

D-Star, DMR and Fusion Which One is Right for You?

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Overview

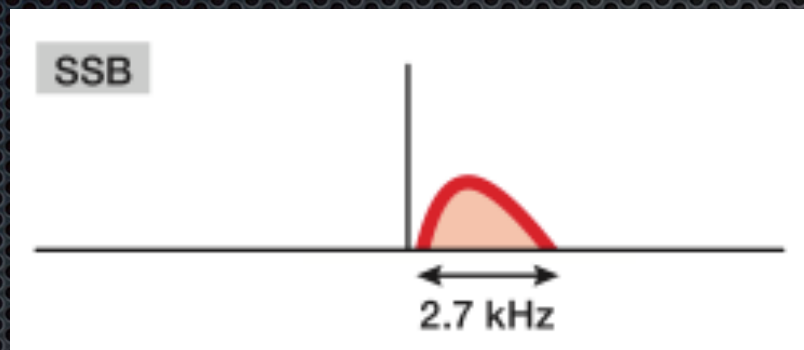
- ✦ How Digital Voice Works
- ✦ D-Star
- ✦ DMR
- ✦ Yaesu System Fusion
- ✦ Other Hardware Options



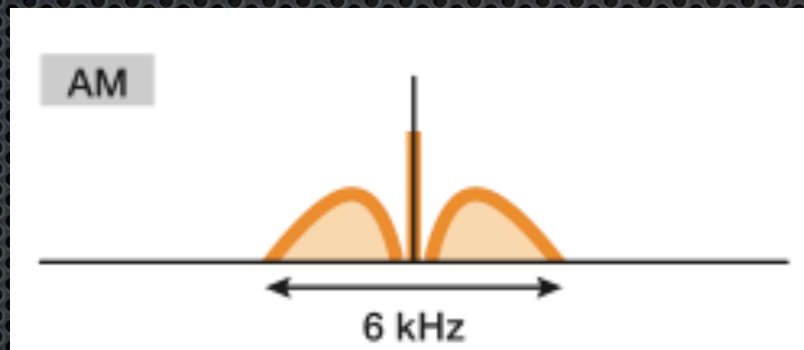
Bandwidth Review

- ✦ CW

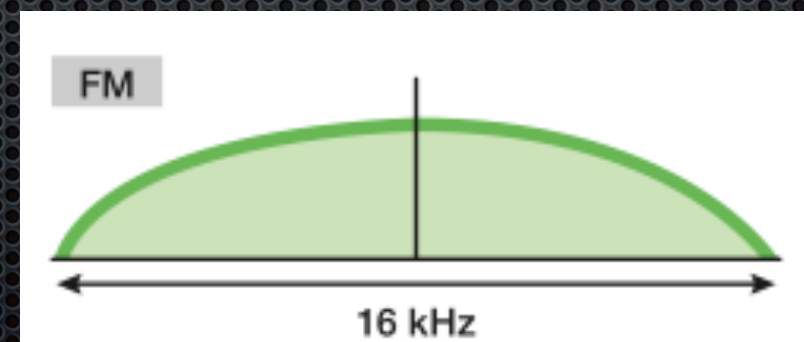
- ✦ SSB



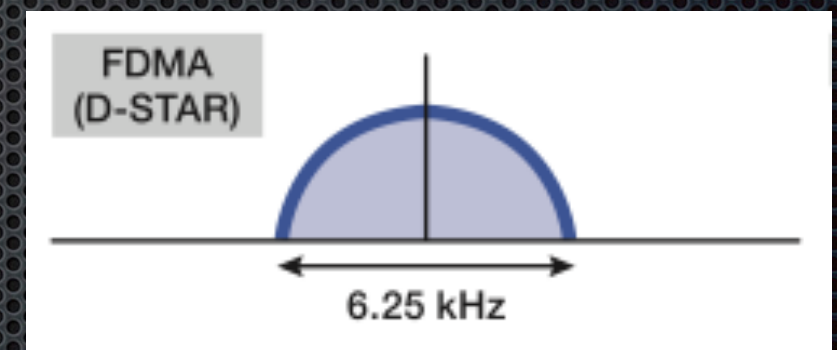
- ✦ AM



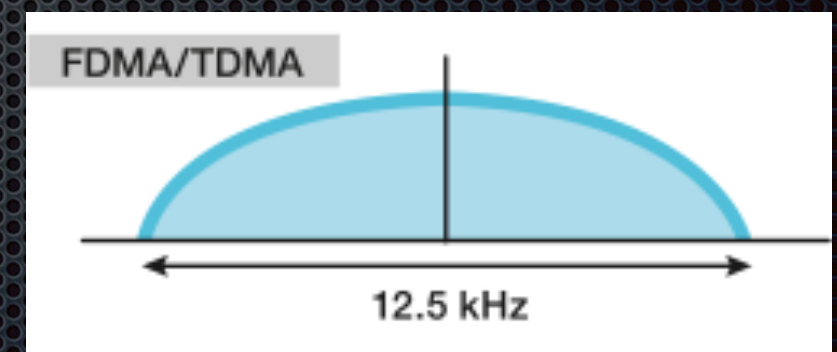
- ✦ FM



- ✦ GMSK



- ✦ TDMA



