT
6/5/19

Figure 3: FreeDV plus Video PC Connections

MFJ-1204 Mods for FreeDV+

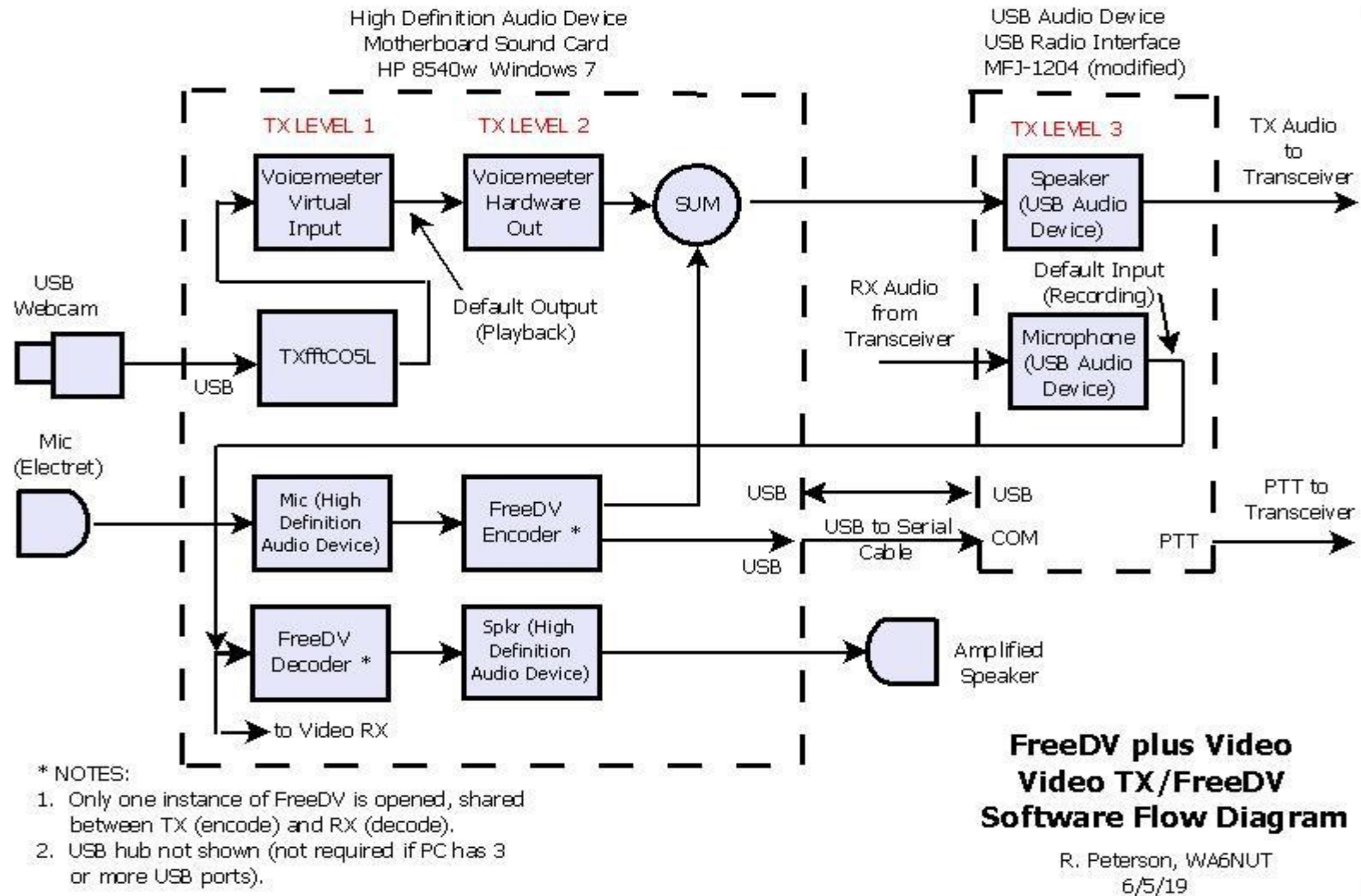


Figure 4: Software Flow Diagram: Video TX/FreeDV

MFJ-1204 Mods for FreeDV+

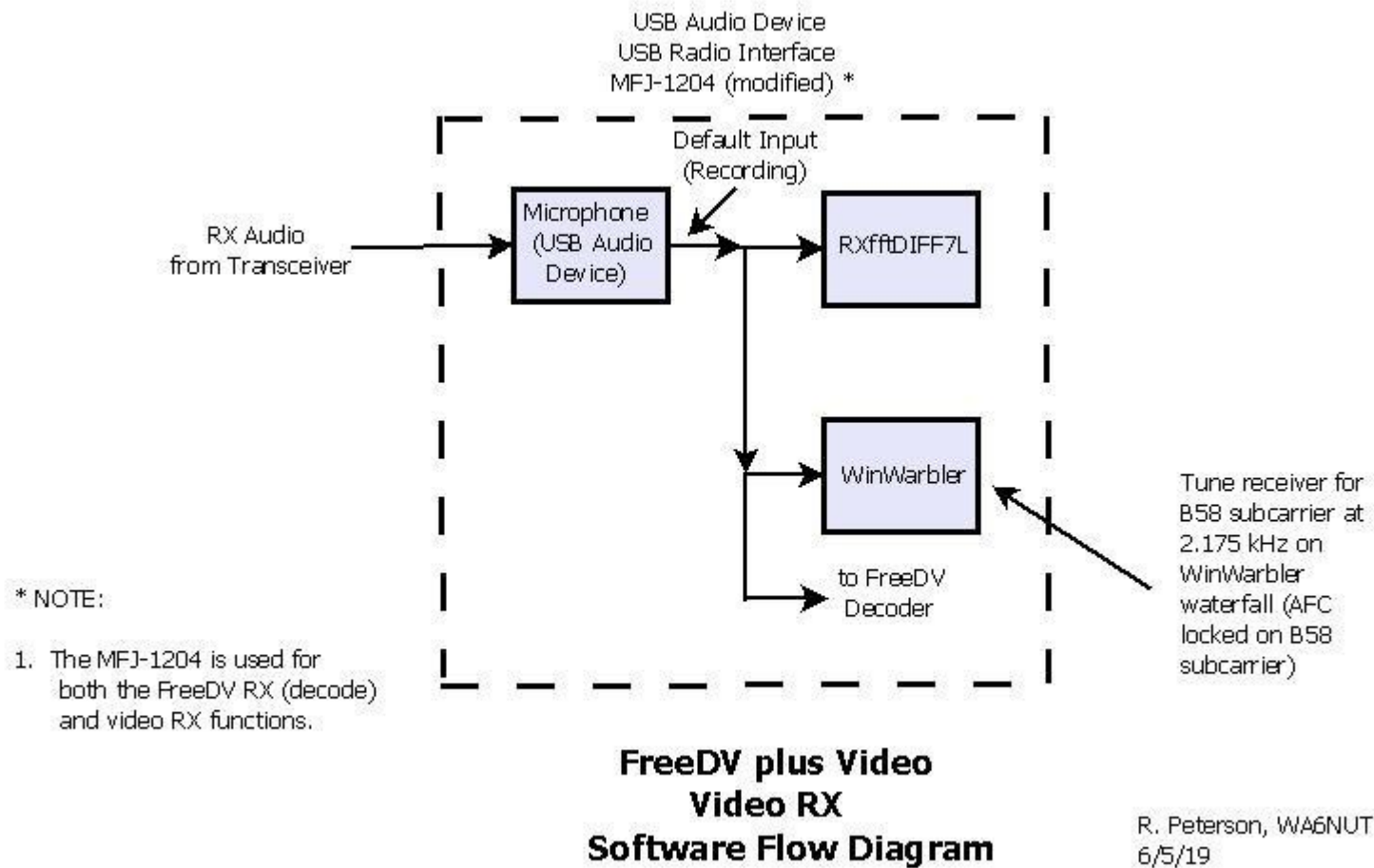


Figure 5: Software Flow Diagram: Video RX

Appendix

Configuring MFJ-1204 for ANAN-10E Transceiver

1. Introduction

The MFJ-1204P8 model is used with the ANAN-10E transceiver. The cable (P/N MFJ-5700P8) provided with this unit has an RJ45 connector at one end for connection to the MFJ-1204. The other end has an 8-pin round connector, to be removed to allow the user to install the required connectors. For the ANAN-10E, three 3.5 mm plugs are installed at the cable end opposite the RJ45.

In the unlikely event that no RJ45 cable is available from MFJ for your transceiver, you can order an MFJ-1204P8 and adapt the steps in 2. and 3. below to your particular setup.

2. Configuring the MFJ-1204 DIP header and wiring to board

1. Change the jumpers on the DIP header as follows (refer to diagram A, p. 6 in the MFJ-1204 Instruction Manual):

From socket	To socket
GND	6
GND	5
