Fusion HT Battery Comparisons

Category: Power
March 13, 2023
See the attached file for supplemental information regarding the VX8, FT1, FT2, FT3, and FT5 series battery comparison discussed during the 13-Mar-2023 Fusion Technical Net. The discussion can be heard on the podcast Part One, Part Two.

Link to the high current (and cheaper) CD-41 replacement desktop charger: https://amzn.to/3G9fUCX

The file has been updated for the 3-Apr-2023 Fusion Technical Net.

HT Battery Evaluation Part ThreeDownload

FT70D High Power Problems

Category: Fusion,Troubleshooting
March 13, 2023
The other day I was working my Fusion repeater with my FT70D. Since I was “DX” I had the HT on high power. Although it looked like I was getting into the repeater just fine, I couldn’t enter the WiRES-X control mode. However when I switched to low power I WAS able to control the repeater.

What gives? Why could I control the repeater (node) on high power, but not on low power?

Back at the house where my repeater is located, the problem

still existed. I could use the WiRES-X control mode on low power but not on high power. Since I’m within 10 meters of the repeater, signal strength couldn’t be an issue.

Looking at the output spectrum of the FT70 revealed the problem. On high power there were some spurs that shouldn’t have been there. The spurs were much weaker on low power. Other radios didn’t exhibit the spurs. Click on the images to compare and see the details.


FT70D spectrum on low power

FT70D on High Power

Date and Time

Category: Date and Time
March 13, 2023

Link	Site	Notes
https://time.is/	Verify the time settting on your computer. Essestial for HF digital modes.	
http://www.thinkman.com/dimension4/	Tool to automatically and accurately set your computer time. Essential for digital modes.	
http://www.timebie.com/std/utc.php	Calculate time zones.	

https://www.timeanddate.com/	Outstanding and fun site for anything to do with dates and time.	

WSPR and FT8 Links

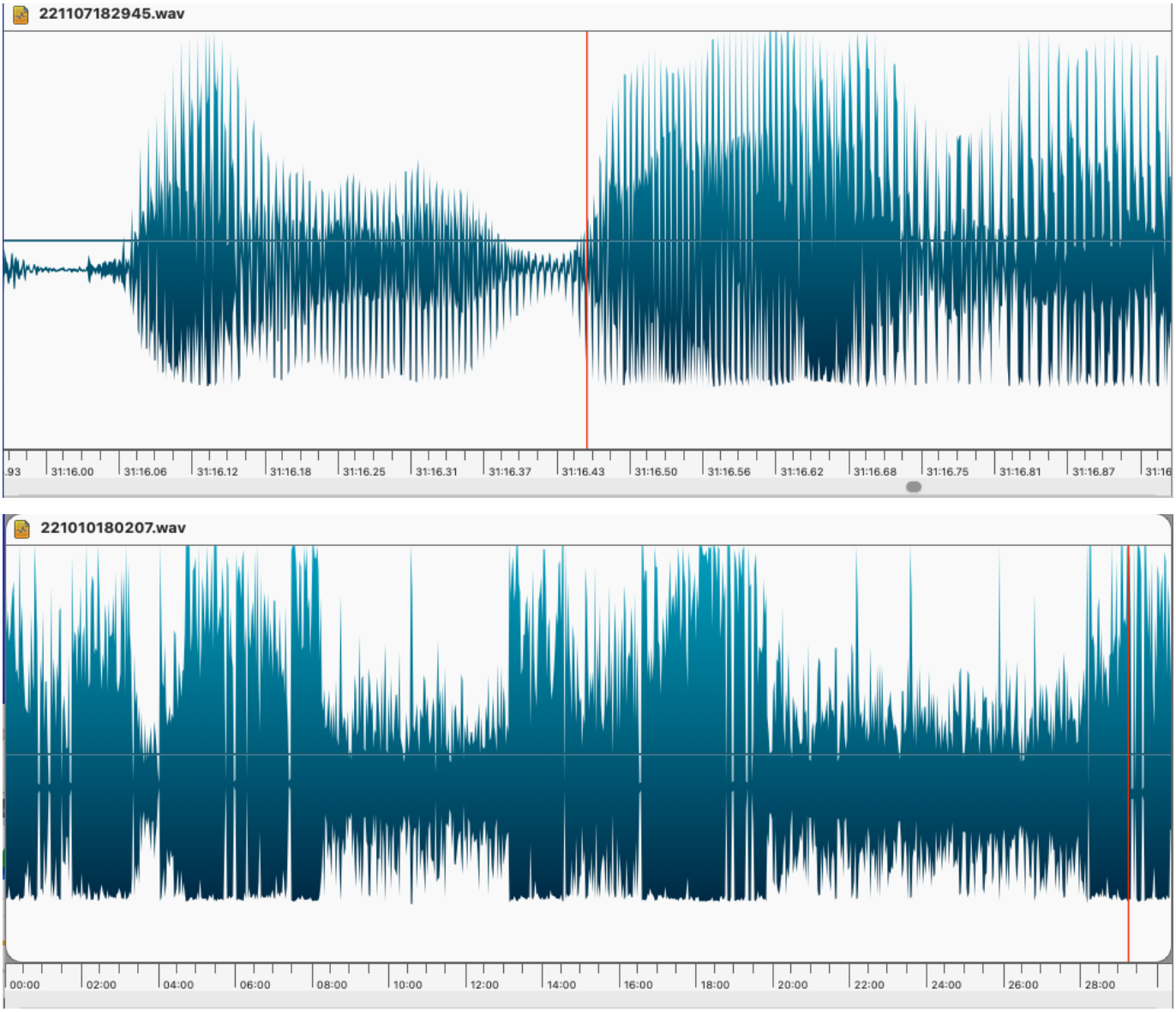
Category: HF Digital Modes
March 13, 2023

