SUTRON SATELLITE TEST SET

MODELS STS-0001 & STS-0002

OPERATIONS & MAINTENANCE MANUAL

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Description

The Sutron Satellite Test Set is a stand-alone device to directly receive and verify data transmissions from DCP's. The test set performs its functions by receiving and processing the uplink transmissions before they reach the satellite. It is a powerful tool to use either in the field or on a bench to verify the operation of a DCP.

The Test set comes in two models: a complete system (STS-0001) and a receiver subsystem (STS-0002). The complete system consists of all the equipment needed for to receive transmissions in the field or on the bench. The system is packaged in a durable, water resistant, transportation case. The receiver subsystem is a subset of the complete system suitable for connection to an existing PC. The receiver subsystem does not include the shipping case, PC, DA/AC adapter.

STS-0001 Satellite Test Set Complete
- STS-REC Test Set Receiver with USB cable
- STS-ANT Test Set Antenna
- STS-PC Test Set PC
- STS-HOOD Test Set PC Hood for outdoor viewing
- STS-DCAC Test Set DC/AC adapter
- 5000-0100 Antenna, GPS, SMA
- 6800-1154-2 Test Set Software
- STS-CASE Test Set Environmental case

STS-0002 Satellite Test Set Receiver Subsystem
- STS-REC Test Set Receiver with USB cable
- STS-ANT Test Set Antenna
- 5000-0100 Antenna, GPS, SMA
- 6800-1154-2 Test Set Software

The PC must meet the following minimum requirements to connect to the STS-REC Receiver.
- Processor speed 2.0 GHz
- 512MB memory
- 20 GB disk
- CDROM
- qty 2 USB 1.0
- qty 1 RS232 (if serial output is desired)
- Ethernet or Wireless Ethernet
- Keyboard/display/mouse
- Windows XP Home or PRO

Connections

Remove the PC from the carrying case for normal operations. Connect the USB cable between the PC and the test set receiver. Connect the GPS antenna to the test set. Connect the whip antenna to the test set. The test set receiver gets its power through the USB cable. If there is a separate USB to serial adapter and you need the RS232 port, plug it in.

Startup

The test set PC should be removed from the case before operating. It may be operated for short periods in the case but during extended operations, there is not enough air flow around the PC to dissipate heat. As a result, the PC and case will heat up and potentially damage the PC. The GPS antenna should also be removed from the case and attached to a horizontal metal surface. The test set receiver can be operated while in the case or removed from the case.

Check all connections as explained in the previous section.

Press the power-on button on the PC to turn it on. (The PC power-on button is at the upper left corner of the keyboard on many systems). As the PC starts it will turn on the power to the USB and power up the test set receiver. The PC will also automatically start the reception and demodulation programs. This process takes 1-2 minutes. You will know that the system is operating when you see the green LED on the test set receiver flash. If the test set receiver green light does not turn on, unplug the USB cable, wait 15 seconds, and plug it in again. When it is plugged in you should hear a USB connect, disconnect and connect tones (if sounds are turned on for your PC) and the green LED on the test set receiver will turn on.

The test set is configured to automatically run the Test Set viewer program on startup. If it does not run automatically, you can also run it via a shortcut on the desktop or via the start menu. When the program runs it should display a message in the title bar saying “Sutron Test Set connected to …”. This is your indication that the test set program has connected to the system and is receiving data.

If the Sutron Test Set software title bar says “disconnected”, select the Options menu directly under the title bar and make sure the server is set to the IP for your PC (or 127.0.0.1) and that all interfaces are “Open”. If not, consult the troubleshooting section of this manual.

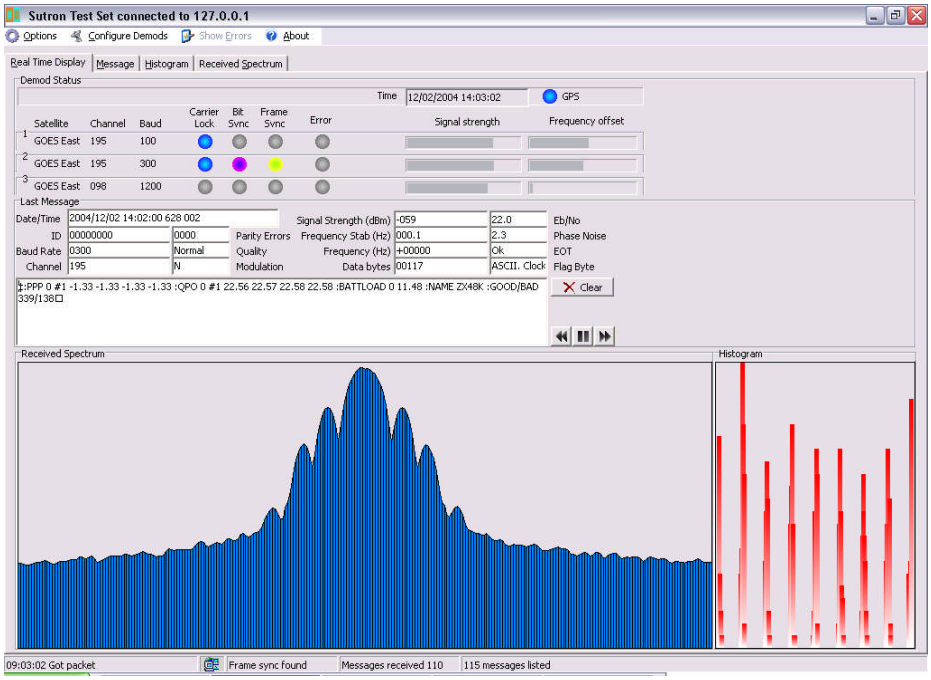
One last step in startup is to wait for GPS. The test set uses GPS as its time and frequency reference. Without it, the test set will not be able to accurately report the time or frequency of the messages it receives. It will take 10-15 minutes for the test set to fully acquire GPS. During this time the GPS indicator will be grey and any messages received will include a ? in the time field. Once the system has acquired GPS, the indicator will turn blue.