How Digital Voice Works

- ✦ Overview
- ✦ Modulation Methods
- ✦ Communication Types
- ✦ Communications Protocol/Implementation

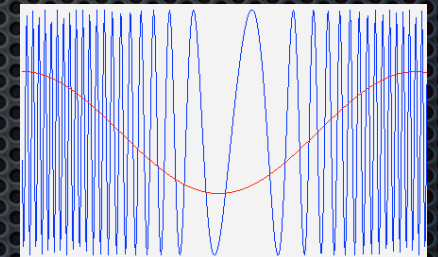
Overview - How DV Works



0101010100110
100110011010100
101001101011010
111011110101001
100010110010010
001001000010001

100110011010100

100110011010100
101001101011010
100110011010100



Audio
(Speech)
-and/or-
Data
(Photo, etc)

Analog to
Digital
Encoder/
Decoder

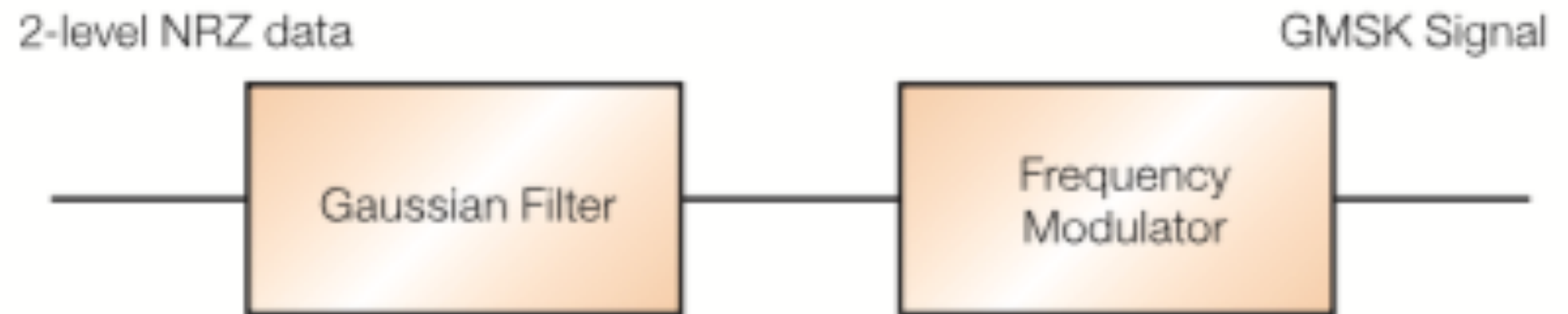
Vocoder
(typically an
AMBE chip)