Site	Purpose	Notes
https://en.wikipedia.org/wiki/WSJT_(amateur_radio_software)	About the WSJT software	
https://en.wikipedia.org/wiki/Joseph_Hooton_Taylor_Jr.	About the Author	
http://physics.princeton.edu/pulsar/K1JT/wsjtx.html	Home Page	
https://en.wikipedia.org/wiki/WSJT_(amateur_radio_software)	Source Code	
http://physics.princeton.edu/pulsar/K1JT/Moonbounce_at_Arecibo.pdf	Running Moonbouce!	
http://www.g4ilo.com/wspr.html	Article	
http://www.qrp-labs.com/	WSPR kits and other cool stuff	
http://wsprnet.org/drupal/	Montor WSPR signals around the world	

https://www.n1rwy.org/?p=157	Set up the FT-991 to run digital modes.	
Date and Time	Check here for tools to set your PC’s time. Essential for these modes.	

C4FM Audio Quality

Category: Fusion
March 13, 2023
Photos show the waveform capture from an FT5 during a MNWis net. Note that they are not symmetrical around zero. The 2nd image has more detail and you can see that the waveforms are not symmetrical. The clipping sound is heard when the audio level hits the limits even though it is still not at 100%. Odd.



Waveform of MNWis net

IMRS LAN Firmware Update

Category: IMRS
March 13, 2023
I don’t know why Yaesu doesn’t make this public, but they don’t. You can download version 1.44 of the IMRS LAN firmware. This

solves some problems with LAN connections constantly dropping.

Listen to 10 C4FM with an HT

Category: Fusion
March 13, 2023
During the Monday Night Fusion Technical Net, a comment was made that it was possible to use an FT5D to receive C4FM on 29.250. This started a conversation about other HT's as well. Thanks to W4IOD, AD0MI, N0PXT, and N0OQL, we now have the definitive answer for most of the Yaesu Fusion radios.

Background

Using 29.250 for C4FM has become popular as 10 meter conditions have improved significantly. The Yaesu FT-991(A) is the only radio that is capable of Tx and Rx on 10 meters as well as operating in Group Mode (GM). When the band is open, you may see or hear C4FM traffic on this frequency.

One way to check 10 meter band conditions is to tune AM down to the CB frequencies near 27.195 MHz. If you hear a lot of racket, then 10 is probably open.

The 'A' band must be used since the 'B' band on all radios cannot tune 10 meters.

Analysis

Note that none of these radios can transmit on 29.250. In addition if 29.250 works, then six meters will work as well.

The following radios cannot receive 29.250 MHz since they don't

tune down that low, bummer:

Mobile Radios: FTM-100, FTM-200, FTM-300, FTM-400, FTM-3200, FTM-3207, FTM-7250

HT’s: FT-70D

The following HT’s tune 29.250 and DECODE C4FM (show callsign and switch between DN/VW)* but do not provide audio:

FT-1D (US version), FT-2D, and maybe FT-3D

*Must be set to Rx DN or VW.

