

Yaesu Fusion / C4FM Update



David Ranch
KI6ZHD
BayCon
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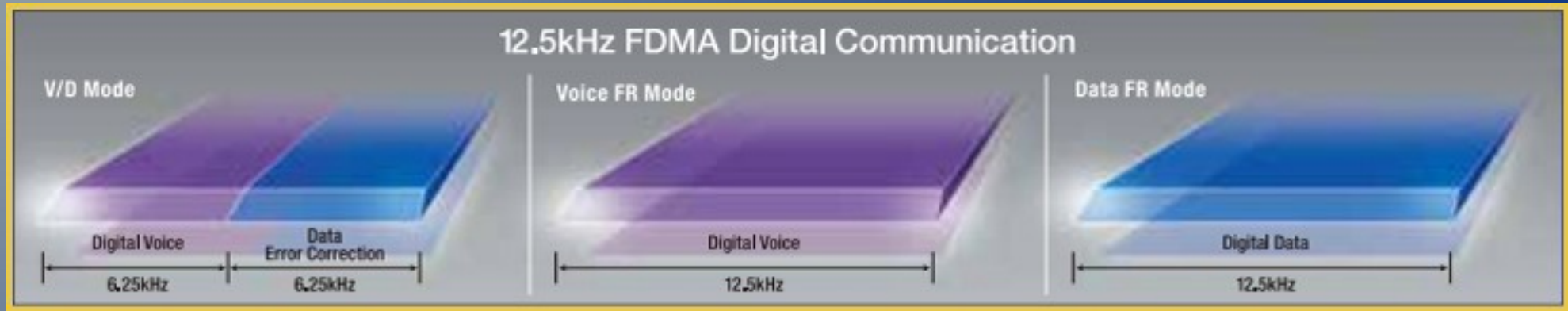
So who is the presenter anyway?

- Amateur Radio licensed since 2009 - KI6ZHD
- Degree in Computer Engineering
- Been using computers since the Z80 days - Epson QX10 / CPM and been running Linux since 1991 installed from 14 floppies!
- Author of several Linux documentation sets:
IP Masquerade (NAT), TrinityOS (entire system administration), SANS Linux Security - Step by Step* and recently the Centos HamPacket suite
- My bent on Ham Radio? Digital HF modes, SDR, Packet Radio with Linux

A Quick Refresh: What is YSF / C4FM?

- System Fusion is Yaesu's answer to Digital Voice which is openly documented in 2013 and has been in levels of operation for ~1.5yrs now
- C4FM : Continuous Four Level Frequency Modulation – A type of 4FSK / FDMA
- This is the **same** mode used in P25 Phase1 used by Emergency Responders but the higher layer framing isn't compatible
- FM envelope uses 12.5Khz BW (narrow FM)
- Uses DVSI AMBE chip used in DMR & P25 but newer version than D*star – patent encumbered

