

MMSSTV -- Description

This program is for transmitting and receiving SSTV using a PC soundcard. I was making a utility to adjust the soundcard clock for PSK31 programs. However, I have changed my mind, and the utility has eventually become an SSTV program.

I thought that I should have made at least one SSTV QSO with this MMSSTV and then declared it as the release version 1.0. However, I am very busy on my own business and will have no time for amateur radio. In addition, there seems to be quite a few people already using this program. At this time, I am planning to release this as version 1.0 after I fix the known bugs.

This program is freeware in version 1.0 and later, forever!

```
=====  
Uninstall MMSSTV  
=====
```

MMSSTV does not add anything to the Windows registry.
Delete the entire directory where MMSSTV is installed.

MMSSTV -- History

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Revision history Version 0.12 -> Version 0.13
=====

- * Added "Zero cross detector." in the demodulator
- * Added "Auto slant adjustment" function
- * Fixed some bugs and applied some improvements

=====
Revision history Version 0.17 -> Version 0.18
=====

- * Fixed some bugs and applied some improvements.

=====
Revision history Version 0.20 -> Version 0.21
=====

- * Added program menu.
- * Improved PLL demodulator and DSP.
- * Fixed some bugs and applied some improvements.

=====
Revision history Version 0.21 -> Version 0.22
=====

- * Fixed the bug in the template of 16-bit color.
- * Fixed some bugs and applied some improvements.

MMSSTV -- System Requirements

OS:	Windows 95, 98, 98SE, ME, NT, 2000
Soundcard:	16-bit 11025Hz or 22050Hz
Video adaptor: (recommended)	256 or more colors (16- or 24-bit video adaptor is recommended)
RAM:	32MB or more

I managed to run MMSSTV on my old PC with a Pentium 100MHz, but a faster CPU is recommended.

The operation speed of MMSSTV is highly dependent on the performance of the video adaptor. In other words, even if two PCs have the same CPU, they will give different performance in accordance with the equipped video card.

In particular, the 256-color video card is likely to consume more CPU Power for the pallet calculation. For this reason, a 16- or 24-bit color adaptor is strongly recommended. If a 256-color video card is used, the displayed colors are affected by the performance of the pallet calculation.

To save the CPU power, try the following steps.

- Increase the buffer size of the soundcard (select Option, select the Misc tab, and increase the value in the sound buffer size)
- Disable the RxBPF (select Option, select the RX tab, and check RxBPF OFF)
- Disable the FFT display (select View and turn off the FFT display)
- Decrease the order number of the PLL OutLPF (select Option, select the RX tab, and decrease the number in the order of OutLPF)
- Choose RX buffer FILE or turn it off (select Option, select the RX tab, and check NONE or FILE in the RX buffer pane)
- Turn the TX BPF off (select Option, select TX tab, and uncheck Tx BPF)

The RX buffer temporarily stores the receiving or just received image to get it back to the RX window after adjusting the slant and phase. The buffer stores 270-second sound data, and therefore it would cause page swapping if the RAM is selected or if the physical memory size of your PC is not sufficient to keep the data on the memory. If you have intermittent halts during the receive operation, please select FILE or turn it off.

MMSSTV -- Modes

MMSSTV supports the following SSTV modes.

Mode	Duration (sec)	Lines	Method
Robot 36		36	240 Color differentiation
Robot 72		72	240 Color differentiation
AVT 90		90	240 RGB (no synchronization pulse involved)
Scottie 1		110	256 RGB
Scottie 2		71	256 RGB
Scottie DX		269	256 RGB
Martin 1		114	256 RGB
Martin 2		58	256 RGB
SC2-180		182	256 RGB

In Canada and the US, the most common mode is normally Scottie. In Europe you will see a lot of Martin. Japan also uses Scottie modes. It is normally not a big problem as the software will auto detect the mode used, switch to that mode, and decode the picture.

It is common courtesy to send the other person a picture in the same mode you received it in.

Receive -- Frequencies

In JA, the most active frequency is 7.033 MHz LSB. The common frequencies in the world are: 14.230, 21.340, and 28.680 MHz USB. Needless to say, they are not for SSTV exclusive.

The most common SSTV frequencies in use are as follows:

- 1.918 Mhz LSB for 160M
- 3.845 Mhz LSB for 80M
- 7.228 Mhz LSB for 40M
- 14.230 and 14.233 Mhz for 20M
- 21.340 Mhz for 15M
- 28.680 Mhz for 10M

Most of these frequencies are calling freq's and as such a qso should take place on another frequency. 3Khz spacing is a must to make it easy for all stations to carry on qso's in a crowded band. Such as, call on 28.680 Mhz and once a contact is made, move to 28.683 or 28.677 etc. This ensures interference free pictures for all.

Receive -- Tones

SSTV's tone frequencies are defined as follows:

Synchronization pulse	1200 Hz
Low level of the image	1500 Hz (Black)
High level of the image	2300 Hz (White)

There are four marker lines in the spectrum window of MMSSTV. From left to right:

Green line	1200Hz	Synchronization pulse
Yellow line	1500Hz	Low level of the image (Black level)
Yellow dotted line	1900Hz	Center level of the image
Yellow line	2300Hz	High level of the image(White level)

To tune a signal in, put the signal energy between the 1500Hz and 2300Hz marker lines. Alternatively, you can tune the receiver so that the synchronization pulses are on the 1200Hz marker line.

However, the synchronization pulse is very short, so it would take time for you to get used to adjusting the frequency in this way.

