SSTV

IMAGES VIA RADIO!

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Ohio Section Technical Coordinator

TECHNICAL COORDINATOR

The ARRL Technical Coordinator (TC) is a section-level official appointed by the Section Manager to coordinate all technical activities within the section.

- Supervise and coordinate the work of the section's Technical Specialists (TS).
- Refer amateurs in the section who need technical advice to local TS.
- Encourage amateurs in the section to share their technical achievements with others through the pages of QST, at club meetings, hamfests, and conventions.

TECHNICAL COORDINATOR

- Be available to assist local technical program committees in arranging suitable programs for local club meetings, ARRL hamfests, and conventions.
- Promote technical advances and experimentation at VHF/UHF and with specialized modes, and work closely with enthusiasts in these fields within the section.

TECHNICAL SPECIALIST

For a section team to be effective in one of the most important arenas in Amateur Radio, technology, there must be a cadre of qualified, competent Technical Specialists (TS).

"Advancement of the radio art" is a profound obligation we incur under the rules of the FCC.

TSes help meet this obligation.

TECHNICAL SPECIALIST

TS supports the TC in two main areas of responsibility: **Radio Frequency Interference** and **Technical Information**.

Technical Specialist can specialize in certain specific technical areas, or can be generalists.

http://www.arrl.org/technical-specialist

OUTLINE

- About SSTV & History
- SSTV Modes
- Image Comparison
- Signal Analysis
- Software & Modern Interfaces
- Slant
- QSO & Frequencies
- Finding out more
- MMSSTV Tutorial
- LIVE Demo!!!

SSTV...

...stands for Slow-Scan TV.

Transmission and reception of static images
via radio,
in color or black and white.

SSTV...

- Line-by-line progression scanning and transmitting of a single image.
- Downloading images in the dial-up days of the Internet.
- Utilizes 3 KHz bandwidth.
- Transmission length varies depending on mode.
- Considered a digital mode, operated in voice portion of many bands.
- 100% duty cycle on SSB.

IN CONTRAST TO...

FSTV

- Fast-scan TV aka HamTV, ATV.
- 25-30 frames per second.
- Utilizes 6 MHz wide channels.
- Broadcast TV.

DIGITAL SSTV

- DRM - Digital Radio Mondiale.
- File transfer protocol.
- Error correction.

Though similar names, completely different.

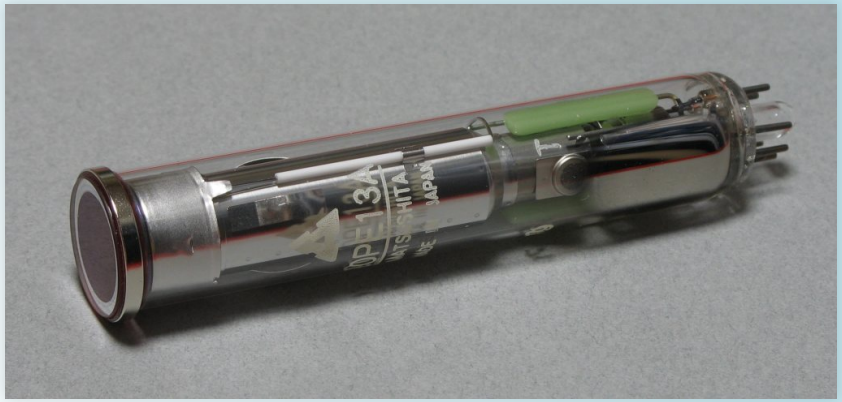
HISTORY

- SSTV developed by Copthorne Macdonald (now VY2CM) in 1957.
- In University of Kentucky Engineering Library, came across Bell System Technical Journal about image transmissions using ordinary phone lines.
- Could this be adopted to ham radio?
- Feasibility study to EE Department head, independent study.
- Ordered surplus CRTs and power transformers from surplus houses like **Fair Radio Sales** **in Lima, Ohio**.

img: ARRL

HISTORY

- Used an electrostatic monitor and vidicon tube.
- Vidicon tube: video camera tube (CRT type).
- Target material is a photoconductor.
- Popular 1970 - 1980.
- Obsolete by CCD and CMOS sensors.