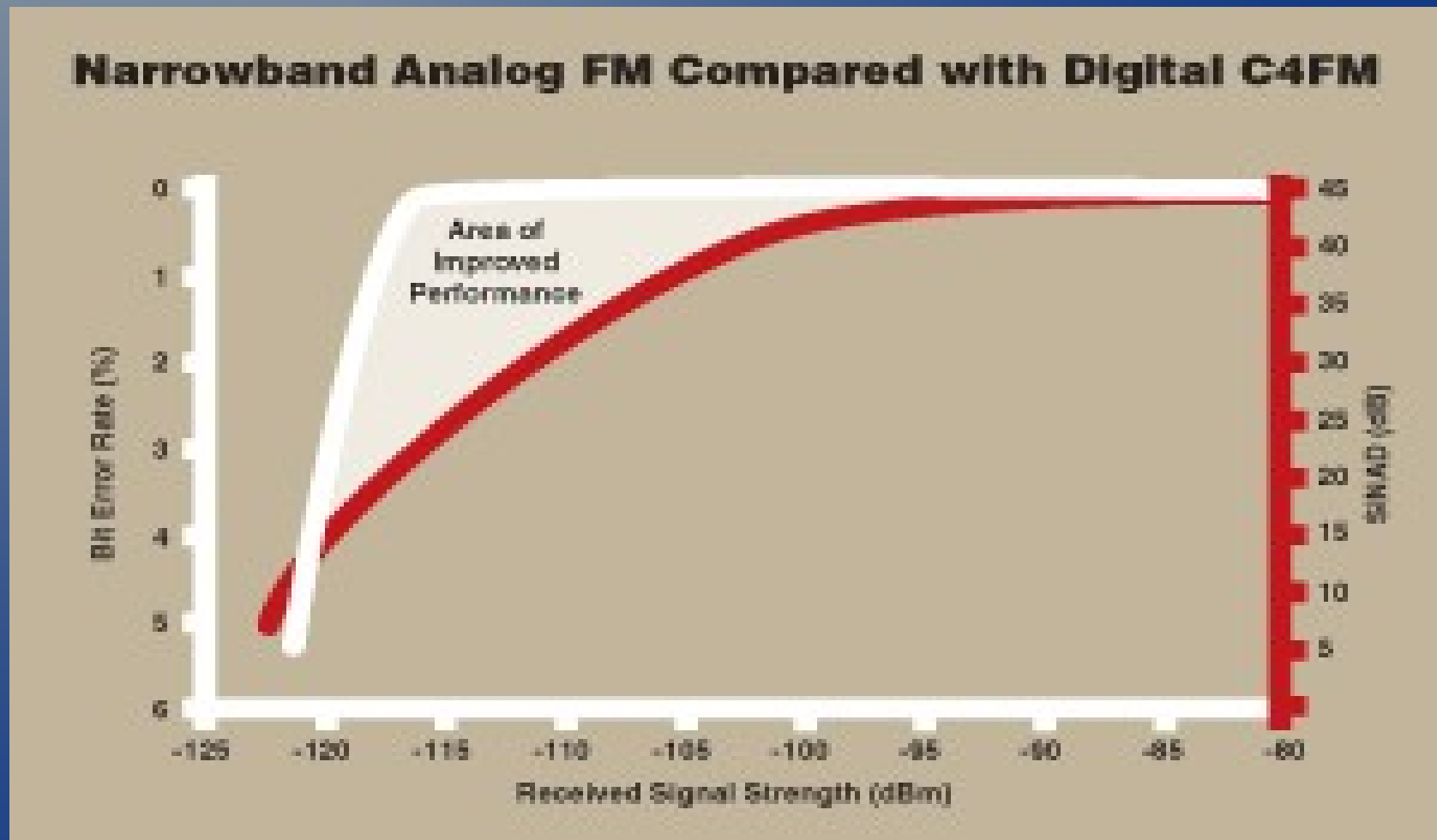
Fusion's Four Sub-Modes



- V/D (Voice / Data) mode has 2 sub-modes depending on volume of data
 - Examples of the data sent would be GPS location & text messages vs pictures and files
 - Digital Narrow (DN) - additional FEC adds between 3 to 5 dB (estimated) of additional system gain plus it helps the system recover faster from bit errors
- Voice Full Rate (VW) uses 4400bps for voice, 2800bps for FEC – no interleaved voice and data like DN mode
- Data Full Rate (DW) supports 7200bps, (no FEC, no CRC)

A Reminder of Digital vs Analog

- Technical levels of Analog breakdown



What Makes it “Fusion”?

- What sets this new technology apart from Dstar, DMR (MotoTRBO), etc? It's automatic backwards compatibility with analog FM!
 - Every Fusion radio and repeater is aware of the current QSO and it's mode
 - If a QSO input starts as FM, the repeater “repeats” FM
 - If the QSO input starts as C4FM, it “repeats” C4FM
 - Each endpoint (HT, mobile, etc) auto-switches
- Wires-X links repeaters much like D*star, IRLP, AllStar, etc be it digital *or analog QSOs!*

Fusion's Wide Data mode – What can use it?

- Yaesu sells a special hand-mic that includes a camera to send 320x200 pictures to remote Fusion-enabled radios



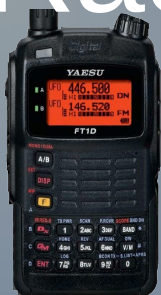
- YSF still has yet to reveal detail on how to utilize the high speed data modes for say D-RATS or other applications

What else do YSF radios do?

