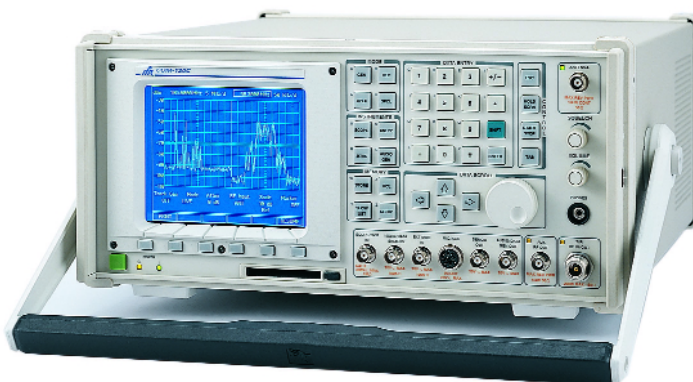# Spectrum Analyzer Operation Using a Computer and EasySpan II Software

Tom Rittenhouse

This application note describes the setup and operation of EasySpan II Software Application - displaying a saved trace and evaluating the results using markers, instrument control by a PC connected directly with a cable or through a modem, and how applications will automate and simplify mundane tasks.

Introduction

The EasySpan II software package operates on a PC in a Windows environment that enables extracting spectrum analyzer traces from IFR Test Equipment. EasySpan II communicates remotely with the instrument through direct connection or a modem using the RS-232 serial communication format. The instrument can be remotely located around the world and when used with a modem, will transmit the trace information through telephone lines. With the use of limit lines and save features, it easily provides traces with time and date stamping for verifying problems, unattended. Using EasySpan II, waveforms can be examined, stored and/or compared to a reference waveform. The number of stored waveforms is limited only by the size of available memory on the PC. Trace and scale offsets can be added to adjust any portion of a waveform to compensate for external devices. Various formats are available for saving traces: BMP, GIF, PCX, csv/txt, clipboard and others.

The scope of this document is not wide enough to bring the full capability of EasySpan II to light. It is designed to enable someone to recall a stored trace and control a spectrum analyzer. It is not intended to cover every aspect of EasySpan II's capability, since the help menu covers almost all operations. We can easily add new capability to the software package for individual requirements. Please call IFR if you feel EasySpan II may be able to provide a solution to a cumbersome problem.

Measurements

The various measurements are listed under Markers on the task bar. It will set up the screen and markers to read the proper value formats.

[Markers][Measurements] - Brings up measurements selection.

1. Level

2. VSWR (return loss bridge and optional tracking generator)

3. Return Loss (return loss bridge and optional tracking genera-
tor)

4. Insertion Loss (optional internal tracking generator)

5. Carrier/Noise

6. Cable Fault (power splitter and optional tracking generator)

7. Field Strength (calibrated antenna)

Operation

EasySpan II operations are broken down into two modes. The first is to examine traces saved in a database, no instrument required. The other is with an instrument attached, collecting and storing traces using some type of IFR spectrum analyzer.

Select Database

To use EasySpan II with an existing database, you must first select a database. Selecting a trace from a database will allow operation without an instrument. Many of the functions are operational on saved traces for scrutinizing problems at a later time.
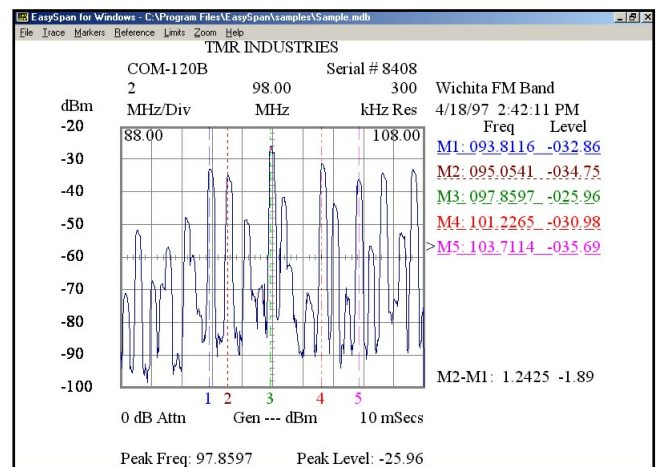
[File] [Database][Open Existing]

[c:\program files\easyspan\samples\ sample.mdb] - Will select the included sample trace database.

