

DOING DIGITAL RADIO DATA TRANSMISSION/RECEIVING

When the Internet is DOWN...radio likely still works!

Gordon Gibby KX4Z

Vietnam War PHONE PATCH

- Hams figured out how to connect the telephone to the radio...audio signals going both directions.

Ham radio and Gardening...

- Growing in ham radio is a lot like becoming a better Gardener....
- You may have to READ a bit,
- And get your HANDS DIRTY!

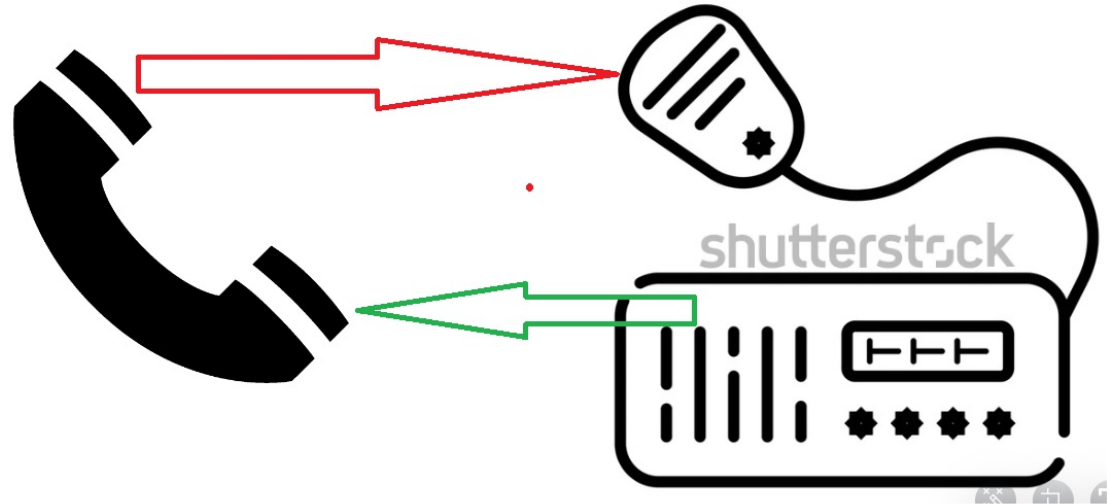
For more information after this Overview Talk

[TechNightWiredSound.pdf](https://www.qsl.net/nf4rc/2021/TechNightWiredSound.pdf)

- Just a few of the thousands of articles out there on this type of topic
- <https://qsl.net/nf4rc/2021/TechNightWiredSound.pdf>
- <https://qsl.net/kx4z/DigitalConnections.pdf>
- <https://qsl.net/nf4rc/2020/Digital101HardwareHandout.pdf>
- <http://www.qsl.net/nf4rc/UnderstandingAudioChannelConfiguration.pdf>
- <https://qsl.net/nf4rc/2022/SolderingIsolator.pdf>
- <https://qsl.net/nf4rc/2021/TechNiteDataModes.pdf>
- <http://www.tigertronics.com/files/Signalink%20USB%20Product%20Guide.pdf>