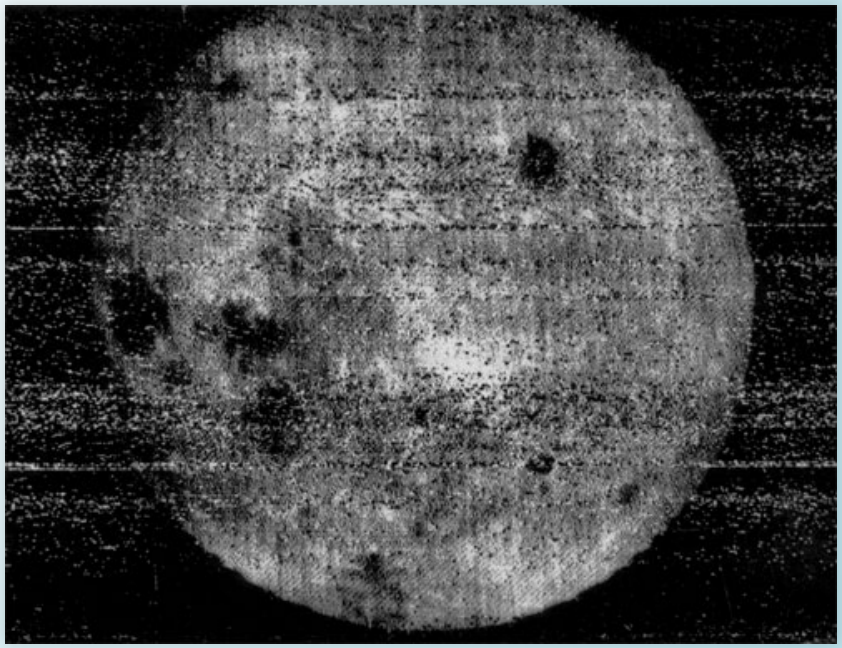


- Early SSTV images... 120 lines, 120 pixels per line.
- Black-and-white.
- 3 kHz of bandwidth.

source & img: Wikipedia

SPACE EXPLORATION

- SSTV used alot in early space exploration.
- No effective way transmit images to ground stations from spacecrafts.
- Luna 3 was launched in 1959.
- Third space probe sent toward moon.
- First ever photographs from far side of the moon.
- Poor quality images, never-before-seen views of the far side.



source & img: Wikipedia

SPACE EXPLORATION

- **Vostok 1/Sputnik 5**: space dogs Belka and Strelka (10 frames/sec, 100 lines).
- **Vostok 2**: 400 line resolution.
- **Krechet**: 2nd generation added overlay data.
- **Faith 7 (Mercury-Atlas 9)**: 1 frame every 2 seconds.
- **Apollo 7, 8, 9, and 11**: 10 frames/sec, 320 lines - TV.
- More like broadcast TV systems.

Strelka Exibit

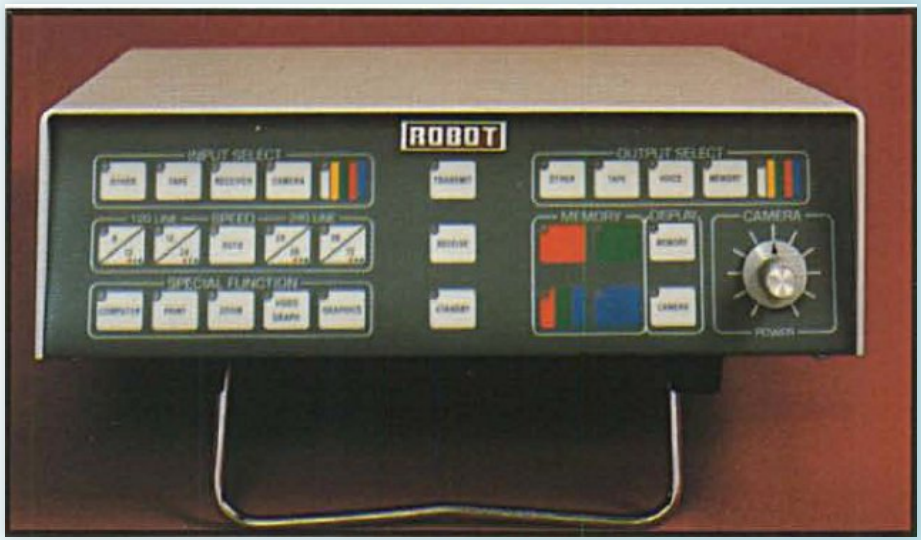
source & img: Wikipedia

HISTORY: '70S

- FCC legalized SSTV for amateur use with an Advanced class license in 1969.
- Required alot of equipment:
  - Scanner or camera image capture.
  - Modem generate/demodulate screeching noise.
  - Transmitter/receiver.
  - Surplus radar gear displayed image.
- CRT radars had "long persistence" phosphors - image visible for about 10 seconds.