[Trace] [Open] Brings up the trace selection box with a thumbnail view of the selected trace before appending it to the EasySpan window.
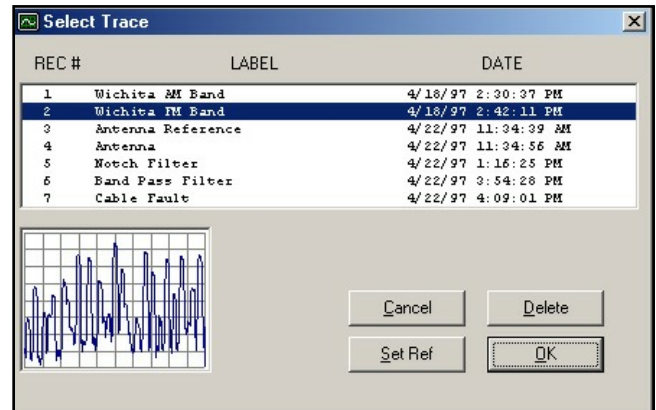
Select trace number [2 Wichita FM Band] and click [OK].

Information present on the screen unless selected to be blank:

Company Name

Reference Level

Attenuator Setting

Center Frequency

Resolution Bandwidth

Peak Frequency and Level

Tracking Generator Level

Spectrum Analyzer Model and Serial Number

Time and Date

Peak Frequency and Level

Settings of 5 Markers

Difference Information of Marker 1 and Marker 2

If the markers are not on select:

[Markers][All][On] - Turns on the 5 makers.

Below the marker column is an M2-M1 field that displays the mathematical difference between markers one and two. It is used for looking to see how signals are related to each other, harmonic, spurs, intermods, etc.

Markers

Markers are used for displaying a specific point on the trace (default is amplitude level and frequency). Each may be selected by clicking on the marker of choice in the right hand frequency and level column. After selecting the marker, click on the trace where the marker is to be placed. Using the right and left arrow keys will move the marker right or left, one data point at a time for fine tuning. Locking markers 1 and 2 will aid in looking for related problems. M2 - M1: provides a delta function displaying the difference between markers one and two. Markers are fully functional on recalled traces.

Various keyboard shortcuts are available, speeding up marker operation.

[F4]	Moves current Marker to next dip.
[Shift+F4]	Moves current Marker to previous dip.
[F5]	Sets connected IFR Instrument Center Frequency to current Marker Frequency.
[F6]	Finds first five (5) peaks over the peak threshold level.
[Shift+F6]	Finds first five (5) peaks over the Limit Line.
[F8]	Moves current Marker to maximum amplitude level on trace.
[F9]	Moves current Marker to next peak.
[Shift+F9]	Moves current Marker to previous peak.

NOTE: If only specific frequency and level information is important, position the markers to the proper location before saving traces. Later when exporting information, select the specific information required such as a marker frequency, level and GPS coordinates. It is easier to save the marker settings with each trace saved the first time rather than having to set each marker later. **[Trace][Export][Options]** will bring up the table for selecting data to be exported to a file.

Trace Saving, Exporting
You can save the trace to another medium such as a word processor document or a spreadsheet format.

[Trace] [Copy To][Clipboard][As Image] or **[As Data]** - Copying to Clipboard **[As Image]** will enable pasting it to a word processor document, **[As Data]** will enable pasting data to a spreadsheet format

Saving traces in other formats is available.