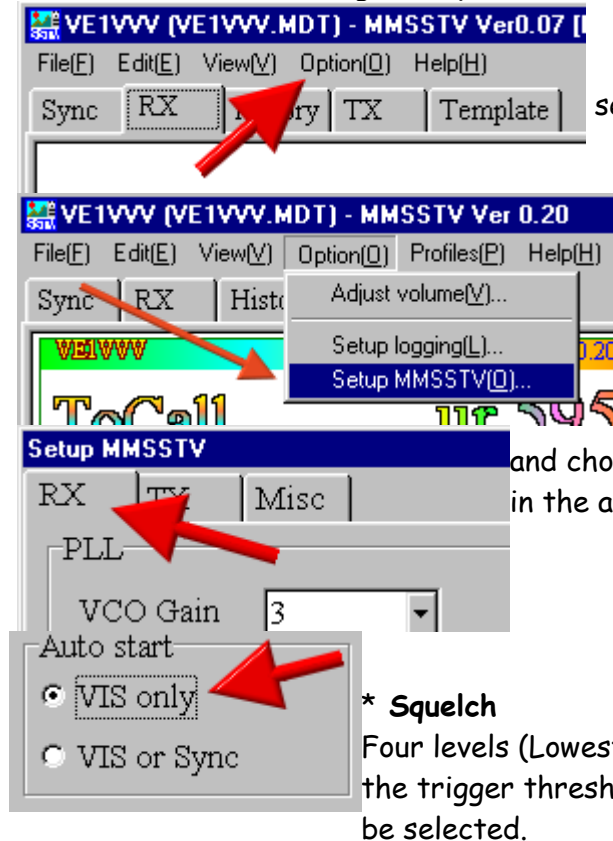
Since SSTV QSOs should be made on fixed common frequencies. You probably will not have difficulty in tuning the radio after you have done so once.

Receive -- Auto Start

When the Auto button in the RX mode pane is depressed, MMSSTV automatically starts the receive operation in response to the start trigger signal.

The start trigger signal is called VIS signal, which consists of the 1200Hz marker signal and the SSTV mode code (1100Hz and 1300Hz FSK). MMSSTV detects the signal by using a resonant FSK demodulator, and automatically starts the receive operation if it finds the mode supported.

To automatically start receiving, MMSSTV provides another method, which measures the interval time of the synchronization pulses. If you do not want to use this method, go to **Option**,



The image consists of three screenshots of the MMSSTV software interface, illustrating the steps to configure auto-start settings:

- Top Screenshot:** Shows the main window titled "VE1VWV (VE1VWV.MDT) - MMSSTV Ver0.07". The menu bar includes File(F), Edit(E), View(V), Option(O), and Help(H). The RX mode pane is active, and a red arrow points to the "Option(O)" menu item. A text label "select **Setup MMSSTV**," is positioned to the right.
- Middle Screenshot:** Shows the main window titled "VE1VWV (VE1VWV.MDT) - MMSSTV Ver 0.20". The menu bar includes File(F), Edit(E), View(V), Option(O), Profiles(P), and Help(H). The RX mode pane is active, and a red arrow points to the "Option(O)" menu. A context menu is open, showing "Adjust volume(V)...", "Setup logging(L)...", and "Setup MMSSTV(O)...". A text label "then the **RX** tab" is positioned to the right.
- Bottom Screenshot:** Shows the "Setup MMSSTV" dialog box. The RX mode pane is active, and a red arrow points to the "Option(O)" menu. The "Auto start" section has two radio buttons: "VIS only" (selected) and "VIS or Sync". A text label "and choose '**VIS only**' in the auto start option." is positioned to the right.

* **Squelch**
Four levels (Lowest, Lower, Higher, and Highest) for the trigger threshold can be selected.

Lowest makes MMSSTV trigger with the weakest signal.

Highest makes MMSSTV trigger with the strongest signal. In other words, only the strong signal can kick off the receive operation.

Receive -- Manual Start

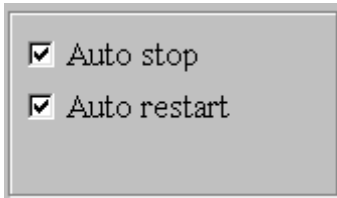
In case MMTTY does not automatically start receiving, or you want to force receiving a picture that is not at the beginning, push one of the mode buttons below the Auto button. In JA, HL, and US, try Scottie 1. In EU, try Martin 1.

Scottie 1 example....



Receive -- Auto start & Restart

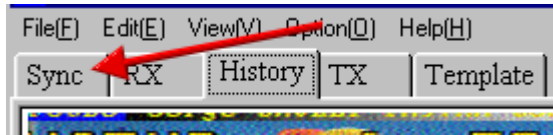
When the auto stop in the RX window of the Setup MMSSTV is checked, MMSSTV automatically stops receiving in case it has lost the synchronization signal (this does not work in AVT90).



When the auto start **VIS only** in the RX window of the Setup MMSSTV is checked, MMSSTV restarts the receive from the beginning, in case it detects the VIS signal even during the receive operation. It should be noted, however, that MMSSTV will not be able to detect the VIS signal, because of the RxBPF effect.

Slant Adjust -- Manual

MMSSTV measures the SSTV signal timing with the soundcard clock. If the soundcard clock is not correctly calibrated, you could have a slanted image. If you have a slanted image, click the **Sync** tab of the main window and do the following procedure.