The following HT’s will receive C4FM on 29.250 but cannot engage GM. GM is handy for seeing the callsigns of stations that are beaconing.

FT-1D (Japan version) Interesting! Maybe the JP versions of other HT’s will do this as well.

The FT1D and FT2D can enter GM using the following process:

1. Enter 29.250 on the A side.
2. Enable both A and B if both sides are not enabled.
3. Switch to the B side.
4. Press the GM key.

The following HT’s can receive 29.250 and can enter GM. Note that they display the GM information but do not beacon:

FT-5D

Bottom line

The FT-5D has more C4FM capability since it allows reception wherever it tunes while other radios do not.

Node Cycling In and Out

Category: WiRES-X
March 13, 2023
This post addresses a WiRES-X node that constantly leaves and rejoins a room.

This type of problem is almost always the result of a networking issue. When certain networking problem occur the HRI-200 software will wack out (a technical term). Once the software has been wacked out, it will continue to cycle in and out of whatever room it is connected to. Restarting the WiRES-X software usually solves the problem.

Router problems:
1. Turn off UPnP. It should never be used!!!!!!
2. Turn off all quality of service features like those to improve Xbox gaming or VoIP functions. (Yes I know we're using VoIP so you'd think it would help.)
3. In fact turn off everything you don't have to have.
4. Some routers are total crap and need to be rebooted every few weeks.
5. You're not using Wi-Fi are you? Wired is always better than wireless – we should know! Drop-outs in Wi-Fi can cause this issue.
6. Did I mention, turn off everything on the router you don't need?

ISP problems:
1. Something as simple as the ISP dropping your connection for a few minutes in the middle of the night when they're doing maintenance.
2. The ISP just doing a bad job of getting packets to you during prime evening Netflix viewing.
3. The ISP switching your IP address. (I think CenturyLink just

does this for the fun of it.)

Computer:
1. Make sure Win10 doesn’t put the USB interface to the HRI-200 to sleep. It really, really likes to do this. Just going to the obvious place in the control panel to turn this feature off doesn’t really turn it off. See the documents on running Win 7/10 24x7x365 remotely in the Fusion Help section at HamOperator.com.
2. Make sure the computer isn’t crap. Cheap computers may not have quite the reliable communication interfaces that we need.
3. Banish all RFI and ground loops. Make sure RF is not getting into the USB interface to the HRI-200. This can cause message errors and really screw things up.
4. Make sure you computer actually has enough power to run the HRI-200 reliably. Get one of those USB power thingies and make sure you have a solid 5VDC under load.

Over the air:
1. Bad data on the WiRES-X network can mess things up. This happens mostly with hotspots that are bridged into the WiRES-X room. On MNWis and a few other networks we’ve banished this problem by banishing FCS and running YSF server software that banishes bad data from hotspots. So if you have this problem in one room, say AmericaLink and not others, there may be nothing you can do.
2. Yaesu radios that are running really old firmware or have not had the firmware updated correctly (I.e., “I did the main CPU but I’ll get around to the DSP later.”)

Side note:
The port check should not be relied upon to definitely prove it’s working or not working. The test is not exactly the same as actually communicating with the Yaesu list servers and the room server. So it can lie to you with false positives and false negatives. This is because the port check uses the Yaesu servers in Japan to perform the test, not the room server you’re trying to connect to. Routing issues can cause one to work whilst the other doesn’t.

You may also experience a similar problem if the Yaesu list servers are not able to keep up with the demand or if maintenance is being done. (When they do maintenance in the wee hours of the morning, that’s right in the middle of the day for us.)

Regarding Fusion

Category: Fusion
March 13, 2023
Some thoughts about Fusion, digital modes, and the future.

Fusion uses the lower layers of the P-25 architecture. Modulation, transport, framing, etc. The primary differences revolve around what’s in the packet. For example: The use of call signs instead of unit IDs. So Fusion shares most of P-25. FWIW, Fusion is also very similar to DMR. The primary difference is that it doesn’t use TDMA – jamming two separate channels into the space of one.

P-25, DMR, NXDN(Kenwood), IDAS (Icom), and Fusion use the same vocoder. D* uses a much older and obsolete vocoder.