[Trace][Copy To][Image File][Save as Type][JPEG 24-bit] - Saves traces in other formats.
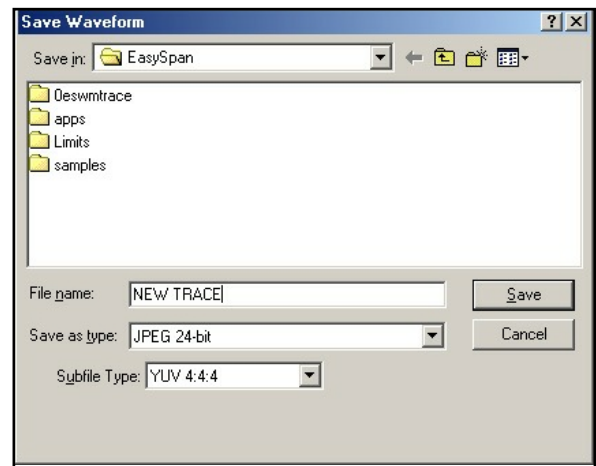
Instrument Control
Before EasySpan II Software can be used to control and extract traces from an IFR Instrument that includes a spectrum analyzer with a digital display, the communication port settings on the PC and the instrument must have the same settings. Only the 2398, 2399, and 2394 Spectrum Analyzers will require the use of the supplied null modem cable or a null modem adapter.

[File] [Configure][Comm Port] - Brings up the comm port setting table.

[Comm Port] - select the RS-232 port on your PC. (If using a modem and the phone system choose the port that selects your modem.)

[Baud Rate] - default is 19200 and sets the data rate or speed the PC and instrument exchange information. The higher the baud rate the faster the traces will be returned from the spectrum analyzer.

[Parity] - is generally set to [None].

[Data Bits] - is generally set to [8].

[Stop Bits] - is generally set to [1].

[Handshake] - is set to **[None]** unless using a modem. RTS/CTS or Xon/Xoff are used with a modem for data flow control.

[Local Echo] - is generally set to [Off]. When in terminal mode it will enable you to see the commands you are sending to the instrument as you type them.

Communications Setup

Comm Port: 1
Baud Rate: 19200
Parity: None
Data Bits: 8
Stop Bits: 1
Handshake: None
Local Echo: Off

Modem Initilazation String
ATZ

Cancel | Find Instrument | Done

After modifying the EasySpan CommPort table above, the instrument's RS-232 settings must be modified to reflect the same settings. After matching up the settings **[Click]** on **[Find Instrument]** and the PC should find the instrument and display its model and serial number on the screen. If it doesn't, check the settings and cable to make sure they are correct.

NOTE: Even though some instruments are capable of RS-232 baud rates greater than 19200, it is best to start at a slower speed. After the PC and instrument are talking to each other, then try a higher baud rate.

Retrieving Traces

After setting up the communication ports and finding the instrument, it is time to extract a trace from the instrument. Pressing **[F2]** on the PC will quickly command the spectrum analyzer to send a trace to the PC.

[F2] - Will command a trace to be sent to the PC.

[Trace][New][Live] - Will command a trace to be sent to the PC.

[Trace][Free Run][Normal] - Will command a trace to be sent to the PC until **[Stop]** is commanded.

[Trace][Free Run][Peak Hold] - Will return a trace in the same manner, but will only update the trace with a level that is higher than any preceding trace level. Peak hold capability provides a history of the RF spectrum.

Limits

Limits are used to see, hear and save traces that exceed an upper or lower limit. Limits are settable in two modes. The first is a limits table and is frequency and level dependent. The limit segments can be flat or sloped and upper or lower limits with a maximum of 60 segments.

The drawn trace is grid dependent and is drawn on the grid pixel by pixel. It is extremely useful when the limit requirement is the same shape but not frequency or level dependent. Hopping from center frequency to center frequency or changing level will not affect the trace limit line on the graticule. The limit line will stay on the screen

grid, where it was initially drawn.

