



Gloucester County Amateur Radio Club W2MMD

Celebrating 63 Years Of Service To Our Community & Amateur Radio

Established In 1959



Yaesu System Fusion An Introduction

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Yaesu System Fusion

Some terms that can be confusing:

- **C4FM ~ The RF modulation scheme**
- **System Fusion ~ The combination of digital and analog communications, both hardware and software**
- **WIRES-X ~ The networking software that extends the operation of local RF nodes**

Yaesu System Fusion - C4FM

4 Level FSK Modulation (FDMA)

- 12.5 kHz channel bandwidth
- Has many similarities to P25 Gen 1
- Uses same the same vocoder as DMR
- Open standard, any manufacturer could implement

Yaesu System Fusion

The melding of analog and digital communications in one system.

- Radios and repeaters can operate analog or digital
- Automatic Mode Select (AMS) allows digital or analog operation without operator intervention
- AMS mode switches the radio or repeater based on the received signal
- Station transmitting digital will not be heard by an analog station and vice versa
- Open standard, any manufacturer could implement

Yaesu System Fusion - WIRES-X

Connects repeaters and stand alone stations across the Internet.

- **Devices connected to the system are referred to as “nodes”**
- **Provides real-time translation between analog and digital users.**
- **Uses a “conference room” metaphor for multi-station connections.**
- **HRI-200 (hardware USB device) needed to support a room.**
- **WIRES-X software supports direct connecting some models of radio directly to a PC.**
- **Closed Proprietary system.**

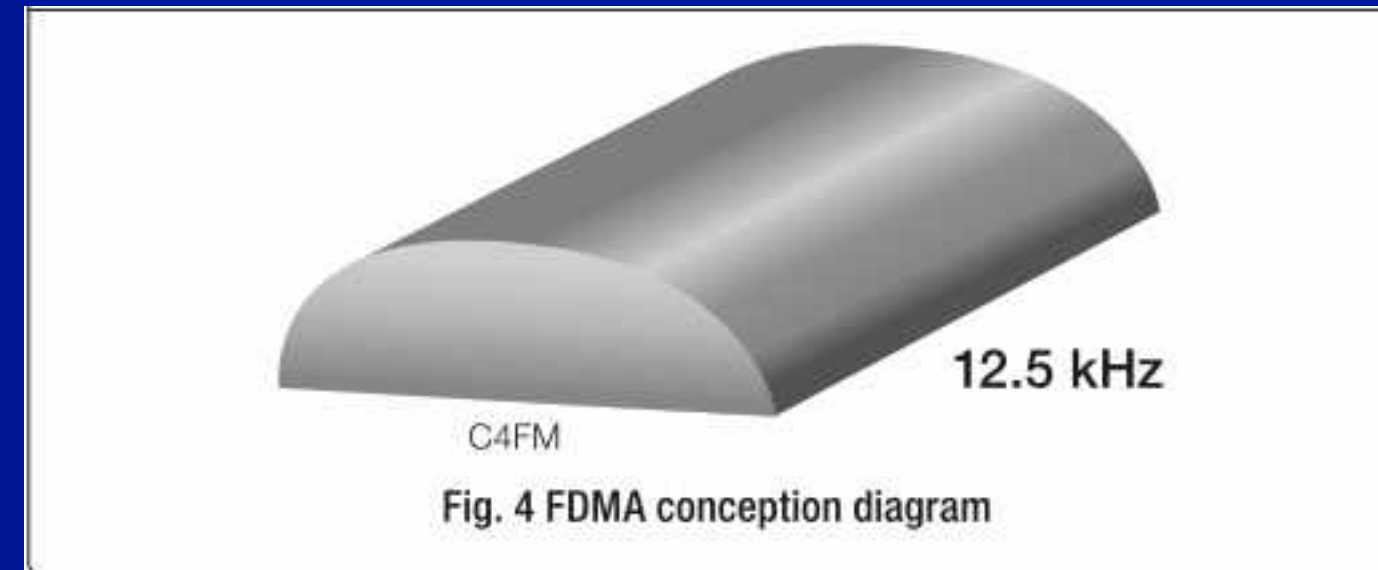
Yaesu System Fusion - Internet Multi-site Repeater System (IMRS)

The “other” linking technology.

