



RF Path Analysis Toolkit User Manual

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Overview

Having trouble analyzing an RF path? Fed up with creating error prone spreadsheet analyzes that take forever to create? RF Path Analysis Toolkit will take the hassle out of analyzing RF paths.

RF Path Analysis Toolkit enables RF designers to use Excel spreadsheets to analyze RF paths (Cascade Analysis). This program offers the flexibility of developing custom template spreadsheets and libraries while eliminating the common problems associated with modifying Excel spreadsheets. RF Path Analysis Toolkit works best for designers who would like to build up an RF component library and analyze several RF paths using a common database of library parts.

Spreadsheet programs are commonly used to perform RF signal path analysis, RF cascade analysis, and RF budget analysis. These spreadsheets offer the flexibility to create customized analyzes to predict performance of the entire RF path. Traditionally, once a template spreadsheet has been created with the desired equations and calculations, the spreadsheet is set up to model a particular RF path by adding specifications of RF components. This can be very time consuming and error prone. Errors are easily incurred by typing incorrect component information or by accidentally overwriting formulas in the spreadsheet. It is also possible to overlook errors in the formulas caused by adding or removing rows. If you need to model many RF paths within a system that uses the same RF components, you would create a spreadsheet for each path. The potential for error within a spreadsheet is multiplied by the number of RF paths that need to be created. RF Path Analysis Toolkit provides a user friendly interface for developing a database of RF components and analyzing RF Paths without incurring the errors associated with traditional spreadsheets analyzes.

Key Features

- The program is built with a LabVIEW user interface that controls Excel as needed.
- Includes three user friendly modules for creating and running RF paths: Path Builder, Path Runner, Library Manager
- Uses an Excel "library" spreadsheet for organizing a database of RF components.
 - A preliminary RF component library is included with hundreds of parts.
 - New parts may be added in the Library Manager module, and existing parts may be modified.
 - RF components are modified in only one place instead of in each individual spreadsheet path. This saves time and reduces the potential for error.
 - The RF Path Analysis Toolkit dynamically loads RF components from the library into the template spreadsheet and formats the spreadsheet. It then saves the detailed RF analysis spreadsheet.
- Uses Excel "template" spreadsheets to perform RF signal path analysis (2 sample templates included).
 - Analyze noise figures, gains, signal levels, third order intercept points, and other parameters for any RF path.
 - The Path Builder interface provides a "real-time" display of the RF path performance as you build up the RF path.
 - Customize the template spreadsheet to add your own calculations.
- Build up the RF signal path by cascading RF components together in the Path Builder module.
- The RF path parameters and components in each RF path can be saved to and loaded from text files.



Trial Version Limitations and System Requirements

- Trial Version
 - The trial version of RF Path Analysis Toolkit has all the features of the full version with a few limitations:
 - The maximum number of components in an RF path is limited to seven.
 - The template spreadsheets are locked and may not be customized.
 - The full version is available for purchase for \$295.00 (US Dollars). Buy now to unlock all program features.
- System Requirements
 - RF Path Analysis Toolkit was designed to operate in the Windows NT, 2000, and XP environment.
 - The program has not been fully tested in the Windows Vista operating system.
 - Works with Microsoft Excel 97 – 2007. Please Note: Excel 2007 must be in compatible mode using .xls file extensions.



Changes by Version

Thank you for choosing RF Path Analysis Toolkit!

___ Current Version: 2.1.3 ___

___ Changes in Version 2.1.3 ___

Path files work better when the named spreadsheet range in the path file does not exist on the template spreadsheet. The program now ignores named ranges that do not exist on the template spreadsheet, and continues to the next one.

Improved the Sub path capability. "Export to Excel" works with sub path parts, but should be used with caution. This is because not all parameters available in the library are available in the sub path parts.

Sup path parts can be "updated" from the originating path files when a path file is loaded that contains sub path parts.

Fixed the "Unlock Template", so now it works with the selected template spreadsheet for registered users.

___ Changes in Version 2.0 ___

Added two new columns to the RF Path in the Path Builder (Device Slope and Cumulative Slope).



Changes by Version

Updated and improved sub path capabilities, particularly when utilizing sub path parts.

___ Changes in Version 1.4 ___

Added new sub path capability.

Added new options when exporting to excel from the Path Builder.

New options for loading/saving path files on the Path Builder settings tab were added.

Users can now drag and drop parts in the path list when using the Path Builder.

There are two new parameter columns in the Path Builder path list.

Fixed several bugs and improved the UI.

File Path dialog boxes are more descriptive and helpful.

Fixed minor spelling and typo errors.

___ Changes in Version 1.2 ___

Excel messages will now be displayed after closing the software if Excel remains open. Added description field to the Transmission Lines.



Changes by Version

Enhanced the registration process.

__ Changes in Version 1.1 __

Enhanced the registration process.

RF Path Analysis Toolkit allows engineers to create RF path (cascade) analysis spreadsheets to analyze their RF and microwave designs. The program uses library files, RF path files, and template spreadsheets within a LabVIEW user interface to create an full RF path analysis environment.

As always, we appreciate your feedback. We continually strive to improve our software packages based on your suggestions.

We would like to thank you for choosing our product and for your continued support.

Enjoy RF Path Analysis Toolkit!