Limits can be used in the current session or saved and recalled as needed. EasySpan is shipped with limit lines for CISPR, FCC, VCCI and VDE conducted and radiated emissions. Traces can also be massaged to create limit lines.

EasySpan can be instructed to store only traces that exceed the line in the following modes:

1. NORMAL - In this mode, all traces exceeding limit line are saved.

2. CROSSING - The first trace to cross the limit line and the first to fall within the limits are saved (no traces in between minimizing memory requirements).

3. PEAK CROSSING - The first trace exceeding the limit lines, the peak signal achieved, and the last trace exceeding the limit is saved (minimizing memory requirements).

To enter a limit line in the table:

[Limits][Entry Table][Start] - Enter start frequency in MHz (1.3717).

[Level] - Enter start level in +/- dBm (-65).

[S/F] - Selects flat or sloped line-click to toggle (F).

[Stop] - Enter stop frequency in MHz (1.42422).

At this point, select **[Save] [Save As]** or just select **[Done].**

[**Limits][Limits][On]** - Turns on limit line on the screen display.

[Limits][Limit Alarm][Audible] - Turns on audible alarm.

[Limits][Limit Alarm][Visual] - Turns on visual alarm.

[Limits][Limit Save][Normal] - Saves every trace exceeding the limit.

[Limits][Limit Save][Crossing] - Saves only first and last trace exceeding the limit.

[Limits][Limit Save][Peak Crossing] - Saves first and last trace exceeding the limit and peak trace during the time in between.

Limit Line Entry Table - NEXTEL

	Start	Level	Type		Start	Level	Type
1	1.3717	-65	F	11	0	0	F
2	1.4422	-65	F	12	0	0	F
3	0	0	F	13	0	0	F
4	0	0	F	14	0	0	F
5	0	0	F	15	0	0	F
6	0	0	F	16	0	0	F
7	0	0	F	17	0	0	F
8	0	0	F	18	0	0	F
9	0	0	F	19	0	0	F
10	0	0	F	20	0	0	F

Next Page

Enter Start Values in MHz
Enter Level Values in dB

Open | Delete | Save | Save As | Done

Front Panel

Allows user to read and change the most important front panel settings of the instrument for remote operation without writing text code in terminal mode. (Center Frequency, Span, Bandwidth, Video Bandwidth, RF Level, Attenuation, Units, Scale) Click on **[Read All]** to view instrument settings.

[File][Front Panel] - Brings up Front Panel
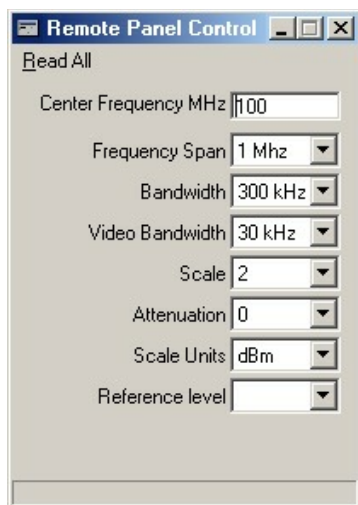
GPS Monitor

A GPS receiver may be connected to your PC in addition to the instrument allowing EasySpan to store GPS (Global Positioning Satellite) information with trace information. GPS position can trigger traces to be saved. The GPS receiver will require another RS-232 input port to the PC.

**[File][GPS Monitor]** - Brings up GPS monitor
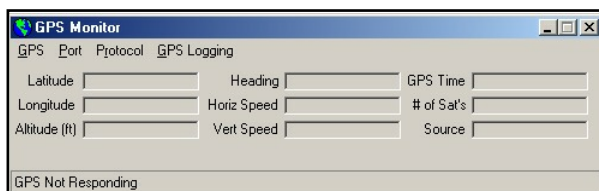
Applications / Macro

Macro capability in the program allows writing an application to perform a specific test. This results in accurate, repeatable results an unskilled operator can perform. The application may follow a sequence unassisted, without human intervention. Pictures can be inserted to show setup/connections and calibration.

