

*Yaesu System Fusion*  
*Analogue FM*  
*And*  
*C4FM Digital*

## Modulation Scheme

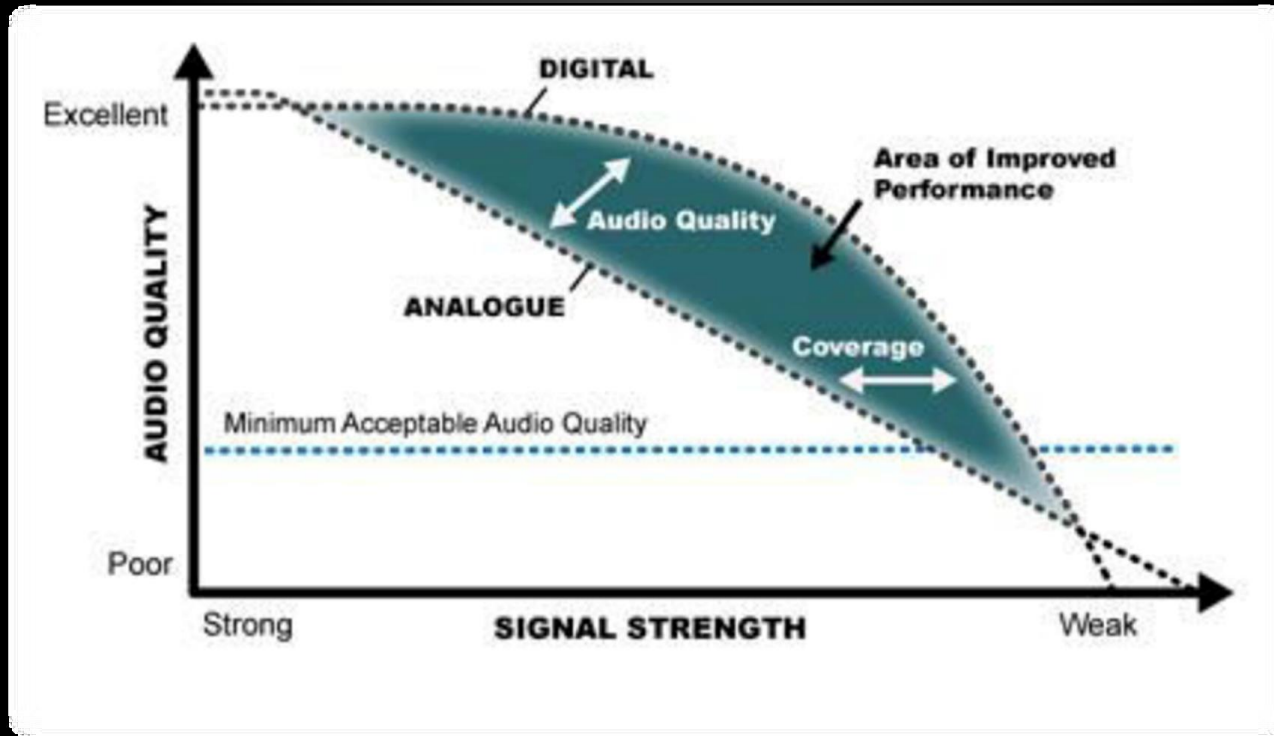
Analogue FM at +/- 5 kHz deviation and 3 kHz Max modulation frequency occupies about 16 kHz bandwidth.  $BW = 2 (\text{Peak Dev} + \text{Mod freq})$

C4FM (Yaesu's method of digital same as 4 level FSK)

At 9.6 kbps, this amounts to occupying about 12.5 kHz bandwidth.