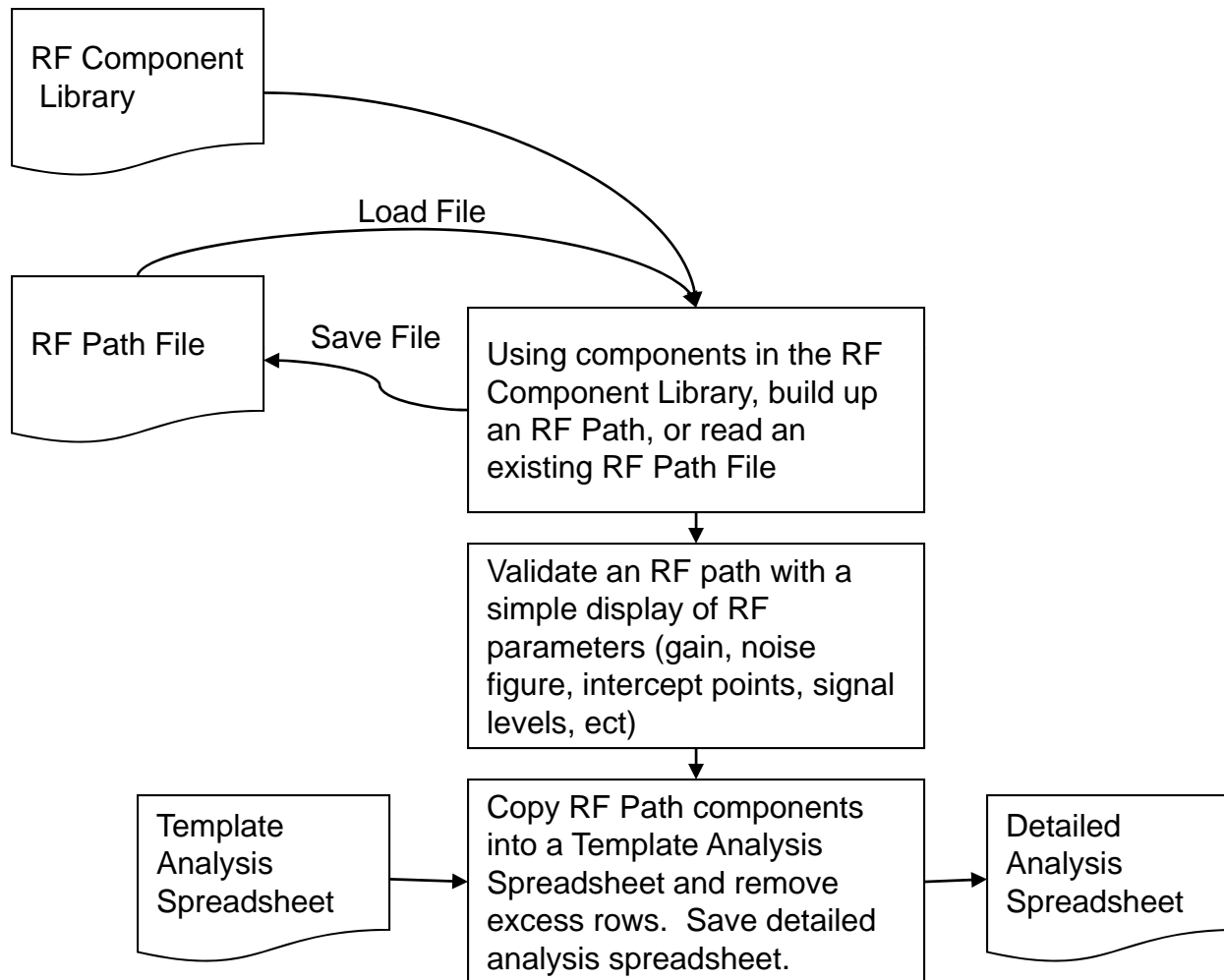
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Installing RF Path Analysis Toolkit

- To check out RF Path Analysis Toolkit for yourself, visit the R.A. Wood software download page at:
http://rawood.com/software_products/download_software_page.html#rf_toolkit_anchor
- Select *Download Now!* next to the RF Path Analysis Toolkit_2_0_Installer.exe
- Click *Save File* to save the installer.
- After the installer download is complete, double click on the *RF Path Analysis Toolkit Installer icon* to start the installation process.
- Work through the user prompts to install RF Path Analysis Toolkit.
 - Select a folder to save the RF Path Analysis Toolkit setup files to and select *OK*.
 - Select *Next>* on the Installation Wizard
 - Browse to select a location to save the RF Path Analysis Toolkit 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>>RF Path Analysis Toolkit* 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 RF Path Analysis Toolkit.
 - 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 maximum number of components in an RF path is limited to ten. In addition, the template spreadsheets are locked and may not be customized.
- Click *Continue* again to use the trial version of RF Path Analysis Toolkit or enter the Registration number and click *Unlock Software* to access the full version.
- For detailed screen shots of the installation process visit:
<http://helprfpathanalysis2.rawood.com/tiki-index.php?page=Downloading+and+Installing+the+Program>

Program Operation





Definitions and Terms

RF Component Library

The RF Component Library is a comprehensive database of parts and their specifications. A sample database is included with the program. Each part uses a unique Lib Ref No (library reference number) that is used to identify the part. All three modules of the RF Path Analysis Toolkit (Path Builder, Path Runner, and Library Manager) use the RF Library. The Library Manager module can be used to edit, add, or delete parts from the database. There are two main parts to the RF Component Library:

- ❑ **RF Component Library Sheet** – This sheet contains all the data for individual parts.
- ❑ **Transmission Line Losses Sheet** – This sheet contains a table to look-up losses of transmission lines based on frequency and length.

RF Path

The RF Path is a complete RF signal path that consists of the RF components from the input to the output, and the input parameters such as the input signal levels, and the input noise levels. The end to end performance of the RF path is calculated based on the parameters of the RF components that make up the path.

RF Path Files

The RF Path File is a text file that contains all the information for a unique RF path. Information stored in the RF Path file includes the list of RF components from the RF Component Library that make up the RF path, the input signal levels, the input noise levels, and the formatting information.

RF Template Spreadsheets

The Template Spreadsheet is an Excel spreadsheet that contains the calculations for the RF path. The template spreadsheet is always longer than the longest RF path to be analyzed. Template spreadsheets are saved to detailed spreadsheets while RF Path Analysis Toolkit is running. Template spreadsheets may be customized as long as certain guidelines are followed. The RF Template has several parts:

- ❑ **Component Sheet** - This is where all the RF Component Data from the RF Component Library is placed when a Detailed Spreadsheet is created. Do not make formula changes to the RF Template on the Component sheet as it will have little effect on the Detailed Spreadsheet.
- ❑ **Analysis Sheet** - This sheet uses the data from the Component Sheet to calculate a detailed analysis of the RF Path. The formulas on this sheet should represent the detailed analysis that is desired of the RF path.
- ❑ **Charts** - There are several charts to display the data calculated in the Analysis Sheet.