Applications are text files, containing EasySpan II macro commands and the standard command set from the spectrum analyzer to be controlled. The combination of commands adds the ability of the software package to control the spectrum analyzer and test sequence in an automated manner. Two applications are included with the package, Insertion Loss and Return Loss using an IFR COM-120B/C Radio Test Set. With standard installation, the above applications can be found in the **[Program\Files\EasySpan\apps]**. The files can be opened and edited with a text editor or even MS

Word™. If you require a modification of one of the files just edit the frequency or other parameter and save it as a new file.
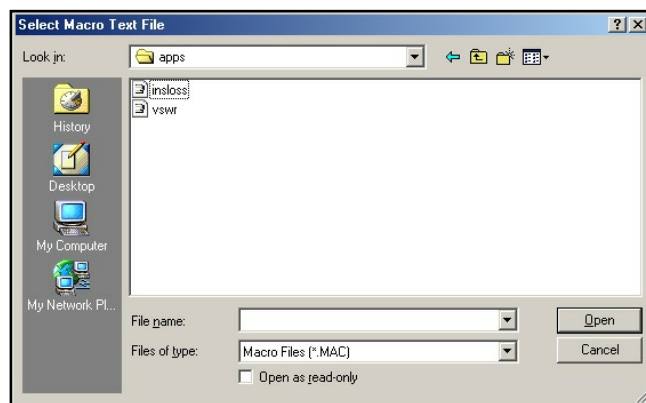
The program below is for setting up a COM-120 Radio Test Set for testing insertion loss of a device. Commands preceded by a # sign are for EasySpan II and all others are for the instrument's spectrum analyzer.

#trace:plots:norm	(EasySpan - Sets up a normal trace)
#mark:all:off	(EasySpan - Turns off markers)
#clr	(COM120 - Clears the screen)
syst:default	(COM120 - Sets instrument to factory defaults)
disp:anal	(COM120 - Sets display to analog)
#wait 2	(EasySpan - Wait 2 seconds)
anal:inp:ant	(COM120 - Selects antenna input
anal:freq 500	(COM120 - Sets center frequency to 500 MHz)
anal:span 100000	(COM120 - Sets Span to 100 MHz)
anal:track 1	(COM120 - Turns on tacking generator)
anal:track:lev -20	(COM120 - Sets tracking generator level to -20 dBm)
#promptimage insloss1.pcx	(EasySpan - Inserts calibration picture)
#trace:new:live	(EasySpan - Gets a trace)
#ref:setref	(EasySpan - Sets last trace as a reference)
#promptimage insloss2.pcx	(EasySpan - Inserts test picture and prompts to continue)
#trace:new:live	(EasySpan - Get new trace)
#mark:mark1	(EasySpan - Turn on marker #1)
#markermin	(EasySpan - Move marker #1 to minimum point on trace)
#trace:plots:insloss	(Displays trace on PC screen)

The program below could be used to scan specific frequencies and log possible interference, if the save trace in limits mode is activated. It sets up the 2399 Spectrum Analyzer for a specific span, attenuator to 0.0, reference level to -30 dBm, and then tunes to the center frequencies and operates in a free run mode for 12 seconds (0.2 minutes).

#REM FREQUENCY SCAN

#REM RST

SP 250KHz

#REM SETS SPECTRUM ANALYZER SPAN TO 250 KHZ

AT 0

#REM SETS SPECTRUM ANLAYZER TO ZERO

RL -30dBm

#REM SETS SPECTRUM ANLAYZER REFERENCE LEVEL TO -30 dBm

#WAIT 1

CF 50MHz

#REM SETS SPECTRUM ANLAYZER CENTER FREQUEN-CY TO 851.0875 MHz

#TRACE:FREERUN .2

#REM SETS SPECTRUM ANALYZER TO FREE RUN MODE FOR 0.2 MINUTES. ANY TRACE EXCEEDING THE LIMIT LINE WOULD BE SAVED.