1) Push **Slant** button



2) Click the upper right edge of the synchronization signal (white line)

3) Click the lower right edge of the synchronization signal (same white line)



The synchronization signal is displayed in a relatively fat line, so you must click the same side. Immediately after you click once on the line, a guide cursor is displayed. Adjust the cursor in parallel with the synchronization signal line, and click again.

According to this procedure, MMSSTV recalculates the sampling clock of the soundcard and adjusts the receiving or just received image. If you do not obtain an acceptable result, repeat the procedure.

When you have obtained a successful adjustment, and want to use it as the default frequency, push the **Mem** button, otherwise MMSSTV applies the adjustment to the current image only.

* If you have a very slanted image with the default sampling frequency, try changing the source of the soundcard to Stereo (Left or Right) in the Misc

page of the Setup window. Some soundcards have different sampling frequencies in Monaural and Stereo settings.

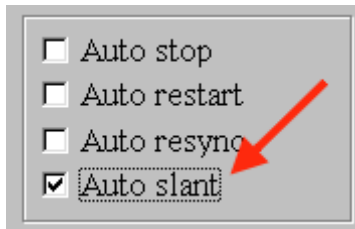
* If you turn the RX buffer **off**, you cannot redraw the picture after adjusting the slant.

Slant Adjust -- Auto

Although you have the sampling frequency accurately calibrated, the station you are in contact with might not have it done correctly. To facilitate the slant adjustment, MMSSTV has an automatic slant adjustment function.

To activate this function:

Check "**Auto slant**" in the RX window of Setup MMSSTV option or



Right click the RX image window and check Auto slant adjustment.

It should be noted, however, that this function will not always give a satisfactory result when you have multipath or QRM, which causes jitters in the synchronization.

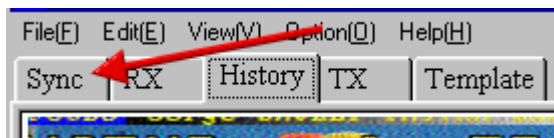
* The automatic slant adjustment can be used only if the receive buffer is turned on.

Slant Adjust -- Sync Point

MMSSTV automatically gets the receive operation synchronized with the transmitted image except in case of AVT90. However, it at times fails to do so in very bad conditions. You should immediately become aware of such a condition because the image is ill colored.

If this situation happens, try the procedure below:

1) Push **Sync** tab of the main window.



2) Push **Phase** button.



3) Click the **left edge** of the **synchronization** line (fat white line).

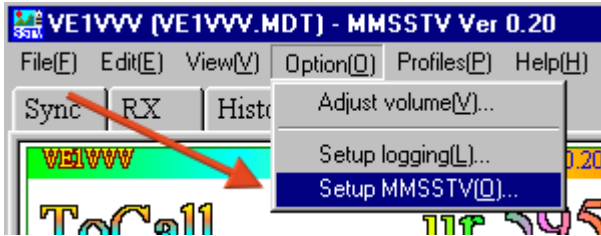
MMSSTV arranges the image so that the clicked point becomes the leftmost position of the image window. If you do not get it in the right position, repeat the procedure.

AVT90 does not have the synchronization signal in the image data. For this reason, you will see only a monochrome image in the Sync window. You can click one of the gaps (there are three gaps).

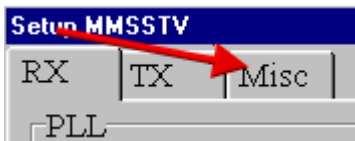
* If you turn the RX buffer off, you cannot redraw the picture after you adjust the phase.

Receive History -- Images

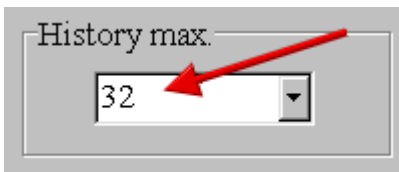
MMSSTV can store up to 32 received images in default. To increase or decrease this number, click **Option**, select **Setup MMSSTV**,



click **Misc** tab,



and change the value in the **History max** box.



If the number of stored images would exceed the specified value, the oldest image is erased in an FIFO (First In First Out) manner.

It should be noted that one image requires about 200KB disk space,(BMP) and thus 256 images require about 50MB. JPG format is much smaller and probably the preferred method for picture files. Pay attention to the disk space of your PC. Click the picture with the right button of your mouse and select **Use JPEG** format in the pop-up menu.

The RX history is only used for a temporary buffer. The old pictures will automatically be deleted. If you want to keep them, right click and check the **auto copy** to another folder.

With this automatic copy function turned on, MMSSTV records the index into the QSL field of the log so that it can retrieve the picture later.

To manually copy the history picture to another folder, drag and drop the

picture in the history window to the QSL box in the log window. To use this function, you must define the name of the target folder in advance.

MMSSTV automatically records the index in the QSL field of the log, either, if the auto copy is turned on, or if the history image is dropped in the QSL box. Using the MMSSTV log facility, you can refer to the image by pressing the **Image** button.

Transmission -- Basics

To transmit an SSTV image, click **TX tab** of the main window. The image you have there is transmitted (What You See is What You Transmit). Adjust the mic gain appropriately.

