



SpurFinder User Manual

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Overview

SpurFinder is a spurious product calculation utility that was designed for the RF Engineer who needs to quickly and conveniently analyze transmitter or receiver conversion schemes. Developed by engineers for engineers, SpurFinder provides a powerful interface with access to all pertinent input variables. It also includes highly accessible analysis tools to track groups of spurs on a frequency by frequency basis as well as individual spurs.

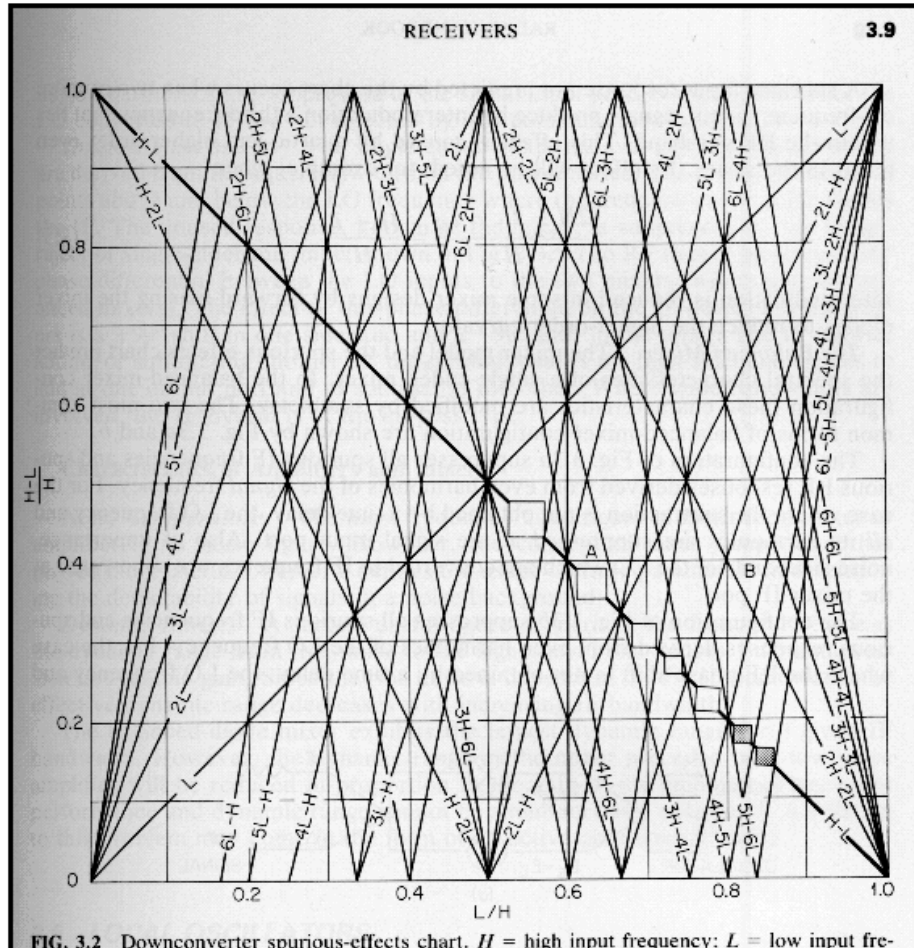
SpurFinder is a valuable and necessary tool for all receiver designers. It enables designers to evaluate various frequency conversion schemes before implementing them. The user simply enters an input frequency range, an output frequency range, and a fixed LO frequency. The program then displays a mixer spur chart that shows the output frequencies for all mixer spurious products up to the 20th order of $M \cdot RF$ and $N \cdot LO$. Use this program to choose the conversion scheme (RF, LO and IF frequencies) with the best spurious performance. The program also provides a look at the pre-selection and post selection filter rejection requirements for the conversion scheme.

For frequency conversions where the user does not have a choice of IF or LO frequencies, the program shows where in-band spurs and out-of-band spurs are located. This enables the designer to determine the correct filter rejections to meet receiver specifications.

SpurFinder is a huge upgrade from the old "Radar Handbook" spur charts. These generic, normalized charts don't show the actual input and output frequencies that enable you to determine where the spurious frequencies are located. See the next page for an example generic spur chart from the "Radar Handbook".



Spur Chart from "Radar Handbook"





Key Features

Key Features

- Allows you to evaluate your receiver or transmitter conversion scheme before you start the design.
 - Optimize your conversion scheme for best spurious performance.
 - Analyze pre - selection and post - selection filter requirements based on spurious frequencies.
- Graphically displays the location of spurious products in a frequency conversion process.
- View spurious products any order up to order 20R X 20L.
- Plots up to 24 spurious signals. If more than 24 spurious signals are calculated, a warning light will appear indicating that not all spurs are plotted.
- Replaces the old "Mixer Spur" charts and nomographs
- Works for up conversions and down conversions.
- Three Conversion Modes
 - Fixed Input Frequencies, Fixed Output Frequencies: The input and output frequencies do not move as the LO frequency is adjusted.
 - Sliding Input Frequencies, Fixed Output Frequencies: Used for fixed output IF frequency range, such as a down conversion. As the LO is tuned, the input frequency range "slides", and the output frequency range remains fixed.
 - Fixed Input Frequencies, Sliding Output Frequencies: Use for fixed input frequency range, such as in a transmitter or Up Converter. As the LO is tuned, the input frequency range stays fixed, and the output frequency range "slides".
- A *Continuous Run* mode allows you to change the SpurFinder parameters while the spurious plots are updated in real time. This option is great for scanning through many frequency conversions.
- Data and parameters from SpurFinder may be automatically transferred to TunerHelper.
 - Buy both TunerHelper and SpurFinder to take advantage of using these programs in tandem.
 - If you have mixer parameters defined in TunerHelper, you can view the level of spurious signals for the conversion scheme in SpurFinder.
- Load and Save SpurFinder scenarios to files.
- Create a Multi Scenario file to quickly view multiple conversion schemes.
- SpurFinder automatically saves a log file to track all conversion schemes tested during each session. The log file may be opened with the Multi Scenario file utility to review the previous session.
- All graphs and charts may be printed.
- Context sensitive help is available for all plot parameters.



Trial Version Limitations and System Requirements

- Trial Version
 - The trial version of SpurFinder has all the features of the full version with the following limitation:
 - The Local Oscillator (LO) value is limited to 16.0 +/-0.25 MHz
 - The full version is available for purchase for \$129.99 (US Dollars). Buy now to unlock all program features.

- System Requirements
 - SpurFinder was designed to operate in the Windows NT, 2000, and XP environment.
 - SpurFinder currently only supports 1024 X 768 dpi or higher screens.
 - Please let us know if you are interested in a 800 X 600 dpi version. We will try to accommodate you in our next revision.



Changes by Version

- Thank you for choosing SpurFinder Version 3.5!
- We are continually improving this program. Please let us know what you think and any other comments and suggestions you may have.
- Latest Version: 3.5

Changes in Version 3.5

- Created a Multi Scenario utility to enable users to quickly view multiple conversion schemes.
- Added an automated log file to track all conversion schemes tested during each session. The log file may be opened with the Multi Scenario utility to review the previous session.
- Settings may be edited to change the location and name of the log file.

Changes in Version 3.3

- Enhanced the registration process.

Changes in Version 3.2

- Removed the Run and Stop options from the software.
- Added in-screen error message when Input is greater than Output.

Changes in Version 3.1

- Improved the registration process. You can now send payment by PayPal, WWW form, or E-mail. The user name and registration key are sent to us electronically, thereby making the registration process easier and less prone to error.

Changes in Version 3.0

- Increased max RF and LO order to 20, allowing spurious levels up to 20RX20L.
- Added Conversion Mode to Allow Input and Output Frequencies to 'slide' with LO Frequency.
- Moved Save and Open Options to File Menu.
- Fixed carriage return problem when saving comments.
- Made graphical changes to User Interface.

Changes in Version 2.1.1:

- Made scenario files have the suffix *.ssn.
- Added cursor locations to scenario file.



Changes by Version Cont.

Changes in Version 2.1:

- Added the capability to load and save SpurFinder scenario text files.
- Added a continuous run button and capability.
- Added the capability to switch dynamically to TunerHelper, and use the SpurFinder settings in TunerHelper.

Changes in Version 2.02:

- Improved the registration process.

Changes in Version 2.01:

- Removed continuous run button from Front Panel
- Added TunerHelper connectivity (to be released soon).
- Changed the Spur Rating on the front panel to more accurately rate the conversion scheme based on typical mixer spur levels.

Changes in Version 2.0:

- There is no longer a time limit on the trial version.
- SpurFinder generates a warning if the Input or Output Start frequencies exceed their respective stop frequencies.
- A New Plot button has been added. This allows for implementation of modified analysis parameters without having to completely rerun the program. For convenience the button is tied to the Return key.
- A Stop button was added to halt program execution at any time.
- The new Slider Bar allows for easy measurement of all Spur Orders it intersects. It allows the user to choose any input frequency within the analysis bandwidth, and view the output signal and spurious frequencies in real-time via the Output Signals Table.
- The Spur Rating provides a dimensionless comparison between individual SpurFinder Analysis. This purely relative indicator is beneficial when comparing different conversion schemes within the SpurFinder environment.