CF 100MHz

#TRACE:FREERUN .2

CF 200MHz

#TRACE:FREERUN .2

CF 300MHz

#TRACE:FREERUN .2

CF 400MHz

#TRACE:FREERUN .2

CF 500MHz

#TRACE:FREERUN .2

CF 600MHz

#TRACE:FREERUN .2

#REPEAT 1 2

#REM REPEAT repeats the cycle. The first number is where to start the repeat. The second number is the number of repeats.

Remote Operation, Modem in Terminal Mode

Using EasySpan II for Windows allows the collecting of traces from a remote spectrum analyzer using modems and the phone system. In addition to collecting traces, the Front Panel screen allows limited modifications to the remote spectrum analyzer settings without writing code.

1. Start EasySpan for Windows

2. **[File][Terminal]** - to enter terminal mode.

3. **[File][Terminal][CommPort][Port Settings]** - Configure as required to match your instrument, PC and modem (sample below).

4. **[Done]** - will close the **[Port Settings]** dialog box.

5. **[File][Terminal][CommPort][Dial Phone Number]** - Enter phone number in dialog box and **[Click][OK]**. PC modem will call phone number.

NOTE: Enter the number plus any "prefix" numbers required for outside lines.

6. Wait for the terminal to display a **[CONNECT]** dialog box. Switch to the main EasySpan II screen by clicking on main screen, or minimizing terminal mode and press **[F2]** or **[Trace][New] [Live]** to command the spectrum analyzer to send a trace to the PC.

7. **[File][Front Panel]** - Open the Front Panel and enter a desired center frequency.

8. **[READ ALL]** - Will confirm the change.

9. **[F2]** to capture another trace with the new settings.

NOTE: [Terminal][CommPort][Hang Up Phone] - To close down the connection. This will reset the instrument to a more friendly mode for the next call.
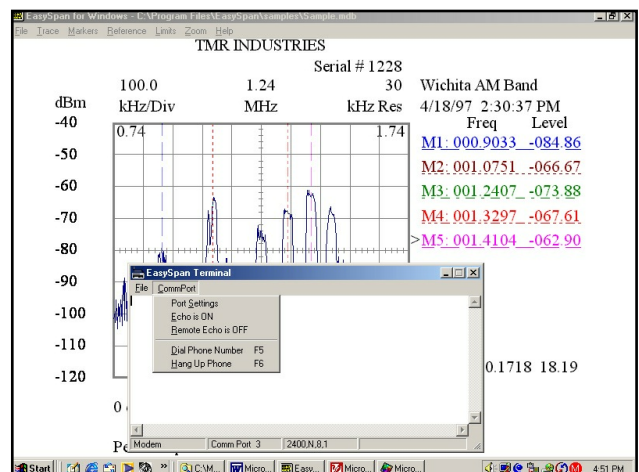
Before you hang up, if you want to get creative, return to the terminal mode and type in various commands to set up the S/A.

*idn?   Will return the product's model and serial number

*rst   Will reset the instrument to factory defaults

The code below is for a 2390A series Spectrum Analyzer. Code for

other instruments can be found in their respective programming manuals.

freq:cent 500	Set center frequency at 500 MHz unless units are specified (Hz, kHz, MHz, GHz)
freq:cent?	Returns center frequency in MHz to PC
freq:span 1	Set span at 1 MHz unless units are specified (Hz, kHz, MHz, GHz)
freq:span?	Returns span frequency in MHz/Div to PC
freq:span 0	Will set span to zero span and will enable you to look at demodulated signal.

Write a simple program in text format and run it as a saved file.