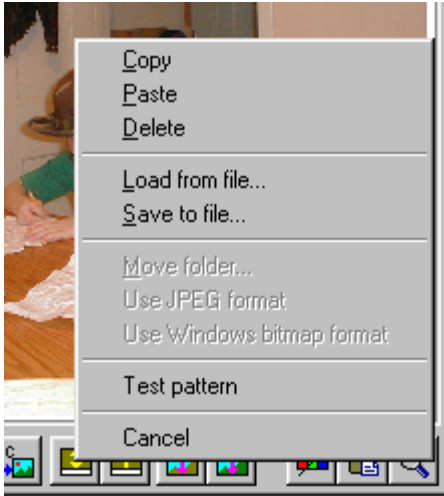
There are several ways to prepare the TX image.

1. Drag&drop an image from the stocked pictures gallery at the bottom in the main window to the TX window.
2. Drag&drop an image from the thumbnail window of the folder (View -> Always show thumbnails of files folder) to the TX window.
3. Drag&drop an image from Windows file manager (Explorer) to the TX window.
4. Drag&drop an image from another image manipulation tool that supports Drag&drop to the TX window.
5. Copy&paste an image from another image manipulation tool to the TX window through the Windows clipboard.

You can make the TX image superimposed with a template. The template operation is explained in a later section of this document.

Click the TX image with the right button of the mouse to get a pop-up menu that facilitates image manipulations, such as file load and save. Drag&drop from Internet Explorer is also supported.

If you right click on the tx window you will get a menu like this...



Copy is to copy from the TX window into the windows clipboard. **Paste** is to paste data from windows clipboard into the TX window. **Load from file** is to load a picture from disk. **Save to file** is to save the current TX window contents to a file on disk. **Move folder** only works on the thumbnail area, and will let you select another folder to use when pictures are saved to stock pictures area. If you want all your pictures saved in C:\pictures then select that dir when the dialog box asks you to select a folder.

The next two options select whether you want to use .bmp or .jpg formats. If using .jpg it will have option of **Use windows bmp format**. If using bmp it will have **Use jpg format**. If you change options it will convert from jpg to bmp or from bmp to jpg, all files in your current directory.

The **test pattern** is available in tx window only and puts a test pattern into tx window.

Cancel clears menu without doing anything.

Do **NOT** use the speech processor.

Transmission -- Image Preparation

You can create a TX image by using drag & drop from the stock picture gallery or from other image manipulation software through the Windows clip board. In addition, you can superimpose a predefined template with it.

Click the TX image with the right button of the mouse to get a pop-up menu that facilitates image loading and pasting from the clipboard. Also a test pattern is available to test your signal with somebody.

These buttons will let you adjust your image and make it fit 240 or 256 line modes.



Transmit image immediately.



Send a 1750 Hz tone.



Place current template on top of image to be transmitted. So you can see what it will look like.



This is to adjust image for 240 line mode, or to shift image up to compensate for 240 line mode, with the up arrow button.



Adjust or shift image for header bar.



Adjust image. Sharpness, brightness, contrast etc..



Blow up image, or enlarge for viewing.

Transmission -- Mode Selection

Select the SSTV mode.

* If you uncheck "**SSTV mode fixed**" in the TX page of MMSSTV Setup option, MMSSTV automatically uses the SSTV mode that was used by the most recently received image.

The mode box looks like this....

RX Mode
Auto
Robot 36
Robot 72
AVT 90
Scottie 1
Scottie 2
Scottie DX
Martin 1
Martin 2
SC2 180



Transmission -- Transmission

Push the TX button at the left bottom of the window to start transmission. The horizontal marker line moves from top to bottom as the image is transmitted. MMSSTV automatically returns to RX after it completes the transmission. If you want to abort the transmission, push the TX button again.

MMSSTV has a 12-second sound buffer, which should be big enough in the normal environment. If your PC is not powerful, you had better not do other operations during transmission.

If MMSSTV has lost the timing during TX, it shows a caution message after the TX completion. In this particular case, you might be able to solve this problem by increasing the number of buffers in the **Misc** page of the Setup window.

Transmission -- Tx Slant

Some soundcards (especially PCI form factors') have slightly different frequencies for recording and playing. In this particular case, even if you have correctly adjusted the clock in RX, you would have a slant image in TX.

MMSSTV has a means to adjust the soundcard clock for TX and RX independently. Refer to the Soundcard [Calibration](#) section at the end of this document for details.

Transmission -- Tune / CW ID

For repeaters in US, MMSSTV has a tone generator. Push the Tune button to transmit a 1750Hz tone.

You can send a CWID after the TX completion. Check the CWID box in the TX of the Setup window. This is for a European friend of mine.

Templates -- Functions

Using a template, you can make a simple picture, which is superimposed to the TX image. For example, you can use a macro command that puts his/her callsign on the TX image.

MMSSTV provides primitive image-manipulation functions, but has no support for the group operations now.

Make picture items using the tool buttons at the bottom of the window.

- Arrow button Turn on/off the selection mode
- Line button Draw line
- Square button Draw rectangle
- Shaded square button Draw rectangle with color pasted
- T button Draw text
- Picture button Insert picture or history image
- Color bar button Draw color bar
- Scissors button Cut the item
- Paste button Paste the item
- Color palette button Change the color
- L button Change the property of the selected item
- f button Change the font

To use a macro text, for example, push T button and then click the point in the window where the text is placed. The text input dialog box is displayed. Push Macro button and select %c to place his/her callsign there.

To move the item, push Arrow button and use drag&drop it.

Here I do not cover all the operations, but they are similar to the DRAW software. Give it a try by yourself.

* You can use drag&drop to copy an image (BMP or JPG) from a file manager (e.g., Explorer) to the template box.

* The sample templates included in the installer would have small characters. This is because I use large fonts in my PC.