Changes by Version Cont.

- All plots have the LO Frequency incorporated into the Plot Title for easy recognition when comparing screen captures or printouts of different conversion schemes.
- Spur Orders are differentiated by line color, style, and thickness. Specifically, high order spurs are represented by thick solid lines while low order spurs are shown in thin dashed lines. Each spur retains its coloring regardless of order, between one run to the next.
- The Date and Time of the analysis is automatically displayed each time the user initiates a New Plot.
- The user can add Comments about the spur model, which are stored with a Date/Time stamp in the spur data whenever a model is saved to disk.
- The ghost spur markers in the Spur Order Key table have been removed. Only keys for actual spurs are now displayed.

Changes in Version 1.01:

- Fixed a bug that did not show a Spur line on the graph when Spur started in upper left hand corner of the graph and ended on the right side of the plot. We apologize for any inconvenience this might have caused. All registered users are being informed of this bug. If you know anybody who has not yet registered, please tell them to download the newest version.

Changes since Version 1.0

- Fixed the "Number of Spurs" and the "Warning" Display.
- Closed the "SpurFind2.vi" after getting to the Spur Program screen.
- Reduced the memory requirements.

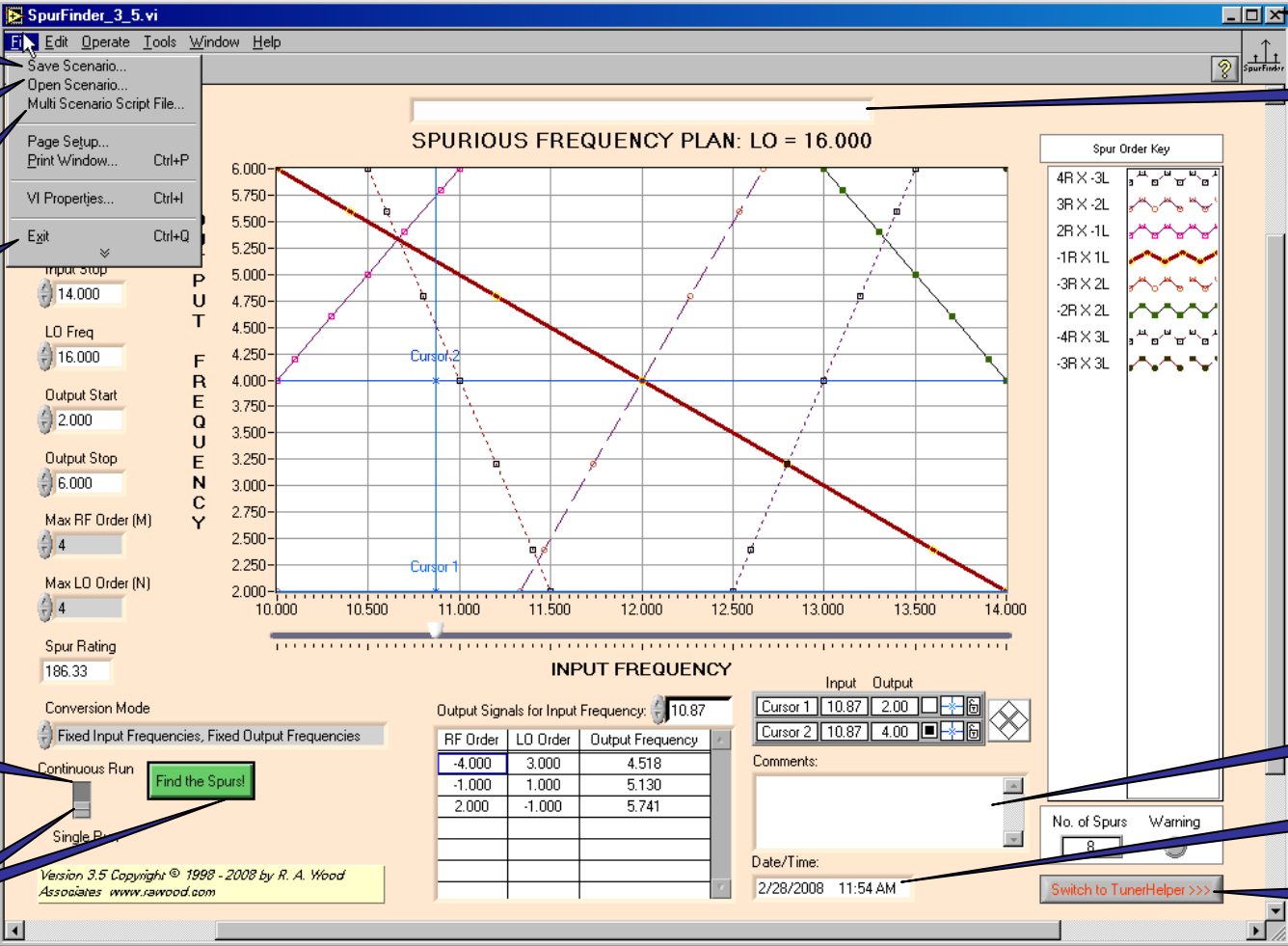


Installing SpurFinder

- To check out SpurFinder for yourself, visit the R.A. Wood software download page at:
http://rawood.com/software_products/download_software_page.html#spurfinder_anchor
- Select *Download Now!* next to the RAWOOD _ Software _ 3 _ 9 _ Installer.exe
- Click *Save File* to save the installer.
- After the installer download is complete, double click on *SpurFinder Installer icon* to start the installation process.
- Work through the user prompts to install SpurFinder.
 - Select a folder to save the SpurFinder setup files to and select *OK*.
 - Select *Next>* on the Installation Wizard
 - Browse to select a location to save the SpurFinder program files to, and Select *Next>*.
 - Select *Next>* again to continue with the installation process.
 - Select *Finish* to exit and complete the installation.
- Once the installation is complete, go to *Start>>All Programs>>R.A. WOOD Software>> Spur Finder* to load the program.
- An Electronic End User License Agreement will appear. Read the agreement and select *Agree* to continue.
- The Change Log will appear next. This document describes the software changes and improvements by version. Click *Continue* to start the program.
- On the start up screen, create a user name. This name will only be used for registration purposes.
 - Select *Register* to pay for the full version of SpurFinder. You may pay through paypal or contact us with other arrangements.
 - Select *Continue* to use the trial version. Each time you open the trial version you will have the opportunity to register for the full version. In the trial version the Local Oscillator (LO) value is limited to 16.0 +/-0.25 MHz.
- Click *Continue* again to use the trial version of SpurFinder or enter the Registration number and click *Unlock Software* to access the full version.
- For detailed screen shots of the installation process visit:
<http://helprawoodsoftware.rawood.com/tiki-index.php?page=SpurFinder+Downloading+and+Installing+the+Program>

Program Operation

The screen shot below is of the default main panel in SpurFinder. Input Parameters are entered directly on this screen in their labeled fields. Each Spurious Product ($\pm M \times RF$) + ($\pm N \times LO$) is represented by a different line on the graph. The X and Y axis show the actual input and output frequencies (not normalized). See the following page for details about the features available on this panel.



SPURIOUS FREQUENCY PLAN: LO = 16.000

OUTPUT FREQUENCY (Y-axis): 2.000 to 6.000

INPUT FREQUENCY (X-axis): 10.000 to 14.000

Spur Order Key:

- 4R X -3L
- 3R X -2L
- 2R X -1L
- 1R X 1L
- 3R X 2L
- 2R X 2L
- 4R X 3L
- 3R X 3L

Input Parameters:

- Input Stop: 14.000
- LO Freq: 16.000
- Output Start: 2.000
- Output Stop: 6.000
- Max RF Order (M): 4
- Max LO Order (N): 4
- Spur Rating: 186.33

Conversion Mode: Fixed Input Frequencies, Fixed Output Frequencies

Buttons: Continuous Run, Single Run, Find the Spurs!