FREQ:START 800 MHz

FREQ:STOP 900 MHz

INP: 0

INP:RLEVEL -40

MARK 1

MARK:PEAK 1

MARK:TRACK 1

Typical configuration for both the PC comport and spectrum analyzer RS-232 settings

EasySpan II (FILE/CONFIGURE/COMMPORT)		Remarks
Comm Port	2	PC modem port
Type	Modem	
Handshake	RTS/CTS	
Baud Rate	19200	IFR Wichita, KS modem setting
Local Echo	Off	
Parity	None	
Data Bits	8	
Stop Bits	1	

Spectrum Analyzer RS-232 Setup with Modem (UTILITIES/SETUP/RS-232)		Remarks
Operation Mode	Host	
Baud Rate	2400	Determined by modem
Data Bits	8	
Stop Bits		
Parity	None	
Handshake	CTS/RTS	
RCI Echo	Off	Modem may not answer if set to on.
RCI Control	Enable	

Modem Settings for Auto Answer Mode

If the modem does not answer the phone when called it probably needs to be set to auto answer mode.

1. To view modem settings, connect the "remote modem" to the PC via the RS-232 port and talk to it through **[File][TERMINAL]** mode in EasySpan II. Type **[AT&V]** at the cursor and then **[Return]**. The modem will return a string of information that includes **[S00=000]** or **[S00=001]**. **[S00=000]** is not the auto answer mode, it should return a **[S00=001]** for auto answer mode.

2. To set auto answer mode, type**[AT&S00=001]** then **[Return]** in terminal mode to change the setting to auto answer.

3. View the settings again to make sure it was changed to auto answer. Send **[AT&V][Return]** again to check for **[S00=001]** in the string for auto answer.

4. You must store auto answer settings; without storing the setting it will return to its previous setting. Type **[AT&W0][Return]** to store the setting. Check the setting again, type **[AT&V][Return]**.

Modem Settings, 2398 Spectrum Analyzer Only

Since the RS-232 port is structured differently than all the other instruments, you must modify the operation of the modem in addition to AUTO ANSWER MODE.

1. The modem does not require a null modem adapter for operation.

2. Send the string ATTE0Q1&s2s0=1.

3. Then send AT&W0 to store the above settings.

Appendix

Macro Commands

EasySpan macro commands, like most remote commands, are not case sensitive. Italics indicate variable command parameters. Lower case characters may be omitted.

A few of the more common examples are listed below. For a more complete listing look in the help menu.

[Help][Contents][Search] type in [macro] click on [Macro Commands] - Select macro commands list.

#CHECK

This command is valid only after performing the #GET TRACE command. The #CHECK command compares the peak value of the current trace against the value entered with the #PEAK command. If trace peak value level is greater than the level set with the #PEAK command, the current trace is saved as a new trace in the Recorded Trace List located in the Destination directory.

#CLR

Clears the display.

#DEC

Sets variable <value> by adding the increment (see #SET command) to the current <value>.

#INC

Sets variable <value> by subtracting the increment (see #SET command) from the current <value>.

#LIMITS:ON

Turns the selected limit line on.

#LIMITS:OFF

Turns the limit line off.

#LIMITS:SAVE:NORMal

Turns on limit saving function. Whenever a signal exceeds the limit line, it is saved to the database.

#LIMITS:SETaslimit:Upper X

Sets the current trace as the upper limit with an offset of X. If X is omitted, offset is 0.

#MARKers:MARKer1

Toggles Marker # 1. If Marker 1 is off, this command will turn it on and make it the current marker.

#MARKerFindPeaks

Places markers on peak signals that exceed the peak threshold level.

#MARKERFREQ x

Sets current marker to frequency x.

#MARKERMAX

Sets current marker to the highest level of the current trace.

#MARKERMIN

Sets current marker to the lowest level of the current trace.

#MARKers:xdbBW:3db

Finds the 3 dB bandwidth of the signal that marker 1 is positioned on.

#PAUSE

Pauses macro execution until the user presses the Enter key. Displays a "Press Enter to Continue" box.

#PeaKSOVRLIMit

Places markers on peak signals which exceed the limit line.

#PROMPT message

Pauses macro execution and displays a box containing a user message. Macro execution continues when the user selects OK or presses the Enter key.