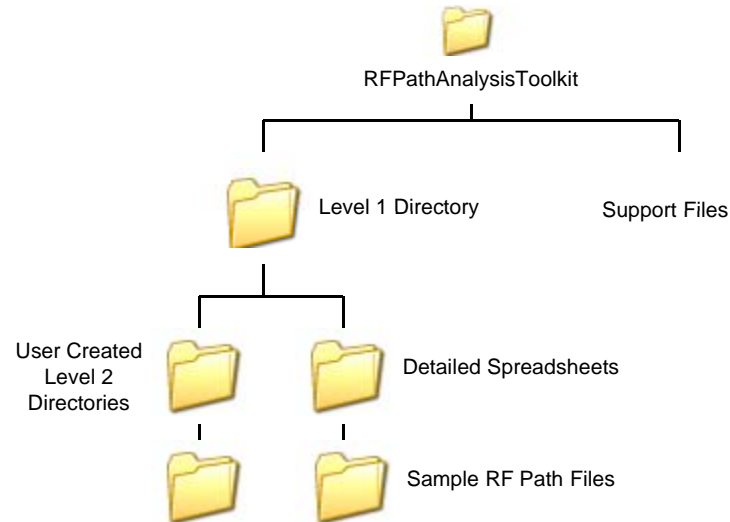
Detailed Analysis Spreadsheets

The Detailed Analysis Spreadsheet is created from the template spreadsheet and the RF path file. This spreadsheet contains the RF components and their parameters, the RF path parameters from the RF path file, and the formatting information from the RF path file.



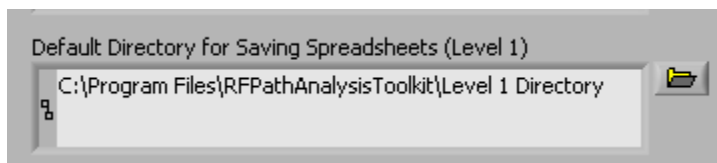
File Directory Structure

Support files for RF Path Analysis Toolkit are located in the C:\ProgramFiles\RFPathAnalysisToolkit directory. These files include the sample RF Template Spreadsheets and the RF Component Library. Within this directory is a subdirectory named "Level 1 Directory". This subdirectory organizes the Detailed Analysis Spreadsheets, Sample Path Files, and user defined path files.



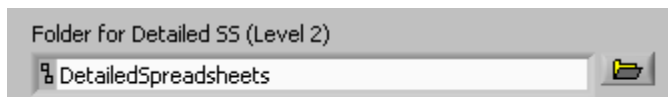
Level 1

Level 1 represents the top level directory for saving files in the program. By default, all path files and Detailed Analysis Spreadsheets are saved to this location. At the startup of the program, this folder must be specified on the Settings Tab of the main panel by selecting the *Default Directory for Saving Spreadsheets*. If the path files are ever moved to a new location, simply specify the new directory that points to their location. This allows the program files to be portable.



Level 2

Level 2 folders may be created by the user to separate individual analyzes and their associated path files. The level 2 folders must be created as subdirectories of the level 1 directory. The level 2 directories may be specified in the Path Builder module.