Templates -- Superimpose

When you use a template, MMSSTV superimposes all the colors except a transparent one in the template over the TX image. The default transparent color is defined at the bottom right position of the template window. You can change the position by right clicking at the arbitrary spot in the window. However, you must click the spot where no template item resides in.

Special care should be taken if you place a template item at the bottom right of the window.

In version 0.21 or later, the function that automatically replaces the transparent point is default ON. Therefore, the transparent point is automatically moved to where no template item exists.

You can use any color as the transparent (background) color, but you must choose the color that you do not use in the template. However, a color bar and an image are the exceptions. In other words, you can choose a color that is used in a color bar or an image as a transparent one.

* You can settle a background color that is not used in the template by right clicking on the template and selecting "find unique background color."

If you want to create or edit the TX picture during the QSO, I would recommend you use other editing software programs, which have excellent capability in manipulating images.

The template of MMSSTV is supposed to offer the macro functions, such as his/her callsign, RSV report, and contest numbers. Therefore, you would not find good reason to use templates if you do not use the logging function.

Stock Area -- Functions

MMSSTV has a stock area that stores up to 300 images. Each stocked image has the image data and the template information. To manipulate the clipboard, save and load files, click the stock image with the right button of the mouse. You will see a popup menu.

To save the disk space, you can use the JPEG format for the stocked images. Right click the image and select Use JPEG format in the pop-up menu.

It is a good idea to make a template picture in association with the TX image in advance. The stocked area can store the images and the templates independently. However, if you use drag&drop to copy the stock image to the TX window, MMSSTV copies the associated template, too. This is effective only if the Show superimposed templates box is checked. If the box is not checked, MMSSTV copies the image and the template independently.

The following table shows how MMSSTV performs the drag&drop operation.

[Show superimposed templates ON]

From	To	Action

--		
Stocked image	TX window	Copy the image and template
Stocked template	Template window	Copy the template only
TX window	Stocked image	Copy the image and
template		
Template window	Stocked template	Copy the template only

[Show superimposed templates OFF]

From	To	Action

--		
Stocked image	TX window	Copy the image only
Stocked template	Template window	Copy the template only
TX window	Stocked image	Copy the image only
Template window	Stocked template	Copy the template only

You can drag&drop an image from Explorer or My Computer to the stock area.

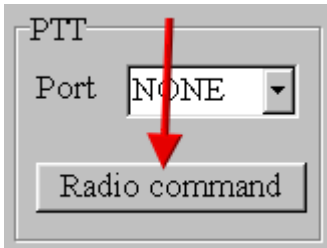
It takes substantial time to make the text change in the template. For this reason, the window redraw is slowed down during superimposing of the template in the stocked image area. If you do not like it, try checking off Show superimposed templates or checking on Draft. In addition, the JPEG format will require a little bit longer time to re-read the file.

* If you get the thumbnail window of the folder displayed on the stocked images window, MMSSTV will use the thumbnail window on behalf of the stocked image window.

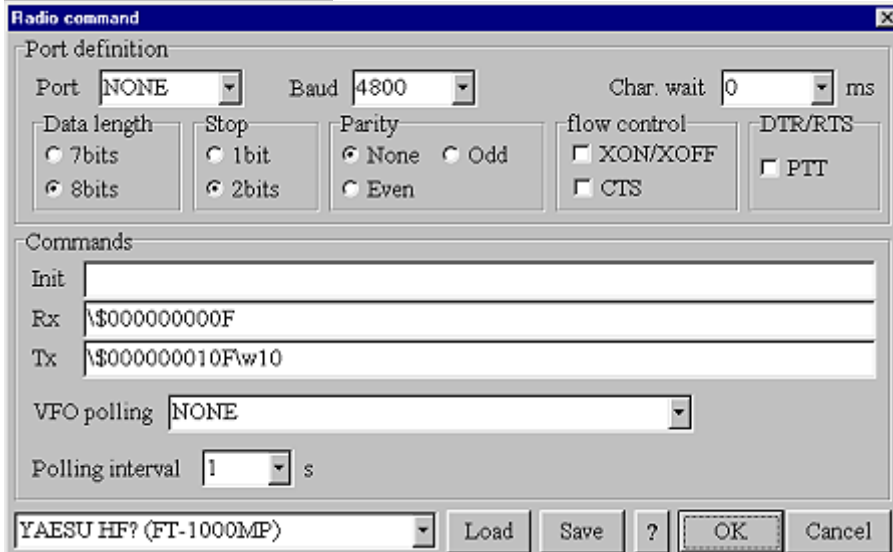
MMSSTV temporarily hides the thumbmail window when you switch to the stocked template window.

Radio Commands -- Setup

To setup radio control commands in MMSSTV, go to Options, Setup, and then click on the Radio command button in upper left.



You will then be presented with the radio command screen.



You will need to determine the correct parameters for your particular radio from your manual or internet site perhaps.

Demodulator -- Config

This section describes the digital signal processing used in MMSSTV.

MMSSTV has two types of demodulators, PLL and zero-cross detector.