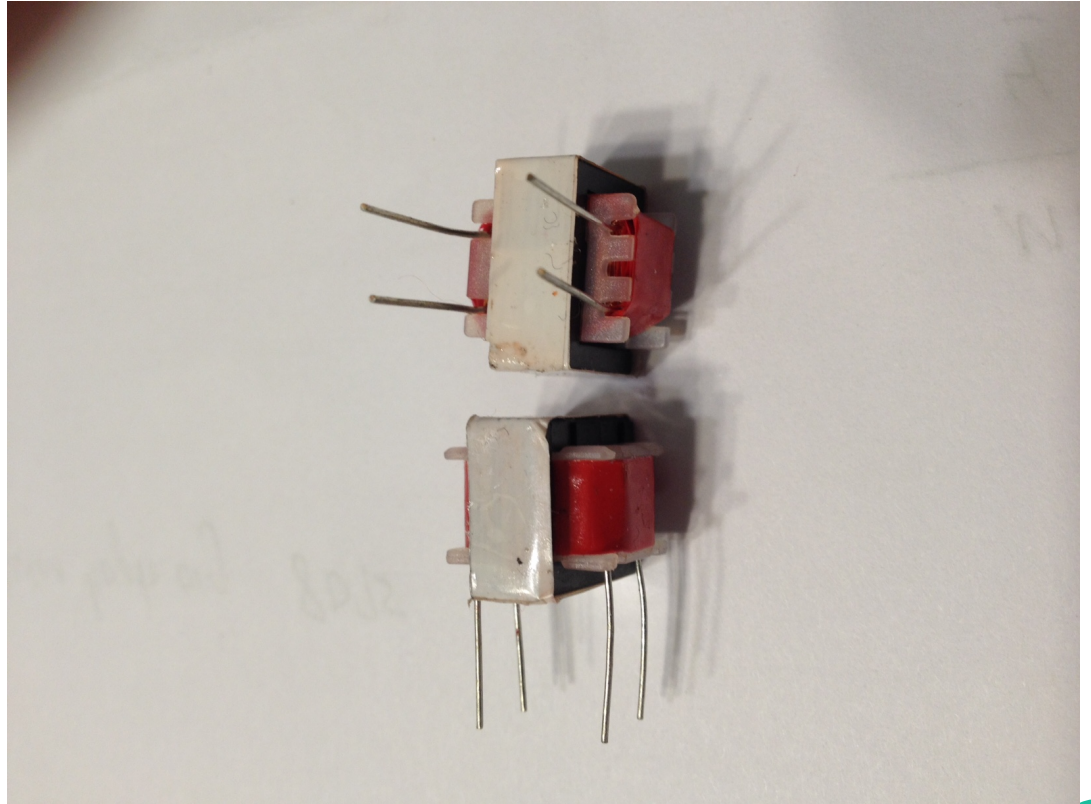
1960's PHONE PATCH

- Many many hams helped out families by patching telephone handsets to their radios.
- Allowed the serviceman's voice from the RADIO SPEAKER to go to the TELEPHONE MIC
- Allowed the wife/girlfriend's voice from the TELEPHONE SPEAKER to go to the RADIO MIC



How did they connect the radio to the telephone

- Using 1960's versions of these little devices!



Radios really only do TWO THINGS

- Take in sounds from a microphone line...and transmit them over radio
- Take in “sounds” from the Ether and make them into audible sounds from a SPEAKER / HEADSET

- That’s all, folks!

Magic Whistles

- That is all radios know how to do. Move sounds in and out.
- If you want to do digital voice (FUSION, DSTAR, P25, whatever)
- If you want to do digital texting (FT8, JT9, JS8, PSK31, MFSK32)
- You are going to have to both CREATE and INTERPRET the “magic whistles” of each of those modes.....and generally with a computer.
- Digital voice “whistles” become intelligible SPEECH... if you have enough signal level [not always better than analog radio]
- Digital texting “whistles” become intelligible words on the screen...if you have even a FAINT SIGNAL!! [Almost ALWAYS better than analog radio]