2 bits data	Symbol	Deviation
00	+1	+900
01	+3	+2700
10	-1	-900
11	-3	-2700

# Digital Voice has Improved Signal to Noise Ratio Compared to Analogue FM



Item	Yaesu Digital	ICOM DStar
	C4FM FDMA	0.5 GMSK FDMA
Over-the-air bandwidth	12.5 kHz	6.25 kHz
Over-the-air data rate	9600 bps	4800 bps
Vocoder data rate	3.6 or 7.2 kbps	3.6 kbps
Vocoder Technology	DVS Inc AMBE+2	DVS Inc AMBE
User net-data-transfer-rate	Probably > 4.8 kbps	900 bps
Built in GPS	Yes	Yes
Direct APRS on 144.39	Yes	No
Digital voice recording	No	Yes
Micro SD card storage	Yes	Yes
Data Serial Port	Yes	Yes

*System Fusion joins Digital and Analog FM Communication into a single multiple function system.*



FT1D  
vhf/uhf  
Portable  
\$395 cdn



FT2D  
vhf/uhf  
Portable  
\$650 cdn



FTM 400 DR  
dual band  
50 W mobile  
\$840 cdn



FT 991  
hf/vhf/uhf  
base radio  
\$1770 cdn



DR-1x  
dual band  
repeater



Wires-X Internet  
Interface  
\$150 cdn

## Features common to User Equipment

- GPS Receiver built in
- Dual Band and Dual Watch Receiver (RX 2 freq's at same time)
- APRS functionality direct to APRS network on 144.39 MHz
- Automatic Mode Select on Reception for FM and Digital Voice modes
- Wide range reception, MW, SW, VHF and UHF
- Group Mode to view member in range response and geo-position
- Two digital voice mode data rates for high and higher voice quality.
- Micro SD card slot to record GPS and QSO data and store channels
- Computer programmable
- Send and record pictures via optional camera-microphone.



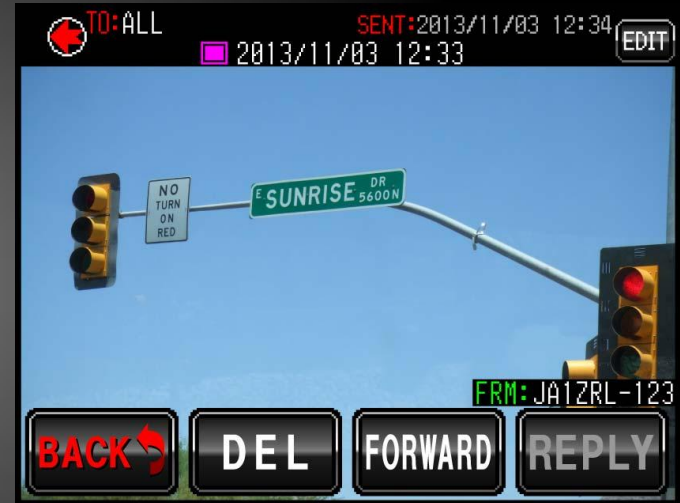
APRS Beacon plot on 144.39 from my FT1D while taking a Walk in the neighbourhood.

The screenshot shows the aprs.fi website interface. The main map displays a blue path with red dots representing beacon locations in a neighborhood. The path starts near the intersection of 34 and 55, loops through streets like Notre-Dame St, Henri-Lauzon St, and Beauséjour Dr, and ends near the intersection of 55 and 56. A search bar at the top left shows coordinates: 45°27.73' N 75°31.66' W, FN25FL. The sidebar on the right contains the following elements:

- aprs.fi · Login**
- GPS Tracking System**  
Real-Time Tracking-No Data Charges.  
Free Upgrades. Book A Live Demo Now
- Track callsign:** Clear [input field] Search ?
- Address, city or Locator:** Clear [input field] Search ?
- Show last:** 1 hour Show all
- Track tail length:** 1 hour
- VE3LC** (star icon) X
- Updated: 2015-08-30 10:11:18 (38m)
- Position: 45°27.44' N 75°31.58' W
- Year selection: 2013 2014 2015
- Other SSIDs:** VE3LC-7, VE3LC-9
- Wx: 20.4°C 80% 1018 mbar 1.0 m/s NW
- Other views:**
  - Station info
  - Raw packets
  - Status packets - Beacon packets
  - APRS/CWOP weather - Telemetry
  - Messages - Bulletin board
  - Prefix browsing
  - Google Earth KML ?