Fusion and D* have been optimized, although differently, for Amateur Radio. DMR, NXDN, and IDAS have been optimized for commercial services, like taxi cabs. P-25 has been optimized for government services, like police departments.

Fusion was actually designed by Motorola in that period of time that Motorola owned Yaesu. This benefits Fusion since the vocoder and the signal processing firmware are pretty much the same as what Motorola uses in their radios. (Believe me, not all

signal processing firmware is designed the same!) Thus, the performance of Fusion is pretty darn good. Add to that an additional layer for FEC provided by Yaesu's modification to P-25, and the performance of Fusion is better than all the others. (D* is substantially worse than the other protocols.)

What we see from this is that most of the communication industry has evolved around the same technologies even though the systems are not directly compatible with one another. This is why it is so easy for a hotspot to translate between DMR, P-25, NXDN, IDAS, and Fusion. But is this the best we can do?

No. Digital performance could be much better. C4FM already blows away FM with superior range and capability, but it was intentionally limited – to work with FM/PSK transmitters and receivers like those used with FM.

FM is a non-linear system thus it does not transmit all the information it could in the available bandwidth. Linear systems, such as OFDM, can provide higher bit rates lower error rates, better resistance to fading and multipath, amongst other things. The problem is OFDM requires linear amplifiers and thus is not compatible with all the FM/PSK transmitter and receiver designs.

Personally, I'd like to see OFDM as an option for digital's future.

But all digital systems could be made better by some enhancements at the repeater site. The use of multiple, diversity receivers incorporating very low-level discrimination could improve receiver sensitivity by as much as 10 dB. That means HT would perform almost as well as a mobile rig with no changes required of the user. Having multiple diversity receivers at various locations around a city could mean that a low power HT would work virtually anywhere in that city. Sadly, there doesn't seem to be a market for doing such things. (This

technology is well understood and used by your cell phone.)

One last note. Several attempts have been made to build multi-protocol radios incorporating DMR, Fusion, D*, FM, and others into a single unit. Should be simple, right? But we have yet to see such radios on the market. If we did, they wouldn't do Fusion as well as Yaesu, or D* as well as Icom, or DMR as well as Motorola. Why? Protocols are damn hard to get right. They are even harder to get working really, really well where they take into account all the things that can go wrong with data transmission. (Hotspots try to do the conversion, but never work as well as going "native".)

I would argue that the amateur community should focus on those systems designed for Amateur Radio. Ultimately those will be easier to use and better suited for the job. (Police departments and taxi cabs should not use Fusion!) A good user experience is critical if digital, any digital, is to become generally accepted.

One last note: Nothing prevents Icom from building a Fusion radio. Every last little detail about Fusion is public information, particularly since most of it comes from P-25 – for which Icom builds radios. The only proprietary aspects of Yaesu's system are WiRES-X and IMRS.

Purchasing amateur radios that do digital help support the future of digital by encouraging companies to develop more and better digital features. Buying commercial Chinese radios just helps the Chinese economy.

Understanding DGID and IMRS

Category: IMRS
March 13, 2023
DG-ID is like a CTCSS tone, but for digital. It filters out signals with different DGID’s as well as having the ability to do split DG-ID’s (like split CTCSS). DG-ID can be in a state of Rx & TX (DG-ID), Rx Only, Tx Only, and Split Rx & Tx (different DG-ID).

DG-ID servers as a means of selective signaling for access to a repeater or for a WiRES-X node. For the repeater it has a couple of different applications (IMRS and access purposes) while with WiRES-X it offers control of voice and control access.

DG-ID’s cannot be reused within the same configuration or network. For a repeater that means the DG-ID can only be in the LOCAL, RPT GROUP, or GROUP. There will be issues if in an IMRS network has anything with the same DG-ID.

DG-ID Repeater usage

LOCAL DG-ID: There are two factors:
1) The DG-ID it will not be sent down IMRS links and only allow access to the local repeater.
2) In an IMRS set-up, you will always hear the status beeps: One for end conversation; Two for link drop/end; and three for a repeater is not connecting with the DG-ID/IMRS group.

RPT GROUP DG-ID: This offers the ability for an IMRS link to be established in a one-way direction. The DG-ID used is the LOCAL DG-ID of the other repeater that you are calling. If users are using DG-ID Tx AND RX they will not hear beeps the confirmation beeps (see above).

