

SSTV1 Modem User Guide

The SSTV1 Modem software is an AFM modem that runs on the TAPR/AMSAT DSP-93 hardware platform that can be used to receive and transmit Slow Scan Television(SSTV) signals.

Features:

- AGC function on input samples.
- I and Q quadrature signal components generated with Hilbert Bandpass filters.
- Digital complex PLL used for obtaining input frequency information.
- SSTV encoding using a phase coherent modulation of a numerically controlled oscillator.
- Automatic CW callsign ID after picture transmission.
- Communication with modem uses 38400bps serial data using DSP-93 UART.
- Uses JVFAX(7.0 or 7.1) for user interface and various picture format conversions.

DSP-93 SSTV Front Panel LED Usage:

LED1 is PLL lock detect

LED2 is Input level too low

LED3 is HSYNC 100Hz too low in Freq

LED4 is HSYNC indicator

LED5 is HSYNC 100Hz too high in Freq

LED6 is Transmit on

LED7 is Input level too high

LED8 is Power

Radio Port Setup

The SSTV1 modem can use either radio port depending on how the code is assembled. Please follow the instructions carefully for attaching radios to the DSP-93 using the procedures called out in the DSP-93 Operations Manual. ***Pay particular attention to the pin strapping of the TNC connector for selecting the proper PTT polarity.*** Failure to do so could turn on your transmitter unexpectedly. It might be a good idea to disable your transmitter PTT or use a dummy load until you have checked out all the connections and signals from the DSP-93.

Customizing SSTV1 Software

The SSTV1 software can be customized by assembling with various command line controls and/or by modifying the source code default settings.

The following source files are needed to assemble this code-

"sstvmain.asm"
"sstvain.asm"
"sstvaout.asm"
"sstvin.asm"
"sstvout.asm"
"sstvdata.tbl"

The following include files from TAPR are needed to assemble this code-

"REGS.INC"
"PORTS.INC"
"MONITOR.INC"
"SERIAL.INC"

Two things can be customized by assembly commands:

- Radio port. Either port 1(default) or port 2 can be specified with the following assembly invocation:
tasm -3225 -g0 -dRx sstvmain.asm
where Rx is the radio port (R1=port1 R2=port2)
- Input gain. Seven different gains can be selected. The default gain is x4. These can be specified with the following assembly invocation:
tasm -3225 -g0 -dGx sstvmain.asm
where Gx is the input gain (G1=1, G2=2, G4=4, G8=8, G16=16, G32=32, G64=64)

Example of using radio port 2 with a gain of 8:

```
tasm -3225 -g0 -dR2 -dG8 sstvmain.asm
```

Example of using radio port 1 with gain of 16:

```
tasm -3225 -g0 -dR1 -dG16 sstvmain.asm
```

In order to enable the CW ID feature you must modify one line of code in the SSTVMAIN.ASM file.

First un-comment the line in the source code by removing the first semicolon.

```
; .text "de ae4jy" ;replace text string with your call
```

Next place whatever you want to ID with in CW in between the double quotes. The text can be upper or lower case and can contain a '/'. The text in this string will be output in 700 Hz tone modulated CW at about 20wpm after each SSTV transmission.

For the more adventurous, digging around a little more will reveal that the CW speed, amplitude, and tone frequency can be changed by playing with a couple of defines in the SSTVIN.ASM file. Don't go too much faster than 20wpm or an amplitude above 32767.

```
DOT_TIME .equ 12 ; DOT_TIME = 240/wpm or wpm = 240/DOT_TIME  
CW_AMPLITUDE .equ 20000
```

Loading SSTV1 Software

After the SSTV1 modem software is configured by assembling it to your requirements, the SSTV1 modem software must be loaded into the DSP-93 using the normal dspload.exe program from DOS or the D93WE program from within Windows. Refer to the DSP-93 Operations Manual for a thorough description of file loading and configuration.

First reset the DSP-93 box so that LED1 and LED8 are on. This places the unit in the monitor mode and allows program loading.

If in DOS make sure the proper com port is selected in the DSPLOAD.CFG file then
Type→ DSPLOAD SSTVMAIN.

If using D93WE in Windows, select the SSTVMAIN.OBJ file for downloading.