GND	2 (was the jumper between SPKR and 8)
MIC	4
SPKR	1

Reconnect the #24 tinned solid wire jumpers provided with the MFJ-1204P8 as shown above.

MFJ-1204 Mods for FreeDV+

2. Install the DB9 connector, construct the perfboard and wire the DB9 as described on pp. 4 - 5, steps 3.1 - 3.4 and 4.1 - 4.2.
3. Solder a wire from "PTT Ground" on the perfboard to the midpoint of the jumper connected between the "GND" and "2" sockets (see jumpers p. 15).
4. Solder a #24 tinned solid wire at the perfboard Q1 collector connection and insert the wire into the "3" socket (or, if you've saved a lead clipped from a 1N4148, insert one end of the 1N4148 lead in the "3" socket and solder a wire between the other end and the perfboard Q1 collector connection).

3. Installing the 3.5 mm plugs on the RJ45 cable

3.5 mm plugs: 3 ea. Jameco P/N 231176
(order online at <https://jameco.com>)

Remove the 8-pin round connector and wire the three 3.5 mm plugs as follows:

Plug	Wire connected to plug:		Comments
	Tip	Body	
1. ANAN-10E MIC (front panel)	Red	Green	-----
2. ANAN-10E HEADPHONE (front panel)	White	Black	-----