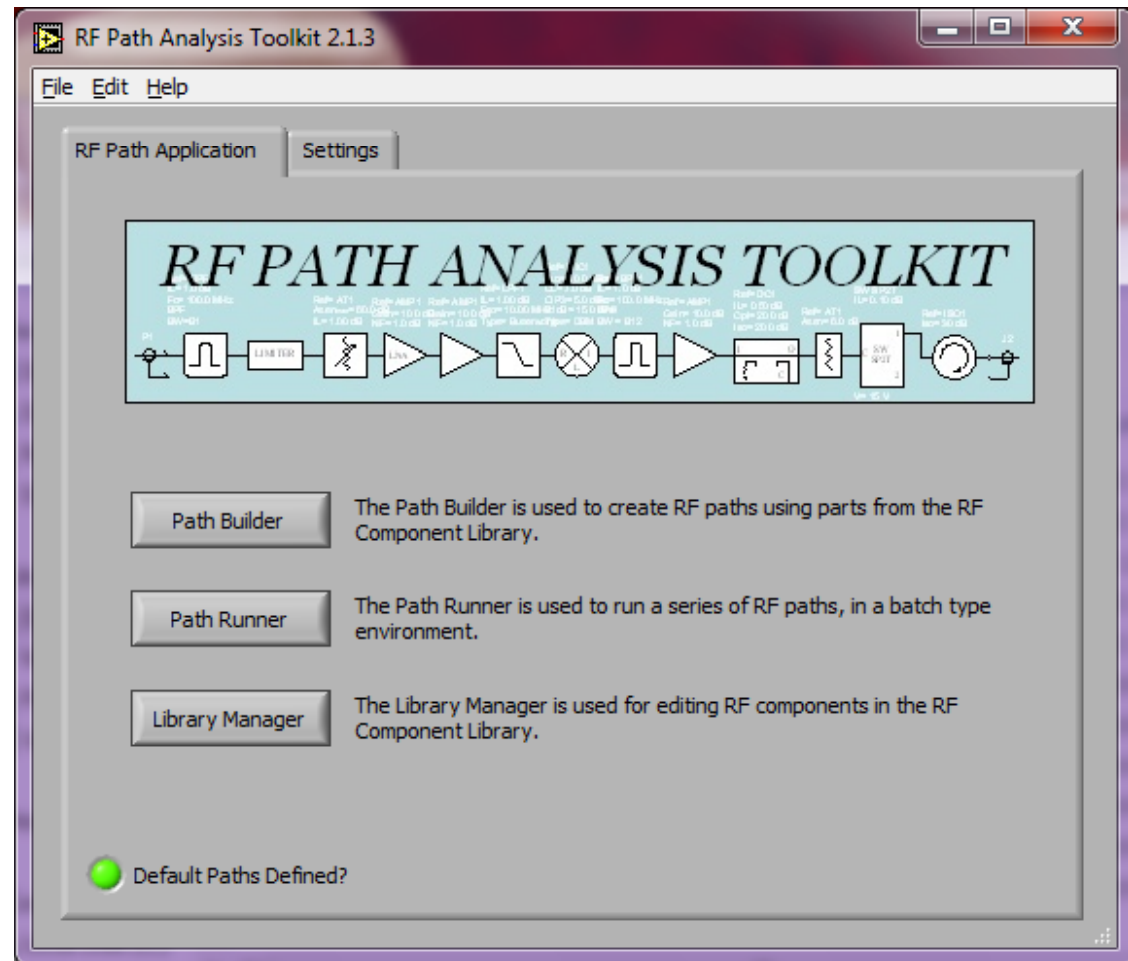




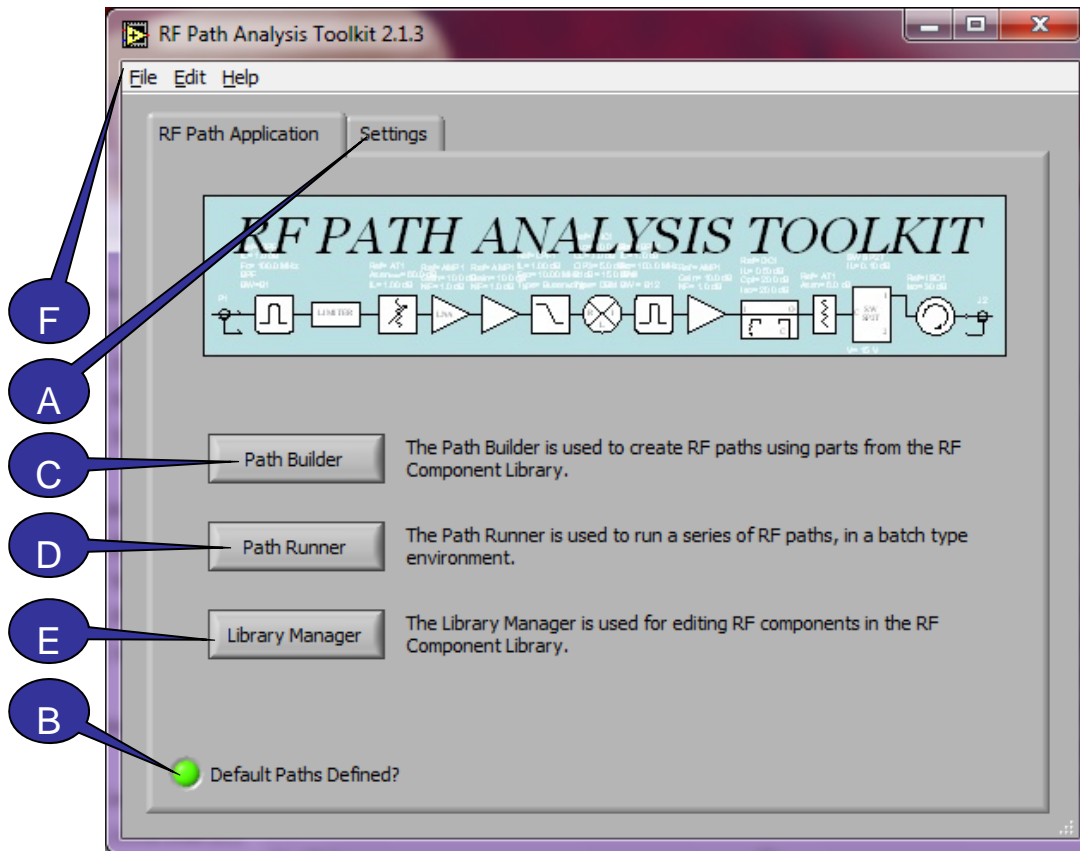
RF Path Analysis Toolkit Main Panel

This is the main panel of the RF Path Analysis Toolkit. There are three primary sections in this program:

- **Path Builder** - The Path Builder is used to create RF paths with parts from the RF Component Library. You can also load RF path files, change the order of the RF components, and save RF path files.
- **Path Runner** - The Path Runner is used to run a series of RF paths. This is useful when you have multiple RF paths set up, or when components in the RF library have been updated. You can use this utility to run the RF paths that were affected by the updated RF components.
- **Library Manager** - The Library Manager is used to edit RF components in the RF Component Library. You can add new parts, edit existing parts, or delete parts.