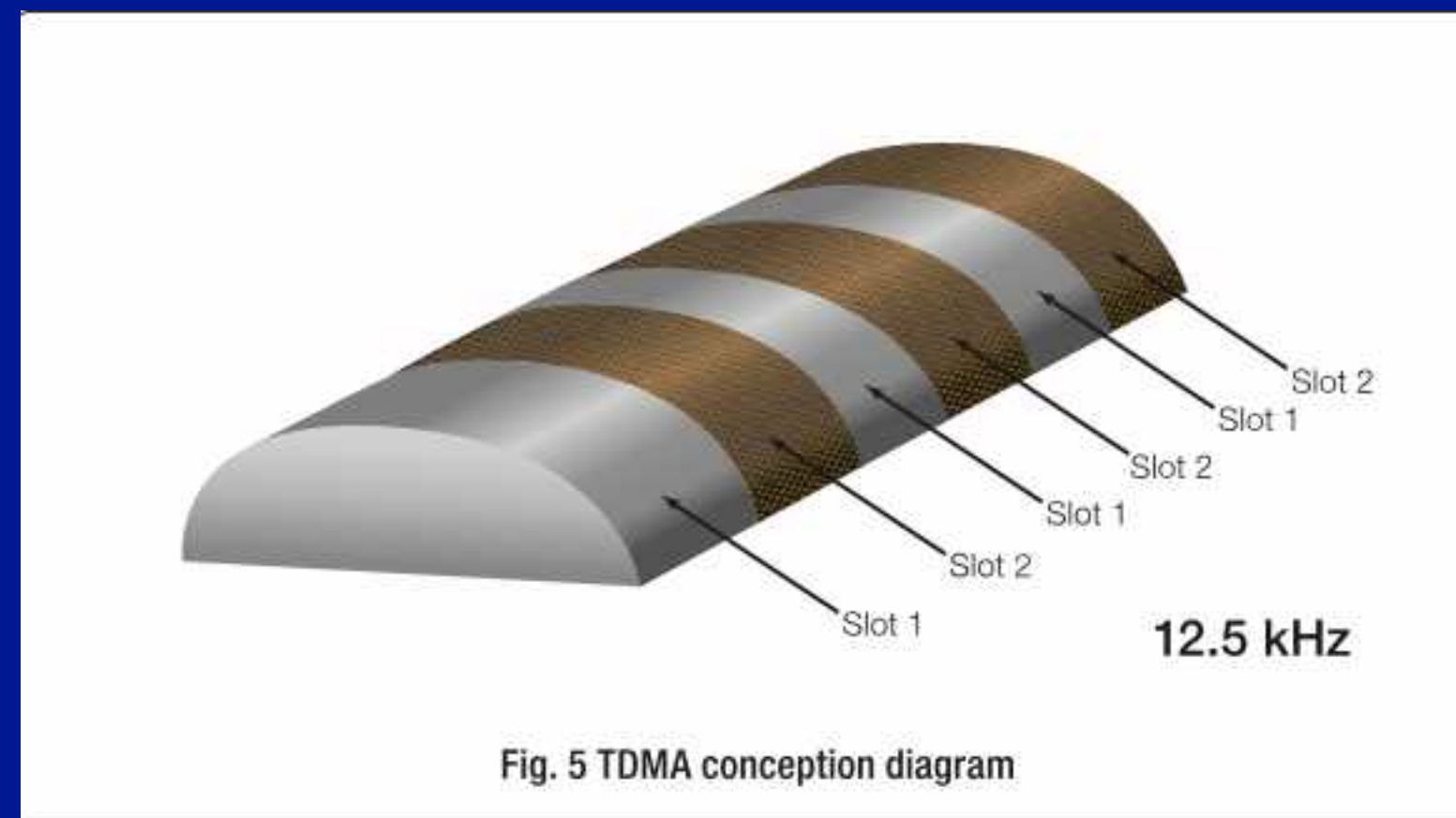
- Allows multi-site linking of DR-2X repeaters via IP
- Links can be RF, ethernet, or combination of both
- Does not use the WIRES-X system but can be bridged to it
- IMRS repeater module is a single board linux computer
- Closed proprietary system