The test set normally resumes operation on whatever channels that were being used when it was shut down. Be sure to check the satellite and channel information to make sure that the test set is working on the desired satellite and channel. If there is any question, simply press the Configure Demods control to get full access to the configuration.

If you ever need help operating the test set, press the help control at the top of the display. Help is “context sensitive” so it will display information relevant to the screen that is displayed. Major portions of this manual are included in the help.

Operation

The Sutron test set program gives a real-time view into the operation of the test set. A typical screen is shown below. The screen is designed with four tabs to select what is displayed: Real Time Display, Message, Histogram and Received Spectrum. Across the top of the screen are controls for Options, Configure Demods, Show Errors, Help and About. Across the bottom of the screen is additional information as to the operation of the program.



Real Time Display

The Real Time Display gives a complete view of the test set operation. It is organized into four sections: Demod Status, Last Message, Received Spectrum and Histogram.

Demod Status

The Demod Status is constantly changing to show the date/time, GPS status, and operation of the three test set demodulators. The Date/Time will be synchronized to GPS when the GPS screen LED is blue. This also means that the PC clock is being synchronized to the time from GPS. If the screen LED is off (gray), the date and time will come from the PCs internal time.

The test set contains three demodulators. This is done so the test set can receive transmissions at 100, 300 and 1200 baud without changing settings. Demod 1 is typically configured for 100 baud, demod 2 for 300 baud and demod 3 for 1200 baud. In addition, demods 1 and 2 will typically have the same channel assignment while the 1200 baud channel will be roughly ½ of the 100/300 channel. The channel setting for demod 1 is very important as it controls the tuning of the receiver. As a result, demod 1 must always be ON and all demods that are ON must be set to the same satellite.

The demod status includes satellite, channel, baud, carrier lock, bit sync, frame sync, error, signal strength, and frequency offset. The satellite, channel, baud are all set using the *Configure Demods* control. The other status are real-time information from the demodulators. Carrier lock, bit sync and frame sync will light as a message is received. All three lights must be on for a message to be received. Frequency offset shows the demodulator sweeping across the channel looking for a

message. The center of the bar represents 0 hz and the ends represent –500 and +500 Hz. The error LED will light if any errors were detected while receiving the message. The errors are: configuration error, address error.

The LEDS will turn off when the transmission is finished at which time the PC will perform some additional processing on the message and then display and process it according to the test set configuration. This is explained in detail in the section titled Message handling.

Last Message

The Last Message frame gives the details for the last received message as follows:

Date/Time	The date/time the frame sync is detected. The format is YYYY/MM/DD HH:MM:SS MMM, the MMM being the milliseconds into the second. The time will be based on the GPS clock if the GPS virtual LED is on. If it is not on, the time will be based on the PC time and may not be accurate.
ID	The received ID (or Address) for the message, corrected for any errors. Note: if you have made up IDs yourself, they are probably not valid and will be "corrected" as they are received.
Baud Rate	The received baud rate for the message.
Channel	The received channel for the message.
Parity Errors	A count of the number of parity errors in the message.
Quality	Data quality computed from RMS phase error implied by the phase histogram. N: Normal, error rate better than 1E-6 F: Fair, error rate between 1 E-4 and 1 E-6 P: Poor, error rate worse than 1 E-4
Modulation	N: Normal – 60 deg +/- 5 deg (100 bps only) H: High – > 70 deg (100 bps only) L: Low – <50 deg (100 bps only)
Signal Strength	Received power of the message in units of dBm. Note, the more negative the number, the weaker the received power. The normal range for the signal strength will be –20 to –90 dBm.
Frequency Stab (Hz)	Frequency stability in Hz. Peak-to-peak variation in the demodulator's frequency estimate from frame sync to EOT. This includes the error in the test set itself that adds between 1 to 3 Hz to that of the DCP.
Frequency (Hz)	Frequency error in Hz for the received message. The range is +/-400 Hz for proper reception. This is only valid if the GPS is locked.
Data bytes	A count of the number of data bytes in the message.
Eb/No	Estimated Eb/No based on the RMS phase error. The larger the value, the stronger the signal.
Phase Noise	Estimated phase noise computed from the phase error of each received symbol. This value will vary based on the received signal strength. This is not a confirmation of DCP phase noise accuracy due to the influence of signal strength.
EOT	Indication if EOT was detected.
Flag Byte	Details of the flag byte with the following possible results: ASCII, PSEUDO BINARY, BINARY, CLOCK SYNC UPDATED (since last transmission), DATA COMP ON, DATA COMP OFF, REED SOLOMON ON, REED SOLOMON OFF.

The message data is contained in the large text box beneath the message information. To the right of the message data is a clear control to clear the last message data. To the right of the message data are also left, pause and right scroll controls. These controls allow you to view the previous 10 messages received. The pause is activated automatically whenever left or right is pressed and it

will change to a run control. Remember to press run to resume normal updating of the last message frame.

Received Spectrum

The Received Spectrum frame gives a spectrum analyzer view of the test set receiver. The normal span for the received spectrum is +/-1000Hz centered on the selected channel. Since you can have up to three channels enabled for the spectrum analyzer, the spectrum displayed can be any of the enabled channels.