- Full 2m / 70cm analog FM and FM-narrow
- Full APRS Support:
 - APRS Voice Alert & 1-button QSY support
 - Built-in GPS
 - Built-in 1200/9600 BAUD AFSK TNC (not accessible for standard packet connections)
- FT991 doesn't do APRS but has HF+VHF+UHF
- Supports listening to Broadcast FM at the same time as listening to Ham frequencies (break in)
- Supports listening to AM (broadcast, Aircraft)

Gear Update: What's out there and What's New

Radios since last BayNet update



FT1D - a steal of an HT w/ APRS too



FTM-400DR - also inexpensive for a mobile APRS radio : Nice interface and touch screen



Wires-X Linking module



DR-1X complete Repeater w/ controller



FT-991 – HF/VHF/UHF base

FT-2D – HT with touch screen



What's New for Fusion HW?

- New FT-1XD, FTM400XD radios with improved GPS receivers (bigger 2200mAh batt. for FT1X)



- FTM-100 Mobile (lower cost; one VFO w/ APRS)



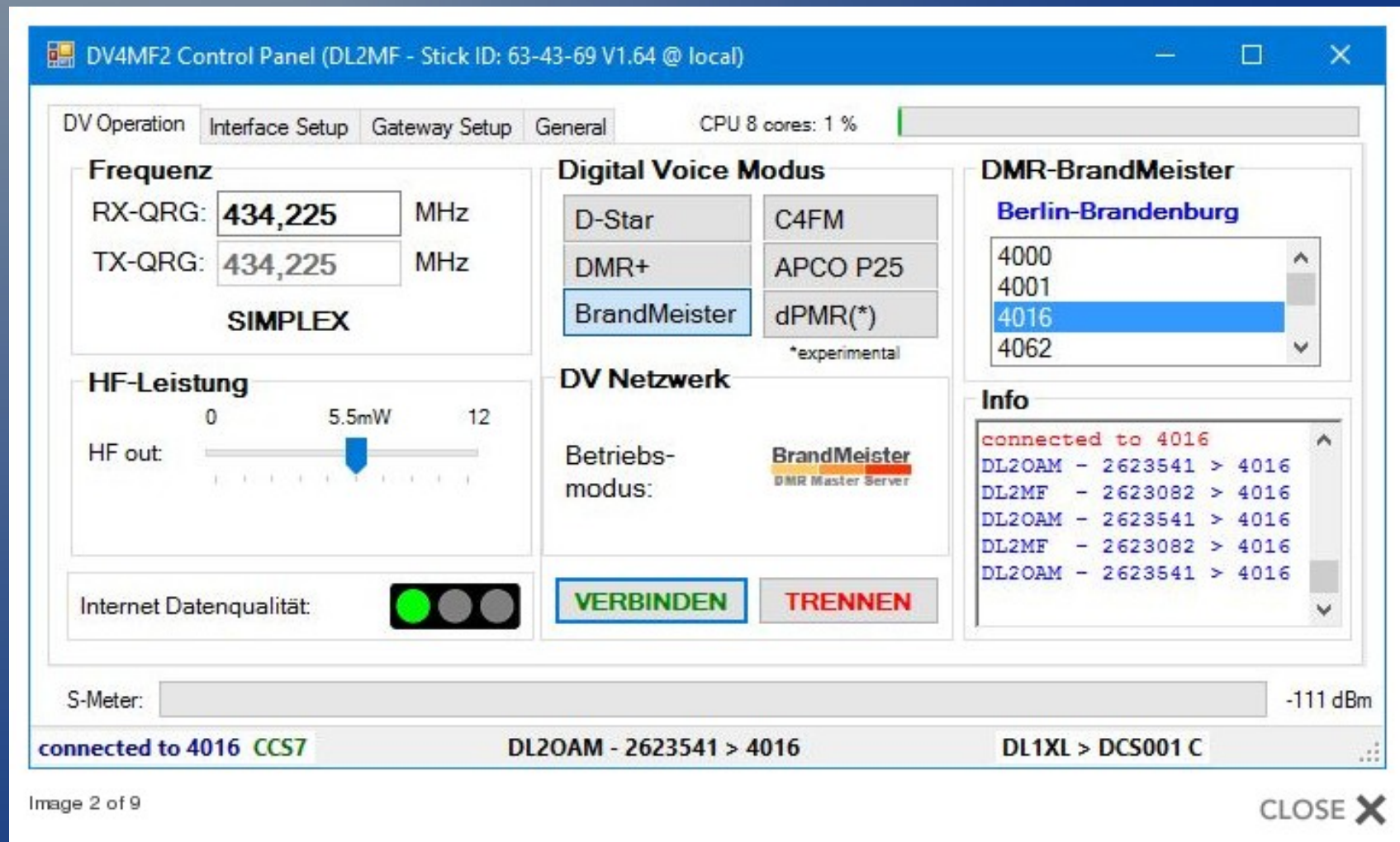
- DV4Mini – All mode 300mw dongle - *K6DGN to talk more about this device!*