Yaesu System Fusion vs. DMR

C4FM - Frequency Division Multiple Access (FDMA)



DMR - Time Division Multiple Access (TDMA)



Yaesu System Fusion vs. DMR - continued

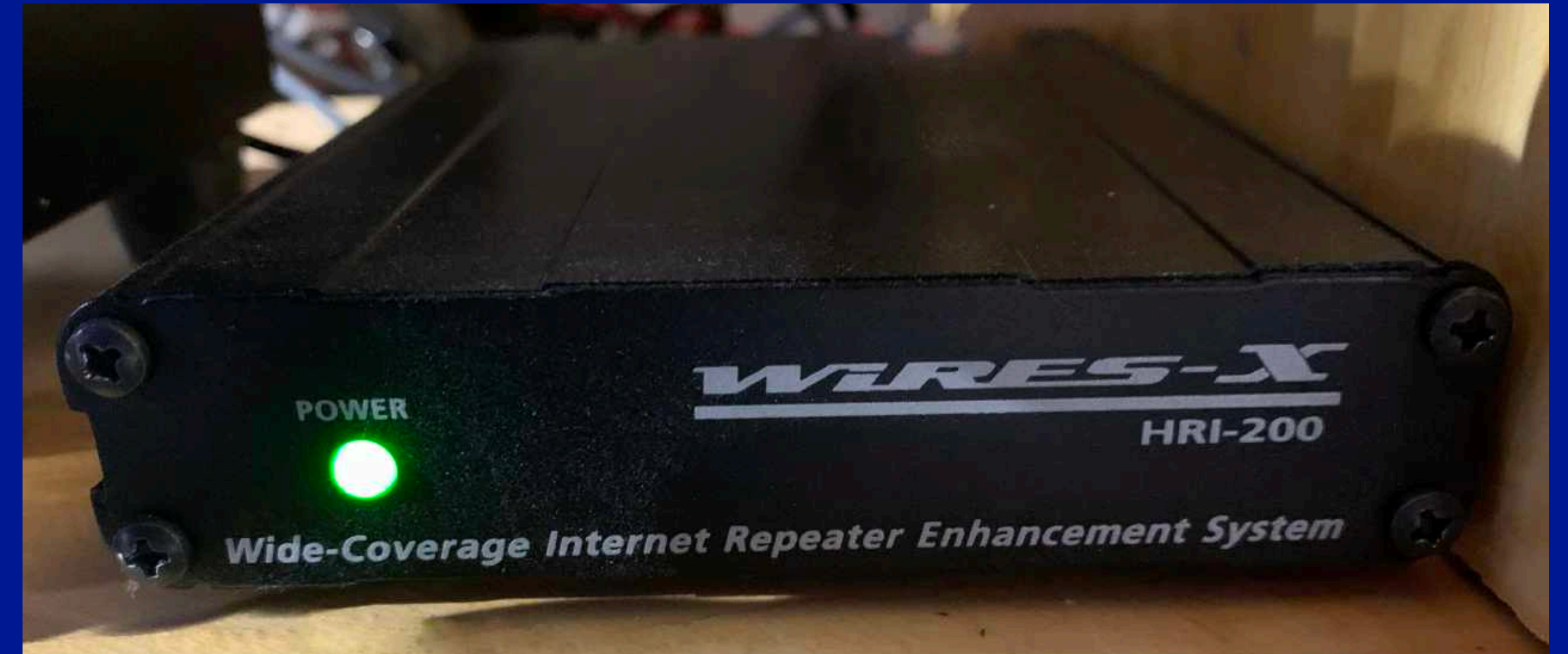
Feature	YSF	DMR
Radio Selection	Limited, as new 2 HTs, 3 mobiles, 1 base	Rich selection of manufacturers, mobile, and handheld radios.
Radio Programming Software	Provided by Yaesu free, different version for each radio, limited features. Also RT Systems.	Free, manufacturer provided. Different for each radio. Also RT Systems, Chirp for some radios
Required Initial Programming	Type your callsign into the radio.	Register for a DMR ID, build or download a code plug.