RF Path Application Tab

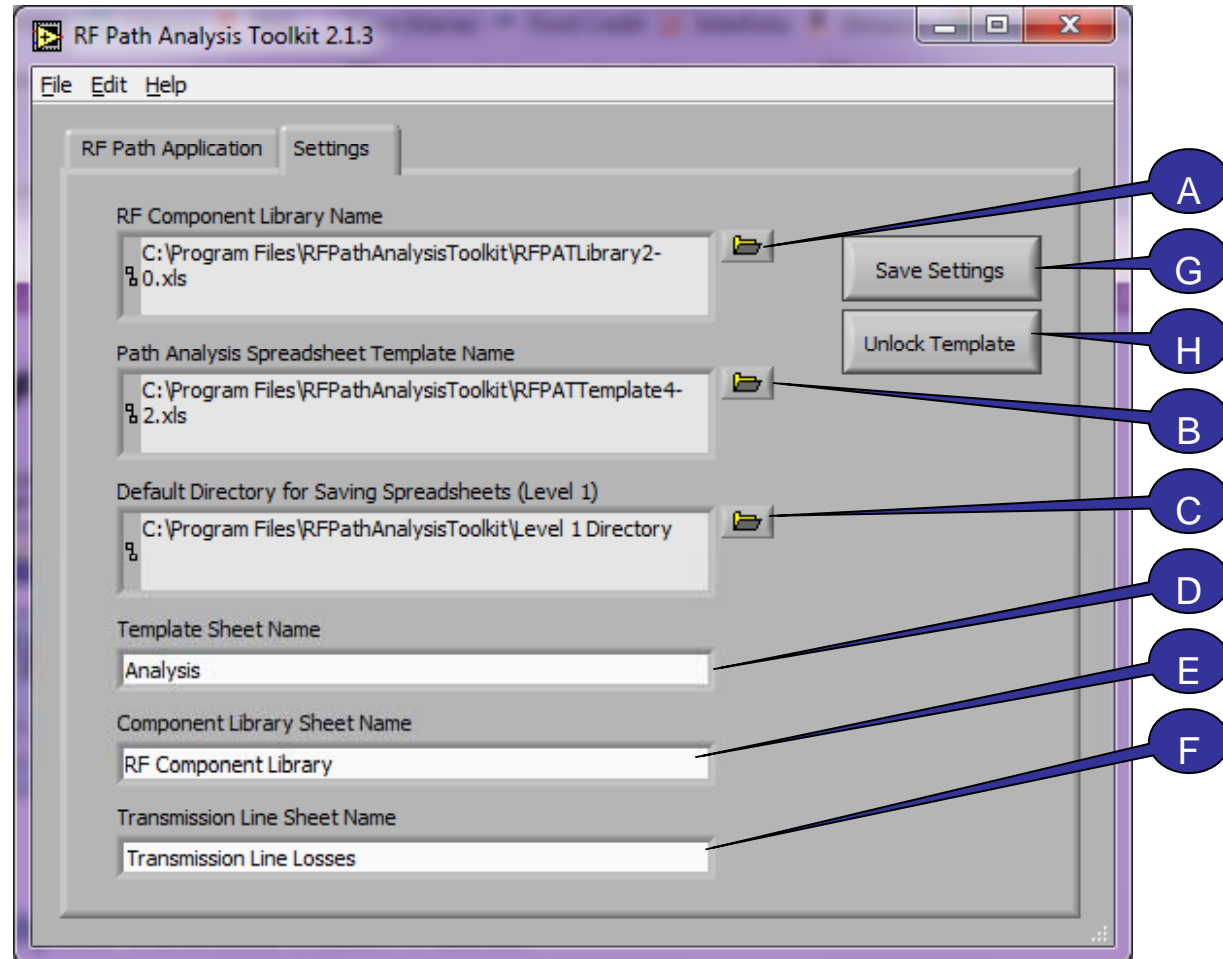


The RF Path Application Tab opens in the first window at the start of the program. This tab is used to navigate through the three primary sections of RF Path Analysis Toolkit. The following options are available on this tab:

- A. Settings Tab** – Provides access to the RF Path Analysis Settings. Displays fields for various paths and parameters used in the RF Path Analysis Toolkit. Make changes to the settings on this tab before accessing other parts of the program.
- B. Default Paths Defined** - This indicator turns bright green when the paths fields on the Settings tab are defined. It turns dark green when they are not defined. Make sure the indicator is bright green before proceeding to the rest of the program.
- C. Path Builder** – Click this button to open the Path Builder module, and Excel.
- D. Path Runner** – Click this button to open the Path Runner in a new window.
- E. Library Manager** – Click this button to open the Library Manager and Excel.
- F. Exit** – To exit the program go to *File>> Exit* or click the 'X' in the upper right corner. The *Exit* button will stop the program operation. It will not close the program.

Settings Tab

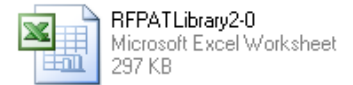
The Settings Tab on the main panel of the RF Path Analysis Toolkit is used at the start of the program to setup the file directory structure and to locate the support files. By default, the program expects the RF Component Library and Template spreadsheets to be located in the C:\ProgramFiles\RFPathAnalysisToolkit directory. If these files have been moved or if the file names have been changed, it is important to adjust the settings on this tab accordingly. This tab is also used to select the Level 1 directory for saving files. See the following page for descriptions of the features available on this tab.





Setting Tab Cont.

- A. RF Component Library Name** – This field should contain the path to the RF Component Library Excel file. This file will be referenced by the program in all three modules. By default, this file is located in the C:\Program Files\RFPathAnalysisToolkit directory under the name “RFPATLibrary2-0.xls”. If the default directory or name have been changed, click on the folder icon to the left of the field to browse for the new file.
- B. Path Analysis Template Spreadsheet Name** – This field should contain the path to the desired RF Template Excel file. Three sample templates have been included with the program (RFPATTemplate4-2, RFPATTemplate6-3, and RFPATTemplate 8-4). The selected file will be referenced by the program in the Path Builder, and the Path Runner modules. By default, the file is located in the C:\Program Files\RFPathAnalysisToolkit directory. Click on the folder icon to the left of the field to browse for the desired template file.
- C. Default Directory for Saving Spreadsheets (Level 1)** – This field should contain the path to the directory in which the Detailed Spreadsheets will be saved to by default. It is recommended that an RF Path Analysis Toolkit folder be created in My Documents or on the Desktop for this purpose. This directory is the Level 1 program folder (see File Directory Structure) that is referenced by the program in the Path Builder, and the Path Runner modules. Click on the folder icon to the left of the field to browse for the default directory. Use the *Select Cur Dir* button once you have found the desired folder.
- D. Template Sheet Name** – This is the worksheet name for the main sheet in the RFPATTemplateX-X.xls file. By default, the worksheet is named “Analysis.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Template Sheet Name* field.
- E. Component Library Sheet Name** – This is the worksheet name for the main sheet in the RFPATLibrary2-0.xls file. By default, the worksheet is named “RF Component Library.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Component Library Sheet Name* field.
- F. Transmission Line Sheet Name** – This is the worksheet name for the second sheet in the RFPATLibrary2-0.xls file. By default, the worksheet is named “Transmission Line Losses.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Transmission Line Sheet Name* field.
- G. Save Settings** – Click the *Save Setting* button to save the current setup as default. A dialogue box will pop up to replace the “RF_Path_App_Preferences.txt” file. This file allows the default settings to automatically load into the program at startup.
- H. Unlock Template** – The original RFPATTemplateX-X.xls file is write protected to prevent formulas and other data from being edited. Click the *Unlock Template* button to create an unprotected copy this file. The new file will be saved in the Default Directory for Saving Spreadsheets under the name “RFPATTemplate_Unprotected.xls”