HISTORY: 70S - '80S

img: Martin Bruchanov



img: Martin Bruchanov

MODERN SYSTEMS: '90S - TODAY

- PC's replaced customized equipment.
- (Image) Scanner, digital cameras, or images from the Internet replaced camera.
- Soundcard with software acts as the modem.
- Computer screen provides the output.

MODES

- B/W, Robot, AVT, Scottie, Martin, SC (Wrasse), PD, P (Pasokon), MP, MR, ML, MP (narrow), MC (narrow).
- Different resolutions.
- Common: 320x256 - 4:3 aspect ratio.
- Different transmission times.
- Longer transmission times, greater clarity on reception.
- Repeater: less than time-out timer (3:00 TOT = 2:30 or less).

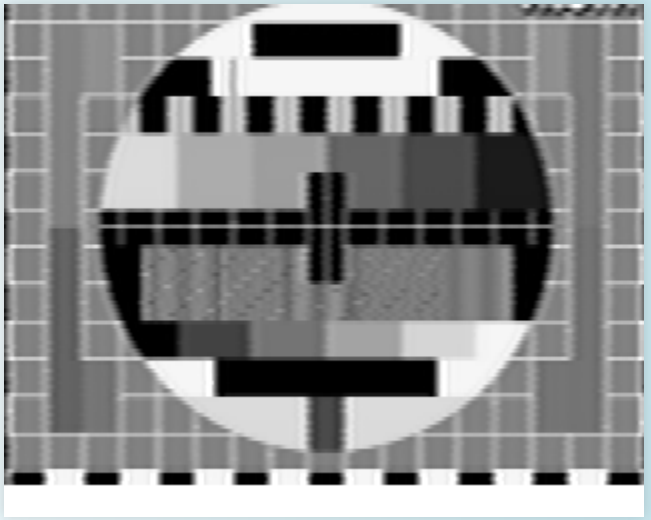
MODES

Use	Mode	Resolution	TX Time
US	Scottie 1	320x256	1:50
Europe	Martin 1	320x256	1:54
DX	Scottie DX	320x256	4:29
Quickest TX	B/W 8	160x120	0:08
Longest TX	P7	640x496	6:46
Highest Res	PD290	800x616	4:49

As supported by MMSSTV.