Yaesu System Fusion - C4FM Modes

Mode	Characteristic
DN (Digital Narrow)	6.25 kHz voice information 6.25 kHz FEC, GPS, call sign, text messaging
VW (Voice Wide)	12.5 kHz voice data, no FEC, no data. Very high quality audio
Data Full Rate	12.5 kHz data. Currently only accessible when sending photos with the MH-85A11U Camera Mic.

AMS mode will also switch freely between digital modes

Yaesu System Fusion - HRI-200



USB connected sound card *plus more*

Supports one analog radio with a 6 pin mini-DIN connection

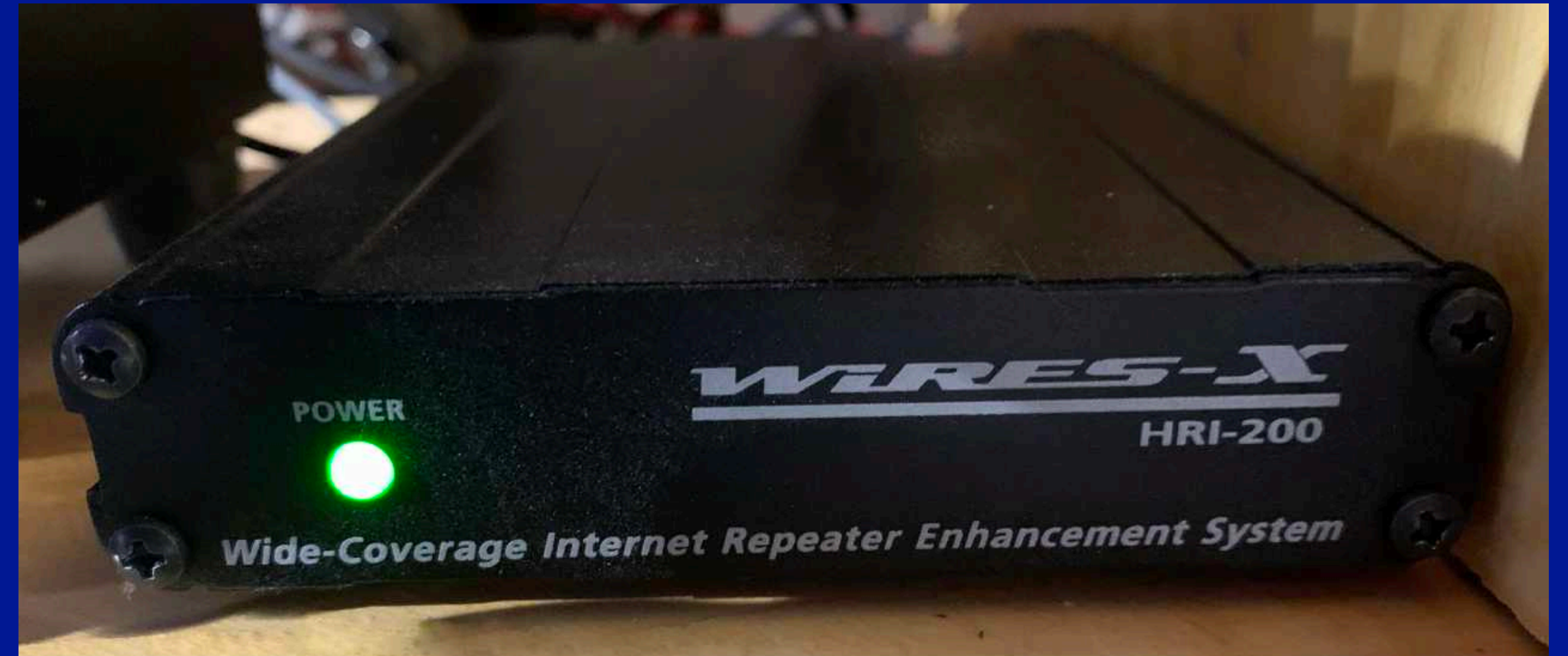
OR

Up to 2 Yaesu digital radios (FTM-100, 200, 300, 400, 400XD, or upcoming FTM-500)