Output Signals for Input Frequency: 10.87

RF Order	LO Order	Output Frequency
-4.000	3.000	4.518
-1.000	1.000	5.130
2.000	-1.000	5.741

Cursor Data:

Cursor	Input	Output
Cursor 1	10.87	2.00
Cursor 2	10.87	4.00

Comments:

Date/Time: 2/28/2008 11:54 AM

No. of Spurs: 8

Warning:

Switch to TunerHelper >>>

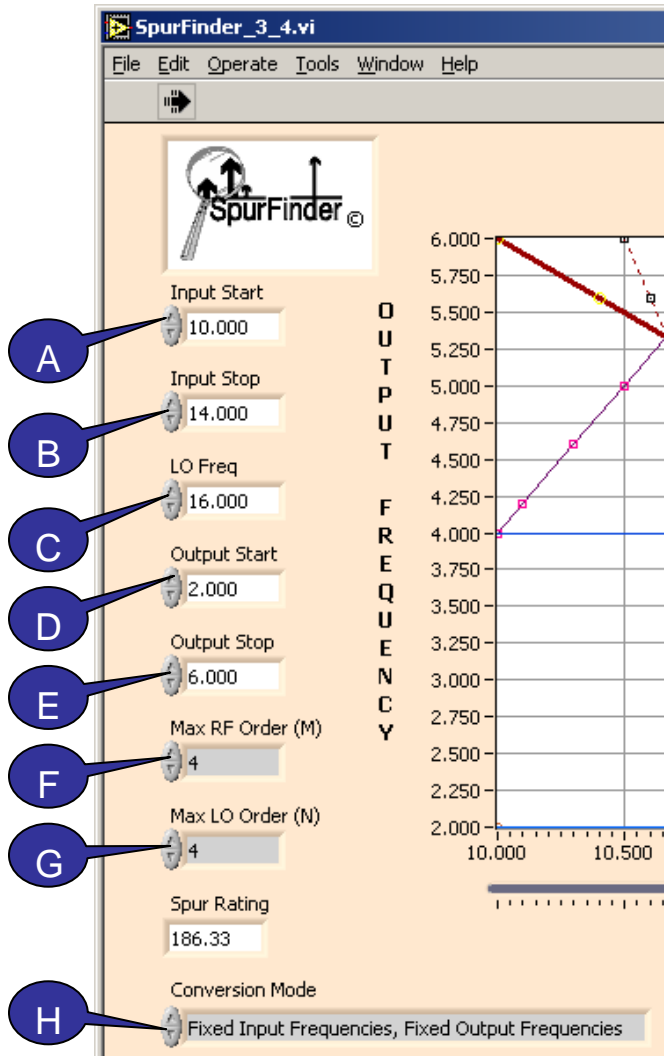
Callout Letters: A, B, C, D, E, F, G, H, I, J



Program Operation Cont.

- A. Single Run Mode** – This is the default mode at the start of the program. In Single Run Mode the graph does not automatically update as parameters are adjusted. To update the graph, click the *Find Spurs!* button or hit *Return*.
- B. Continuous Run Mode** – To put the program in continuous run mode move the toggle switch to *Continuous Run* and click the *Find Spurs!* button. As input parameters are adjusted, the graph will automatically reflect the changes.
- C.** The **Comments** field allows the user to document the current setup. Comments are saved with the scenario file.
- D.** The real **Date** and **Time** are displayed at the bottom of the screen.
- E. Save Scenario** – To save the input parameters to a tab delineated text file go to *File>>Save Scenario...*
- F. Open Scenario** – To open an existing setup file go to *File>>Open Scenario...*
- G. Multi Scenario Script File** – To view, edit, or create multiple conversion scenarios, go to *File>>Multi Scenario Script File...* Learn more about the this feature on the Multi Scenario Utility page.
- H. File Path** – After a scenario has been opened or saved the file location will be displayed here.
- I. Switch to TunerHelper** - Click this button to open TunerHelper. All input parameters from SpurFinder will automatically transfer to TunerHelper.
- J.** To **exit** the program click the *X* in the upper right corner of the panel or go to *File>>Exit*.

Input Parameters



Input parameters are entered directly on the main panel of SpurFinder. To update the graph after the input parameters are set, hit *Return* or click on the *Find Spurs!* button.

- A. **Input Start** – Enter the input start frequency by typing a desired value or using the arrows to increase or decrease the current value.
- B. Enter the **Input Stop** Frequency
- C. Enter the **LO frequency**
- D. Enter the **Output Start** Frequency
- E. Enter the **Output Stop** Frequency
- F. **Max RF Order (M)** – Select the number of RF harmonics to be displayed (max 20) by selecting a value from the pull down menu.
- G. **Max LO Order (N)** – Select the number of LO harmonics to be displayed (max 20).
- H. **Conversion Mode** – Select the frequency conversion mode. See the Frequency Conversion Modes page for details.



Frequency Conversion Modes

Conversion Mode

Fixed Input Frequencies, Fixed Output Frequencies

- Fixed Input Frequencies, Fixed Output Frequencies** – User enters all frequency values independently.

Input Start
10.000

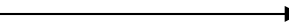
Input Stop
14.000

LO Freq
16.000

Output Start
2.000

Output Stop
6.000

User increases the LO by 0.1



Input Frequencies and Output Frequencies remain the same

Input Start
10.000

Input Stop
14.000

LO Freq
16.100

Output Start
2.000

Output Stop
6.000

Conversion Mode

Sliding Input Frequencies, Fixed Output Frequencies

- Sliding Input Frequencies, Fixed Output Frequencies** – The Input Frequency will increase or decrease with a change in the LO Frequency.

Input Start
10.000

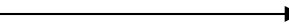
Input Stop
14.000

LO Freq
16.000

Output Start
2.000

Output Stop
6.000

User increases the LO by 0.1



Input Frequencies are automatically increased by 0.1

Input Start
10.100

Input Stop
14.100

LO Freq
16.100

Output Start
2.000

Output Stop
6.000

Conversion Mode

Fixed Input Frequencies, Sliding Output Frequencies

- Fixed Input Frequencies, Sliding Output Frequencies** –
- The Output Frequency will increase or decrease with a change in the LO Frequency.

Input Start
10.000

Input Stop
14.000

LO Freq
16.000

Output Start
2.000

Output Stop
6.000

User increases the LO by 0.1



Output Frequencies are automatically increased by 0.1

Input Start
10.000

Input Stop
14.000

LO Freq
16.100

Output Start
2.100

Output Stop
6.100



Multi Scenario Utility

The Multi Scenario Utility is new in SpurFinder Version 3.5. This utility allows the user to quickly view and save multiple conversion schemes in SpurFinder without having to save a separate scenario file for each setup. A multi scenario file is a tab delineated text file that may be created in Excel, Notepad, or SpurFinder. This file contains the Input parameters for a different scenario on each line. In SpurFinder, the Multi Scenario File may be opened in a table to easily view and compare the setups.

To utilize this utility, first create a multi scenario file. Simply open the "Multi Scenario Template File", or "Multi Scenario Sample File" that was included with the SpurFinder software. These files should be located in the default installation directory: C:\Program Files\RAWOOD_SOFTWARE and may be opened in Excel, or Notepad.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Comments	Input Start Freq	Input Stop Freq	LO Freq	Output Start Freq	Output Stop Freq	Max RF Order	Max LO Order	Conversion	Input Freq	Cursor1 In	Cursor1 Out	Cursor2 In	Cursor2 Out
2	Default Settings	10	14	16	2	6	4	4	0	10.87	18	2	10.87	4
3	Sample 1	9	13	15.75	2.5	5	3	3	0	10.87	18	2	10.87	4
4	Sample 2	10.5	14.5	16.25	3	7	5	5	0	10.87	18	2	10.87	4
5														

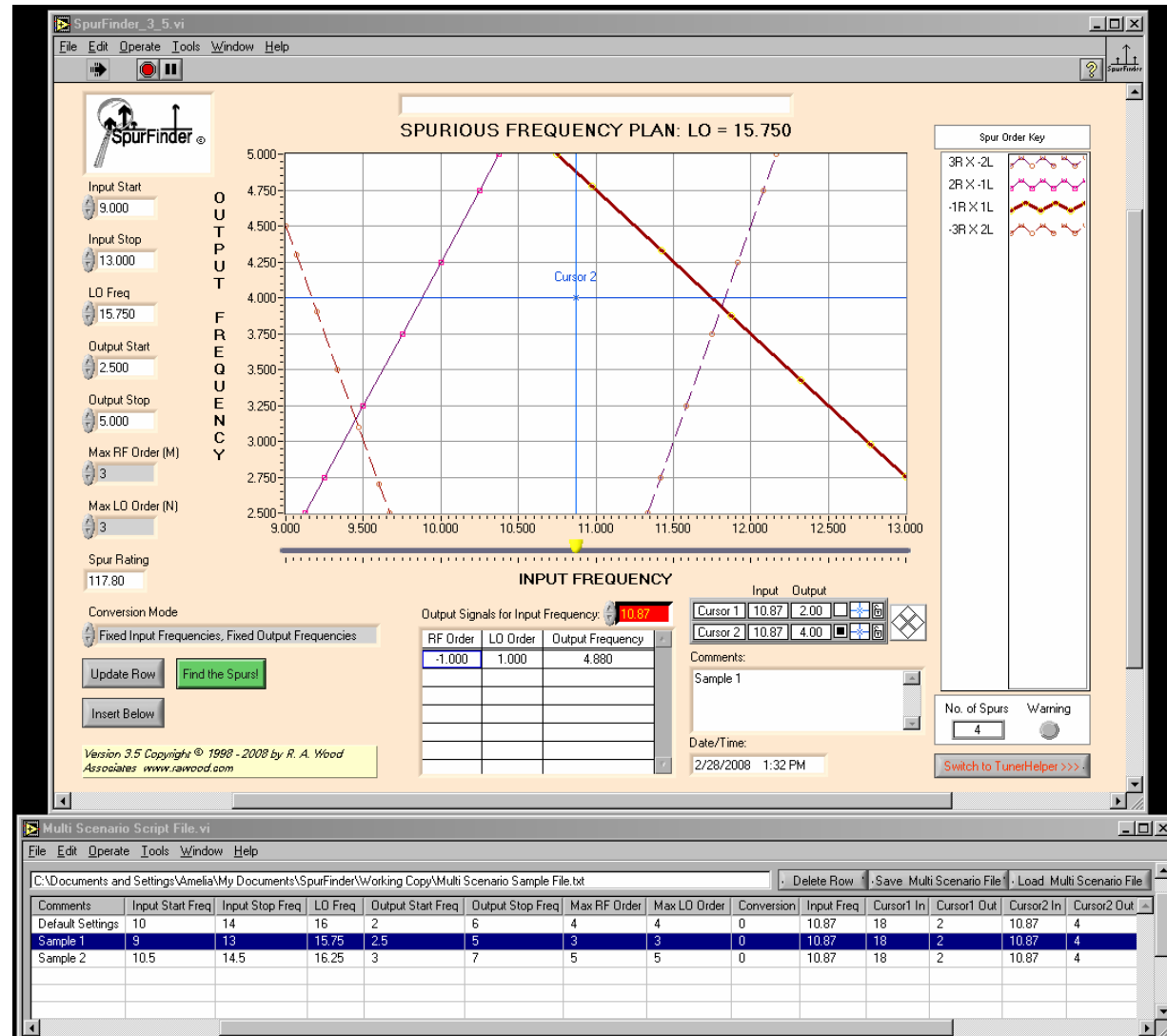
Type each desired setup on an individual line as shown in the sample file above. When the file is complete, save it as a .txt (Tab delineated Text) file. This file may now be opened in SpurFinder to quickly scroll through and graph the results.