LED1 should briefly flicker and then the file download begins. The download process will take 10 seconds or more. When the downloading is complete, all 8 LED's will sequence briefly then LED8 will remain on and the other LED's may be active depending on what signals are present.

Setting Receiver Audio Level

With the radio squelch open without any incoming signal except for the receiver noise, adjust either the volume control if you are using the speaker output, and/or R215/R213(port1/port2) inside the DSP-93 until LED7 just flickers every few seconds then back off so that the LED does not flicker. If the incoming signal is out of range of the pots then there is a way to increase or decrease the overall gain of the DSP-93 by

re-assembling. If LED7 flickers during reception of strong signals, readjust R215/R213(port1/port2) until it just stays off.

When an SSTV signal is being received, LED1 should be on. This is the carrier detect. LED3, 4, or 5 should pulse every half second or so during horizontal line sync signal. If LED2 is on, then there is no input signal or it is too low.

Setting Up The Host Computer

The SSTV program for displaying and transmitting SSTV pictures is a program called JVFAX written by Eberhard Backeshoff, DK8JV. This is the only program I could find that had a serial port interface which was essential for the DSP-93 based modem. It is a DOS based graphics program vintage 1994.

There are two versions floating around, 7.0 which uses GIF file format and 7.1 which uses Targa file format. This program is strictly DOS and would probably blow up shelled out from Windows. A fairly exhaustive manual is included that explains the intricacies of it's operation so only a few of the more unique setup issues using the DSP-93 will be discussed. The program can be obtained from various places on the Web as well as FTP sites and BBS's. One good site is WB4EJC's at <http://members.icanect.net/~rlehman//>. This site contains lots of SSTV information and links.

JVFAX must first be configured to match your available hardware. Various graphics adapters can be selected and display resolutions. VESA compliant cards probably have the best chance of working with JVFAX and you should pick as high a resolution and color depth as you can. 256 color mode will work but the image quality is very bad.

The setup of the serial port is important for using the DSP-93 with it. The following is a screen shot of the configuration for using COM port 1. The key items are highlighted in bold.

For COM port 2 just change addr: from 03F8 to 02F8.

(JV)-FAX 7.1 configuration screen

```

-----
Demodulator: 8 bits serial port/ser  addr: 03F8  IRQ: -   LSB-SSTV-sync: yes
Modulator:    6 bits on serial port   addr: 03F8  Bdrate: 38400 Dtarate: 4800

Graphics:      VESA 800x600x256          | HIRES-movie:          yes
TC-graph.     VESA 800x600x64k (HiColor) | Enable scrolling:     yes
Printer:      IBM/Epson 8/9-pins         | Formfeed at end of pict.: no

Fixed zoom values for show pictures:  yes | Max. interrupt frequency: 7500
Enable autolock when ATC is on:       yes | Clock-timer frequency: 1193181

Default picture directory:
C:\JV\FAX\PICS

Store pictures compressed:             yes | Miscellaneous settings:
Store true color with h24 bit           yes | Program starter config:

```

```
| Callsign:                DK8JV      | UTC time diff:          2 |  
|                               |                               |  
| Enter baud rate for TX serial port (9600-57600) |  
-----  
Hit <Ctrl>+<Enter> to terminate configuration session
```

Run the JVFAX program and become familiar with its commands. Selecting S) SSTV from the main menu places the program in the slow scan receive mode. You should see some activity on the frequency histogram window if the DSP-93 is running and there is some noise or signals being received. If not, make sure the correct radio port is set and the proper com port is being used.

Once receive activity is obtained, one should be able to begin receiving SSTV pictures. If using SSB, a popular frequency is 14.230 MHz USB. Tune in the voices normally and that should be sufficient to receive any pictures. If only SSTV signals are heard, LED1 should light and you can slowly tune back and forth until LED4 is flashing at about a half second rate in time with the clicking sound of the slow scan signals. This is the line sync pulse. If LED3 is flashing the signal is low by 100Hz and needs to be tuned to a slightly higher pitch. If LED5 is flashing the signal is high by 100Hz and needs to be tuned to a slightly lower pitch.

You may hear signals that are too noisy to flash the LED's but can still be received.

