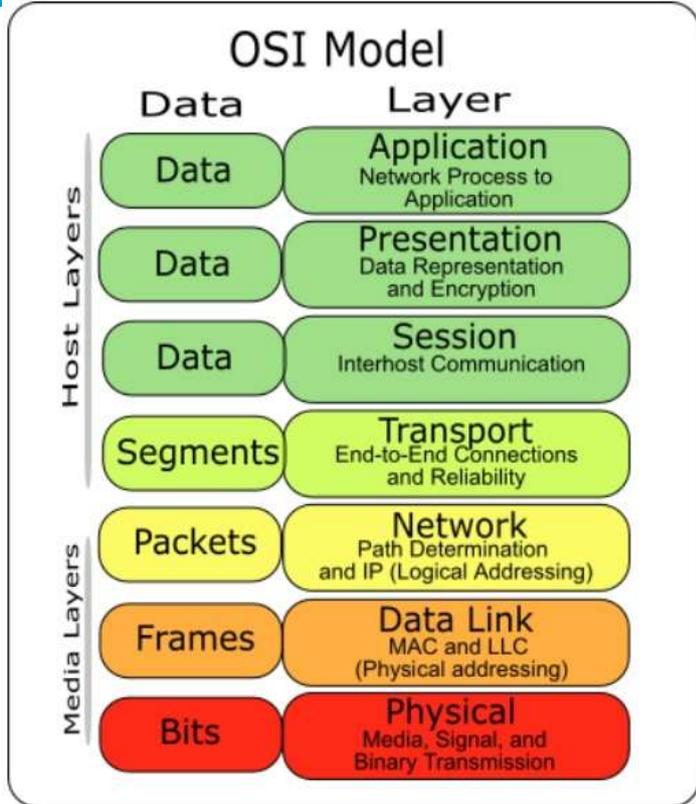


AX.25 Part 2:
Using AX.25 and VARA-FM
Comparison / Contrast
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Two Protocols: Very Different

	AX.25	VARA-FM
Speed	Slow	FAST
Channel	Multi-User	Single-User
Error Handling	Listen-before-transmit ARQ (Acknowledge/Request)	ARQ (Acknowledge/Request)
Specification	Non-Proprietary Protocol Version 2.2 https://www.tapr.org/pdf/AX25.2.2.pdf	Proprietary, Commercial, Single-Source (EA5HVK)
Price	Free	\$69
TNC Software	Soundmodem: http://uz7.ho.ua/modem_beta/soundmodem114.zip Direwolf: https://github.com/wb2osz/direwolf/releases	https://rosmodem.wordpress.com/ (Both HF and VHF/UHF versions)
Higher Level Software Applications that Use:	Windows: Winlink, Easyterm (QSO software) Linux: PAT Thousands of older packages	Windows: Winlink and now VARA-C (QSO software)
Connection Capabilities	Digipeating (lots) Connections (unlimited)	Digipeating (2)

The Layered OSI Model for Networking



REF: [https://inst.eecs.berkeley.edu/~ee123/sp17/lab/lab5/Lab5_Part_2-Audio_Frequency_Shift_Keying\(AFSK\).html](https://inst.eecs.berkeley.edu/~ee123/sp17/lab/lab5/Lab5_Part_2-Audio_Frequency_Shift_Keying(AFSK).html)

Last month we discussed the Physical layer

AX.25 – listens before transmit, elaborate system for MINIMIZING collisions

VARA- FM – no such system. It just blurts out packets!!

Differences in Capabilities

TCP/IP
("Internet")

A specific PORT used by one program on your computer	Your home network	Your home router	Cox Cable	Zillions of intermediate routers!	Amazon.com	Specific computer at amazon	Specific port that handles <i>https</i> : credit card payments
WINLINK Application AX.25 Session	Your Radio (Callsign) (node)	<p>May digipeat or connect through 1, 2 or more intermediate radios</p> <p> </p> <p>AX.25 knows ROUTES between callsigns</p> <p>Multiple stations allowed on channel simultaneously.</p> <p>Nodes Broadcasts</p>			Their Radio (Callsign) (node)	Friend's Peer to peer Application AX.25 Session	
WINLINK Application VARA-FM Session	Your Radio (Callsign)	<p>May digipeat through 1 or 2 intermediate radios</p> <p>SINGLE USER CHANNEL AT A TIME</p>			Their Radio (Call sign)	Friend's Peer to Peer Application VARA-FM Session	