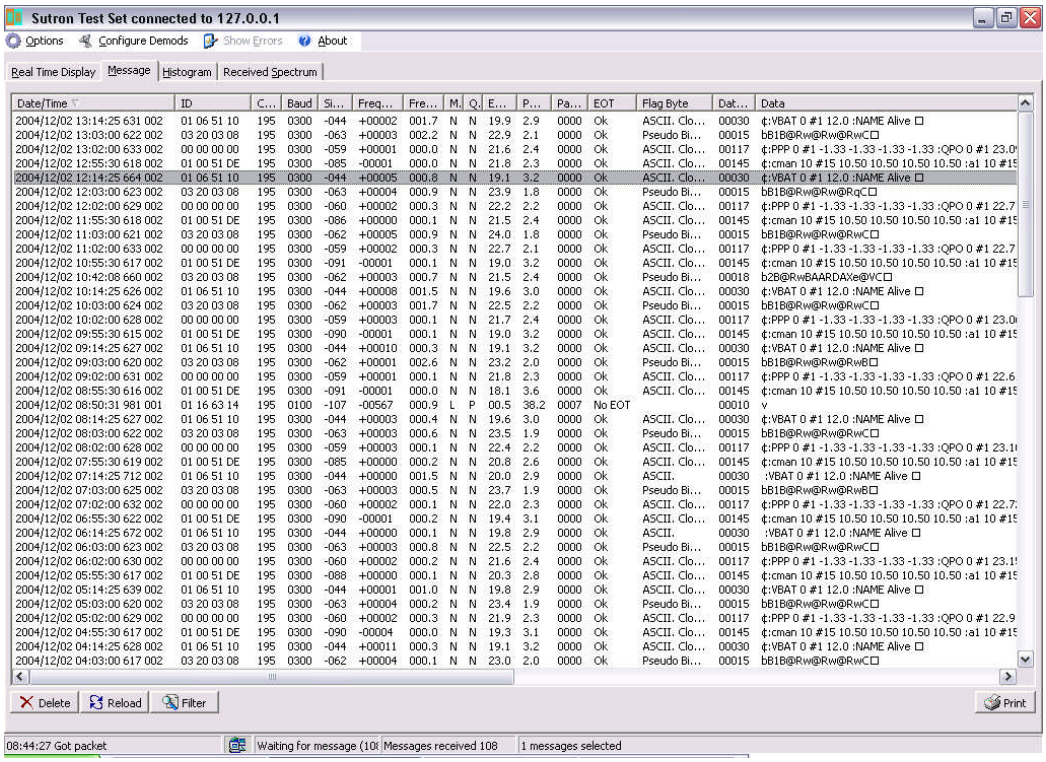
Histogram

The Histogram frame gives a graphical view of the phase state data detected in the message. For a 100 baud message, the data is transmitted and thus grouped into two phase states. Accordingly, you'll see two main peaks in the histogram. The sharper the peaks, the better the overall quality of the received message. For a 300/1200 baud message the data are grouped into 8 phase states. You will see 9 peaks in the graph because the first and last are really adjacent just as 359 degrees and 0 degrees are adjacent. Again, the sharper the peaks, the better the overall quality of the data. The Quality value and Phase Noise value assigned to each message is calculated from this phase state data.

Message

The message tab gives quick access to the messages received by the test set. The messages are organized in a tabular format with the information for a single transmission in a single row. The columns provide the details for the message with all the information provided in the last message display.

The message tab gives you the freedom to resize any of the columns or sort the data by any of the columns. To resize a column, simply move the cursor to the line between two column labels. The cursor will change at which time you can hold down the mouse button and drag the line left or right to shrink or expand the column. To sort the data click on the column you wish to sort by. The data will now be sorted by that column. Click the same column again and the data will now be sorted in reverse order. If the column label is wide enough, an indicator will be displayed after the label indicating the direction of the sort.



Selecting messages

You can select multiple lines in the message list by using holding CTRL while clicking with the mouse (selects/deselects individual lines) or holding SHIFT while clicking with the mouse (selects/deselects a block of lines). With lines selected you can perform some additional functions such as deleting messages, printing messages, and decoding messages. With messages selected, right click on a message and a dialog is displayed with options to Delete, Print, Select All, Select None, and Decode Data.

Delete

Delete will delete from the list any selected message(s). If no messages are selected, all messages are deleted from the list. This does not actually delete any of the messages that have been stored on the disk – it just deletes them from the list being displayed. Reload will read the data from the disk and display it in the message data.

Print

Print will send a copy of the selected line(s) to a printer or file. For Print to operate, the PC needs to be configured with a printer even if you intend to only print to a file. To print to a file, select the "Print to File" check box when the Printing dialog is displayed. A sample line is shown below with the diagnostic data on the first two lines and the data starting on the third line:

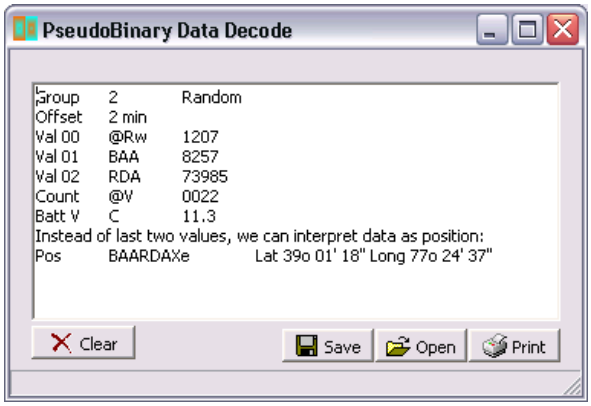
2004/12/02 13:14:25.631 ID=01065110 CHAN=195 BAUD=0300
FREQ=001.7 POWER=-044 MOD=N QUAL=N PARITY=0000 Eb/No=19.9 DATA=00030
¢:VBAT 0 #1 12.0 :NAME Alive

Select All and Select None

Select All and Select None are shortcuts to help decide what is selected.

Decode Data

Decode Data is only available if the message is in Pseudo-Binary format. If you select a line and then right click and select Decode Data, a dialog of the decoded data will be displayed. The following example shows decoded data from a random transmission. Currently the decoder only supports Sutron pseudobinary formats. Since the decoder does not have detailed information on the format it cannot scale the values to engineering units.