Decoding / Encoding the Whistles

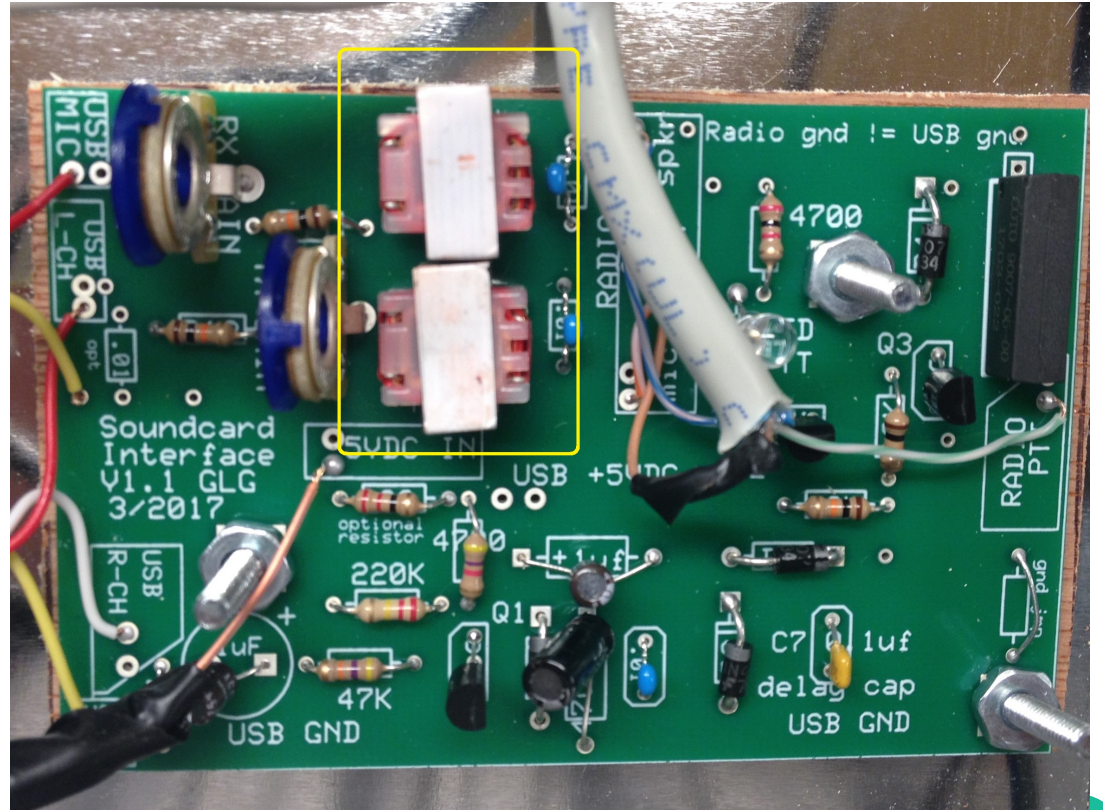
PROTOCOL	<u>Audio Protocol Smarts</u> (“Software TNC”)	<u>Additional software</u> <u>required?</u>
FT8 (keyboard)	Built into WSJT-X	NONE
JS8 (keyboard)	Built into JSCALL	NONE
FLDGI (psk31, etc) (Keyboard)	Multiple protocols built into FLDGI	NONE
WINLINK ARDOP	Built into stock Winlink Express	NONE
WINLINK VARA	Requires 3 rd Party Software	Google VARA to get it
WINLINK PACKET	Requires 3 rd party hardware or software	Google SOUNDMODEM to get it
Keyboard Packet	Requires 3 rd party hardware or software	Google SOUNDMODEM to get it

Four systems OVERVIEW

TYPE RADIO:	Old Old Heathkit SB-102	Semi-Modern ICOM 718	Very Modern ICOM 78300
FUNCTION			
Receiving whistles	“speaker” audio from SIGNALINK (sound card)	“speaker” audio from SIGNALINK (sound card)	CODEC speaker from built-in sound card
Sending Whistles	“microphone” audio to SIGNALINK	“microphone audio to SIGNALINK	CODEC mic to built-in sound card
PushToTalk	Signalink provides “VOX” to key the PTT	Signalink provides VOX to key the PTT	Done by CAT control (often)
Frequency Control	Get outta here! Turn the dial yourself!!	CAT via RS232 or USB – may require special cable!	CAT via USB, same cable as all the above!!

How do new-fangled Signalinks etc isolate radios from computers?

- With the same old components, making the SAME wiring connections, that Phone Patches used to use!