IMAGE COMPARISON

Original



BW 8
8s

IMAGE COMPARISON

Original

Robot 36
36s

IMAGE COMPARISON

Original

Scottie 1
1:50

IMAGE COMPARISON

Original

Scottie 2
1:11

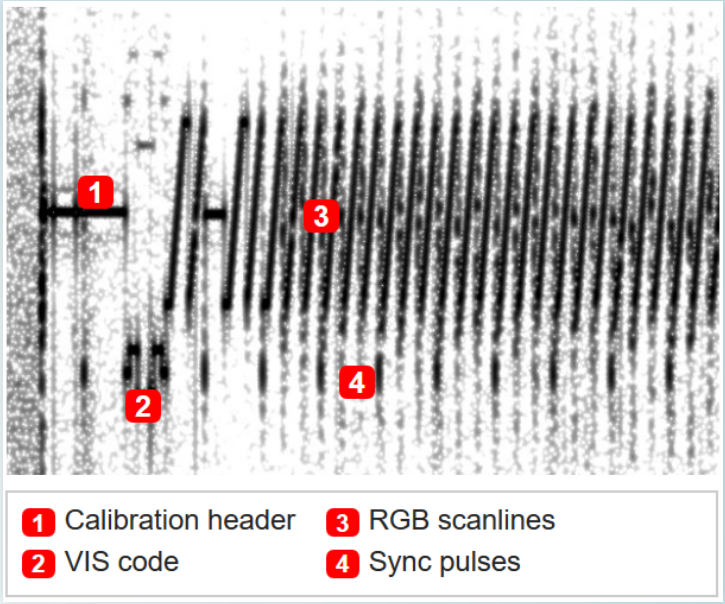
IMAGE COMPARISON

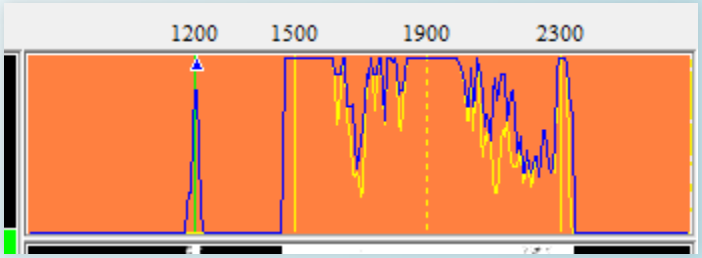
Original

Scottie DX
4:29

SIGNAL ANALYSIS: HEADER

- 300ms leader tone at 1900 Hz [1].
- 10 ms break at 1200 Hz [1].
- Second (continued) 300ms leader tone at 1900 Hz [1].
- 30ms VIS (Vertical Interval Signal) code identifying SSTV mode [2].

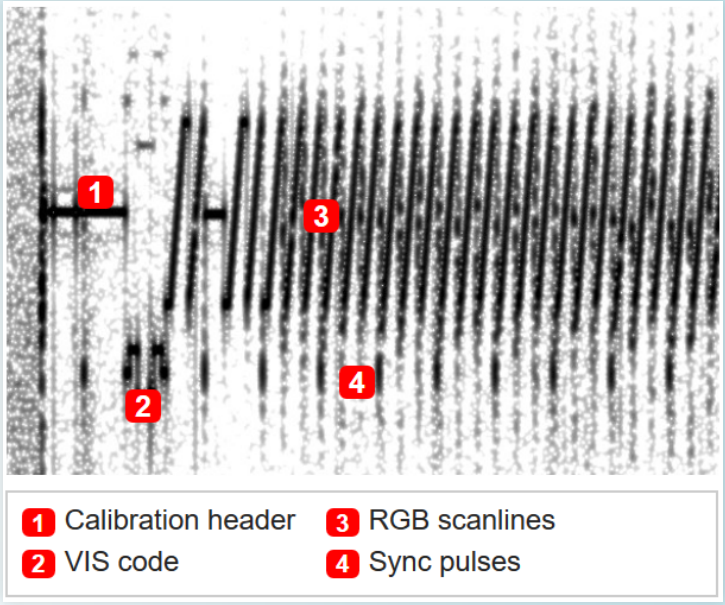


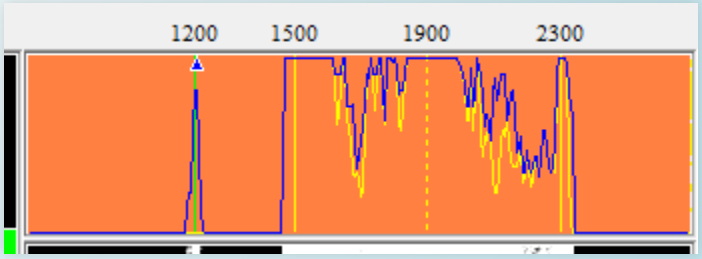


source & img: Wikipedia

SA: SCANLINES

- Horizontal lines scanned from left to right.
- RGB color encoding, YC (Luminance & Chrominance), or black-and-white.
- Modulating between 1500 Hz and 2300 Hz.
- Signal frequency shifts up or down to designate brighter or darker pixels.