Path Builder

RF Path Builder

File Edit Help

Path Builder | **Format Info** | Settings | RF Path Title: SAMPLE 1 PATH | **CLOSE**

Folder for Detailed SS (Level 2)
DetailedSpreadsheets

File Name for Detail SS
Sample Path.xls

Title	Value	Named Range
Revision Date	10/14/2004	Rev_Date
Signal 1 Input	-75	Signal_1_dBm
Signal 2 Input	-15	Signal_2_dBm
RF SNR Required (dB)	10	SNR_Required
Receiver IF BW (MHz)	500	Rec_BW_MHz
Signal 3 Input (two tone)	-15	Signal_3_dBm

Path File Name: Load Path Save Path Export to Excel

Library Parts

LIBREFNO	Part Type	Description	Gain	Noise Figure	T.O.O.I.P	1dB Pout
DEFAULTPART	Connector	Default Passive Part	-0.001	0.001	150	150
TNC5MAB3	Connector	TNC/SMA Adapter B3	-0.23	0.23	109	100

Part Type
Connector Add Part to End Insert Part Replace Part Remove Part Empty List

LIBREFNO	Part Type	Description	Nominal Gain v	CUM Gain	Noise Figure v	CUM Noise Figure	SIG 1 Power	SIG 2 Power	T.O. O.I.P v	CUM T.O. I.I.P	Pout 1 dB v	SIG 2 DIFF From Comp Point	Device T.O. Spurs	CUM Pin 1 dB
MODULEIN	Marker	Module Input	0.00	0.00	0.00	0.00	-75.00	-15.00	150.00	150.00	150.00			151.00
SAMPLE1S1	Switch	Sample 1 SP3T 60 dB	-0.80	-0.80	0.80	0.80	-75.80	-15.80	28.00	28.80	20.00	-35.80	-87.60	21.80
SAMPLE1FL1	Filter	Sample 1 Prefilter FL1	-1.50	-2.30	1.50	2.30	-77.30	-17.30	150.00	28.80	150.00			21.80
PAD-01.0	Attenuator	Pad/Attenuator [1 dB]	-1.00	-3.30	1.00	3.30	-78.30	-18.30	150.00	28.80	150.00			21.80
SAMPLE1L1	Limiter	Sample 1 Limiter L1	-0.40	-3.70	0.40	3.70	-78.70	-18.70	22.00	23.97	14.00	-32.70	-81.40	16.97
SAMPLE1AR1	Amplifier	Sample 1 Amplifier 1	20.00	16.30	3.50	7.20	-58.70	1.30	28.00	11.45	15.00	-13.70	-53.40	-0.38
SAMPLE1FL5	Filter	Sample 1 LP Filter	-1.00	15.30	1.00	7.21	-59.70	0.30	150.00	11.45	150.00			-0.38

Final Path Analysis

LIBREFNO	Part Type	Description	Nominal Gain v	CUM Gain	Noise Figure v	CUM Noise Figure	SIG 1 Power	SIG 2 Power	T.O. O.I.P v	CUM T.O. I.I.P	Pout 1 dB v	SIG 2 DIFF From Comp Point	Device T.O. Spurs	CUM Pin 1 dB
SAMPLE1FL5	Filter	Sample 1 LP Filter	-1.00	15.30	1.00	7.21	-59.70	0.30	150.00	11.45	150.00			-0.38

This is the main tab of the Path Builder module. The Path Builder is used to create RF paths with parts from the RF Component Library. The RF Component Library will automatically open in Excel when this module is opened. After a path has been created, it may be exported to Excel for analysis. See the following pages for details about the features available on this panel.

- A. Format Info Tab** – Used to setup the cell format for the Excel detailed spreadsheet.
- B. Settings Tab** – Provides access to the settings for the Path Builder support files, and the default cell format for the detailed spreadsheet. Make changes to the settings on this tab before building a path.
- C. Close** – To exit the Path Builder panel and return to the RF Path Analysis Toolkit main panel, click on the *Close* button. Using *File>>Exit* will close the entire program, not just the Path Builder module.

Path Builder – Creating a Path

- D. Library Parts** – The Library Parts table displays the RF parts from the RF Component Library that match the *Part Type* listed in the field below. These parts will be used to create an RF Path.
- E. Part Type** – Click on the *Part Type* field to select the type of part to display in the *Library Parts table*. RF Parts, Transmission Lines, and Sub Path files may be selected. Parts may be sorted by type or by name. To search for a part by name, select the *Component User Search* option and type the first few letters of the component name in the search field.
- F. Add Part to End** – To add a part to the end of the path, highlight the desired part in the *Library Parts table*, and click the *Add Part to End* button. The part will be displayed at the bottom of the *Path table* below.
- G. Insert Part** – The selected part from the *Library Parts table* may be inserted above the selected part in the *Path table* by clicking *Insert Part*.