Hardware and Software Required

Connection Required	Hardware	Software
Bidirectional Audio	Signalink: special cable to radio / jumpers 7300: Load ICOM Driver software, plug in USB Cable – done!	Same for OLD and NEW: Select audio devices for both connections in drop down entry boxes
Make PTT work	Signalink VOX for older radios keys the PTT line based on TX signals. 7300: Also via USB Cable.	OLD: claim VOX use NEW: select 7300 from CAT list
Frequency Control	718: Special CI-V cable 7300: Also via USB Cable	Select proper radio so proper commands will be issued

#1 Audio Find the soundcard – very similar between applications

SoundCard

icom7300-VARA

Device Input

Microphone (Conexant SmartAudio H)

Microphone (USB Audio CODEC)

Microphone (Conexant SmartAudio H)

Speakers (Conexant SmartAudio H)

Drive level: -14 dB

Tune

Press Tune and set the Drive Level for ALC=1/3

ICOM HF/50MHz TRANSCEIVER IC-7300

14.076.00

19:06

AGC-S

VFO A

BLANK

SoundModem by UZ7HO - Ver 1.13 - [AFSK AX.25 ...]

Settings View Clear monitor Calibration About

A: AFSK AX.25 1200bd 1700 DCD threshold

icom7300 soundmodem (packet tnc)

Settings

Sound Card

Output device: **Speakers (USB Audio CODEC)**

Input device: **Speakers (USB Audio CODEC)**

Speakers (Conexant SmartAudio H)

Dual channel TX SampleRate 11025

TX rotation TX corr. PPM 0

Single channel output RX SampleRate 11025

Color waterfall RX corr. PPM 0

Stop waterfall on minimize Priority Highest

Minimized window on startup

Server setup

AGWPE Server Port 8000 Enabled

KISS Server Port 8100 Enabled

PTT Port

Select PTT port NONE Dual PTT

Advanced PTT settings Swap COM pins for PTT

	Sent pkts	Sent bytes	Rcvd pkts	Rcvd byte

Often, looking for something with “USB” or “CODEC” in it

Troubleshooting Audio Connections

- **GET BACKGROUND NOISE VISIBLE ON THE WATERFALL**
- **If you can't get background noise visible, you have a hardware connection issue, a software selection issue, or both.**

HARDWARE WIRING

- **ICOM USB Cable (7300).** There is no wiring. Just connect the USB cable between computer and Icom7300 as long as you have loaded their DRIVER SOFTWARE.
- **Radios without internal sound card**
 - You'll use a SIGNALINK or equivalent (homebrew vs other manufacturer)
 - Must wire Radio Speaker to Signalink audio input
 - Must wire Signalink audio output to Radio microphone
 - Must wire Signalink PTT to Radio PTT
 - Must wire Ground
 - EVERY RADIO IS DIFFERENT!!!

Making Push To Talk Work

Icom 7300 PTT

Radio Selection: Select Radio Model: Icom 7300, Antenna Selection: Default

Icom Address: 94, USB: , USB Digital: , FM: , Use Internal Tuner:

Codan login and optional password:

Radio Control Port: Serial Port to Use: COM7, Baud: 115200, Enable RTS: , Enable DTR: , TTL:

PTT Port (Optional): Serial Port to Use: Icom 7300, Baud: 9600,

Update Close

You may wish to get a little "help" or follow a recipe to make a particular new radio work...

Tube radio with Signalink

Radio Selection: Select Radio Model: Manual, Antenna Selection: Default

Icom Address: 94, USB: , USB Digital: , FM: , Use Internal Tuner:

Codan login and optional password:

Radio Control Port: Serial Port to Use: None, Baud: 115200, Enable RTS: , Enable DTR: , TTL:

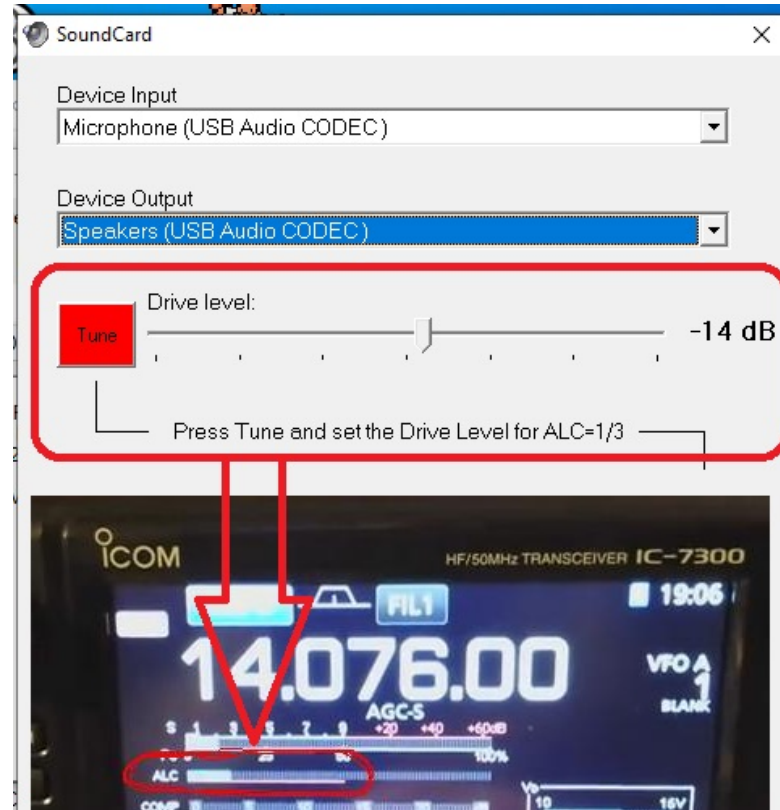
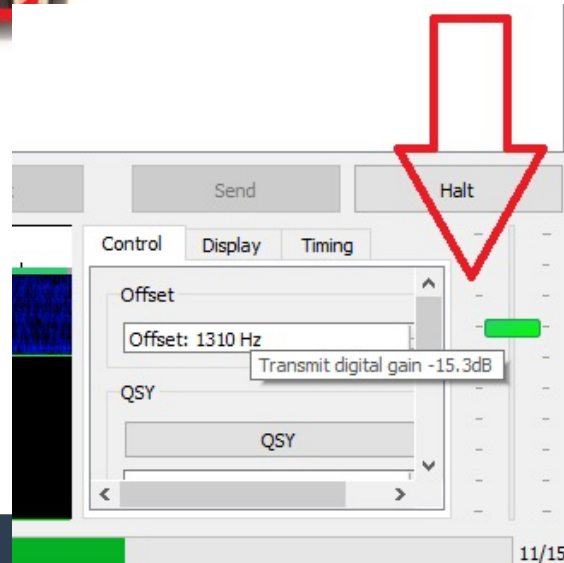
PTT Port (Optional): Serial Port to Use: External, Baud: 9600,

Update Close

Signalink will sense TX and close the PTT - "external"