Multi Scenario Utility Cont.

To access the Multi Scenario Utility, go to *File>>Multi Scenario Script File...* A dialog box will open. Browse for the desired file and select *OK*. Try opening the "Multi Scenario Sample File" found in the default installation directory to demo all available features. The selected file will open in the table shown below. The scenario setup of the highlighted row will be displayed on the SpurFinder graph. Highlight a different row in the table to automatically update the graph. This will allow you to easily click through multiple scenarios and compare the results.

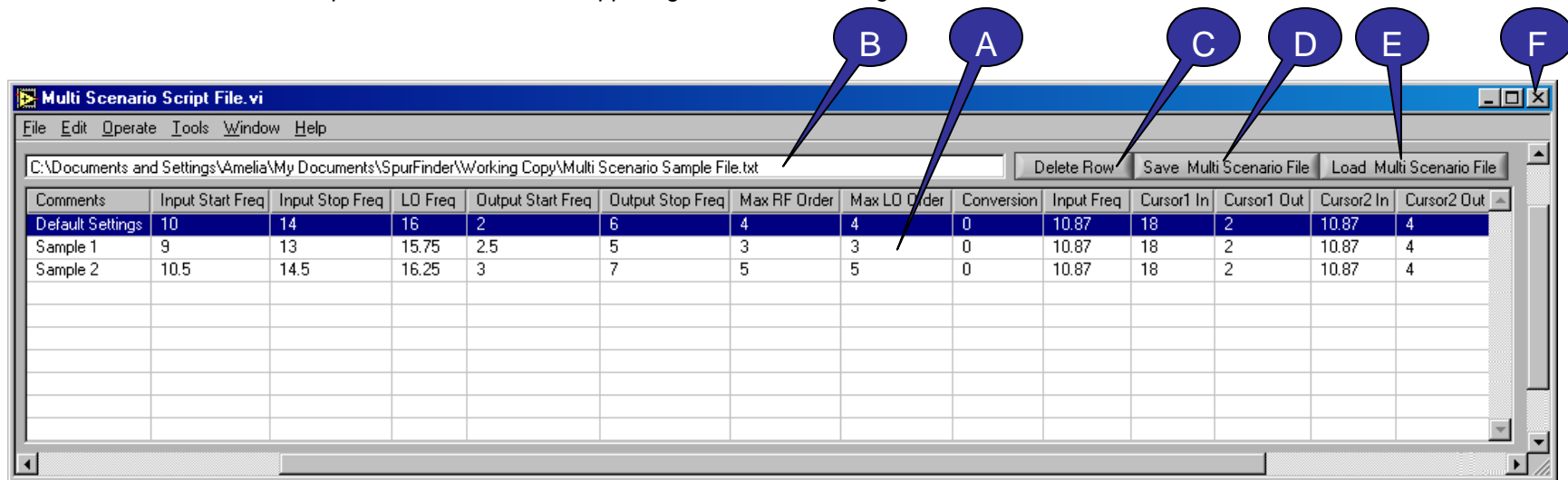
The *Update Row*, and *Insert Row* buttons on the SpurFinder main panel may be used to update or add additional scenario setups to the current Multi Scenario file. *Update Row* replaces the highlighted row with the input parameters from SpurFinder. *Insert Row* adds a new scenario below the highlighted row.

See the following page for details about the features in the Multi Scenario Utility.



Multi Scenario Utility Cont.

- A. Multi Scenario Table** – The input parameters for each scenario appears on a separate line in this table. The highlighted line in the table is displayed on the SpurFinder main panel and in the spurious graph.
- B. File Path** – The location of the current Multi Scenario file is displayed here.
- C. Delete Row** – Go to Edit>>Delete Row, or click the Delete button on the panel to remove the highlighted row from the Multi Scenario file.
- D. Save Multi Scenario File** – To save changes made to the Multi Scenario file go to *File>>Save Multi Scenario File...*, or click the Save button on the panel. A dialog box will open. Browse for the desired save location and click OK. The file will be saved as a tab delineated text file that may be opened in SpurFinder, Excel, or Notepad.
- E. Load Multi Scenario File** – To load a new Multi Scenario file, go to *File>>Load Multi Scenario File...*, or click the Load button on the panel. A dialog box will open. Browse for the desired file and click OK.
- F. Close** – To close this panel, click the X in the upper right hand corner, or go to *File>>Close*.



The screenshot shows the 'Multi Scenario Script File.vi' window. The file path is 'C:\Documents and Settings\Amelia\My Documents\SpurFinder\Working Copy\Multi Scenario Sample File.txt'. The interface includes buttons for 'Delete Row', 'Save Multi Scenario File', and 'Load Multi Scenario File'. A table displays scenario parameters, with the 'Default Settings' row highlighted. Callouts A-F point to the file path, the highlighted row, the 'Delete Row' button, the 'Save Multi Scenario File' button, the 'Load Multi Scenario File' button, and the window's close button (X) respectively.

Comments	Input Start Freq	Input Stop Freq	LO Freq	Output Start Freq	Output Stop Freq	Max RF Order	Max LO Order	Conversion	Input Freq	Cursor1 In	Cursor1 Out	Cursor2 In	Cursor2 Out
Default Settings	10	14	16	2	6	4	4	0	10.87	18	2	10.87	4
Sample 1	9	13	15.75	2.5	5	3	3	0	10.87	18	2	10.87	4
Sample 2	10.5	14.5	16.25	3	7	5	5	0	10.87	18	2	10.87	4



Log File

The Log file is another new addition to SpurFinder in Version 3.5. The Log file is an automated tracker of all scenario setups tested throughout a session. Every time the *Find the Spurs!* button is selected, or a Multi Scenario file is opened, the Log file will track the changes. The Log file is a tab delineated text file in the same format as the Multi Scenario file. It may be opened with the Multi Scenario Utility, Excel, or Notepad. This will allow you to review and compare any setups made in a previous session. The save settings for the automated Log file may be customized to meet your needs. See the following page for details.