Library Parts Table:

LIBREFNO	Part Type	Description	Gain	Noise Figure	T.O.O.I.P.	1dB Pout
DEFAULTPART	Connector	Default Passive Part	-0.001	0.001	150	150
TNC5MA83	Connector	TNC/SMA Adapter B3	-0.23	0.23	109	100

Path Table:

LIBREFNO	Part Type	Description	Nominal Gain	CUM Gain	Noise Figure	CUM Noise Figure	SIG 1 Power	SIG 2 Power	T.O. O.I.P.	CUM T.O. I.I.P.	Pout 1 dB	SIG 2 DBFF From Comp Point	Device T.O. Spurs	CUM Pn 1 dB
MODULEIN	Marker	Module Input	0.00	0.00	0.00	0.00	-75.00	-15.00	190.00	190.00	190.00			151.00
SAMPLE1S1	Switch	Sample 1 SP3T 60 dB	-0.80	-0.80	0.80	0.80	-75.80	-15.80	28.00	28.80	20.00	-35.80	-87.60	21.80
SAMPLE1FL1	Filter	Sample 1 Prefilter FL1	-1.50	-2.30	1.50	2.30	-77.30	-17.30	190.00	28.80	190.00			21.80
PAD-01.0	Attenuator	Pad(Attenuator [1 dB])	-1.00	-3.30	1.00	3.30	-78.30	-18.30	190.00	28.80	190.00			21.80
SAMPLE1L1	Limiter	Sample 1 Limiter L1	-0.40	-3.70	0.40	3.70	-78.70	-18.70	22.00	23.97	14.00	-32.70	-81.40	16.97
SAMPLE1AR1	Amplifier	Sample 1 Amplifier 1	20.00	16.30	3.50	7.20	-58.70	1.30	28.00	11.45	15.00	-13.70	-53.40	-0.38
SAMPLE1FL5	Filter	Sample 1 LP Filter	-1.00	15.30	1.00	7.21	-59.70	0.30	190.00	11.45	190.00			-0.38

Final Path Analysis Table:

LIBREFNO	Part Type	Description	Nominal Gain	CUM Gain	Noise Figure	CUM Noise Figure	SIG 1 Power	SIG 2 Power	T.O. O.I.P.	CUM T.O. I.I.P.	Pout 1 dB	SIG 2 DBFF From Comp Point	Device T.O. Spurs	CUM Pn 1 dB
SAMPLE1FL5	Filter	Sample 1 LP Filter	-1.00	15.30	1.00	7.21	-59.70	0.30	190.00	11.45	190.00			-0.38



Path Builder – Creating a Path Cont.

- H. Replace Part** – The selected part in the *Path table* may be replaced by the selected part in the *Library Parts table* by clicking *Replace Part*.
 - I. Remove Part** – To remove a part from the path, select the desired part in the *Path table* and click *Remove Part*.
 - J. Empty List** – To clear the *Path table*, click *Empty List*.
 - K. Path** – The *Path table* displays the current RF path components as well as a simple analysis of the path. You can drag and drop RF components in the path table to rearrange the parts as desired. See the Detailed Spreadsheet for a more in depth analysis of the Path. The following page describes the analysis parameters displayed in this table.
 - L. Final Path Analysis** – The *Final Path Analysis* row displays the end results of the simple analysis up to and including the last part.
-

Path Table Parameters

The following parameters are displayed in the Path table on the Path Builder tab. These parameters are useful when designing RF paths with difficult dynamic range requirements. They provide more insight into dynamic range contributors as you are building the RF path. Parameters in **green** are exported directly from the RF Component Library. Parameters in **black** are calculations associated with the selected path. As the path is created, each calculation updates automatically.

- **LIBREFNO** – The Library Reference Number is a unique identification string for each RF component in the RF Component Library.
- **Part Type** – Indicates the type of RF Component. *Part Types* include connector, Marker, Limiter, Isolator, Amplifier, Power Divider, Power Combiner, Filter, Temp Comp, Switch, Mixer, Antenna, Coupler, Cable, Attenuator, Equalizer, Transmission Line, and Sub Path.
- **Description** – Provides an identifying string, part number, or manufacturer's number for each component in the path.
- **Nominal Gain** – Displays the device nominal gain associated with each individual component in dB. These values are taken directly from the RF Component Library. To edit the nominal gain for a component, go to the Library Manager module and select *Edit Part*.
- **CUM Gain** – Calculates the cumulative gain to device output as a running total down the table. The last row indicated the net gain for the path in dB.
- **Noise Figure** – Indicates the noise figure for each individual component in dB.
- **CUM Noise Figure** – Calculates the cumulative noise figure as a running total down the table. The last row indicates the total noise figure for the path in dB.