The Windows taskbar at the bottom shows the search bar and various application icons. The system tray on the right indicates the time is 10:50 AM on 2015-08-30.

## Digital Image Transmission (Data Mode)



*The MH-85A11U Camera microphone allows digital image transmission using the “Data” mode.*

**\$145 Cdn**



Pictures Taken with Yaesu Camera and transmitted to another Yaesu Portable and stored on uSD card.



Dave VE3ZZU

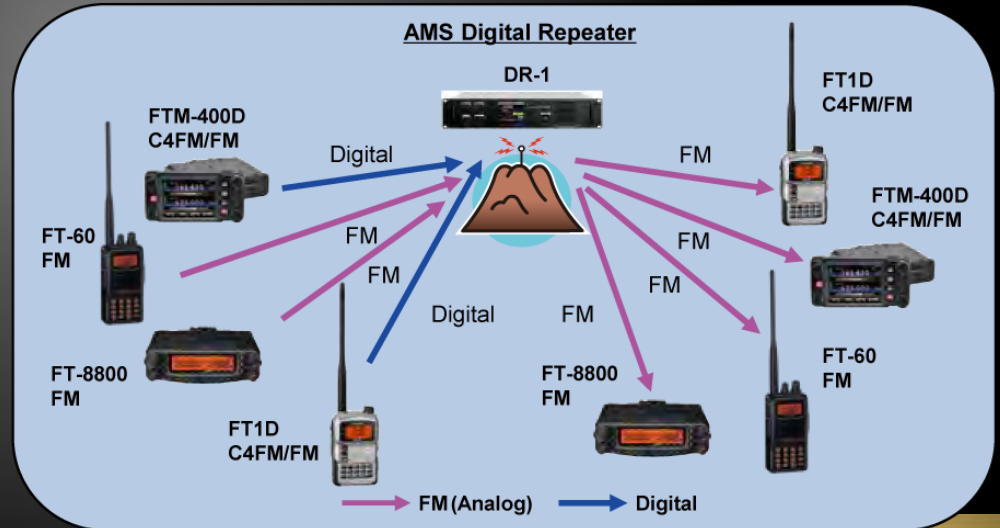
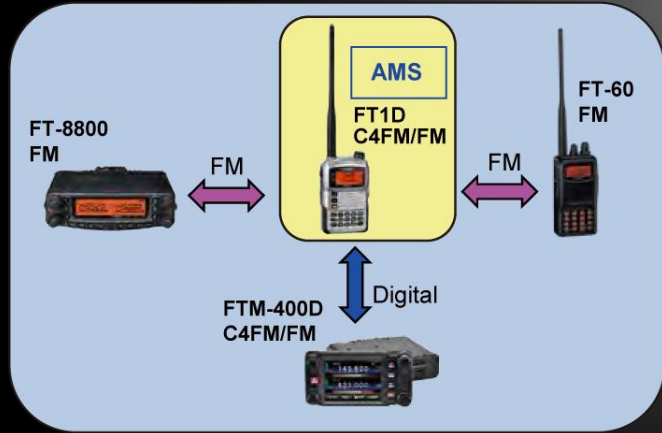