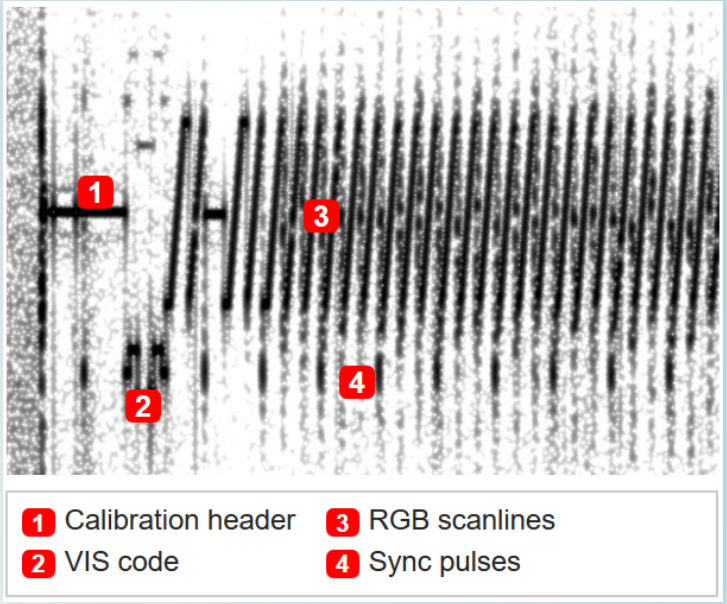


source & img: Wikipedia

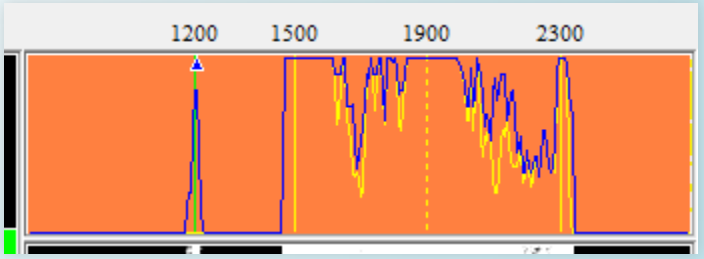
SA: SYNC

1200 Hz sync tone 5ms duration, after all line color components are sent **4**.

SSTV is sensitive



... to sound card timings.



AVT mode has no sync tone!

source & img: Wikipedia

SSTV SOFTWARE

- **Windows PC**: MMSSTV.
- **Mac**: MultiScan 3B, MultiMode (Trialware).
- **Linux (and Raspberry Pi)**: QSSTV.

- **Android**: DroidSSTV ($6.99).
- **iOS**: SSTV Slow Scan TV ($2.99) / Ham Radio Decoder Bundle ($6.99).

INTERFACES

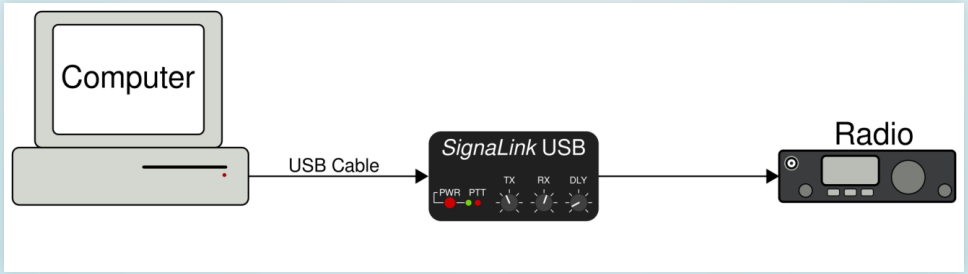
Need a radio, computer, interface between the two, and software.

- SignaLink USB (preferred).
- Rigblaster.
- Built in USB on newer HF radios.
- Build your own connection.
- Acoustic interface.

All audio/DSP enhancements must be disabled!

SIGNALINK USB

- $120 for the SignaLink USB and connecting cable at ham retailer.
- Connecting cable depends on radio.
- Simple wiring instructions for radio and cable. Jumper modules available $10/ea, good using multiple radios.
- W: 3.2 in., H: 1.6 in., D: 3.6 in. 0.40 lbs.
- VOX. Computer audio triggers PTT.



img: F8DZY, W3YJ

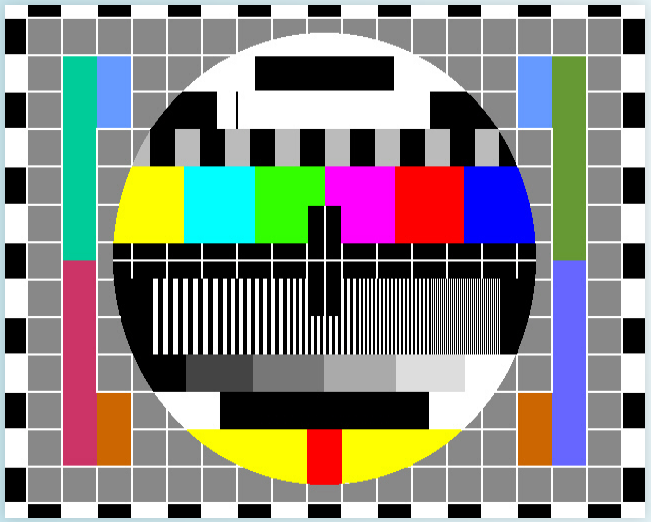
ACOUSTIC INTERFACE

- Doesn't require additional hardware.
- Participate even without an interface.

img: FLEMA

- **Receive data**: hold radio to computer microphone.
- **Transmit data**: hold radio to computer speakers.
- **PTT**: manually.
- Not an optimal setup.
- Works poorly or not at all for some digital modes, requires more attention, and disruptive.