#PROMPTUSERINPUT message

Pauses macro execution and displays an input box displaying message. Macro execution continues when the user enters a value or string and presses Enter or selects the OK or CANCEL buttons. The value is assigned to the <USERINPUT> variable. The variable <USERINPUT> is used as a value or string in remote commands (e.g. ANAL:FREQ <USERINPUT>, #STORE TRACE <USERINPUT>).

#PROMPTIMAGE Filename

Pauses macro execution and displays an image file Filename. Macro continues when the user selects OK or presses the Enter key. Filename must contain the full path to a valid graphics image. The following formats are supported: BMP, PCX, GIF, JPG.

#REFerence:referenceON

The reference trace is displayed.

#REMark comments

Allows comments or remarks in the macro. No action is taken.

#REPEAT m n

Transfers command execution to command line m of the macro. N sets the number of times to run through the repeat loop before continuing on past the #REPEAT command. If n is omitted, the macro repeats until Esc or Cancel is pressed.

#SetInstrumentToMarkFreq

Sets the connected Instrument Center Frequency to the current Marker Frequency.

#TRACE:FREERUN X

Starts freerun mode. If X is included, will force freerun mode to run

for X minutes and then stop.

Keyboard Shortcuts

KEY	ACTION
F2	Downloads current trace from connected IFR Instrument.
F3	Quick Save. Saves the currently displayed trace.
F4	Moves current Marker to next dip.
Shift+F4	Moves current Marker to previous dip.
F5	Sets connected IFR Instrument Center Frequency to current Marker Frequency.
F6	Finds first five (5) peaks over the peak threshold level.
Shift+F6	Finds first five (5) peaks over the Limit Line.
F7	Moves current Marker to minimum amplitude level on trace.
F8	Moves current Marker to maximum amplitude level on trace.
F9	Moves current Marker to next peak.
Shift+F9	Moves current Marker to previous peak.
Shift+F2	Download trace stored in connected IFR Instrument.
M	Toggle current marker (between active markers).
PageUp	Increase Marker position by 1/10 full scale.
PageDown	Decrease Marker position by 1/10 full scale.
Right Arrow	Increase Marker position by 1 data point.
Left Arrow	Decrease Marker position by 1 data point.
N	Display next recorded trace in database.
P	Display previous recorded trace.
Delete	Deletes the currently displayed trace and displays the next trace in the database.

Trouble Shooting

Cables RS-232 - Some cables are null modem and adding a null modem adapter will make it appear defective. The cable should be less than 15 to 20 feet long according to RS-232 standards. If longer, the delay will cause problems.

Baud Rate - After setting the baud rate some instruments require shutting down before it is set into the instrument's memory.

Installation - After installation turn off PC and turn it on again.

Limit Table Segment Entry - Limit segments must be entered from a lower frequency to a higher frequency. This includes entering separate segments. The segments must be from lower to a higher frequency. If you do not want the segments to be connected, you must leave a line empty between segments.

Modem - When using the PC modem select the port to which the modem is connected. If, when calling the remote modem it does not answer the phone, set it to auto answer.

Null Modem - check to see if the cable is null modem. Some instruments require a null modem and others do not.

No Instrument Found - There are a number of reasons for not making a connection to the instrument. The most common are:

1. Does the instrument need a null modem cable? Some do not.

2. Is the cable a null modem cable? If it is, do not use a null modem adapter, it will defeat the null modem cable.

3. Have you selected the right comm port on the PC?

4. Have you selected the same baud rate for the PC and the instrument?

5. Have you selected the right HANDSHAKE?

6. If all the above fails:

a. Turn the PC off and back on again.

b. Preset the instrument and turn it off and on again.

c. Retry all the above.

EasySpan II software is a simple inexpensive program that will expand the capabilities of an IFR Spectrum Analyzer. Log onto our web site www.ifrsys.com to download a functional copy for evaluation.

An Aeroflex Company