Guy VE3VCF



Richard  
VE3RNM

# AMS (Automatic Mode Select) FM Friendly Digital Easy Migration Co-existence



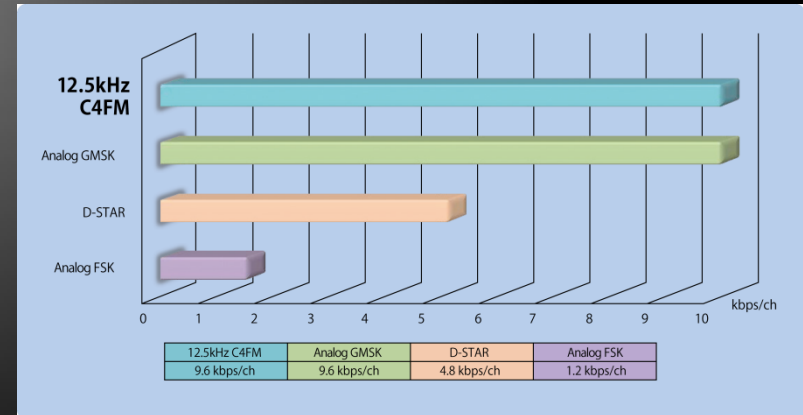
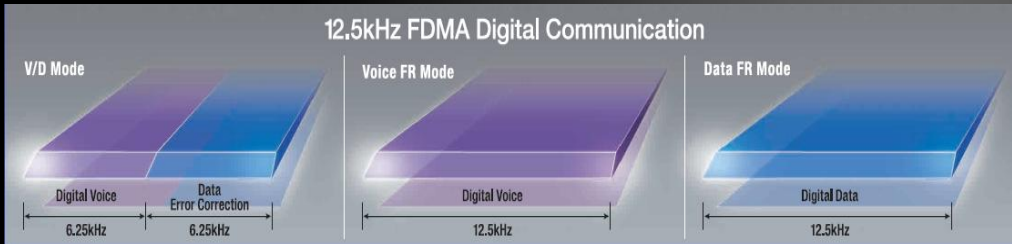
# Multiple Modes of Communication

*V/D mode - Voice/Data simultaneous communication mode*

*Voice FR Mode - Voice Full Rate Mode*

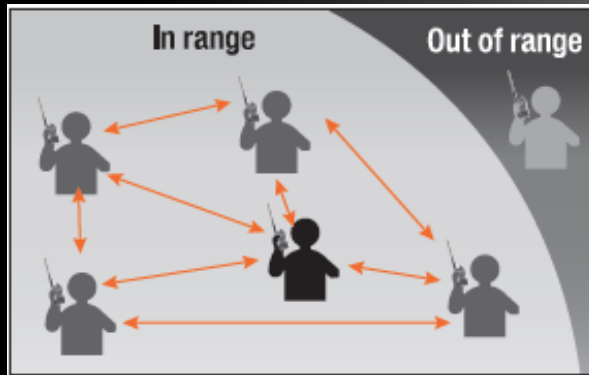
*Data FR mode - High Speed 9600 bits per second data transfer*

*Analog FM mode – For Conventional Communication*



## Digital Group Monitor (GM)

*Automatically checks whether members registered to a group are within communications range of your transceiver. The group mode screen then displays information such as the Distance and Heading for each station registered to the group.*



# YAESU

The radio

## *DR-1X Repeater – C4FM/Analog FM AMS Repeater*

*The YAESU DR-1X is a Digital/Conventional Analog FM dual mode Repeater that covers the VHF & UHF Amateur Radio bands.*

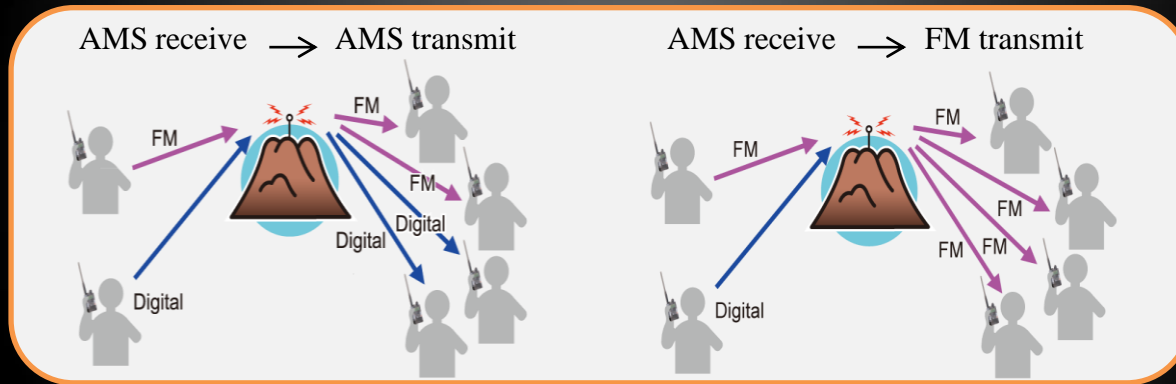
*The DR-1X was designed to co-exist in current analog environments providing the control operator with the ability to offer an exceptional Digital experience while co-existing with Conventional Analog services.*