Microsoft Excel - Log File

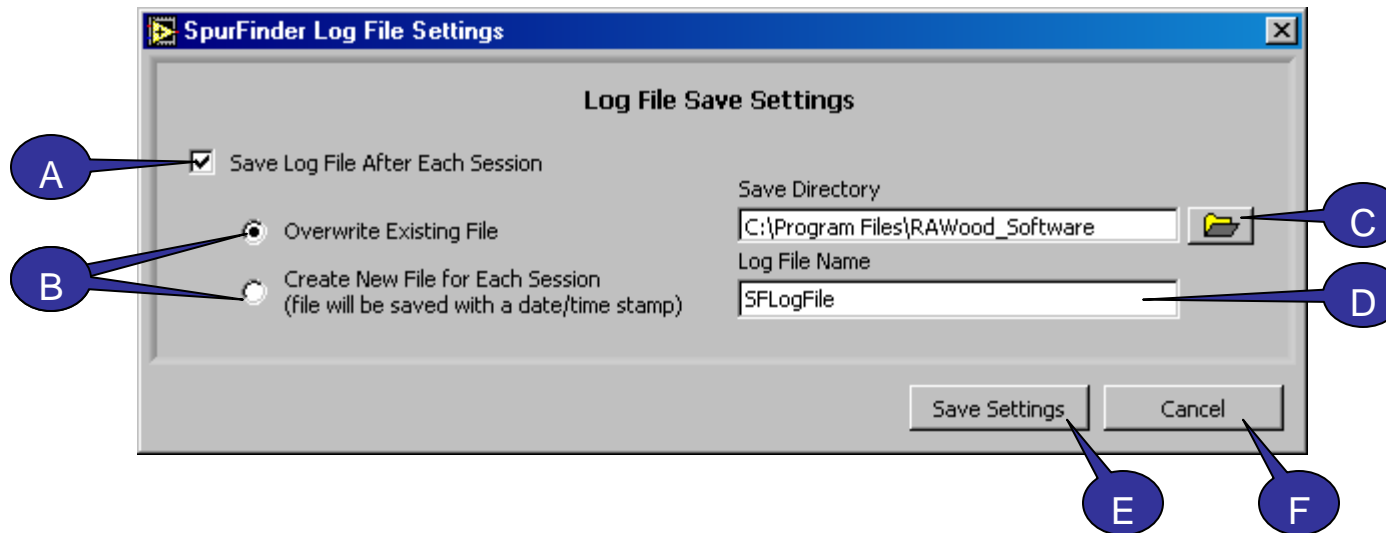
File Edit View Insert Format Tools Data Window Help Adobe PDF

100% Arial

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Comments	Input Start Freq	Input Stop Freq	LO Freq	Ouput Start Freq	Output Stop Freq	Max RF Order	Max LO Order	Conversion	Input Freq	Cursor1 In	Cursor1 Out	Cursor2 In	Cursor2 Out
2		10.1	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
3		10.2	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
4		10.3	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
5		10.4	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
6		10.5	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
7		10.6	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
8		10.7	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
9		10.8	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
10		10.9	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
11		11	14	16	2	6	4	4	0	10.87	10.87	2	10.87	4
12														

Log File Settings

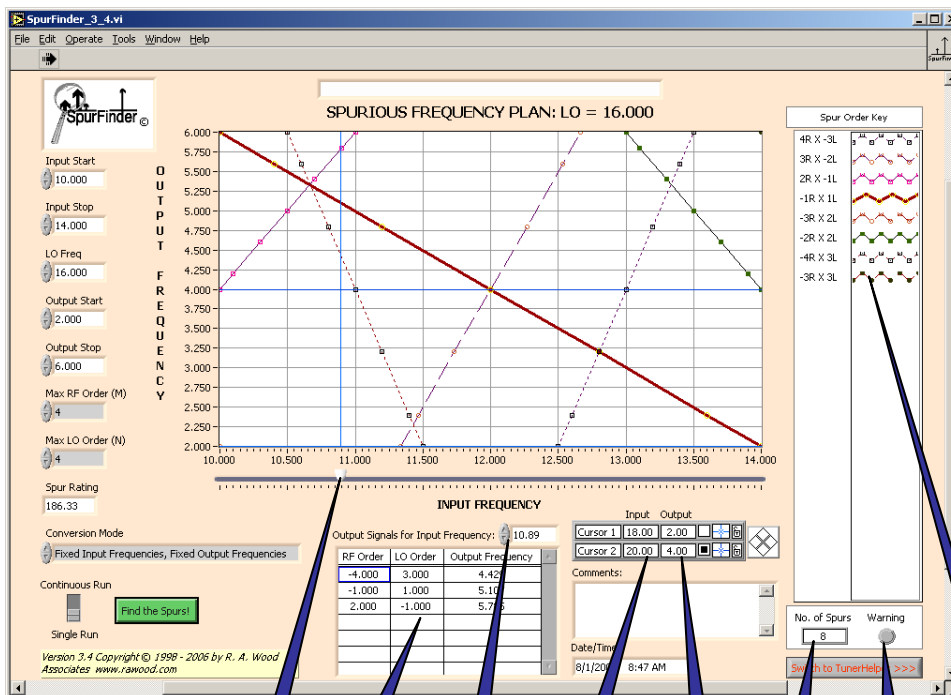
- A. Save Log File After Each Session** – Check this box to automatically save the Log file after each session. The Log file will be saved in the *Save Directory* with the *Log File Name*. If left unchecked, the Log file will not be saved.
- B. Overwrite Existing File / Create New File for Each Session** – Select between overwriting the existing Log file, and creating a new Log file for each session. If *Overwrite* is selected, warnings will not be displayed to indicated that the existing Log file is replaced. If *Create New File* is selected, it will be saved with the Log File Name followed by a date/ time stamp. By default, *Overwrite* is selected.
- C. Save Directory** – Click the file icon to browse for a save location for the Log file. When you have located the desired directory, click *Select Cur Dir*. By default, the Log file is saved to the default installation directory: C:\Program Files\RAWOOD_SOFTWARE .
- D. Log File Name** – Type the desired name of the Log file. By default, the file is named SFLLogFile.
- E. Save Settings** – Click *Save Settings* to save the existing Log file settings. These settings will be used by default for each session.
- F. Cancel** – Click *Cancel* or the X in the upper right corner to exit the panel without saving changes.



Graph Setup

The *Output Frequency Vs Input Frequency* plot in SpurFinder displays up to 24 spurious signals. The plot contains two cursor lines and a slide bar to assist the user in reading the charts. If the application is a down conversion, the input frequency, or the X-axis, will be the RF Input Frequency range. The Y-axis, or the output frequency, will be the IF frequency range. If the application is an up conversion, the X-axis will be the lower IF frequency and the Y-axis will correspond to the output RF frequency.

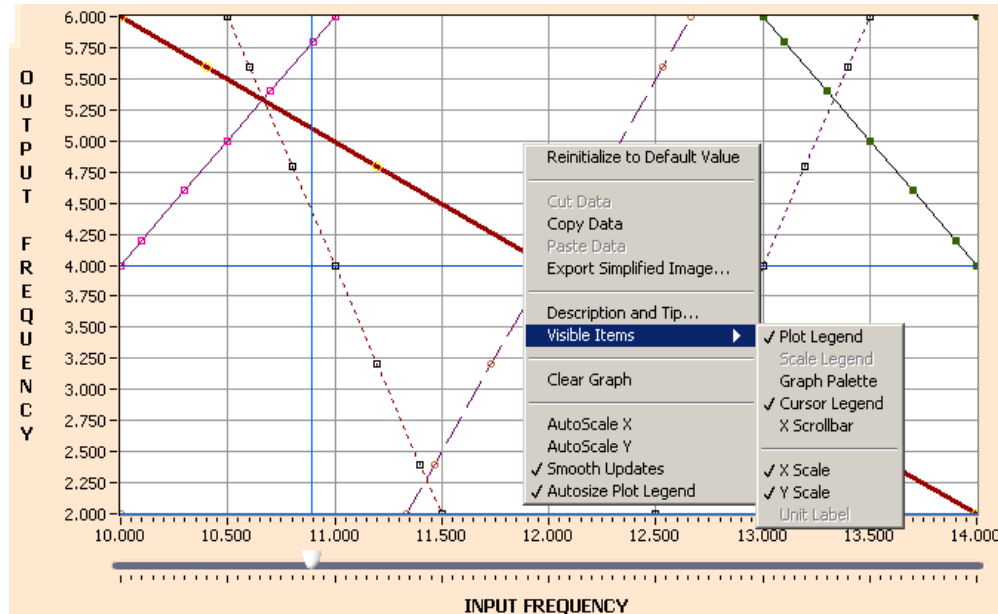
- A. **Slide Bar** – Used to select Input Frequency at which the Output Signals will be read. Click and drag the *slid bar* to any location on the graph. The *input frequency* numeric display will automatically update.
- B. **Input Frequency** – Enter a numeric value to three decimal places for the *Input Frequency*. This will automatically update the location of the *Slide Bar* on the graph.
- C. **Output Signals** – All spurs that intersect the slide bar will be displayed in this table.
- D. **Cursor Input** – The input frequency at the cursor location will be displayed here. Cursor lines may be moved by simply clicking and dragging them.
- E. **Cursor Output** – The corresponding output frequency at the cursor location will be displayed here.
- F. **No. of Spurs** – Displays the total number of spurs calculated.
- G. **Warning** – If more than 24 spurious signals are calculated, a red warning light will turn on. This light indicates that not all spurs are plotted.
- H. **Spur Orders** are differentiated by line color, style, and thickness. See the Line Display Options page for details.



Graph Display Options

To change the display options or visible items on the graph, right click anywhere in the graphical display window to view a pop up menu.