Ham Radio
AX.25 for
WINLINK

Ham Radio
VARA-FM for
WINLINK

Layers of AX.25

OSI MODEL	IP MODEL	AX.25 MODEL
Application Layer	Application Layer e.g. User Protocols such as TELNET, FTP, SMTP Support protocols such as DNS, BOOTP, RARP, SNMP	WINLINK or EASY TERM or Any Other Application
Presentation Layer		
Session Layer		
Transport Layer	Transport Layer Provide end-to-end comm. services e.g. TCP (reliable comm between <i>ports</i> of one computer to <i>ports</i> of another) and UDP - connectionless "datagram" transport from a port on one computer to a port on another, no guarantees	
Data Link Layer	Internet Layer IP numbers, no guarantee	AX.25 Establishes error-free connections between "nodes" (possibly via other nodes)
Physical Layer	Media Access Layer - e.g. wired ethernet, or WIFI	Bell 202 Tones

VARA

- VARA attacks a much simpler goal. Station to Station, single use of the channel (generally)
- VARA makes modulation adjustment MUCH EASIER...
- Additions to VARA are chipping away at the capabilities of other systems such as Packet conversations, Winlink file transfer, and JS8 message caching

VARA FM Setup -1

Select your soundcard input/output (so you use the RADIO and not the computer speakers!)

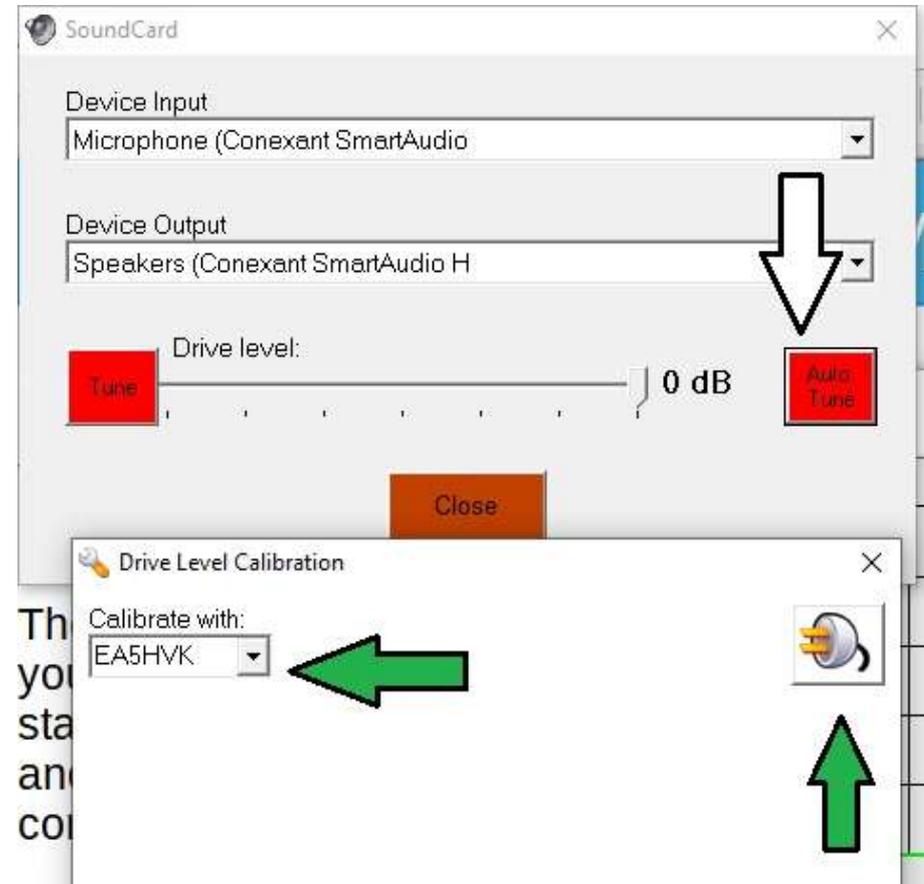
Then select the station you want to reach the standard winlink way, and direct or digipeater connection.