Example of RPT GROUP usage:

San Diego Repeater – Local 1 Los Angeles Repeater – Local 2, RPT GROUP 1

San Diego users using DG-ID 1 stay on San Diego for usage; Los Angeles users use DG-ID 2 stay on Los Angeles for usage. Los Angeles users who use DG-ID 1 will establish a one-way link to San Diego and will communicate with one another until the IMRS TOT is reached. Once the link drops it is reestablished by someone using DG-ID 1 on the Los Angeles repeater group as San Diego cannot establish the link as it is not a RPT GROUP.

GROUP DG-ID: offers the ability for an IMRS link to be established in either direction by any of the repeaters that have it programmed into IMRS. If users are using DG-ID Tx AND Rx they will NOT hear the confirmation beeps.

Example of GROUP usage:

San Diego – Local 1, GROUP 10 Los Angeles Repeater – Local 2, GROUP 10

San Diego users use DG-ID 1 only stay on San Diego for usage. Los Angeles users use DG-ID 2 only stay on Los Angeles for usage. San Diego or Los Angeles users that use DG-ID 10 will connect to one another via IMRS and stay connected till the IMRS TOT times out.

Overall example with LOCAL, RPT GROUP, and GROUP:

San Diego – LOCAL 1 – RPT GROUP (blank), GROUP 10

Los Angeles – LOCAL 2 – RPT GROUP 1 – GROUP 10

San Diego: DG-ID 1 talks locally, using DG-ID 10 talks between San Diego and Los Angeles

Los Angeles: DG-ID 2 talks locally, using DG-ID 10 talks between San Diego and Los Angeles. DG-ID 1 establishes a link between San Diego and Los Angeles.

WiRES-X & DG-ID Local

Using WiRES-X with a DG-ID, it is not recommended to use the LOCAL DG-ID if you have an IMRS setup with a DG-ID. Here's why: WiRES-X will hear all the confirmation beeps from IMRS (argh!). Also WiRES-X will hear everyone but only talk locally since a LOCAL DG-ID is being used.

Example of WiRES-X and IMRS (with three repeaters in an IMRS Network)

- San Diego – LOCAL 1 – RPT GROUP (blank) – GROUP 10, 20, 99
- Los Angeles – LOCAL 2 – RPT GROUP 1, 3 – GROUP 10, 30, 99
- Chicago – LOCAL 3 – RPT GROUP (blank) – GROUP 20, 30, 99
- WiRES-X – DG-ID 99
- DG-ID 10 connects San Diego to Los Angeles
- DG-ID 20 connects San Diego to Chicago
- DG-ID 30 connects Los Angeles to Chicago
- DG-ID 99 connects all together along with WiRES-X

In this setting the users can do the following, per repeater, with the DG-ID's.

San Diego:

- DG-ID 1 is local.
- DG-ID 10 establishes a link between San Diego and Los Angeles.

- DG-ID 20 establishes a link between Los Angeles and Chicago.
- DG-ID 99 establishes a link between San Diego, Los Angeles, Chicago and WiRES-X.

Los Angeles:

- DG-ID 2 is local.
- DG-ID 1 establishes a one-way link between Los Angeles and San Diego.
- DG-ID 3 establishes a one-way link between Los Angeles and Chicago.
- DG-ID 10 establishes a link between San Diego and Los Angeles.
- DG-ID 30 establishes a link between Los Angeles and Chicago.
- DG-ID 99 establishes a link between San Diego, Los Angeles, Chicago and WiRES-X.

Chicago:

- DG-ID 3 is local.
- DG-ID 20 establishes a link between San Diego and Chicago.
- DG-ID 30 establishes a link between Los Angeles and Chicago.
- DG-ID 99 establishes a link between San Diego, Los Angeles, Chicago, and WiRES-X

Once an IMRS link is established ALL the DG-ID’s in the repeater can be used to keep the link active. If in the San Diego example a link is established, then DG-ID’s 1, 10, 20, and 99 can all be used to keep the link alive. DG-ID that established the link is the only one that will be transmitted by San Diego.

If a link established by DG-ID 10 on the San Diego repeater, the repeater will Rx DG-ID’s 1, 10, 20, and 99 but will only

transmit back DG-ID 10. Therefore, if you have DG-ID 99 set-up in your radio for Tx & Rx you will be able to talk down the link but you will not hear anything because the repeater is Tx DG-ID 10.

Information from N9UPC.