3. ANAN-10E PTT KEY (J16 Breakout Board at rear)	Blue	Yellow	14 in. longer to reach J16 Breakout Board at rear (see note next page)

MFJ-1204 Mods for FreeDV+

NOTE: Make a 14 in. twisted pair and solder to the Blue/Yellow pair, extending the pair to reach the J16 Breakout Board. Wire the 3.5 mm PTT KEY plug at the end of the extension as shown on p. 16.

The bare stranded and Brown wires are not used.

With the RJ-45 cable connected, using an ohmmeter, check for continuity between:

L5 on MFJ-1204 board and tip of MIC plug (note error on MFJ-1204 schematic)

L6 on MFJ-1204 board and tip of HEADPHONE plug

Collector (case) of Q1 on perfboard and tip of PTT KEY plug

Midpoint of GND-to-2 jumper and the body of the MIC, HEADPHONE, and PTT KEY plugs

4. Configuring the ANAN-10E Hermes J16 Breakout Board

Refer to N8UR's website at:

https://febo.com/pages/hpsdr/hermes_breakout/index.html

Connect jumpers on the breakout board as follows:

	From	To
JP1	2	3
JP3	1	2

Install the PTT KEY plug into the "PTT KEY" jack on the J16 breakout board.

MFJ-1204 Mods for FreeDV+

- 5. Continue to pp. 6 - 8, Section 5, Configuring Software and Testing, steps 5.1 – 5.9**

Last revised: 6/2/20