The screenshot displays the VARA FM Winlink Session - NF4AC interface. The main window shows connection settings: Connection: Direct, via [blank], Freq.: 0.000, Range: [blank], Bearing: [blank]. The status bar indicates 'In: 0/0 Out: 0/0 0/0 Disconnected Time to next Autoconnect = Disable'. A settings dialog box is open, titled 'VARA FM v4.2.6 NF4AC', with a message: 'Settings: Soundcard - pick your INPUT and OUTPUT sound device properly.' The dialog also features a graph and several gauges: VU (Audio Input: -89 dBFS), CPU (CPU Usage: 15%), TX Delay, and S/N. The status bar at the bottom shows 'RX Disconnected', 'Date: 2018/05/22 16:52', 'From: SERVICE', and 'To: NF4AC'. A list of contacts is visible on the left side of the interface.

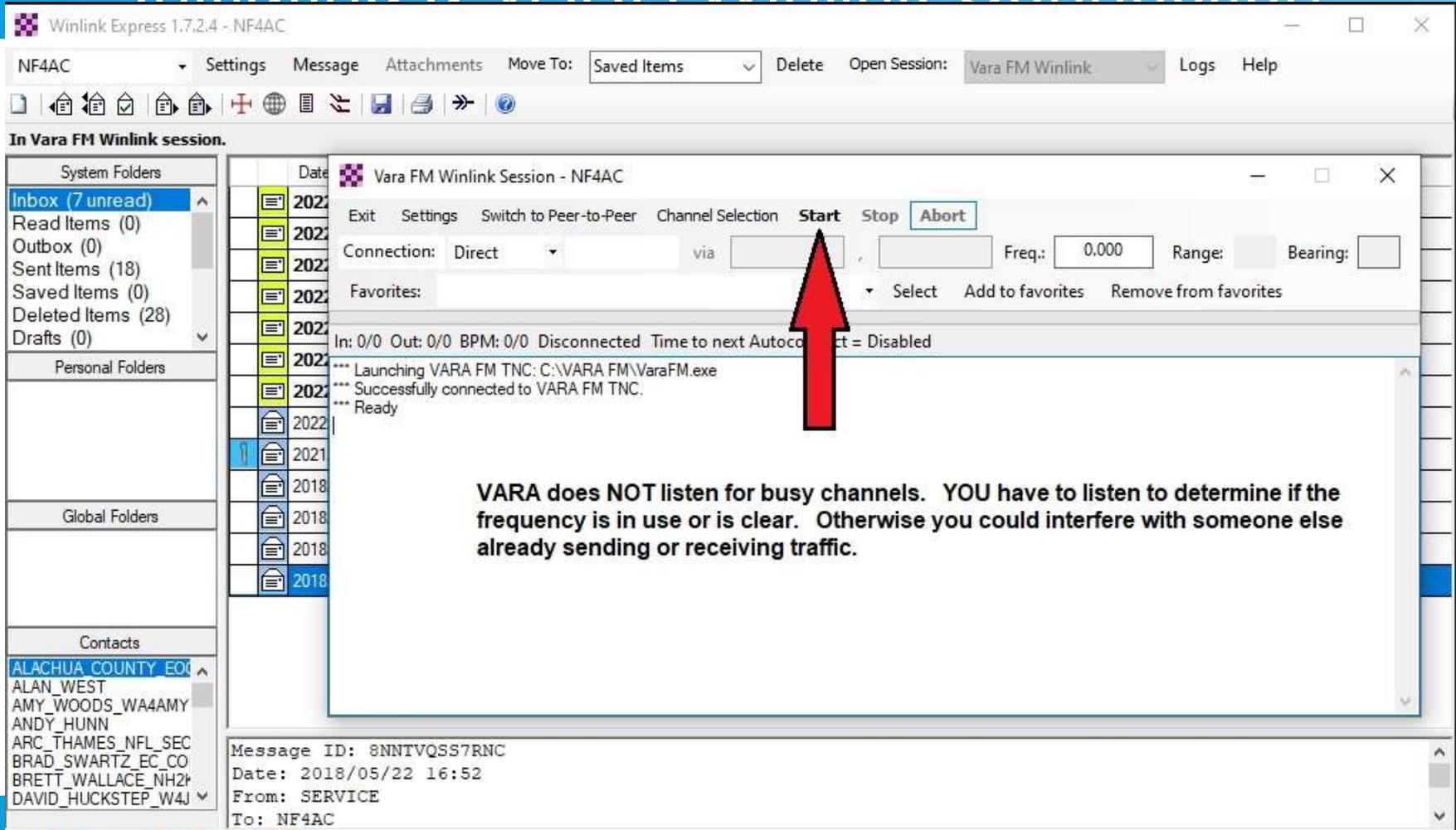
Select DIRECT or DIGIPEATER options (for digipeater, select one or two VIA stations)