Demodulator configuration

MMSSTV's demodulator has the following configuration.

```
Sound --> BPF (FIR) --+> BPF1100 (IIR) --> VIS symbol '1'
      |
      +> BPF1300 (IIR) --> VIS symbol '0'
      |
      +> BPF1200 (IIR) --> Sync
      |
      ---> Zero cross det. --> Picture data
          (1500 to 2300)
      or
      |
      ---> PLL(1500 to 2300) --> Picture data
```

The zero cross detector's configuration is

```
---> Differentiator ---> Counter ---> Out LPF ---> Pic. data
```

The next figure shows the PLL configuration

```
---> Phase det. ---> Loop LPF -----> Out LPF -----> Pic. data
      |               |
      <----- VCO <-----
```

In comparison with the zero cross detector, the PLL has higher frequency resolution. However, it seems to fail locking for signals that have a rotating phase shift through the propagation. For this reason, the zero cross detector will give an image with less noise.

MMSSTV virtually raises the sampling frequency for the zero cross detector in order to obtain the higher counter resolution even with a lower

sampling frequency. However, this trick by nature uses approximation and therefore it would lower the color resolution compared with the PLL (this can be compensated by using higher sampling frequency).

As a result, it is a good idea to use the PLL for good conditions and the zero cross detector for unstable conditions.

Demodulator --Zero Cross

[Out LPF]

This filter smoothes the frequency ingredients obtained by the counter.

If you want a sharp image, increase the cut-off frequency.

If you want a low-noise image, decrease the cut-off frequency.

It is dependent on your preference.

Demodulator --PLL

The parameters of the PLL affect the picture quality. Since the behavior of this PLL is just the same as that of the hardware PLL, try adjusting the parameters as you have better results.

Demodulator --VCO Gain

VCO gain has a strong impact on the response of the PLL. The default value (gain = 3) is a little bit over responsive, but I dare to have chosen this value for the sharp appearance of pictures. If you decrease the VCO gain, you have less overshoot, but at the same time you will have less margin for the lock range.

Demodulator --Loop LPF

In addition to the VCO gain, the Loop LPF is another parameter that dominates the dumping factor for the PLL loop. You should use the filter order of one.

If you increase the cut-off frequency, the filter is apt to oscillate in the 1500Hz range. However, it is not so significant in the picture quality because the energy of this range is relatively small. It is a good idea to see how it works by using the built-in oscilloscope.

Demodulator --Out LPF

The Out LPF filter does not affect the response of the PLL because it sits outside of the loop. It, however, should be noted that it strongly affects the picture quality. If you want a sharp picture, set the cut-off frequency higher. If you want a low-noise picture, set it lower. Adjust it according to your preference.

Demodulator --Limiter

The limiter reduces the noise even for a weak signal, but it increases the phase distortion and lowers the picture quality. If the sampling frequency is set higher, the phase distortion will be decreased and therefore will not be observed.

Demodulator --Linear Calibration

The PLL demodulator has a good linearity, which is suited for the SSTV demodulation. You should not have a trouble in using the default parameters. However, if you have changed the PLL parameters to improve the image quality, it is a good idea to calibrate the parameters. In the **RX** page of the **Setup** window, push the **Linear calibration** button. MMSSTV starts the automatic parameter calibration. It takes about 20 seconds for the calibration. After the calibration, MMSSTV displays the frequency characteristics figure. Make sure that it has the shape of a straight line. If it is not straight, you have inappropriate PLL parameters.

When the PLL works properly, the offset, 1500Hz, and 2300Hz values are approximately:

Offset	0
1500Hz	16384
2300Hz	-16384

Even if your video adaptor is 24-bit full color, the SSTV has only 256 steps of the color resolution and therefore those values need not to be very exact.

Demodulator --Profile

The default PLL parameters are settled according to my experiments, which, however, are very limited. I have had no sufficient time for parameter optimization. If you are a master of SSTV, you already have found some good parameters.

With the Profile function, you can easily save and load up to 8 sets of the PLL parameters. Each set can be named as you like.

It is a good idea to save your favorite PLL parameter set as MyDefault before you try many different parameters. If you got lost in the parameter setting, you will be able to step back to the start point.

MMSSTV has a special profile "MMSSTV Default," which cannot be modified by the user. This is the MMSSTV default parameter set.

* It should be noted that the Profile memorizes the PLL parameters only.

Sampling Frequencies -- Frequencies

MMSSTV has an option that allows the following sampling frequencies:

8000 Hz Secondary standard frequency
11025 Hz Primary standard frequency
12000 Hz
14000 Hz
16000 Hz
18000 Hz
22050 Hz Primary standard frequency
24000 Hz
44100 Hz Primary standard frequency

If you are a quality chaser, use as high frequency as possible. It should be noted that not all the soundcards support the frequencies listed above all. All the soundcards, however, should support 11025Hz, 22050Hz and 44100Hz. In addition, the high frequency dissipates more CPU power and more memory space.

Tips:

* If you use a high sampling frequency, it is recommended to increase the buffer size for sound processing. This can be done in the Misc page of the Setup window. For instance, 4096, which is twice bigger than the default value, is recommended for the 22050Hz sampling frequency.

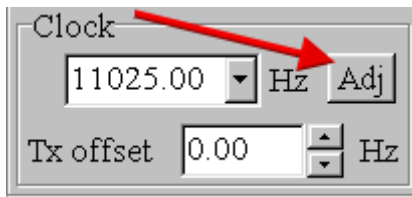
* MMSSTV always calculates the FFT with 2048 points. To obtain the proper frequency resolution, MMSSTV uses a half frequency for FFT in case the sampling frequency is 18000Hz or higher. In the same manner, MMSSTV uses a quarter frequency in case of 44100Hz.