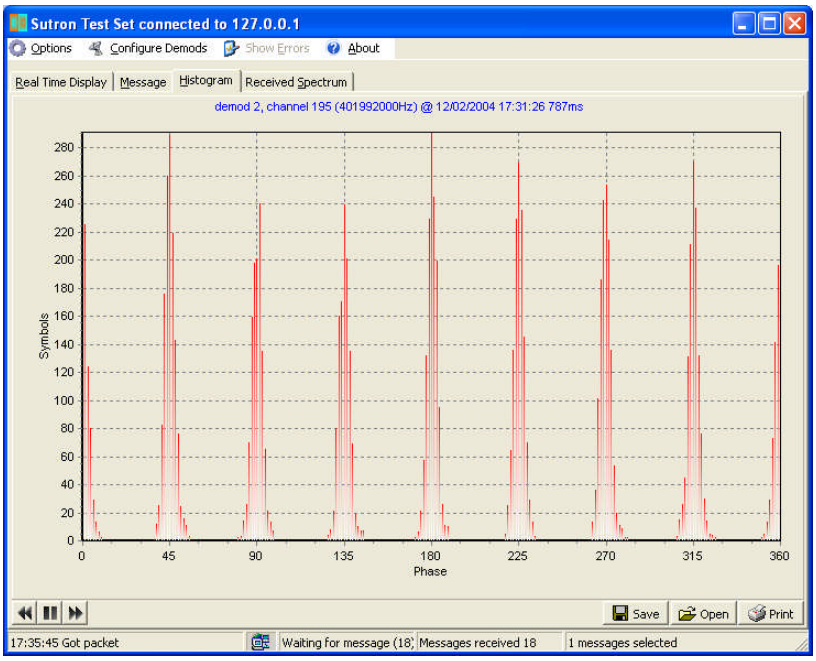


Filter

Filter will display a dialog that allows you to only display data for a certain ID and/or time.

Histogram

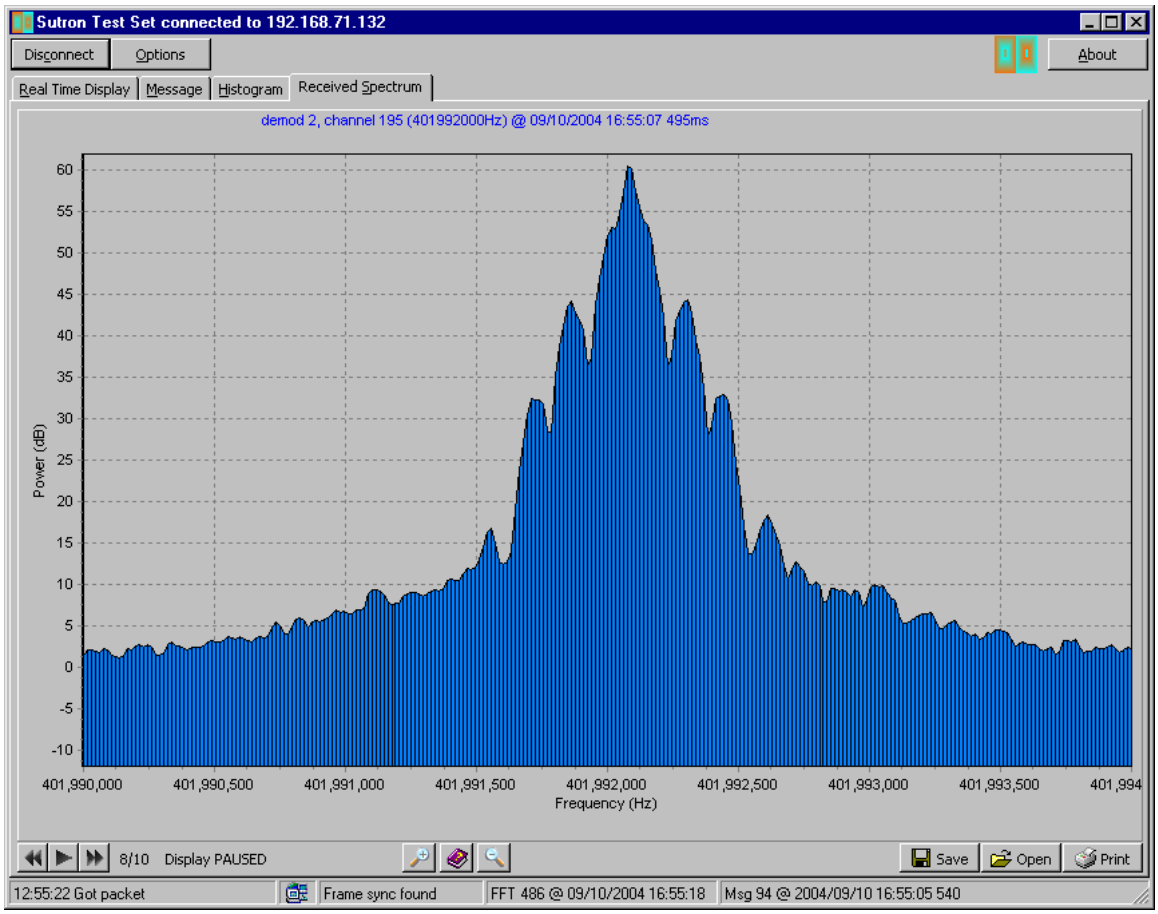
The Histogram tab gives a full graphical view of the phase state data detected in the message. For a 100 baud message, the data is transmitted and thus grouped into two phase states. Accordingly, you'll see two main peaks in the histogram. The sharper the peaks, the better the overall quality of the received message. For a 300/1200 baud message the data are grouped into 8 phase states. You will see 9 peaks in the graph because the first and last are really adjacent just as 359 degrees and 0 degrees are adjacent. Again, the sharper the peaks, the better the overall quality of the data. The Quality value and Phase Noise value assigned to each message is calculated from this phase state data.



The controls at the lower left allow you to review previous histograms. The software has recorded the last 10 histograms into memory. Pressing left and right will allow you to review them. The demod, channel and time of each histogram is given at the top of the screen. The screen is automatically paused when the left and right controls are used so remember to press record to resume normal operations.

The controls on the lower right allow you to save a histogram to disk, open a saved histogram and print the histogram.

Received Spectrum



The controls at the lower left allow you to review previous spectrums. The software has recorded the last 10 spectrums into memory. Pressing left and right will allow you to review them. The demod, channel and time of each spectrum is given at the top of the screen. The screen is automatically paused when the left and right controls are used so remember to press record to resume normal operations.