Packaging/
Framing for
Modulation

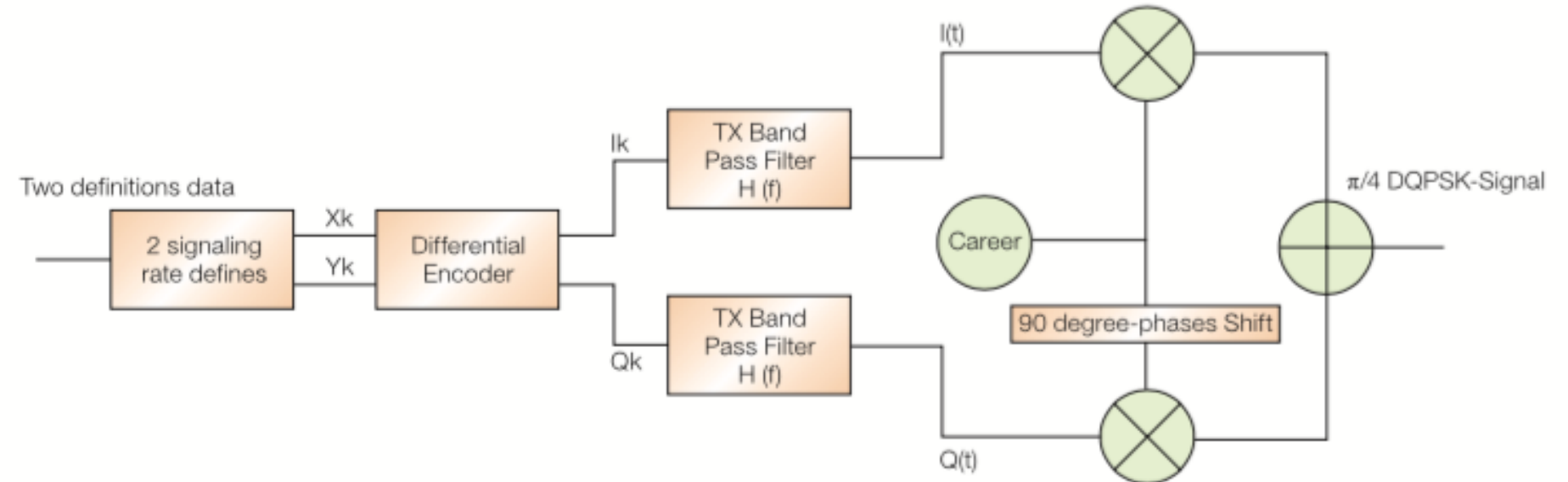
Modulation

DV Modulation Methods

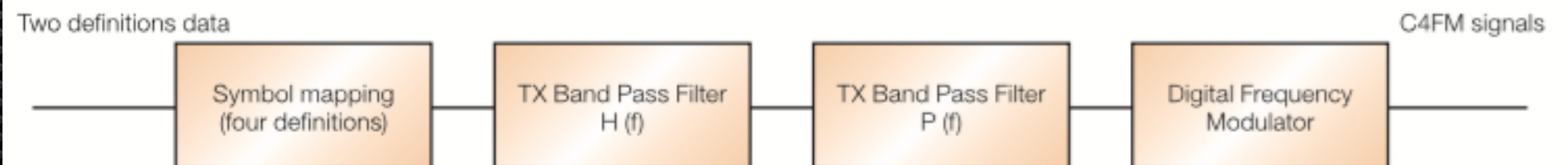
- ✦ GMSK



- ✦ DQPSK

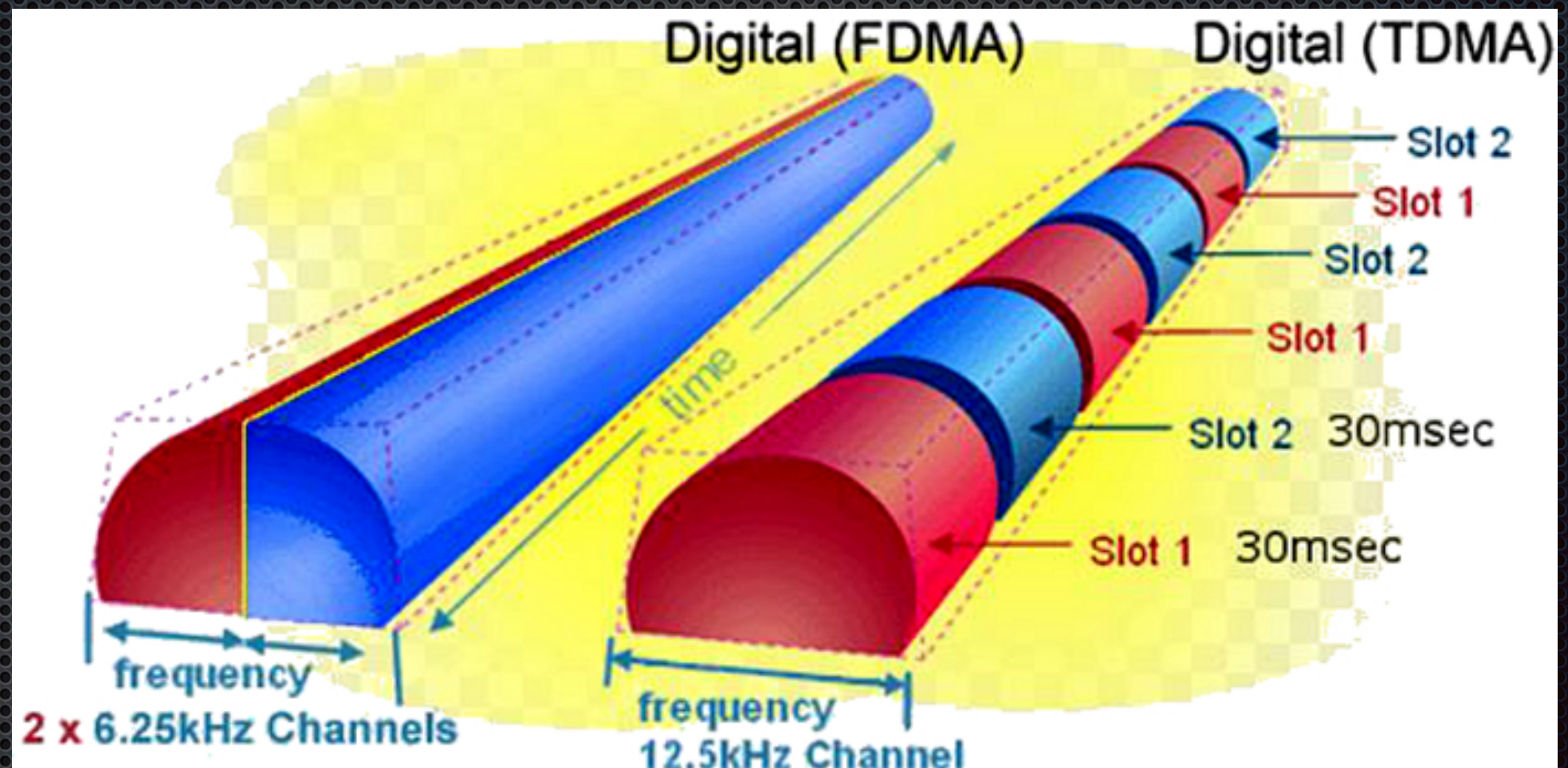


- ✦ C4FM