Sound Card Clock -- Calibration

In SSTV, the discrimination of the clock appears as a slanted image. For MMSSTV, you are not required to have the absolute and exact clock frequency value (e.g. 11025Hz). But it is important to get MMSSTV informed on what the frequency of your soundcard is.

In normal situations, you would only have to adjust the slant by using the Sync window. If you want to calibrate your soundcard very accurately, listen to the standard radio or fax transmission.

1) Go **Option, Setup, Misc** page, and click **Adj** button.



2) Receive standard radio wave (e.g., WWV and JJY).

3) Tune into the tick sound.

4) Continue listening to the sound for a while. You have a vertical line.

5) Click the upper point of the line.

6) Click the lower point of the line.

You could use FAX broadcasting instead of WWV or JJY, but be sure it has exact timing.

If your soundcard seems to have different clock sampling frequencies for TX and RX, adjust the offset frequency with the following procedure.

1) Adjust the slant in RX.

2) Let the current sampling frequency be **RxSamp**.

3) Go **Option, Setup**, and **TX page**. Select **External** in the **Loopback**.

4) Go **Misc** page. Put **0.00** in **Tx offset**.

5) Connect the Line-out to the Line-in of your soundcard.

6) Transmit an image.

7) You should have an image through the external feedback.

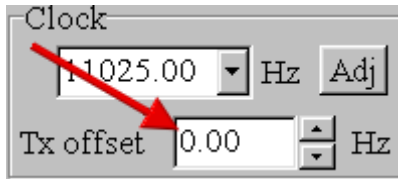
8) After completing the image receive, go to the **Sync** tab and adjust the slant.

9) Let the obtained sampling frequency be **LoopSamp**.

10) Compute Txoffset by $TxOffset = RxSamp - LoopSamp$.

11) Go **Option, Setup**, and **Misc** page. Put **TxOffset** to the Tx offset box.

12) End



You can use the LoopBack function of a mixer program instead of using the external feedback line.

Although this procedure can be applied only for the soundcard that supports the full-duplex mode, the soundcard that does not support the full-duplex mode should not have different frequencies for TX and RX, and therefore you do not need this calibration.

If you have a report that your TX image is greatly slanted, try changing the soundcard modes, monaural or stereo (Source in the Misc window of Setup MMSSTV).

Some soundcards seem to use different sampling frequencies for the full-duplex and no-full-duplex operations. In such a case, the offset calibration using the external loop back does not help. You should always have the loop back External or consult the QSO report.

Setup Misc -- Buffer

Buff is the buffer size of the low level sound processing. You should enlarge the buffer size if you increase the sampling frequency; otherwise you may possibly lose the sound. Use 2048 or larger, buffer size for the sampling frequency of 11025Hz. Use 4096 or larger, buffer size for the sampling frequency of 22050Hz.

Setup Misc --Priority

Priority defines the task priority for low level sound processing. If you lose the sound during RX or TX, raise the priority. If the response of the menu operations is slow, lower the priority. Normal is the lowest, and Critical, is the highest.

Setup Misc --Device ID

DeviceID specifies the ID number of the sound card. When you have only one sound card, put -1 or 0 to DeviceID. -1 uses the default sound card. The sound card IDs are sequentially assigned as 0, 1, 2, When you have two sound cards, for example, and want to use the second one for MMSSTV, set the Device ID to 1.

Setup Misc --Source

Source defines the channel of the sound card. Mono makes the sound card work in the monaural mode. Left or Right makes the sound card work in the stereo mode and uses one of the channels. In TX, MMSSTV outputs the sound to both channels regardless of the Source setting.

Setup Misc --Clock

Clock is the sampling frequency of MMSSTV. Refer to [Frequencies](#) and [Calibration](#) sections.

Closing Remarks

MMSSTV is a freeware program for amateur radio use. You can redistribute it as you like. Please join the following reflector for detailed information,

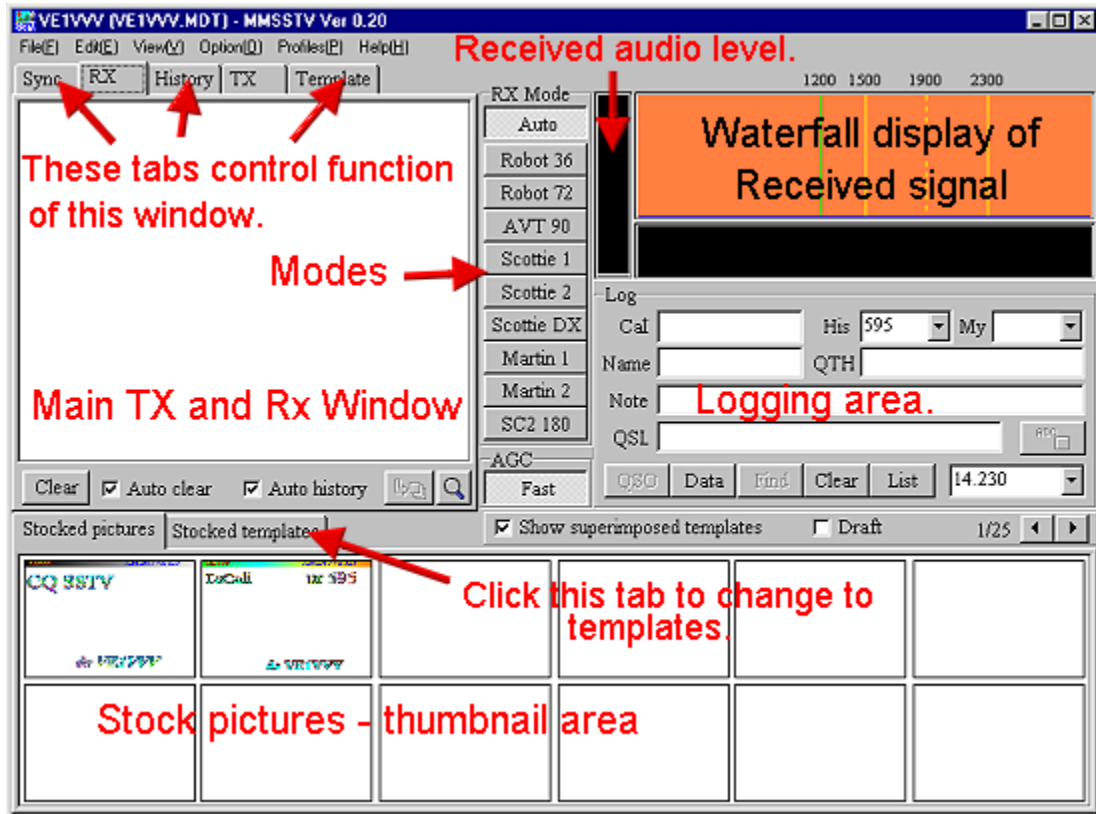
<http://groups.yahoo.com/group/MM-SSTV/>