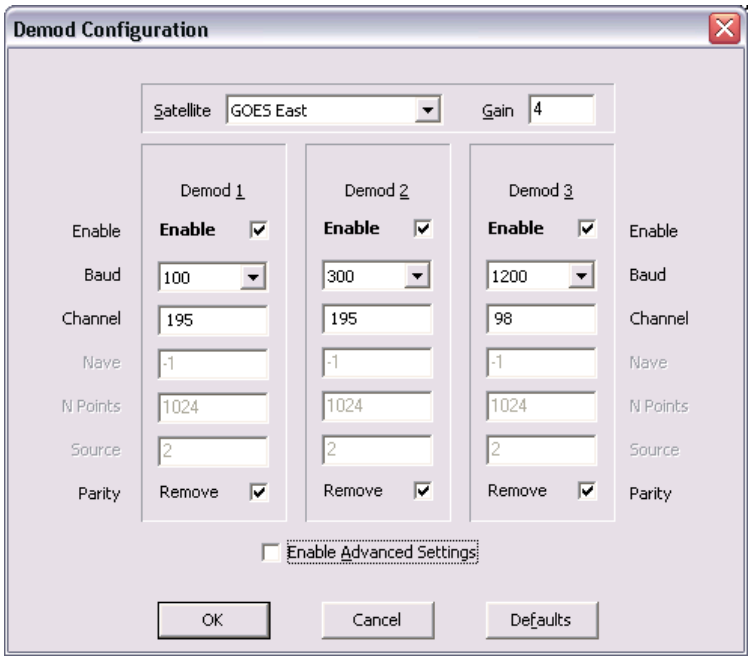
The controls on the lower right allow you to save a spectrum to disk, open a saved histogram and print the histogram.

The controls in the center allow you to zoom in and out of the spectrum for better viewing. You can also use the mouse on the screen to zoom into an area of interest. Simply click on the upper left area you wish to see and then drag the mouse to the lower right, drawing a rectangle as you do. When you release the mouse button, the graph will be redrawn using the rectangle as a guide.

Setting and Changing Channels

Channels are set and changed by selecting the *Configure Demods* menu at the top of the display. (It is also possible to use select Configure Demodson the Server tab of the Options menu. When you a dialog similar to the one below appears. This dialog gives the detailed configuration of each of the three demodulators supported by the test set. Demod 1 must always be enabled as it sets the frequency for the receiver. If you are interested in monitoring a single channel at a single baud rate, simply set up demod 1 and disable the other channels.

When setting the channel for multiple demods, the system will automatically force the channels for the other demods to be consistent with each other. 100 baud and 300 baud channels must be within 5 channels of each other and 1200 baud channels must be within are about ½ the value of the 100/300 baud channels.



Satellite	The choices for Satellite are GOES East, GOES West, Meteosat, INSAT, MSG, International and ARGOS. The INSAT and ARGOS satellites are not yet available. GOES users can select GOES East or West regardless of where they are. There is no difference in the operation of the test set based on these choices – the only difference is what code (E or W) is included in the output data.
Gain	This sets the test set front end gain. For outdoors use, set gain to –1 which is the autogain setting. With this setting, the test set automatically adjusts the gain to receive both weak and strong transmissions. For indoors use, you may need a manual gain setting to eliminate problems caused by multi-pathing of signals. Start with a gain of 8 and if the red LED comes on during the transmission, reduce the gain to 4 or 2. The full range of manual gain settings is 1..12. A gain setting of 0 leaves the current setting unchanged. Since the test set software cannot read the gain setting of the receiver, use gain=0 whenever you want to leave the current setting unchanged.
Enable	This enables the demod. Demod 1 must always be enabled. Its channel sets the tuning for the test set. Enable for the other channels is optional based on the need to receive data at different baud rates or on adjacent channels.

Baud	This sets the baud rate for the channel. For GOES satellites, typically demod 1 is set to 100, demod 2 to 300 and demod 3 to 1200. If other satellites are selected, the baud will be set accordingly.
Channel	This sets the channel for the demod. The channel for demod 1 sets the tuning for the test set. Remember GOES 1200 baud channels are roughly ½ the value of the 100/300 baud channels. The software will automatically set the channel for other demods to keep all the channels within valid limits.
Nave	This controls the *number* of FFTs *averaged* in the spectrum. A value of –1 implies averaging for all of a DCP message. A value of 40 or 80 is useful for a real-time display of the spectrum at times when a message is not being received.
N Points	Number of FFT data points (will be a power of 2). Typical value is 1024.
Source	Source for the FFT: 2 channel selected, 3 matched filter output.
Parity	Remove checked: remove the parity bit from data (normal setting) Remove unchecked: keep the parity bit in the data.
Enable Advanced Setup	Select this to allow user setting of the Nave, Npoints and Source.

The following channels are valid for each of the satellites:

Satellite	Baud	Channels	Spacing	Freq
GOES East/West	100/300	1-266	1500	401.7010
GOES East/West	1200	1-133	3000	401.70175
Meteosat	100	1-33	3000	401.1015
MSG	100	1-223	1500	402.1015
International	100	1-33	3000	402.0025

Note: International channel 1 = GOES East/West 202

Message Reception

The test set performs the following functions for the reception of messages.

1. Demodulators are configured by the user program as to the satellite type, channel and baud rate.
2. Every second the demodulators output status information that is provided in the real-time display.
3. As a message is received, demodulators will timestamp the instant the frame sync is detected and make quality measurements on the received message.
4. At the end of the message the message will be:
   - written to the Real-time display
   - written to the Message list
   - written to disk for later review
   - output to the serial port if enabled
   - written to RAW file if enabled.

Other Test Set Settings

All the settings for the test set can be found by selecting the Options menu. The dialog that is displayed has two main tabs: server and save data.