OR

One Yaesu DR-1X, DR-1XFR, or DR-2X repeater

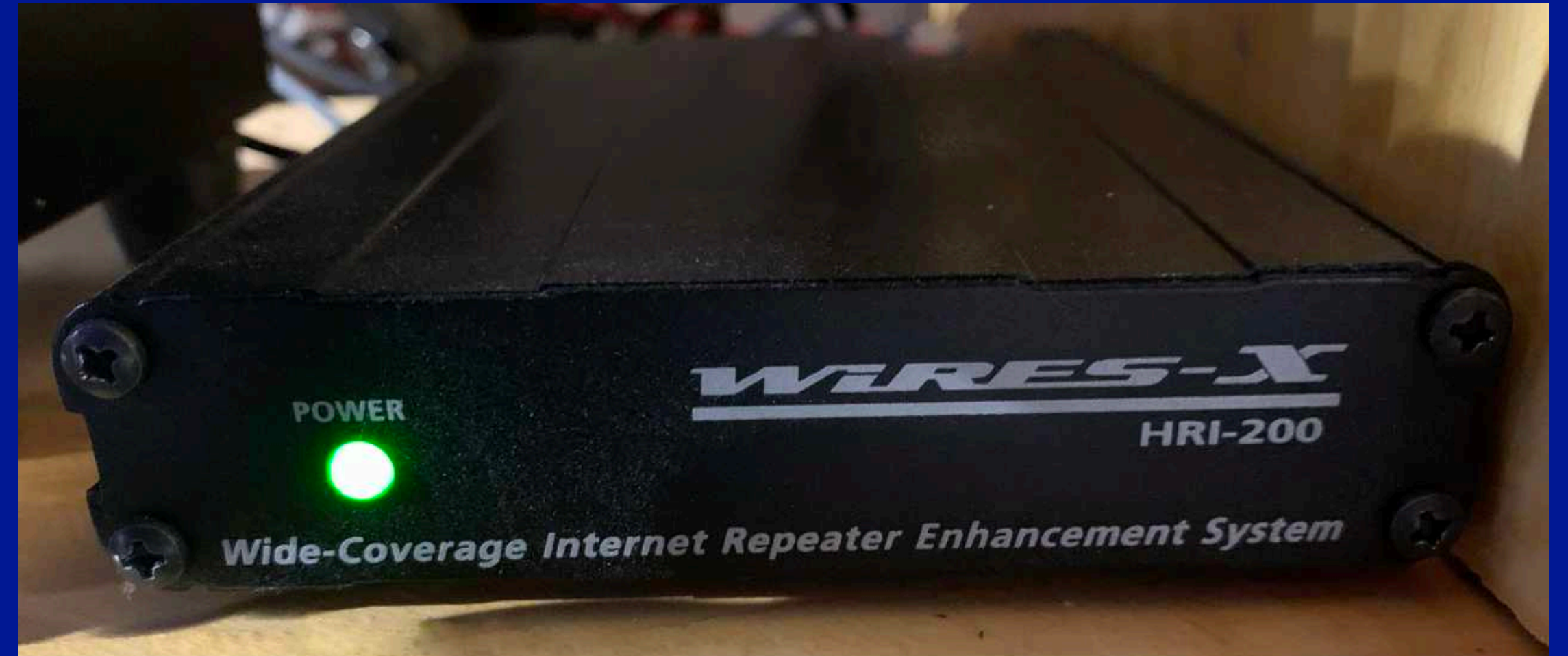
Yaesu System Fusion - HRI-200



- Allows PC to host a conference “room”
- Can convert analog audio stream from WIRES-X system (internet) to digital for local RF transmission
- Can convert local RF digital signals to analog to WIRES-X system
- If analog radio is connected, the reverse is true
- *Seamless and automatic merging of digital and analog, like DMR + Echolink/AllStar connected together*