VARA FM will help you set TX / RX levels!

- Auto-Tune option
- Insert Station to contact
- Press AUTO TUNE
- System will try 10 different signal levels and set the optimal level.
- (The lower levels probably won't even activate the signalink properly)



Initiating a VARA Winlink Connection



The screenshot shows the Winlink Express 1.7.2.4 - NF4AC interface. The main window is titled "In Vara FM Winlink session." and contains a sidebar with folders (System, Personal, Global, Contacts) and a main pane with a date list and a session window. The session window, titled "Vara FM Winlink Session - NF4AC", has a menu bar with "Exit", "Settings", "Switch to Peer-to-Peer", "Channel Selection", "Start", "Stop", and "Abort". Below the menu bar, there are fields for "Connection: Direct", "via", "Freq.: 0.000", "Range:", and "Bearing:". A red arrow points to the "Start" button. The session window also displays "In: 0/0 Out: 0/0 BPM: 0/0 Disconnected Time to next Autoc...", "*** Launching VARA FM TNC: C:\VARA FM\VaraFM.exe", "*** Successfully connected to VARA FM TNC.", and "*** Ready".

VARA does NOT listen for busy channels. YOU have to listen to determine if the frequency is in use or is clear. Otherwise you could interfere with someone else already sending or receiving traffic.

Message ID: 8NNTVQSS7RNC
Date: 2018/05/22 16:52
From: SERVICE
To: NF4AC

AX.25 Winlink Connections

AX.25 is similar but...

Requires separate program (soundmodem or direwolf)

Soundmodem won't set your modulation for you. You have to LISTEN on another radio to make sure it is reasonable. There are more check boxes and settings....
<https://www.qsl.net/nf4rc/UnderstandingAudioChannelConfiguration.pdf>