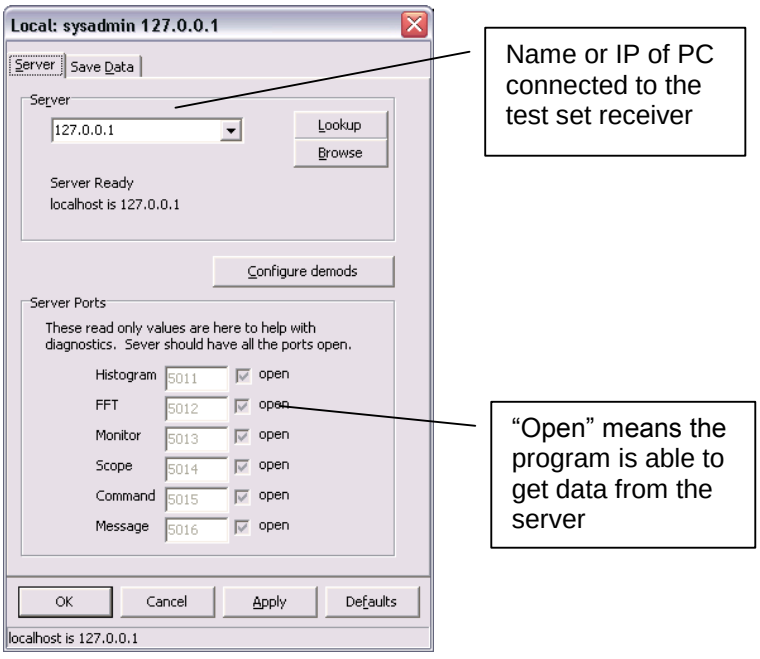
The server tab allows the user to Configure demods and change the server address as shown below. The Demod configuration is discussed in the section on Changing Channels.

Server

The test set software can run either on the same PC to which the test set receiver is connected or on a networked PC. The server field tells the user interface program where to go to get its data. The address will be the IP address or name of the PC which is connected to the test set receiver. This address can also be 127.0.0.1 which is the internal address for the PC on which the software is running.

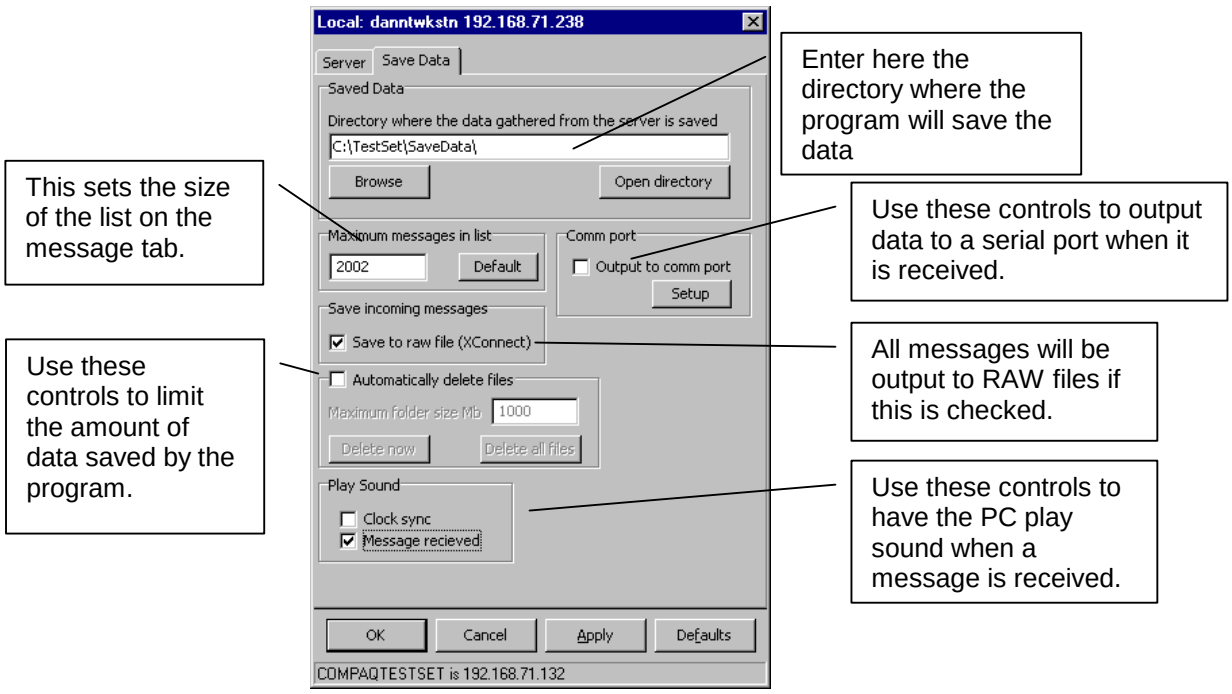
When you type the IP or name of the server into the box under Server and press tab (or Lookup) the software will attempt to access the server to see if the required server ports are open. A list of all the server ports and their status will be displayed in the Server Ports frame. The software must find all of the ports "open" for the software to operate properly. If any ports are "?" the software will not be able to receive messages.

When running in a networked environment, be careful when you "Configure demods". Any changes you make in configure demods will affect the test set receiver and demods. Don't make changes without contacting others who are using the test set. All the other changes in Options apply only to PC on which the test set program is running and can be made without affecting others.



Save Data

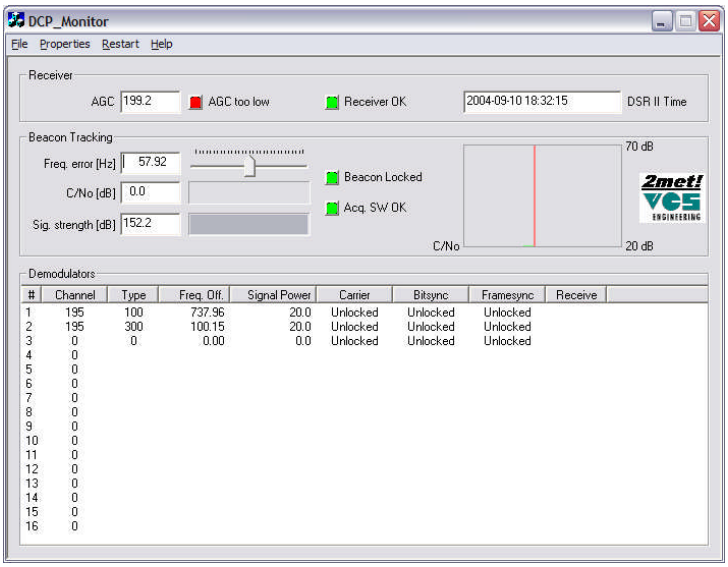
The Save Data tab controls how the test set handles the data it receives. A sample screen is shown below along with a detailed description of each field.