If received pictures are slanted(most likely they will be) then one must adjust your PC clock-timer frequency value in the JVFAX configuration menu. This can be done manually by receiving pictures with the Horizontal mode set to free run and adjusting this number in small increments either way until the pictures are correct. This is very time consuming and there is a better way described in a paper by KB4YZ copied below:

JVFAX SKEW ADJUSTMENT
=====

- 1: In your JVFAX Configuration screen verify the following:
 - a. If your PC is a 486 or better, set the Maximum Interrupt Frequency to 9999.
 - b. If your pictures are terribly skewed reset your Clock Timer Frequency to the default - 1193181.
- 2: Enter SSTV mode to verify that noise appears in the spectrum display with audio coming from your HF rig.
- 3: Enter Fax Mode #5 - Ham 288b (hit "F" for FAX then the "5" key)
- 4: Hit the key "L" several times until the LPM shows 60/288.
- 5: Tune your HF rig to one of the stronger WWV or WWVH frequencies: 2.5, 5, 10, 15, or 20 MHz
- 6: Switch to USB mode and tune about 2.2 KHz below the carrier frequency. This will produce a steady high pitched tone.
- 7: Now hit the key "A". After a minute or so there will be a nearly white display with a near vertical dark line. What is happening is that the WWV carrier is producing the white display and it is briefly interrupted once each second with WWV's second "click" which produces the dark spot on each line. The LPM is 60 so that each second the "click" makes a dark spot just underneath the one on the previous line.
- 8: Now hit the key "A" again to stop the display.
- 9: Now hit the key "/". (Same key as the question mark on most keyboards)
- 10: Move the white line by holding down the key "Ctrl" and using the arrow keys to set the top of the white line on top of the dark line.
- 11: Now release the "Ctrl" key.
- 12: Use the arrow keys alone to tilt the white line so that it touches the bottom of the dark line. The white line should be on top of the dark line completely.
- 13: Hit the "Enter" key to save this as a new timer number.
- 14: Hit the key "Q" to exit FAX.

- 15: Hit the key "C" to enter Configuration and write down the new number displayed by "Clock Timer Frequency". This number should always be the same for this computer's motherboard. This number may also be useful in setting the timing for other versions of SSTV or WEFAX software.
- 16: From time to time you may want to repeat these steps to verify the accuracy of the timer number. In this case, if after step 11, you find that the lines match perfectly, hit the key "Esc" to abort an update to your configuration.

Good luck! 73 - Dave KB4YZ KB4YZ@W9QYQ.#SIN.IN.USA.NOAM
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This method works well and is very accurate.

Once you get the hang of receiving pictures, try sending a picture to the DSP-93 but with the transmitter disabled and a speaker hooked to the DSP-93. LED6 should turn on indicating the PTT line is active and you should hear the slow scan signal as it sends a picture followed by a CW ID if that feature has been enabled. LED6 should then turn off.

Setting Up Transmitter Audio Level

The last step is to adjust the transmitter audio level. Start the setup with the adjustment pot R14/R13 (Port1/Port2) at minimum setting by turning counterclockwise several turns. Send a picture from JVFAX to the DSP-93. Adjust R14/R13 (Port1/Port2) clockwise to increase the modulation to whatever level is correct for your transmitter. Remember that even though the signal is sent as a SSB signal, the duty cycle is 100% and you may not be able to run full power without overheating. Check your rig's manual before toasting your finals. Also be sure to use shielded cable and good grounding from the DSP-93 to your rig. One of the more common problems in SSTV is RF getting into the audio lines going to the transmitter.

Known Problems

- The program JVFAX has several problems. The most noticeable one is that in Scottie1 mode, the sync pulse is place between the wrong color planes resulting in mis-registered color lines in both transmit and receive. Individual red, green, and blue pixels are also not accurately place on top of each other. Being a DOS based program means it is going to be harder and harder to interface to new hardware.
- There is no watchdog timer in the DSP-93 to prevent a stuck PTT signal which could occur if the program got lost due to power fluctuations, RF interference, code instabilities [quite likely :>)] or other random occurrences in the universe. It has not happened during testing, but one should be careful with long unattended operation.
- If the PC is turned off while the SSTV1 program is running, a burst of false characters may trigger the transmitter on long enough to send the CW ID. It's best to turn off or reset the DSP-93 before turning off the PC.