Yaesu System Fusion - HRI-200

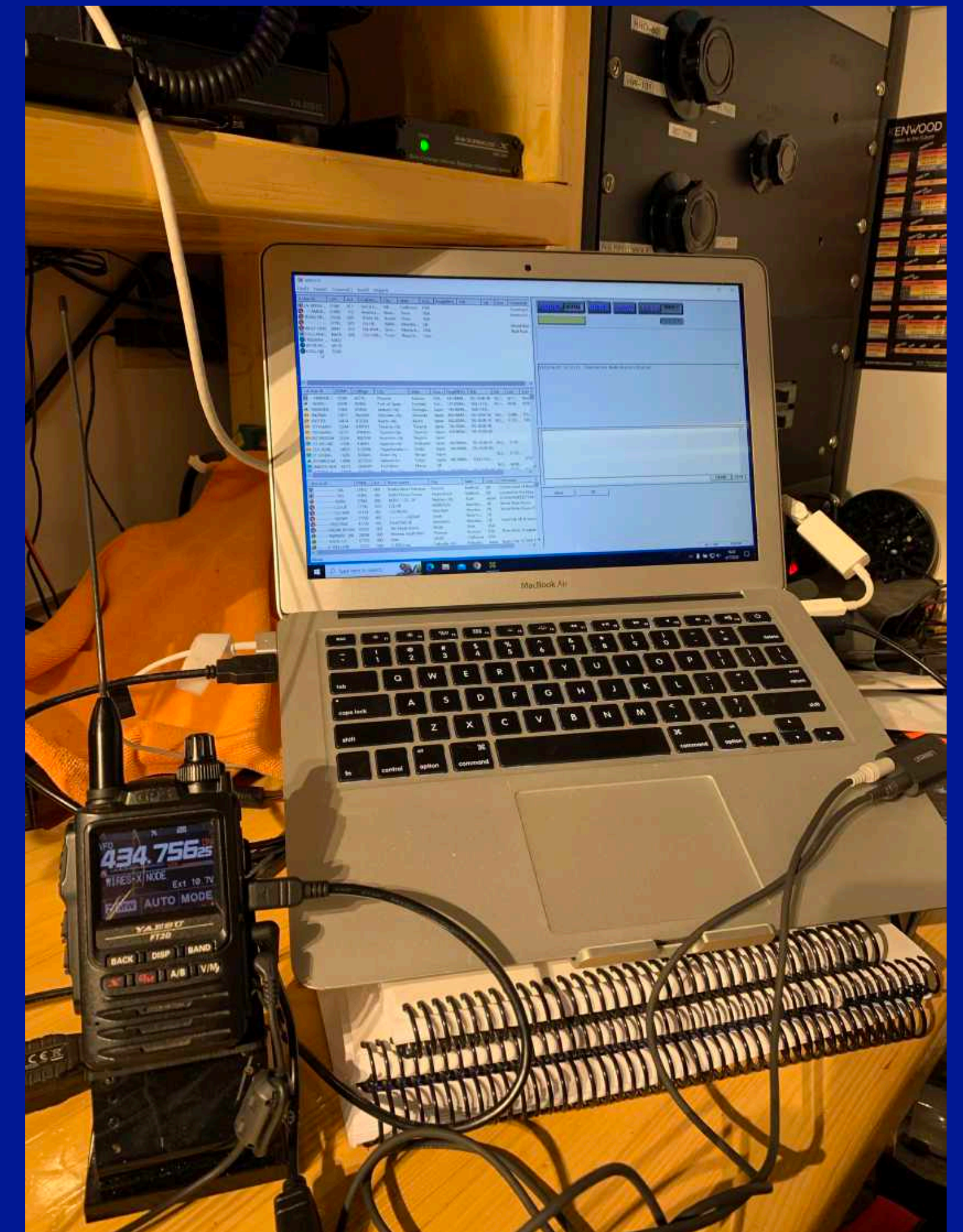
Why 2 digital radios?



- Commonly deployed in Japan in this configuration
- Radio 1 is called "Preset", Radio 2 is called "VCH" or Voice Channel
- In a given region, all the HRI-200s are set to a common preset frequency
- Voice Channels are all different frequencies
- Remote radio is commanded by the HRI-200 node from the preset channel to the voice channel
- In effect, a manual trunking system

Yaesu System Fusion - Personal Digital Node

- **Replicates most of the HRI-200 functionality without additional hardware**
- **Allows later model radios to connect directly to WIRES-X**
- **Handhelds: FT-2DR, FT-3DR, FT-5DR**
- **Mobiles: FTM-100, 200, 300, 400, 400XD, and upcoming FTM-500**
- **Interface cable set needed**
- **PDN mode (digital only) just needs SCU series cable**
- **HRI mode (digital + analog) needs audio cables and SCU cable**



Yaesu System Fusion - HRI-200 vs Personal Digital Node

HRI-200	PDN
Can host a “room”	Cannot host a “room”
Needs network ports opened (port forwarding)	Plug and play
Needs a “donor radio” and end point radio	Can be used with one radio (direct connect) or RF link with second radio
Can connect an analog radio to WIRES-X	Can only connect a Fusion capable radio to WIRES-X

PSA: Please, Please set your audio levels prior to use!