Directory	Sets the directory for data written to disk. All received data are written to disk so they
Maximum messages in List	This sets the size of the list that is shown on the message tab. All the data for this list is kept in memory so larger lists will use more memory. Larger lists will also make the program operate more slowly as it sorts and filters the data.
Com port	When Output to com port is checked, the data will be written to a serial port when it is received. The selection of the port, its baud rate and other settings are available by selecting Setup. The format of the output message is NESDIS DAPS format.
Save to raw file (XCONNECT)	When this is selected, the incoming messages are written to a disk file in Sutron's RAW format. The RAW format is identical to NEDIS DAPS format with the addition of 3 ETX's at the end of each message.
Automatically delete files	When this is checked the software will periodically delete the oldest data files in the saved data directory in order to keep the system from filling the disk. Since the program reads data from this directory on startup to fill up the message list box, it is important that this directory not get too large.
Play Sound: message received	Check this box to have the PC play a sound when each message is received. This helps alert you to the message without looking at the display. Note a different sound is played if the message is received with errors.

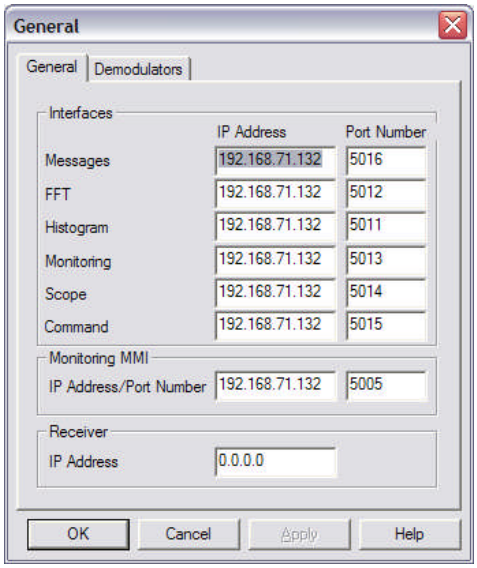
Server Setup

You can manually set the server IP in the PC connected to the test set receiver. This may be needed if there are multiple NICs in the PC or if you want to restrict a PC for just local operation. The server IP is set using the DCP_Monitor program. This program is located in the start menu, Programs, 2Met, DCP_Acquisition. When the program runs the following screen is displayed.



Select Properties, General. The following dialog will appear that allows you to set the IP address for each interface. Do not change the Port numbers! Set the IP address to the address of one of the NIC cards in the PC. If you want to limit the PC to local operation, set the IP to 127.0.0.1. You will need to reboot the PC after making these changes.

Note: the recommended setting for the IP address for all interfaces is 0.0.0.0. With the IP set to 0.0.0.0, the software will first try to use the IP of the first NIC card it finds. If this fails, it will use the IP of 127.0.0.1 for each interface.



Software Installation/Removal

Installation: Complete

Follow these steps to install the software on a PC which will be connected to the test set receiver.

1. Don't connect the test set receiver until instructed to do so.
2. Install the Sutron test set software.
3. Install the VCS Logger software.
4. Install the DCP_TestSet software.
5. Reboot the test set PC.
6. Start the 2met! User Station Banner. Open the "Configuration" menu and select "USB_DRIVER_INSTALLATION. Follow the prompts and press YES when directed.
7. Connect the DCP Test set to the computer.
8. In some cases Windows will detect new hardware and start the "Found new hardware" wizard. In this case, let the system install the software automatically and finish the Wizard. It will probably go through the wizard process twice.
9. The green light on the test set receiver should now be blinking and the system is ready for use.

Installation: Monitoring software

Follow these steps to install the test set software on a PC not connected to the receiver. This PC can get at the test set data through the network.

1. Install the Sutron test set software
2. Run the test set software.
3. Select Options, Server and enter the IP of the PC connected to the receiver. Press Lookup to make sure all interfaces are "open". Press OK.

Software Removal

Follow these steps to remove the test set receiver software.

1. Disconnec the Test Set receiver from the PC
2. Start the 2met! User Station Banner, Open the "Configuration" menu and select the "USB_DRIVER_Deinstallation"
3. Open "Add or Remove Programs" from the control panel.
4. Remove 2met DCP TestSet
5. Remove 2met VCSLOG
6. reboot the system

Follow these steps to automatically run the test set software at startup

1. Right click Startup, select Open All Users.
2. Then go to Start, Programs, Sutron, Test Set and drag the Test Set icon to the opened directory.

Follow these steps to automatically log into the PC at startup

- Go to Start/Run, and type 'control userpasswords2'.
- From Users Tab, Uncheck "Users must enter ...."
- A dialog will allow setting a user and password to be used automatically.

Theory of operation

The test set receiver consists of an RF front end to receive the transmission, an A/D converter to convert the data to digital form and a processor to pass the data via USB to a PC. The front end has automatic gain control to handle a wide range of input levels. A VCO controlled by the processor tunes the front end to the desired frequency of operation. The bandwidth of the front end to the A/D converter is about +-10KHz. The overall tuning range for the front end covers the entire 401.6 to 402.9 MHz bandwidth for the environmental satellites. The receiver is powered off the voltage supplied via USB. A GPS module is also included in the receiver to provide accurate time stamps for the received messages. This time information is included with the data sent to the PC via the USB cable. The GPS also provides a frequency reference for the test set so it can accurately measure the frequency of the received message. This eliminates the need for periodic calibration of the reference oscillator.

Within the PC, special services and programs handle the task of ingesting the data from the receiver and demodulating the messages. The software demodulators are responsible for all aspects of the reception process including carrier detect, clock sync, frame sync, ID recognition and data reception. The demodulators use a variety of digital signal processing (DSP) techniques to accomplish the task. The demodulators used in the test set are the same high-performance demods run at direct readout ground stations. The beauty of the software demods is that they can easily be updated to implement new features and functions should they arise.