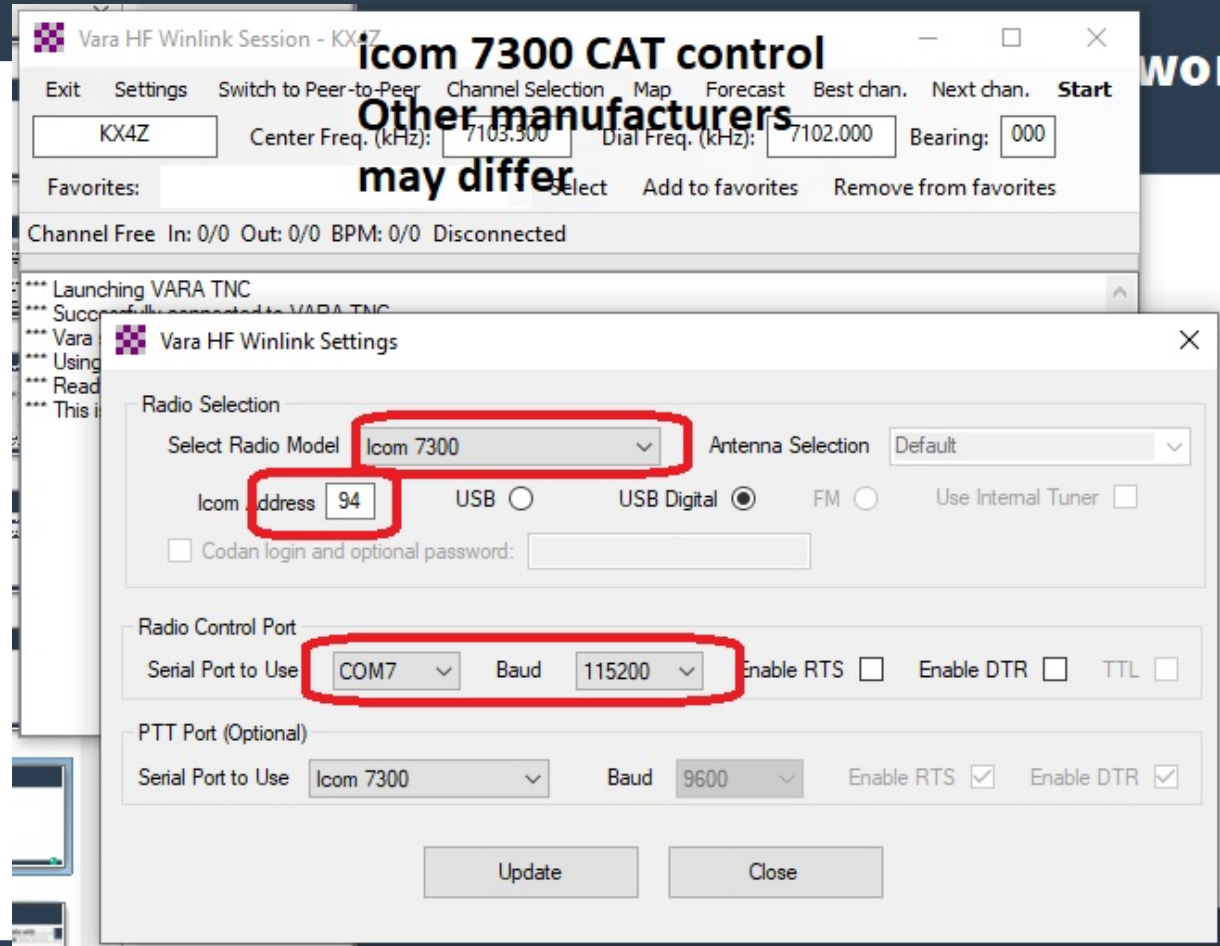
All done in software.....VERSUS....all done in hardware by Signalink

READ to find out how your application sets gain if you don't have a SIGNALINK (where it is EASY)



Making Frequency control work OPTIONAL (helpful!)

- Primarily for HF – on VHF there are so few normal packet channels it is easy to redial the radio yourself.
- CAT control

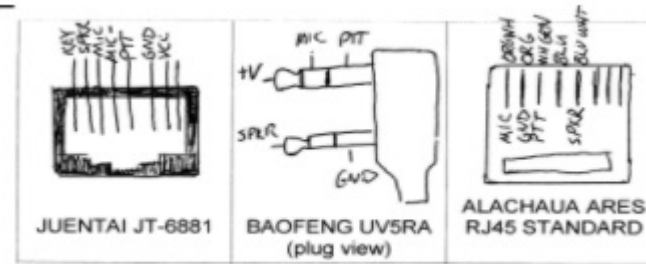
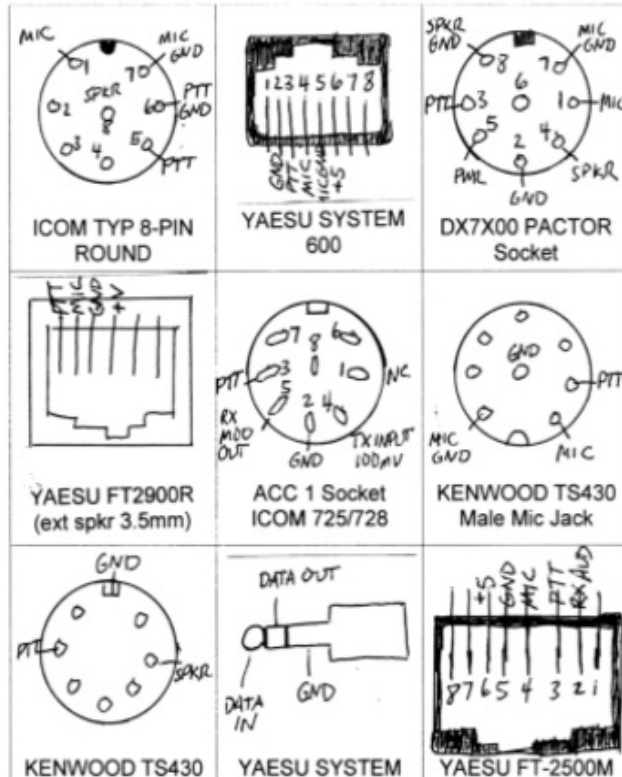