The JPEG converter in MMSSTV is based on the freeware source code, "IJG code," provided by Independent JPEG Group.

73 de JE3HHT Mako

MMSSTV -- Main Screen

Here is what the main screen looks like with some explanation of what some of the buttons and menu tabs do.



This should help you to get started.

Demodulator --Differentiator

When the Differentiator box is checked, MMSSTV compensates the LPF effect by boosting the high-frequency ingredient of the received image. However, it makes the receive image be more likely affected by the noise. Try adjusting the effect with the slider for your preference. As the slider goes right, the differentiator takes sharper effect.

*The differentiator is not related to the differentiator of the zero-cross detector.

Demodulator --Level Converter

The level converter translates the frequency value derived by the decoder into the color amplitude values. MMSSTV provides two types of converters, which can be selected in the RX window of MMSSTV Setup.

- Linear converter (uncheck the polynomial box)

It assumes that the frequency and the color level are linearly related. It is simple, but the frequency characteristics of the decoder must be linear.

- Polynomial converter (check the polynomial box)

It uses a 17-th order polynomial formula for the level conversion. It works better if the frequency characteristics of the decoder are not linear. Since the converter uses a pre-calculated table to boost the processing speed, it should not require much more CPU load.

It is a good idea to use the polynomial converter for the 11025MHz zero-cross detector because it has a little linearity problem in 2200 to 2300Hz. As the sampling frequency goes higher, the decoder will have better linearity. However, even in 11025Hz, the conversion error is $2/256 - 3/256$, and therefore the error might not be visible.

MMSSTV starts the automatic calibration by pressing the calibration button in the RX window of MMSSTV Setup. It takes about 20 seconds. After the calibration, MMSSTV shows the frequency characteristics figure. If the line of the figure goes straight down to the right, you can uncheck the polynomial converter (you can use the linear converter).

Program Menu- Menu

With the program menu, you can instantly start your favorite programs, such as an image manipulation tool, PSK31, RTTY, and MFSK16 programs.

If you check the **Suspend** box, in the **Assign** menu, MMSSTV automatically goes down to the suspended state and starts the selected program. In this state, MMSSTV has released the COM and soundcard resources in order to allow the other program to use them. To restart MMSSTV, first terminate the program and then click the MMSSTV icon in the Windows task bar.

When you want to start the program that is not assigned to the MMSSTV program menu, you can select Suspend in the Program option. MMSSTV has released the hardware resources of the COM port and soundcard, and makes itself iconized.

If you wake MMSSTV up again while the other program that uses the COM and soundcard resources is running, MMSSTV would show an error message. In this case, MMSSTV will not be iconized again. To resume MMSSTV, terminate the other program and wake MMSSTV up again, or select **Restore** in the **Program** menu.

* You do not have to check Suspend for an image manipulation tool, because it typically does not use the COM or soundcard.

MMSSTV generates the TX signal with the flow shown below.

Picture data ----> LPF ----> VCO ----> BPF ----> D/A ----> Sound data
 ON/OFF ON/OFF

LPF and BPF are used to limit the frequency of the digital output as insurance. If the CPU load is too high for TX, you can turn them off. However, I strongly recommend that you turn the BPF on when you use CWID.

Demodulator -- Tx Filter

MMSSTV generates the TX signal with the flow shown below.

Picture data ----> LPF ----> VCO ----> BPF ----> D/A ----> Sound data
 ON/OFF ON/OFF

LPF and BPF are used to limit the frequency of the digital output as insurance. If the CPU load is too high for TX, you can turn them off. However, I strongly recommend that you turn the BPF on when you use CWID.



This filter smoothes the signal translation from the image to the frequency domain. As a result, the frequency bandwidth is substantially limited and the horizontal resolution of the TX image is slightly sacrificed.



This filter limits the bandwidth of the TX signal. It is useful to limit the spectrum spread for CWID.

This help file will continue to evolve as MMSSTV evolves. I will endeavour to keep the information current and accurate. Note some pictures have early version numbers on them but are current, as nothing in that portion has changed.

I hope you find the help file useful and easy to read.

Thanks.

Andrew

VE1VVV