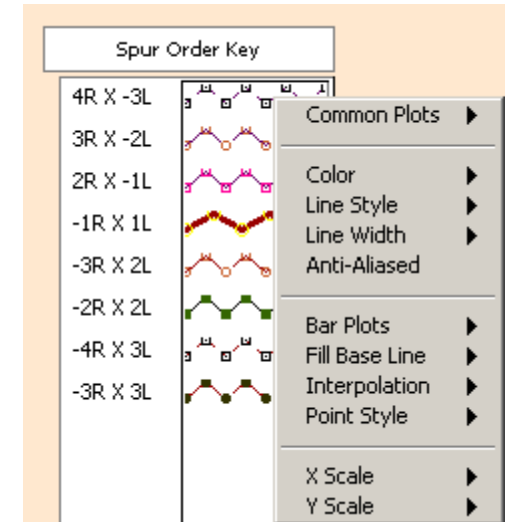
- Reinitialize to Default Value:**
 This option will return the graphical display back to its original settings. This includes clearing the spur lines. Using this option will make it appear as though the spurs were erased. To retrieve the spurs, click the *Find Spurs!* button.



- Copy Data:** *Copy Data* will make a copy of the entire graphical display in its original form. Use this feature to create presentations of the results.
- Export Simplified Image...:** This option will copy the graphical display in a simplified black and white version.
- Visible Items:** Use the *Visible Items* menu to hide parts of the graphical display. Although this will simplify the display, it will also hide valuable information.
- Clear Graph:** *Clear Graph* is similar to *Reinitialize to Default Value*. This option clears the spur lines from the graph. To retrieve the spurs, click the *Find Spurs!* button.
- Other:** The remaining options (Autoscale X, Autoscale Y, Smooth Updates, and Autosize Plot Legend) should be left on their default settings.

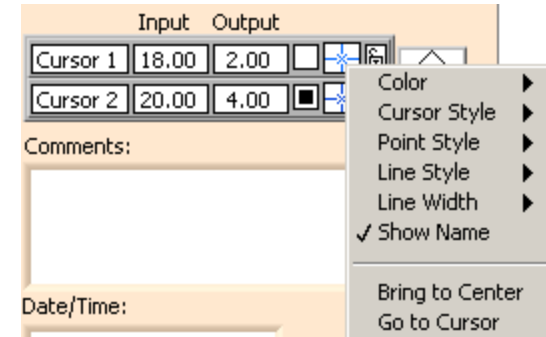
Line Display Options

- The color and style of the spur lines on the graph may be customized. Left click on the Spur Order Key to view an options menu.
- **Common Plots:** The *common plots* menu may be used to change the data display options. These options change the way in which the points are connected and delineated. By default the standard line without individual points is selected.
- **Color:** Select a custom color for the lines to make a bold presentation. This may be useful to distinguish between particular spurs.
-
- **Line Style:** Use the *Line Style* menu to select between dashed and solid lines.
-
- **Line width:** The *Line width* may be adjusted to accentuate the spurs.
-
- **Point Size:** Use the *Point Size* menu to visually define the individual data points. Selecting any of the options in this menu will create bullets at each of the points on the graph.
-
- **Other:** The remaining options (Anti-Aliased, Bar Plots, Fill Baseline, Interpolation, X Scale, and Y Scale) should be left on their default values. Although no harm will come in changing these options, they do not apply to the tests and presentation realm of SpurFinder.



Cursor Line Properties

On the graph there are two blue cursor lines. These lines may be used to specify a region of focus on the graph. You may move these lines to any location by clicking and dragging them to a position or by entering a coordinate (Input, Output) in the appropriate field. You may change the color and style of the cursor lines by left clicking on the blue star shaped button next to the desired cursor line.



- **Color:** Select a custom color for the cursor lines to make them stand out or allow them to hide in the background.
- **Cursor Style:** The *cursor style* option changes the look of the cursor lines. You may choose between a single vertical line, cross hairs, or a single horizontal line.
- **Point Style:** Use the *Point Size* menu to visually define the point at which the cursor line crosses the spur lines.
- **Line Style:** Use the *Line Style* menu to select between dashed and solid lines. By default the cursor lines are solid.
- **Line width:** The *Line width* may be adjusted to accentuate or deemphasize the cursor lines.
- **Show Name:** The *Show Name* option will display the name of the cursor line on the graph.
- **Bring to Center:** *Bring to Center* moves the cursor line to the center of the graph.
- **Go to Cursor:** *Go to Cursor* shifts the graph to be centered around the current location of the cursor line.
- **Lock Position:** To lock the cursor lines to a fixed location, left click on the button with the lock next to the appropriate cursor line.



Reading Spur Charts

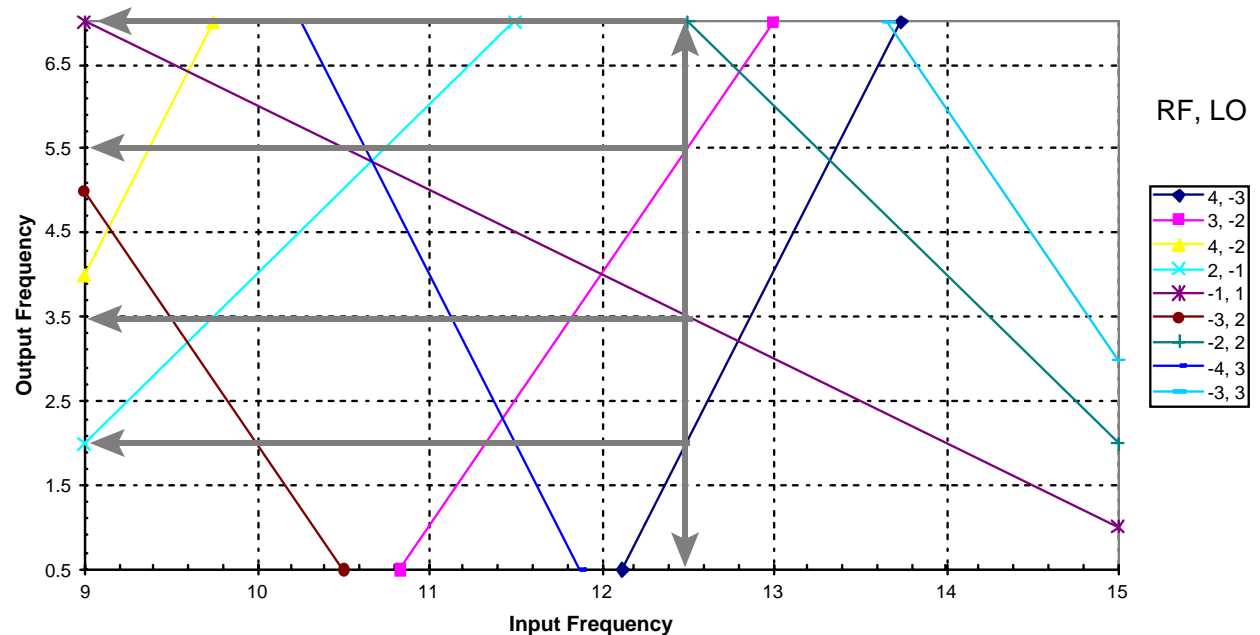
For a given chart, an input frequency is applied within the input frequency range. At this frequency a vertical line is drawn from top to bottom of the spur chart. At every point where a spur line crosses this vertical line, the output frequency of the spurious signal is read. Tuning may be simulated by looking at various output spurious lines as vertical lines are placed at different points across the input frequency range.

The Slider Bar enables the user to easily read the Spur Orders it intersects. It allows the user to choose any Input Frequency within the analysis bandwidth by clicking and dragging the Slider Bar to the desired location on the plot. The numeric display of the Input Frequency is automatically updated with an accuracy of three decimal places. The output signal frequencies are generated in real-time and displayed in the Output Signals Table.

Once the spurious frequencies are plotted, the mixer information may be looked up or measured to determine the relative amplitude levels of these spurious signals for each order of LO and RF harmonics. After the spurious amplitude levels are determined, the pre - selection filtering requirements at the input to the mixer and the post - selection filter requirements at the output of the mixer may be determined. Actual filter rejection points can then be established and filter design can proceed from there.