The acquisition programs support sockets to provide status and data to other programs as well as accept configuration information. These sockets allow the display and control programs to run the local PC or on remote PCs. The test set display program interacts with these sockets to provide a real-time view of the data and to capture the data that is received.

Troubleshooting/Service

There are no user serviceable parts in the test set receiver. The following procedure will help in troubleshooting a station.

Problem

Server quiet, resetting connection

If the system does not start operating, use Options, Server and check/set the Server address. Use Lookup to verify that the Server Ports are “open”. If the system still does not operate, reset the PC.

No demodulator activity/no messages.

Check the tltle bar to make sure the software is “connected”. If not, follow suggestions above. Check demod channel assignments.

No spectrum/histogram

This is the default startup condition for the test set until a message is received.

No Green LED

This means that the test set receiver is not operating. Unplug the USB cable, wait 15 seconds and plug it back in again. If the LED does not turn on and flash, restart the PC. If the PC displays the “Found New Hardware” Wizard, follow the prompts to let the system install the software automatically.

Red LED on.

This means that the signal is to strong for the test set or that there is interference. Move the receiver further away from the transmitter. Try one of the fixed gain settings. If the red LED is on even at the lowest gain setting (i.e. 1) you may need to add attenuation into the antenna.

Missing/Garbled messages

If you are operating the test set indoors, there is a great chance of multipathing where signals are reflected off walls, ceilings and even persons who are nearby. If you experience missing or garbled messages indoors, set the "gain" for the test set to a fixed level (such as 8 or 4). If the red LED turns on reduce the gain setting (e.g. from 8 to 4 or from 4 to 2) until the LED does not turn on during a message.

Glossary

Address Error	The Address or ID is a special code that contains error detection and correction bits. If you make up your own Address (for in house test purposes), the Address is likely to have the incorrect format and be flagged as “Address Error”. Where possible, the software will use the error correcting bits to compute the correct address which may have a different code from the address it received.
Bit Sync	The second stage of a transmission is a series of data for the demodulator to sync to. In the case of 100 bps transmissions, the bit sync data is between 0.5 and 2.5 seconds. For 300/1200 baud transmissions the bit sync data includes 3 phase transitions. Once the demodulator has acquired bit sync it can then look for Frame Sync.
Carrier lock	The first stage of a transmission is a carrier signal. Carrier lock is when the demodulator acquires this signal and can start trying to acquire Bit Sync. The carrier for a 100 bps transmission is between 0.5 and 5.0 seconds. The carrier for 300/1200 baud transmissions is .5/.25 seconds respectively
DBm	This is a unit of measure of RF power level. The dBm represents how many decibels relative to 1 milliwatt. This may be calculated by: Power(dBm)= 10*log(Power in Watts*1000)
DCP	Data Collection Platform, a commonly used term for a measuring device capable of transmitting data through the satellite.
Demodulator	A device capable of acquiring transmissions and converting the signals into usable data.
Eb/No	This is Energy per bit-to-Noise Density Ratio. This is an expression for ‘how strong the RF signal is’ without having to worry about channel bandwidth and data rate variables. This may be calculated from received signals and compared to theoretical values. System margins may also be determined.
EOT	End of Transmission, a character sent at the end of a transmission to mark the end of the transmission. The EOT is 04 Hex for most 100, 300 and 1200 baud transmissions. The EOT is a 31 bit pattern for transmissions on the international channels, MSG, and 300/1200 bps binary mode (TBD). The INSAT transmissions are terminated with a “FADE” Hex string.
Flag byte	300 and 1200 baud transmissions send a Flag byte immediately after the ID before the first byte of data. The test set includes this flag byte as the first byte of data. The flag byte contains bits that report important format and operational information of the transmitter. The test set decodes this information and displays it in human readable form.
Frame Sync	Frame sync is the third stage of a transmission. The frame sync is a specific pattern of data. When the demodulator sees this specific pattern, it knows that the Satellite ID will follow immediately.
Frequency Stability	The demodulator tracks the frequency of the transmission throughout the message and reports the variation it sees. A number greater than 10 Hz for the frequency stability can indicate a problem in the transmitter and can cause errors in the message.

GPS	Global Positioning System capable of providing time and position information.
Histogram	A graphical representation of the modulation information from a transmission. The number of times a symbol was received at a particular phase location will be displayed.
ID	Satellite ID or Address for the message. This is a 32 bit number typically expressed as 8 characters 0..9,A..F. The 32nd bit will always be zero.
Modulation	Modulation is the way the transmitter converts the data to RF energy as it makes the transmission. Different techniques are used for each type of satellite and baud rate. For 100 bps transmissions, the modulation is +/- 60 degrees. For 300/1200 baud transmissions the modulation is in 8 states 0, 45, 90, 135, 180, 225, 270 and 315 degrees. 4800 baud transmissions typically have 2 pahse states, 0 and 180 degrees. The test set reports the modulation as N:Normal, H:High and L:Low.
Parity Errors	The data in a transmission includes an error checking bit called parity. There is one parity bit for every byte of data. The demodulator will check this parity bit and keep count on the number of parity errors in a message. A normal message should be free of parity errors.
Phase Noise	Phase noise is the enemy of a transmission. In order for a transmission to be received properly, the phase noise must be low. Sources of phase noise include faulty transmitters, interference, weak signals.
Phase states	The phase states are the states as identified in the above definition of Modulation. A transmitted symbol will physically involve the transmitter to transmit at a particular phase angle for a period of time approximately defined by the symbol rate.
Quality	Quality is the data quality of the transmission estimated as the transmission is being received. It is computed from the phase error data of the demodulator and assigned values of N (normal), F (fair), and P (poor). Messages with Quality of F or P are likely to have errors in them.
Signal Strength	Signal strength is the received power of the transmission. The normal range is –20 to –90dBm. The more negative the number the weaker the signal. Since the test set is not directly connected to a transmitter, the signal strength will be affected by proximity to the transmitting antenna.
SMA	A type of RF connector
Spectrum	A graphical representation of the transmission energy in order of frequency.
USB	Universal Serial Bus, a hardware interface common on most PCs. The test set receiver connects to the PC using USB. USB provides power to the test set receiver and a way for the data to be read into the PC.