Yaesu System Fusion - Questions and demo

The screenshot displays the WIREX-X software interface. The main window shows a list of users with columns for G.User ID, +DTM..., Act, Call/Rm..., City, State, Cou..., Freq(MHz), SQL, Lat, Lon, and Comment. Below this is a list of rooms with columns for +A.User ID, DTMF..., CallSign, City, State, Cou..., Freq(MHz), SQL, Lat, Lon, and Con. A room selection window is open, showing a grid of call signs for the room '----AMERICA-LINK(21080) member 111 nodes'. The grid contains call signs such as WM4RB-RPT, AMERICANLK, W6BML-RPT, AB4NP-GW, N2UZQ-ND, K3SL-VE2-R, KH6VM-RPT, W5TMP-ND, VE5BB2-RPT, W7B0-ND, VE1JSR-RPT, WA7BND-RPT, VK5HDT-ND1, JA9YDB-ND, JA8YFI-ND, GB7IS-RPT, K3PDR, NK5CC-RPT, W0UJ-ND3, K7EP-ART, TY-JE9BHE, W9CHI/R, N2YN-RPT, WA3VHL-RPT, VE2TBQ-ND, K3CUJ-RPT, WA4TAW-ND, K3ERM-ND, W7ECA-RPT, WIMPR-ND, MB6IMD-GW, JJ6VAR-ND, N8LPQ-RPT, 9Z4JC-ND, KO4OZC-2, AF7YV/R, KG5IAN-RPT, W4ADZ-BOB, W5IAS-443, KN4NL-RPT, N7OZO-GW, AC3CZ-ND, K7PTZ-GW, W4IE-RPT, KD2OMU-ND, SR9NS-RPT, KA9WDX-ND, WA3PNY-ND3, KZ4JON-ND, KD4YDD-GW, N7AER-ND, LA4YMA-ND2, G7MRJ-ND, JE4YOU-ND2, KG5ZJV-ND5, K3IH-ND4, WA3OCV-ND, KN4PNC-ND, KO4AGY-ND2, K2ZA-ND2, WD4LLO-ND2, N4FAF-ND, NM2V-GW1, K6KRI-ND2, WB2VSL-ND, MB6OM-GW, KA9HNT-ND, K2ZZ-ND, W07BSA-RPT, W9NSE-CORY, KG5WWD-ND, NN6EE-ND, KM4TUO-DJ, W4HRC-ND, N9WPD-ND, KE6MTF-ND, NK0V-ND, K8MKN-RPT2, KD6TVP-RPT, KF0GCR-HR1, VA3JDL-ND, KS3M-ND3, NOAMY-TONY, KD4PDY-ND, KJ5IK-RPT, N2JXG-ND1, KE4MJ-ND, KA1JFB-ND, WF1TZ-ND, W4RUT-ND, W5CSR-ND2, SA4MDN-MIK, MB6IAZ-ND, N2XCZ-HD, PA7WP-ND, ZL4AUG-ND, N4BAF-ND, KC2YTD-ND, KG5HME-ND, KA7NWT-GW, N7GEE-GW, KG6AAQ-ND2, KJ4PTK-HB, K6AJT-ND, AB5SI-ND, KC3LQD-ND, N4CET-ND, KE8MFC-ND, W9JES-GW, N5YAI-ND, KH2BR-ND.

Buttons for 'NET DIGITAL', 'ON-AIR', 'LOCAL', 'FT3D', and 'RADIO 1' are visible at the top. A 'SEND' and 'CLR' button is at the bottom right. The status bar shows 'Ver-1.540' and 'ONLINE'.

PSA: Please, Please set your audio levels prior to use!