ONE MORE IMAGE COMPARISON



Original

Acoustic Interface using
PD90
1:30

INTERFACE QUICK TIPS

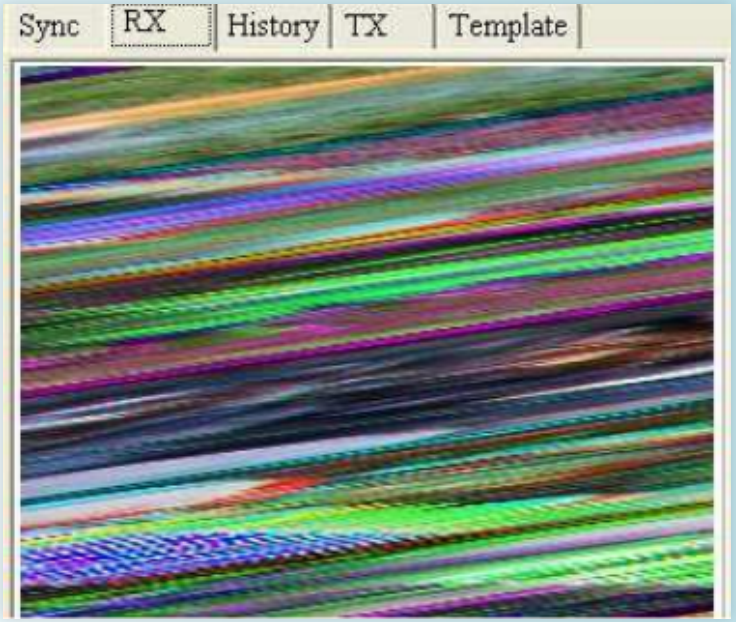
- Pet Peeve & PSA (to save you embarrassment): **DO NOT** leave the sound device as **DEFAULT!!!**
- Your radio **will** transmit system sounds, music, screensaver noises, and anything else I send it.

- Set both "Speaker" and "Microphone" volume levels to 50% (half) in Windows. Linux is good to 100%.
- Disable all audio enhancements.
- Test transmission on simplex channel with HT/scanner.

- Detailed setup steps - includes recording and playback methods.
- Advanced calibration.

SLANT

- Pro tip for HF & side-band operation.
- Sound card timings are not as accurate as stated.
- 11025 Hz might actually be 11027.12 Hz.
- Causes the image to be received askew.
- "Auto Slant" corrects, don't use on SSB.
- Calibration: WWV (preferred) or another station.



Slant

(Extreme Example)

img: WB9KMW

QSO

Template	Station A	Station B
(1)	CQ SSTV	
(2)		Call sign & RST report
(3)	Send RST	
Can go back and forth with other images -Antennas, station info, etc.		
(4)		Send 73
(4)	Send 73	

FREQUENCIES

Band	Freq	Mode
80	3845 kHz	LSB
40	7170 kHz	LSB
20	14230 kHz	USB
15	21340 kHz	USB
10	28680 kHz	USB
6	50680 kHz	USB
2	144.550 MHz	USB
2	145.500 MHz	FM

FIND OUT MORE

- LEARA Digital Net: Thursdays 9pm 146.880-/R.
- LEARA Digital Net page has interface setup tips, getting started with MMSSTV, images transmitted during the net: leara.org/nets
- LEARA Repeater Internet Streaming Audio (testing audio, 45s delay).

- More getting started: WB9KMW SSTV Tutorial.
- Online "Cams" (SSTV receivers).
- ISS SSTV special events (listed on ARRL News, ARISS, ISS Fanclub, or QRZ news) & ISS QSL cards.

STICK AROUND FOR SSTV LIVE!!!

SIMPLEX: 145.500

Reviewed setup and use of MMSSTV as documented here.

THE END

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- This presentation is available on my website: K8JTK.org
- Ohio Section