Example:

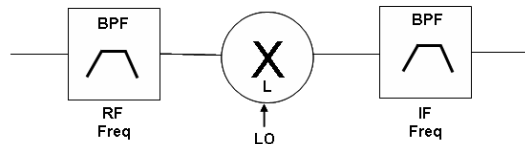
- Input Frequency is set to 12.5 GHz
- LO Frequency is set to 16 GHz (fixed)
- Draw vertical line at 12.5 GHz
- Read outputs on left-hand scale
- IF outputs:
 - 3.5, 4R X -3L at 2.0 GHz
 - 3R X -2L at 5.5 GHz
 - -2R X 2L at 7.0 GHz





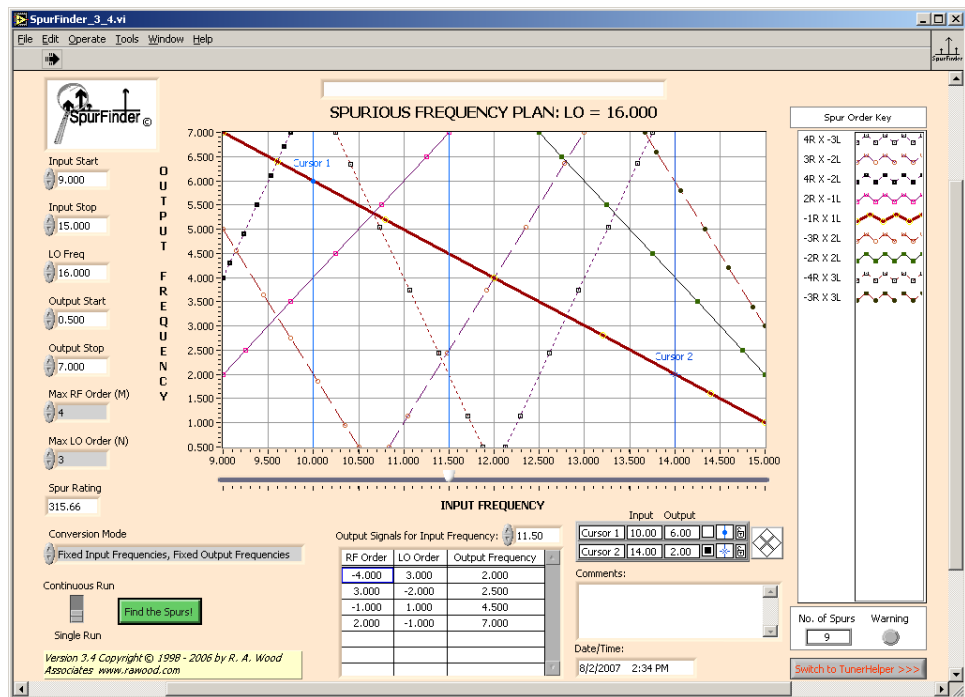
Down Conversion Example

The SpurFinder program easily models a generic tuning structure with the sequence:



The first BPF selects the RF frequency band of the device and the second selects the IF frequency band of the device. The mixer provides down conversion of the input signal based on a Local Oscillator (LO).

For a given down conversion, where the RF Input Bandwidth is 10-14 GHz, the IF Output is 2-6 GHz, and the LO is set to 16 GHz to facilitate this down conversion. Spurs created by signals within the operational band are to be analyzed. In order to be thorough, one should examine frequencies (RF and IF) 25%-30% above and below the band of interest in order to avoid the possibility of large spurs just on the edges of the frequency bands. Thus, the RF range was chosen to be 9-15 GHz, and the IF range was chosen to be 0.5-7 GHz. Spurs of orders up to $M = 4 \times RF$ and $N = 3 \times LO$ are shown on this plot. After inputting these parameters into SpurFinder, hit *Return* or click the *Find Spurs!* button to view all the corresponding spurious products.



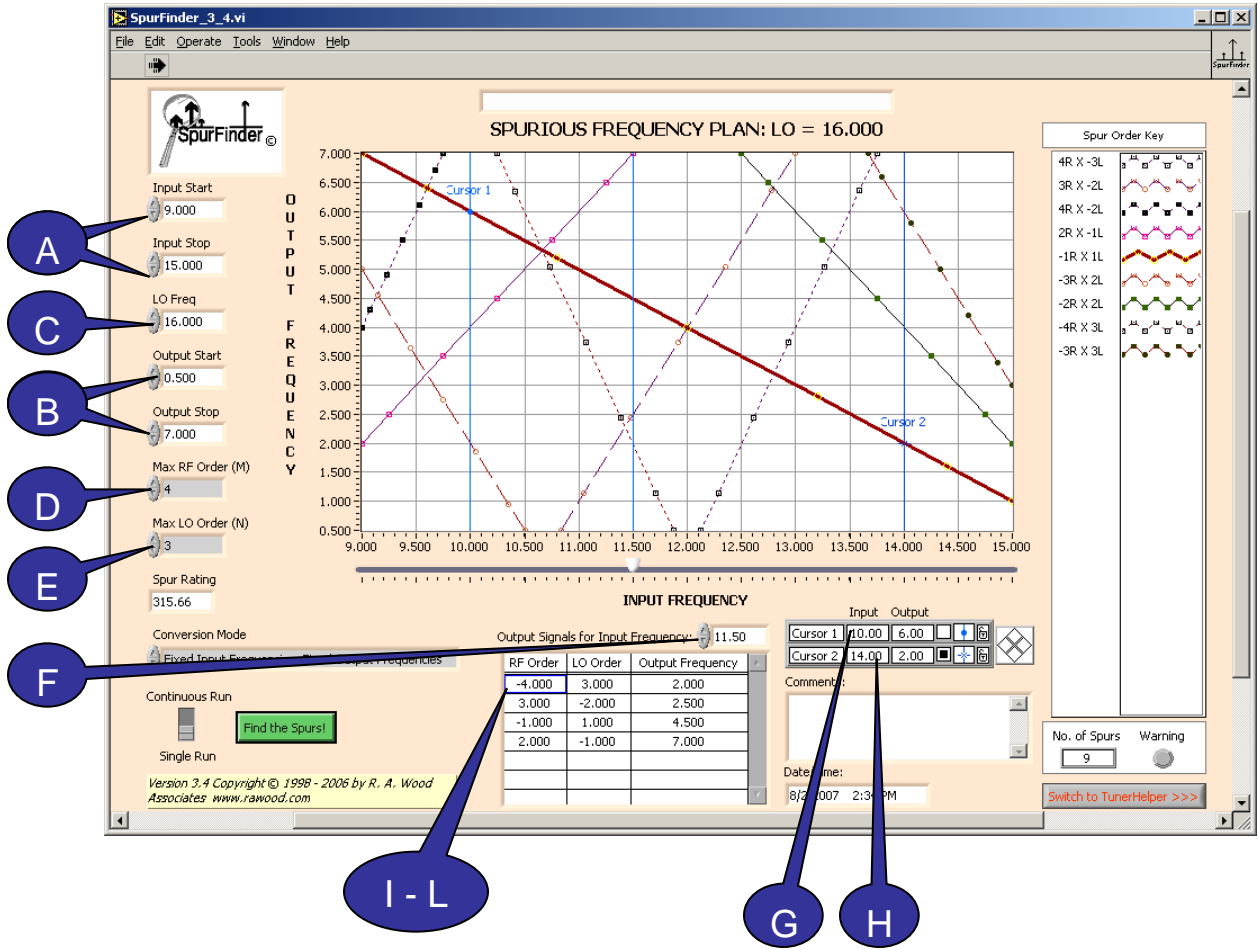


Down Conversion Example Cont.

This example is based on R. A. Wood Associates' RF and Microwave Receiver Design lecture notes. If you are interested in copies of these notes or having a course taught, please contact US.

Input the following Parameters:

- A. RF Range: 9 – 15 GHz
- B. IF Range: 0.5 – 7 GHz
- C. LO Frequency: 16 GHz
- D. Max RF Order: 4
- E. Max IF Order: 3
- F. Input Frequency: 11.50 GHz
- G. Cursor 1 input: 10 GHz
- H. Cursor 2 input: 14 GHz



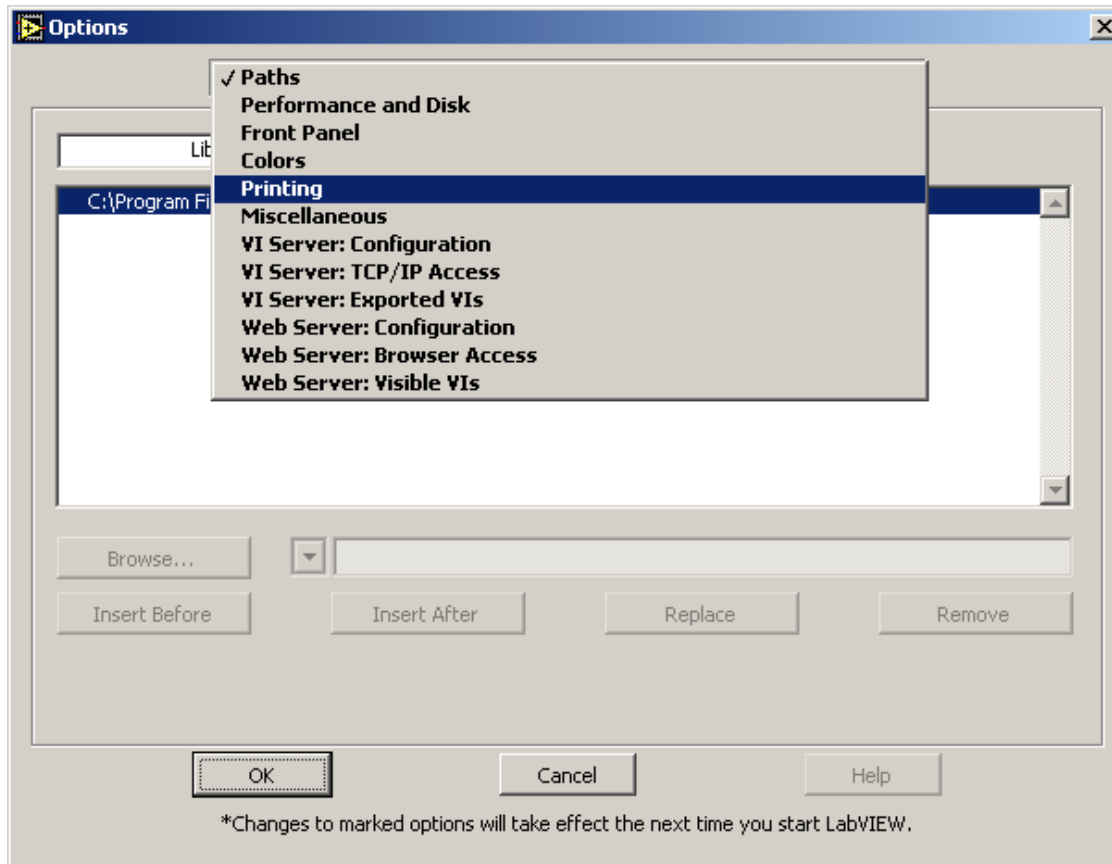
Hit Return to update the graph

The following Output Signals are displayed in the table:

- I. -4R x 3L at 2 GHz
- J. 3R x -2L at 2.5 GHz
- K. -1R x 1L at 4.5 GHz
- L. 2R x -1L at 7 GHz

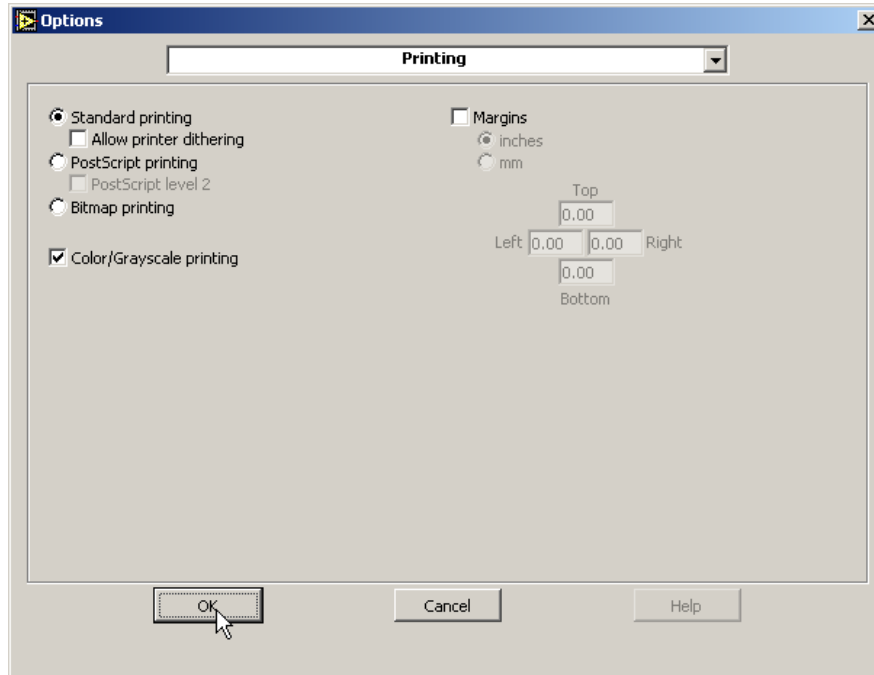
Printing

- The default printer is set for a postscript type printer.
- To print on an ink jet printer go to **Tools>>Options**. In the pop up window, click on the arrow next to Paths and select **Printing**.

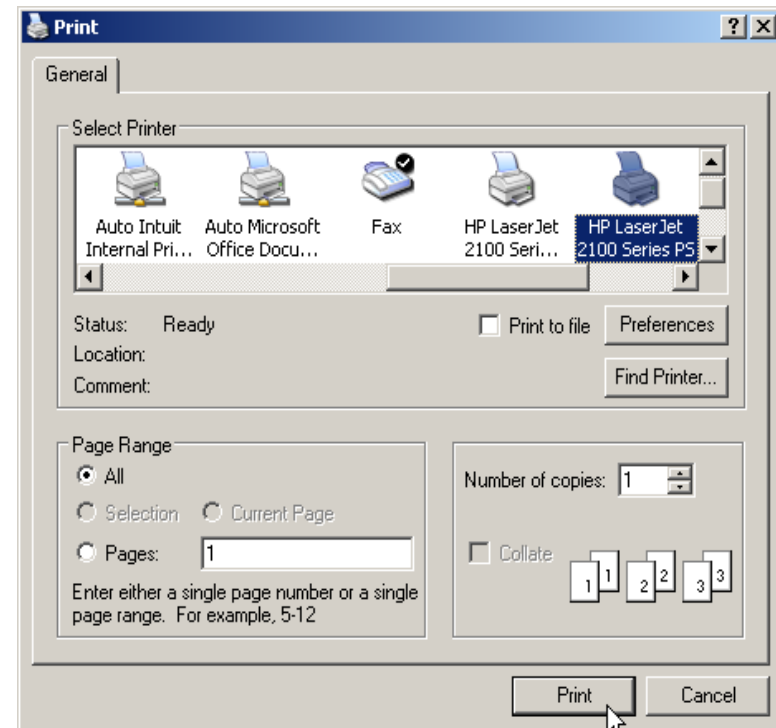


Printing Cont.

- Set the printing options to **Standard Printing** and click **OK**.



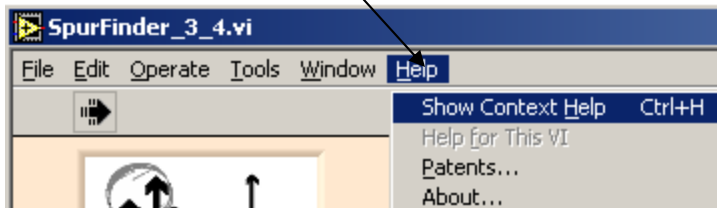
- On the panel that you want to print, go to **File>>Print Window....** In the dialog box select the ink jet printer and click **Print**



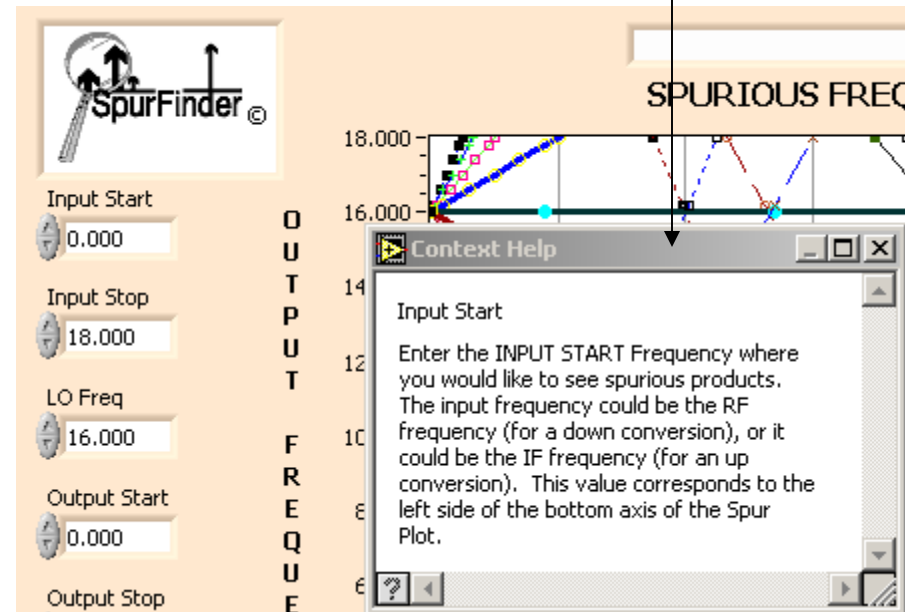
Help Menu

- For help on functions while SpurFinder is running, go to Help >> Show Context Help. This will bring up a window with helpful tips that change according to the location of your mouse. Drag your mouse over buttons, graphs, or tables to view detailed descriptions of their functions (see example below). As always, if you run into problems, don't hesitate to contact us at any time.
- For additional Help resources please visit our Software Support Forum at: <http://rawood.com/support3/index.php>
- As always, if you run into problems, don't hesitate contact us any time at 315-735-4217 or rawood@rawood.com

Click on *Show Context Help* to bring up Help window.



This is an example *Context Help Window* that is displayed when the mouse button hovers over the Input Start field. Move the mouse to hover over different buttons, graphs, or tables to view help on other functions.





Purchasing Information

- We currently offer several methods for purchasing our software products:
 1. Select the desired method from within the program itself (recommended for single purchases)
 2. Use the PayPal Forms on our software download page : http://rawood.com/software_products/purchase_software.html (useful for purchasing multiple programs)
 3. Fill out the WWW form
 4. Contact us directly so we can contact you for payment arrangements
- When purchasing, please double check that both your User Name and Registration Key are correct.