Signalink Purchasing

- You can purchase a pre-made Signalink cable for almost any radio
- It will connect JUST FINE to your radio!
- But they did NOT standardize their wiring pinout on the SIGNALINK SIDE. Why? Beats me! Save money?
- Requires JUMPERS inside the Signalink to accommodate all the different RADIO CABLES they sell....big pain in the tush if you wish to use with more than one radio.

EVERY RADIO IS DIFFERENT

MICROPHONE JACK PINOUT AS VIEWED FROM THE EXTERIOR OF THE TRANSCEIVER



The ability to WIRE A CONNECTOR to a radio is an important skills that takes some effort to attain. It can save you a lot of \$\$\$\$ and make things WORK after a simple failure. However, you CAN purchase ready-made cables, for about \$20, and you might want a spare?

Alachua County Homebrew Sound Card Systems

- We DID standardize the wiring on the interface side!! Every radio gets its own special cable – but the PINOUT on the interface side is **IDENTICAL**
 - Radio Mic is Pin 1 (orange-white)
 - Radio Ground is Pin 2 (orange)
 - Radio PTT is pin 3 (green white)
 - Radio Speaker audio output is pin 5 (blue white)

Alachua County interface connector

ALACHUA COUNTY FLORIDA STANDARDIZED RJ45 PINOUT

PIN	SIGNAL	Wire Color
1	microphone	white/orange
2	ground	orange
3	push to talk	white/green
4	unused	blue
5	receiver audio	white/blue

This table assumes the numbering shown in Figure 2-3, where the gold pins are held upwards and away from the reader.



Figure 2-3 Top View (pins visible) numbering of the RJ45 plug pins.

- **With Alachua County setups, the CABLE STAYS WITH THE RADIO and the computer/interface can be switched willy-nilly and they will all work.**

MAKING RADIO WORK – get signal levels correct

- 1) Easy to set receiver audio level – adjust until you can see a signal on whatever bar, or waterfall, your application provides. DARK – no signal! All WHITE – too much volume!
- 2) Setting TRANSMIT MODULATION LEVEL requires ham radio skills! There is usually a “tune” position and you adjust the modulation until you either have Zero ALC or have power output LESS THAN YOUR POWER SETTING. Very Important to make this work right....and not SPLATTER.
- 3) On FM – power output is always the same and there is no ALC...so adjust while listening to a 2nd receiver until your “loudness” sounds right (your deviation will be OK then)

Trouble Shooting

- 1) If you can't see anything on your waterfall, chances are you didn't get the RIGHT sound card selected or you didn't get the WIRING RIGHT.
- 2) If your frequency can't be controlled correctly, you didn't get the CAT set up properly.
- 3) If your radio won't go into TRANSMIT, you didn't get the PTT software configured or you didn't get the software set up properly.
- 4) If no stations answer you, bad signal = bad antenna / bad modulation / poor frequency vs. ionosphere choice.
- 5) NEVER HURTS to call the "Sysop" and ask them to LISTEN for you.



That's all, Folks!