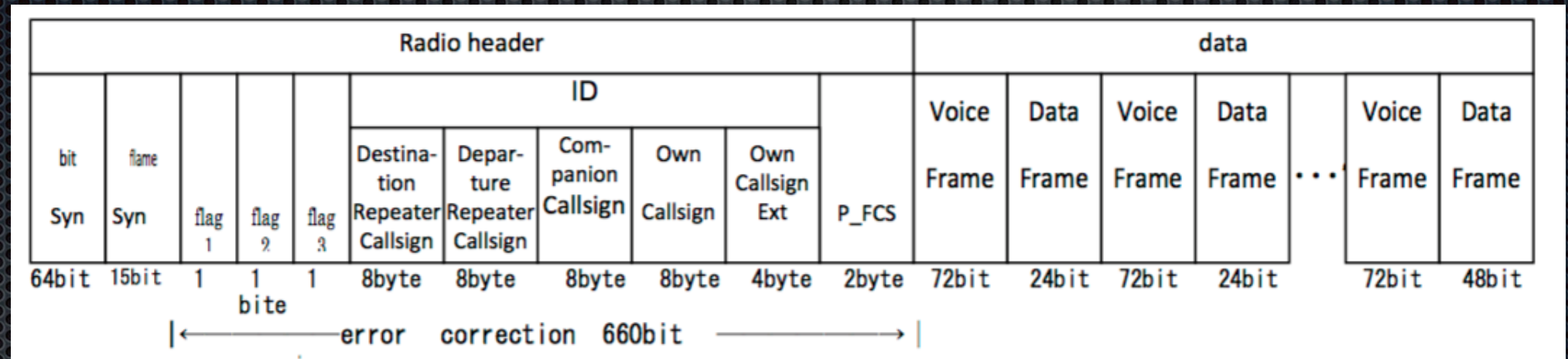
DV Communication Types

- ✦ FDMA
 - ✦ D-Star
 - ✦ Fusion
- ✦ TDMA
 - ✦ DMR

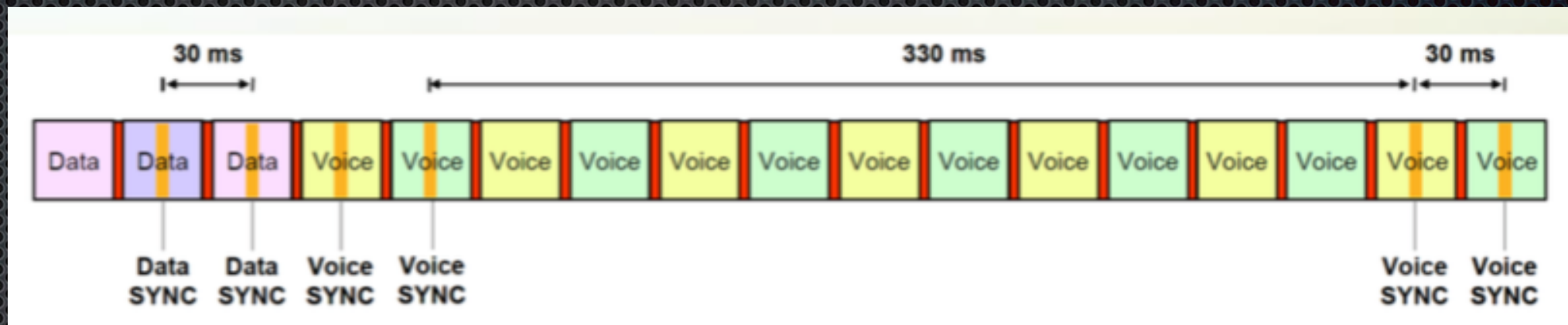


DV Communication Protocols

• D-Star



• DMR



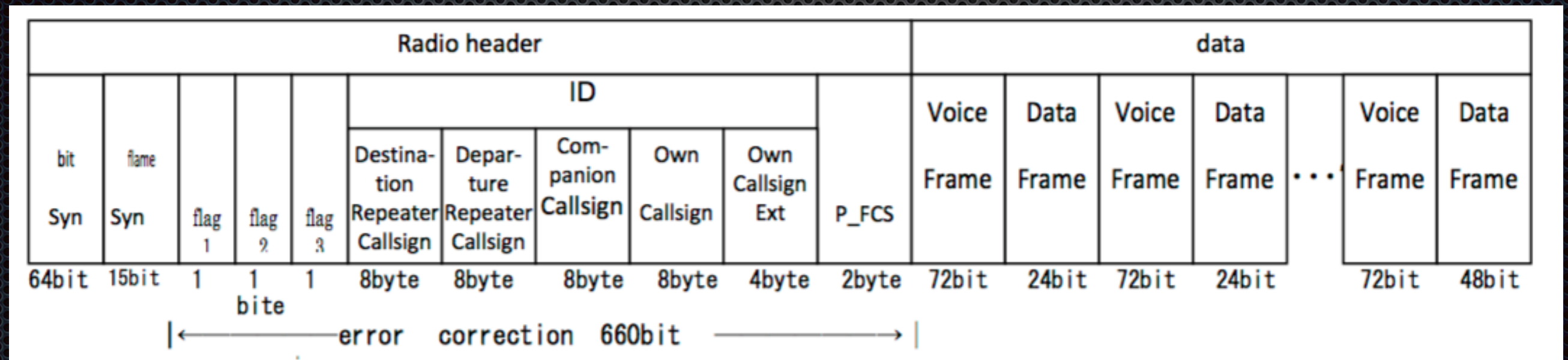
• Fusion

FS	FICH	DCH (0)	VCH (0)	VeCH (0)	DCH (1)	VCH (1)	VeCH (1)	DCH (2)	VCH (2)	VeCH (2)	DCH (3)	VCH (3)	VeCH (3)	DCH (4)	VCH (4)	VeCH (4)	Number of bits
40	200	40	72	32	40	72	32	40	72	32	40	72	32	40	72	32	Total 960 bit