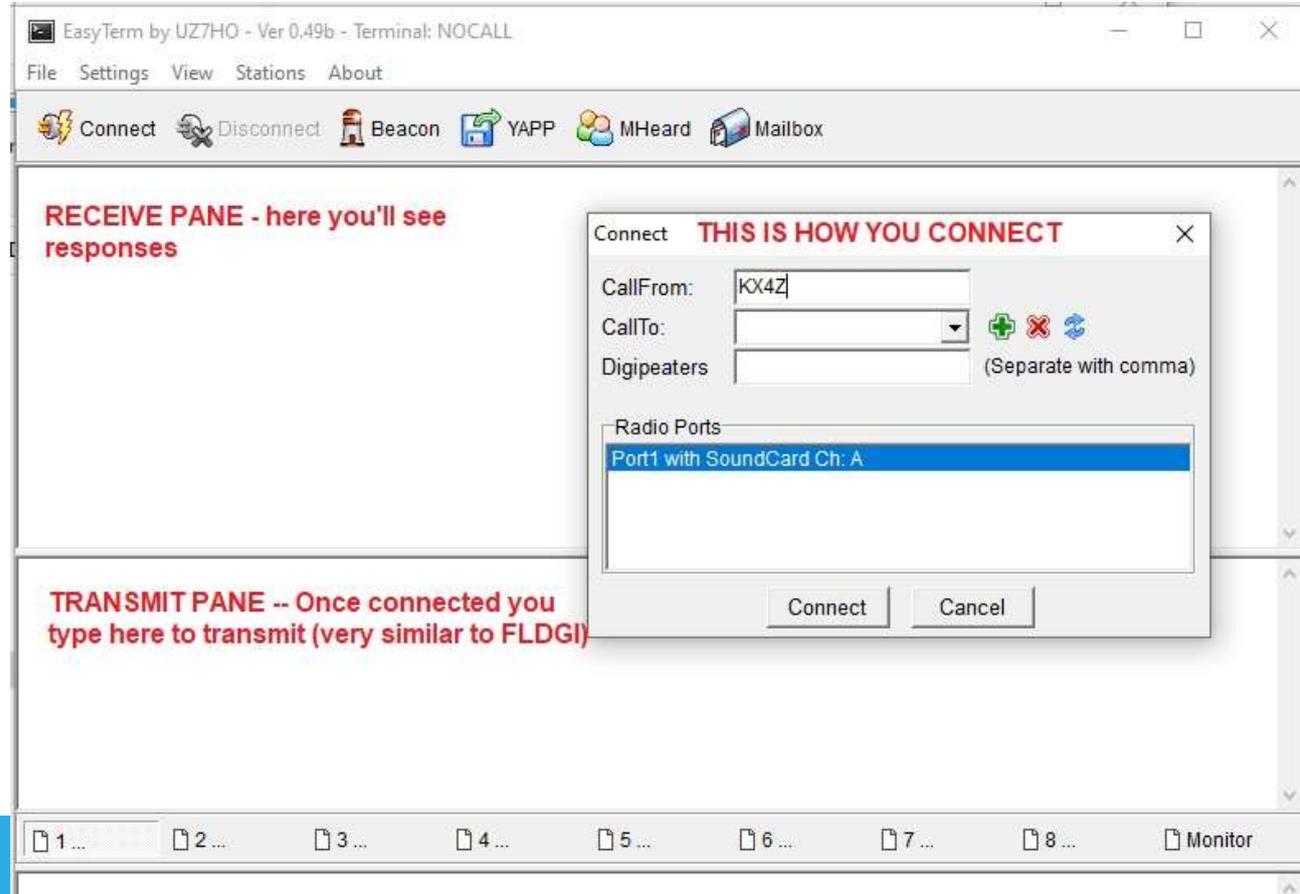
The screenshot displays the Winlink Express 1.7.2.4 - NF4AC interface. The main window shows a message list with columns for Date/Time, Message ID, Size, Source, Sender, Recipient, and Subject. The selected message is from SERVICE to NF4AC, dated 2022/11/10, with Message ID AW59YZ3BY... and size 459. Below the message list, the 'Packet Winlink Session' settings are visible, including 'Connection type: Direct', 'NF4RC-10', and 'Via W4DFU-8'. The 'Time to next Autoconnect' is set to 'Disabled'. A log window at the bottom shows the session initialization process: 'Starting WL2K packet session...', 'Initializing KISS over TCP Host 127.0.0.1 Port 8100', 'Initialization complete', and 'Ready'. To the right, a 'SoundModem by UZ7HO - Ver 1.14 - [AFSK AX.25 1200bd]' window is open, showing settings for 'A: [AFSK AX.25 1200bd]', '1707', and 'DCD threshold'. The taskbar at the bottom shows 'wsjtx', 'VLC media player', and 'Audacity'.