**C4FM**  
Digital ClearVoice  
Clear and Crisp Voice Technology

## *DR-1X Repeater – Additional Features*

- *15 Pin Rear accessory connector for Standard Analog connectivity. (COR/COS, Audio IN/OUT, PTT, Inhibit)*



- *Built-in large-size monitor speaker with volume control for checking the reception state during setup. The speaker can also be used to constantly monitor the reception state*
- *A microphone terminal is provided on the front panel for use in repeater transmitter tests and to enable use as a base station*



## *DR-1 Repeater – Features*

- *Modulation Characteristics:  
25 kHz FM, 12.5 kHz C4FM Digital (V/D Mode, VFR Mode, DFR Mode)*
- *System Fusion is not compatible with D-STAR GMSK digital format*
- *Output Power: 50 W / 20 W / 5 W*
- *Large-size Heat-Sink & Cooling Fan to ensure stable Power Output and increased operating time*
- *Emergency Power Operation: Supports Emergency Battery up to 55 Amp Hour / Trickle Charger Included*

# YAESU

The radio

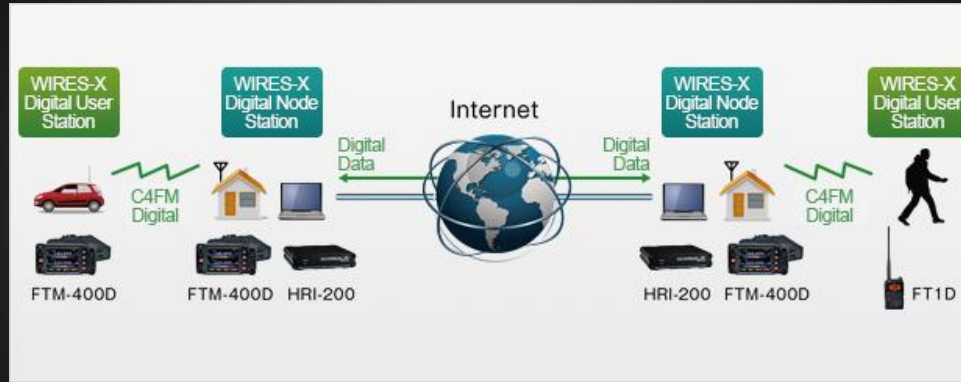
## HRI-200 Interface



- The Yaesu WIRES-X HRI-200 (Wide-coverage Internet Repeater Enhancement System) enables Internet to RF communications that expands the range of amateur radio using internet enabled Voice-over-IP technology. With WIRES-X, an amateur node station connected to the Internet and interfaced to the WIRES-X HRI-200 unit can communicate using VoIP over long distances reliably with ease.
- Unlike any other internet linking technology, Yaesu's HRI-200 is a simple to use plug and play internet linking solution. Included with the unit are pre-made cables that allow the end user to simply plug-in to any number of Yaesu radios and go; No soldering, cable building, or Router configuration required!

# WiRES-X – Digital/Analog Internet Linking

- *Digital and Analog Linking technology allows conventional FM stations to enjoy QSO's with Digital stations.*



- *The Preset Search function enables a remote station to connect the WiRES-X Node to other nodes or rooms with a simple touch of a button.*
- *News bulletins, images, location information and messages can be uploaded to the local node using the News Station Function. Information can be stored and retrieved on demand.*

Let's move onto Demonstration of Equipment

and

Q & A