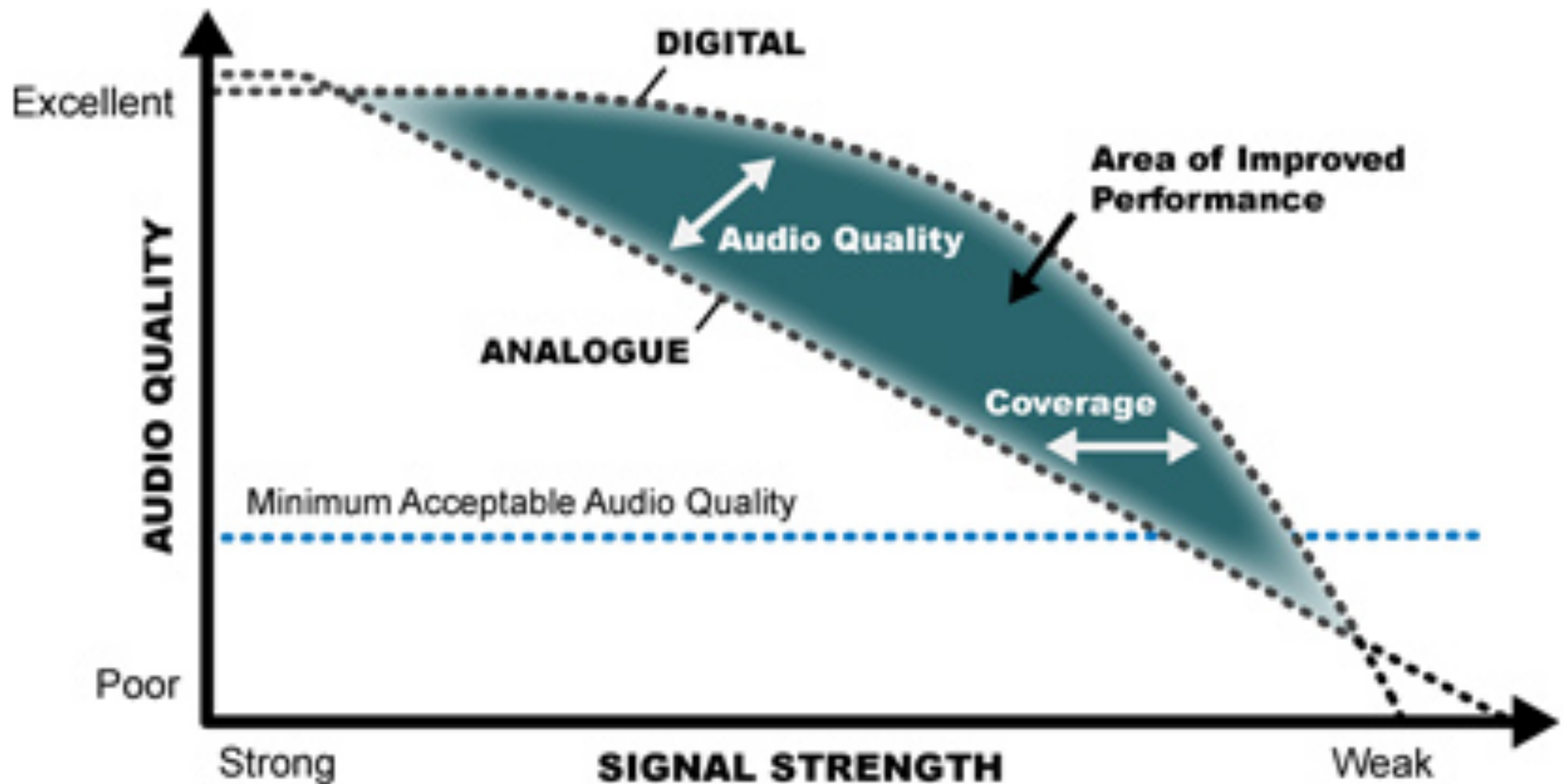
D-Star

- ✦ Digital Smart Technologies for Amateur Radio
 - ✦ D-Star Origins
 - ✦ How D-Star Works
 - ✦ How D-Star Sounds
 - ✦ Pros/Cons
 - ✦ Product Choices and Prices

How D-Star Protocol Works



Analog vs Digital Drop Off



How D-Star Sounds

To An FM User

How D-Star Sounds

N8ZAK In the Shack FM

How D-Star Sounds

N8ZAK In the Shack

How D-Star Sounds

Real World
How it Degrades

How D-Star Sounds

On the Fringe

How D-Star Sounds

Weak Signal D-Star

D-Star Pros/Cons

- ✦ Easy to Program
- ✦ Call-Sign Routing
- ✦ Lots of Infrastructure
- ✦ Voice and Data at the Same Time!
- ✦ Experimenter?
- ✦ Limited Manufacturers*
- ✦ Have to register
- ✦ Degradation
- ✦ Throw out the Manual!

D-Star Product Choices and Prices

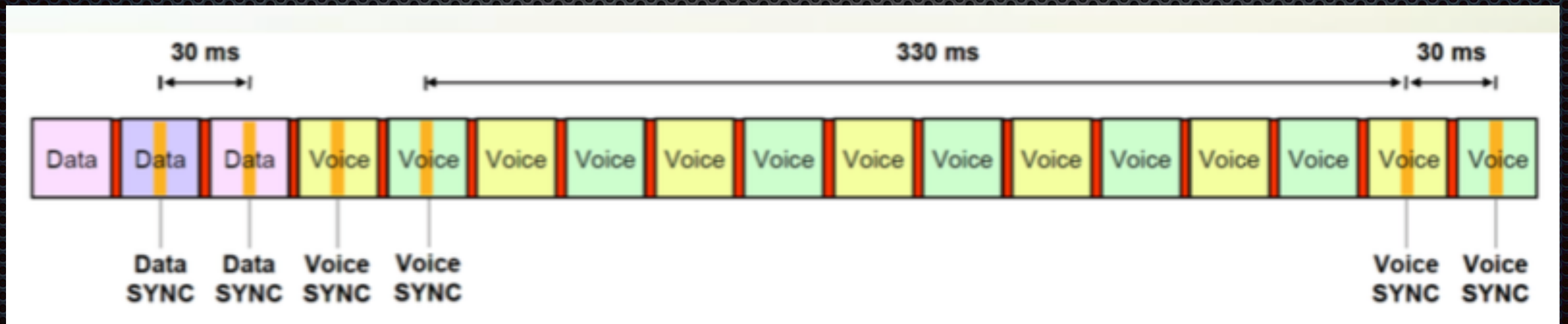
- ✦ Various Manufacturers*
- ✦ Depending on desired result pricing can range from \$200-\$1000
- ✦ ICom HT == \$375.00
- ✦ Kenwood HT == \$700



DMR

- ✦ Digital Mobile Radio
 - ✦ Origins
 - ✦ How DMR Works
 - ✦ How DMR Sounds
 - ✦ Pros/Cons
 - ✦ Product Choices and Prices

How DMR Protocol Works



How DMR Sounds

TDMA

To An FM User

How DMR Sounds

FDMA
Simplex

To An FM User

How DMR Sounds

FM vs DMR

How DMR Sounds

How it degrades

DMR Pros/Cons

- ✦ Open Protocol
- ✦ Good Sound Quality
- ✦ Degradation Recovery
- ✦ Battery Longevity
- ✦ Easy to Use*
- ✦ Cost! (New and Used)
- ✦ Impossible to Program without a Computer
- ✦ Limited Infrastructure but Growing Quickly
- ✦ Networks “In Flux”
- ✦ CallSign != DMR ID
- ✦ Terminology
- ✦ Repeater Owner in Control
- ✦ No dual band radios!