System Folders	Date/Time	Message ID	Size	Source	Sender	Recipient	Subject
Inbox (7 unread)	2022/11/10 0...	AW59YZ3BY...	459	SYSTEM	SERVICE	NF4AC	Undelivered
Read Items (1)	2022/11/10 0...	4IPSG9K6W4HI	460	SYSTEM	SERVICE	NF4AC	Undelivered
Outbox (0)	2022/11/10 0...	HR4M7KDA3...	458	SYSTEM	SERVICE	NF4AC	Undelivered
Sent Items (1)	2022/11/10 0...	85D5TC38IFYR	458	SYSTEM	SERVICE	NF4AC	Undelivered
Saved Items	2022/11/10 0...	FPF21AW90Y...	459	SYSTEM	SERVICE	NF4AC	Undelivered
Deleted Items	2022/11/10 0...						
Drafts (0)	2022/11/10 0...						
Personal Folders							
Global Folders							
Contacts							

AX.25 does much more than WINLINK

Easyterm (“term”) allows easy QSOs

- Also includes ability to transmit files via “YAPP”



AX.25 Features

- **NODES:** stations (identified by callsigns) are NODES. KX4Z as well as any SSID from 1 to 15 KX4Z-1, KX4Z-2 etc..
- **ROUTES:** AX.25 nodes (at least in BPQ software) keep track of “routes” to reach all the nodes they have ever heard.
- **PORTS:** In BPQ software, you can have “ports” somewhat similar to TCP/IP ports. Limited number. E.g. Port 6 might be a radio on 145.030, and port 7 might be a radio on 145.070.
- **CONNECTIONS** – must specify which PORT to use.
- **CONNECT 7 NF4RC-10**
- Shortened version: **C 7 NF4RC-10**

Nuts & Bolts Keyboard Connections

- Connecting to a BPQ AX.25 node using a keyboard-type program such as Easyterm allows you to interact directly with another ham...or with the node itself.
- Typically the node will offer you multiple options:
- CONNECT RMS NODES ROUTES MHEARD...and maybe more
- C = allows you to connect to a more distant node from this one
- RMS = allows you access to WINLINK
- NODES = lists all nodes this node knows about
- ROUTES = shows all the ways this node can connect to others
- MHEARD – allows you to see what this node has heard

Digipeating....versus Connecting

- Digipeaters in AX.25 pass packets along...even if they are corrupt.
- Recipient has to send back a request all the way back to the beginning when a packet is received corrupted. Wasteful.
- AX.25: You can CONNECT from one node to another, do it over and over, and reach stations MANY nodes away....
- And at every node, the packets are CHECKED and requests made immediately. More Efficient. Unclear how VARA compares.

New Twist: VARA-C Adds QSO Capability

3rd Party VAR-AC now adds features of multiple products-

QSO capability
Email (limited)
File transfer

VARA isn't as "low-signal" as JS8....
But it will be far far better than VOICE
And a good choice for fun radio QSO's

The screenshot shows the VarAC by 4Z1AC (V6.3.3) interface. Key features and annotations include:

- Connect Button:** A red box highlights the 'Connect' button in the top left control panel.
- Stations Heard:** A red box highlights the 'STATIONS HEARD - Similar to JS8 / FT8 / FLDGI' section in the top right.
- Call CQ:** A red arrow points to the 'CALL CQ' button in the center control panel, with the annotation 'CALL CQ - similar to FT8'.
- Broadcast and Mail:** A red box highlights the 'BROADCAST' and 'SEND VMAIL' buttons in the bottom right control panel, with the annotation 'Includes FILE and "mail" capabilities' and 'BROADCAST -- allows NET communications like JS8 or FLDGI'.
- TX Delay Gauge:** A circular gauge at the bottom right shows 'TX Delay'.
- Status Bar:** At the bottom, it shows 'Audio Input: -62 dBFS' and 'CPU Usage: 20%'.

Lots of Options

	BEST IN CLASS	RUNNERS UP
Best SPEED	VARA <i>modulation</i> , hands down (on HF: Pactor IV)	
Best FILE TRANSFER	WINLINK or YAPP or VARA-C	
Best distant EMAIL	WINLINK	
Best LOW SIGNAL	JS8Call, on SSB, hands down.	Nothing on FM will come close because of how FM works
Best casual QSO's	HF VARA-C will probably eclipse JS8 just because it is faster Can't really see this becoming an FM thing!	HF JS8 will work for more QRP stations
Best FM (text) NETS	VARA-C, via new broadcast mode, hands down	You can do it with AX.25 but difficult.

- The End!