New Fusion Functionality

- Mobiles: YSF frequency to auto-QSY radio
 - Monitor a specific frequency for finding nearby YSF repeaters and radio will QSY to it
 - US proposals call for 145.690 which is an EP channel in NCPA territory - W4XSC on Frazier Peak in SCC
- Repeaters:
 - Native HRI200 Direct Attach support in 1.10D
 - Tunable Squelch Hysteresis
 - Tunable ECPS shutdown codes
 - Remove PL on CW ID
 - Improved squelch tail on FM w/ PL

New Third-Party Software

- DV4MF2 multi-mode control panel for DV4Mini



New Fusion Repeaters in the Area!

- WW6BAY - Bay-Net – Black Mountain
 - 444.425 “+” 127.3 – no WiresX yet
- N6ZX – Skyline, Woodside - 145.370 “-” & 440.450 “+”
- KE6STH – AlumRock, San Jose - 443.575 “+” 110.9
 - Linked w/ Salinas Valley Group analog system
- W6RTF – Salinas - 440.700 “+” 100.0
- W6PW – San Francisco – 444.225 “+” 114.8 – low level
 - 3 more low level machines coming?
- K6BJ (maybe?) - Santa Cruz - 440.925 “+” 123.0

Join Bay-Net's YSF Net

- Join Jason K6DGN's YSF net every Sunday night at 7pm
- A classic round-table that discusses what's new in YSF and related topics (APRS, etc)
- Has been substantially growing in recent weeks as more people buy radios, etc. from South San Francisco to Gilroy! Impressive coverage from Mount Black!

Yaesu Software / Firmware Updates

- Yaesu has released DR1X 1.10D repeater firmware for full linking on 12/20/15!
 - Only on newly shipping DR1X units, will require special programming cables to upgrade existing units; still waiting on details from Yaesu
 - Requires HRI200 v1.01 firmware upgrade and Wires-X 1.10 server software
- New Wires-X v1.10 software allows full bi-directional digital QSOs via remote radios
- New FT2D 1.01 improves weak signal decodes

Challenges to Fusion's Expansion

- The Fusion ecosystem continues to evolve but it's clear it's still in infancy (aka “BETA”). It seems Yaesu is releasing updates more often to show progress but patience is required
- Several significant regressions on several recent software & firmware releases (1/18/16):
 - DR1X – 1.00m & 1.10D firmware still has TX lockup issues – new 1.00t version as of 1/20
 - Reports of tone-squelch open lockups too
 - FTM400/FTM100 – HRI-mode mode removed repeater freq offset; new 4.20 firmware fixed it but now radios TX lock up when used as Node

More Fusion Evolution

- Wires-X 1.10 Windows software – HRI-200 soundcard driver issue : Code as retracted from web after FTM400 offset issue was found and re-released but sound card problems persist
- FT991 YSF support:
 - ECPS shutdown codes not available on FT991
 - FT991 cannot receive or display DW pictures
 - No microSD slot (FT1D requires this for RX pictures or YSF messages [!APRS MSGs])
 - No connector for Camera MIC

Helpful URLs and Links

- High Traffic Mail group:
<https://groups.yahoo.com/neo/groups/YaesuSystemFusion>
- 2877 subscribers and growing!
- Yaesu's Digital Fusion Facebook page
 - <https://www.facebook.com/pages/Yaesu-C4FM-FDMA-System-Fusion>
- Live Wires-X / Fusion status
 - https://www.yaesu.com/jp/en/wires-x/id/id_usa.php
- Technical specs on the Fusion framing, etc for possible homebrewing (on Yaesu's Digital area)
- <http://www.systemfusioninfo.com/>

Even More URLs

- Technical details of C4FM, etc

http://www.cmsara.org/wp/wp-content/uploads/2015/10/Fusion-Presentation_N5WDG.pdf

Thank you!

Any Questions?

Backup Slides