DMR Product Choices and Prices

- ✦ Many Manufacturers in the commercial space
- ✦ Depending on product pricing can range from \$125-\$1500
- ✦ TYT HT == \$125.00



Yaesu System Fusion

- ✦ Yaesu System Fusion
 - ✦ Origins
 - ✦ How Fusion Works
 - ✦ How Fusion Sounds
 - ✦ Pros/Cons
 - ✦ Product Choices and Prices

How Fusion Protocol Works

FS	FICH	DCH (0)	VCH (0)	VeCH (0)	DCH (1)	VCH (1)	VeCH (1)	DCH (2)	VCH (2)	VeCH (2)	DCH (3)	VCH (3)	VeCH (3)	DCH (4)	VCH (4)	VeCH (4)	Number of bits
40	200	40	72	32	40	72	32	40	72	32	40	72	32	40	72	32	Total 960 bit

How System Fusion Sounds

To An FM User

How System Fusion Sounds



System Fusion Pros/Cons

- ✦ Easy to Program
- ✦ Easy to Use
- ✦ Degradation Recovery
- ✦ Single Manufacturer
- ✦ Proprietary
- ✦ Repeater Capabilities
“In Flux”
- ✦ FM/Digital Capabilities
up to Repeater Owner

Fusion Product Choices and Prices

- ✦ Single Manufacturer
- ✦ Pricing ranges from \$300-\$500
- ✦ FT1XD HT == \$300.00



Other Hardware Options

- ✦ Ability to Take Existing Digital HT/Mobile and Bridge
- ✦ Purchase 3rd Party Devices
 - ✦ DVMega, DV4Mini, OpenSPOT, etc
- ✦ Hack an MD-380/Connect Systems/Baefong
- ✦ Pros/Cons
- ✦ Product Choices and Prices

Other Hardware Choices and Prices

- ✦ Multiple Manufacturers
- ✦ Pricing ranges from \$125-\$300
- ✦ Requires additional equipment, computer and Internet connection



Other Hardware Pros/Cons

- ✦ Makes it possible to bridge networks using existing DV radio
- ✦ Save money!
- ✦ No notable quality differences (receiving party does know)
- ✦ Difficult to make portable
- ✦ Knowledge of Firewall and Port Forwarding Needed
- ✦ Difficult if you travel
- ✦ Computer needed to configure

Summary

- ✦ Explained how Digital Voice communication works
- ✦ Explained and Demonstrated Popular DV Modes
 - ✦ DMR, D-Star, Fusion
- ✦ Other Hardware Options
- ✦ Thank You
- ✦ Questions?



D-Star External Websites

- ✦ <http://www.dstarinfo.com>
- ✦ <http://www.icomamerica.com>
- ✦ <http://www.dstarusers.org>
- ✦ <http://www.dstar101.com>
- ✦ <http://www.dstarinfo.com/dstar-web-calculator.aspx>
- ✦ [http://www.tmrahamradio.org/D-STAR for Dummies v4.pdf](http://www.tmrahamradio.org/D-STAR%20for%20Dummies%20v4.pdf)

DMR External Websites

- ✦ <http://www.dmr-marc.net>
- ✦ <http://brandmeister.network>
- ✦ <http://hose.brandmeister.network>
- ✦ <http://www.va3xpr.net>

Fusion External Websites

- ✦ https://www.yaesu.com/pdf/System_Fusion_Text.pdf
- ✦ <https://www.yaesu.com/jp/en/wires-x/index.php>
- ✦ https://www.hamoperator.com/Fusion/FusionFiles/WB7OEV-Fusion-PDF-0018_WiRESX-Install.pdf