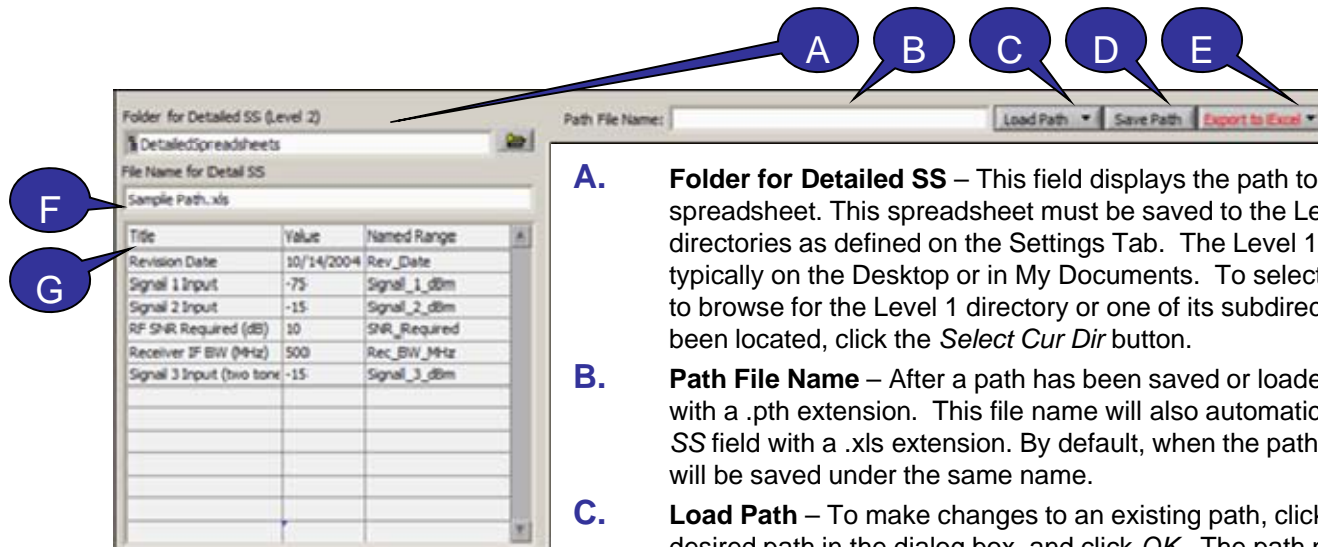
LIBREFNO	Part Type	Description	Nominal Gain v	CUM Gain	Noise Figure v	CUM Noise Figure	SIG 1 Power	SIG 2 Power	T.O. O.I.P v	CUM T.O. I.I.P	Pout 1 dB v	SIG 2 DIFF From Comp Point	Device T.O. Spurs	CUM Pin 1 dB
MODULEIN	Marker	Module Input	0.00	0.00	0.00	0.00	-75.00	-15.00	150.00	150.00	150.00			151.00
SAMPLE1S1	Switch	Sample 1 SP3T 60 dB	-0.80	-0.80	0.80	0.80	-75.80	-15.80	28.00	28.80	20.00	-35.80	-87.60	21.80
SAMPLE1FL1	Filter	Sample 1 Prefilter FL1	-1.50	-2.30	1.50	2.30	-77.30	-17.30	150.00	28.80	150.00			21.80
PAD-01.0	Attenuator	Pad/Attenuator [1 dB]	-1.00	-3.30	1.00	3.30	-78.30	-18.30	150.00	28.80	150.00			21.80
SAMPLE1L1	Limiter	Sample 1 Limiter L1	-0.40	-3.70	0.40	3.70	-78.70	-18.70	22.00	23.97	14.00	-32.70	-81.40	16.97
SAMPLE1AR1	Amplifier	Sample 1 Amplifier 1	20.00	16.30	3.50	7.20	-58.70	1.30	28.00	11.45	15.00	-13.70	-53.40	-0.38
SAMPLE1FL5	Filter	Sample 1 LP Filter	-1.00	15.30	1.00	7.21	-59.70	0.30	150.00	11.45	150.00			-0.38
SAMPLE1M1	Mixer	Sample 1 Mixer	-7.50	7.80	7.50	7.32	-67.20	-7.20	11.00	2.59	3.00	-10.20	-36.40	-5.43
SAMPLE1FL2	Filter	Sample 1 LO Reject Filter	-3.00	4.80	3.00	7.45	-70.20	-10.20	150.00	2.59	150.00			-5.43

Path Table Parameters Cont.

- **SIG 1 Power** – The Signal 1 Power at device output is calculated as the *Signal 1 Input* plus the *CUM Gain* in dBm. The *Signal 1 Input* is defined in the *Path Input Parameters table*.
- **SIG 2 Power** – The Signal 2 Power at device output is calculated as the *Signal 2 Input* plus the *CUM Gain* in dBm. The *Signal 2 Input* is defined in the *Path Input Parameters table*.
- **T.O. O.I.P.** – The device third order output intercept point in dBm
- **CUM T.O. I.I.P.** – The device third order input intercept point in dBm
- **Pout 1 dB** – Output power 1 dB compression point in dBm
- **SIG 2 DIFF From Comp Point** – Calculates the difference between *Sig 2 Power* and *Pout 1dB*. Data is only displayed for components that contribute a value greater than the breaking point as defined on the Setting tab of the Path Builder module. The breaking point reduces the visual noise in the path file and allows you to easily pinpoint significant components. Sig 2 DIFF From Comp Point values below this set point will not be displayed in the *Path table*. By default, this value is set to -40. If the SIG 2 DIFF From Comp Point is less than -40, the values will not be shown. To change this value, see the Settings tab options.
- **Device T.O. Spurs** – Calculates the third order spurs at the device output. Values are only displayed for components that produce a significant *SIG 2 DIFF From Comp Point* as described above.
- **CUM Pin 1 dB** – Displays the cumulative input power 1 dB compression point in dBm.
- **Slope** –
- **CUM Slope** –

	Part Type	Description	Nominal Gain v	CUM Gain	Noise Figure v	CUM Noise Figure	SIG 1 Power	SIG 2 Power	T.O. O.I.P. v	CUM T.O. I.I.P.	Pout 1 dB v	SIG 2 DIFF From Comp Point	Device T.O. Spurs	CUM Pin 1 dB	Slope v	CUM Slope	▲
	Marker	Module Input	0.00	0.00	0.00	0.00	-75.00	-15.00	150.00	150.00	150.00			151.00	0	0.00	
	Switch	Sample 1 SP3T 60 dB	-0.80	-0.80	0.80	0.80	-75.80	-15.80	28.00	28.80	20.00	-35.80	-87.60	21.80	0	0.00	
	Filter	Sample 1 Prefilter FL1	-1.50	-2.30	1.50	2.30	-77.30	-17.30	150.00	28.80	150.00			21.80	0	0.00	
	Attenuator	Pad/Attenuator [1 dB]	-1.00	-3.30	1.00	3.30	-78.30	-18.30	150.00	28.80	150.00			21.80	0	0.00	
	Limiter	Sample 1 Limiter L1	-0.40	-3.70	0.40	3.70	-78.70	-18.70	22.00	23.97	14.00	-32.70	-81.40	16.97	0	0.00	
	Amplifier	Sample 1 Amplifier 1	20.00	16.30	3.50	7.20	-58.70	1.30	28.00	11.45	15.00	-13.70	-53.40	-0.38	0	0.00	
	Filter	Sample 1 LP Filter	-1.00	15.30	1.00	7.21	-59.70	0.30	150.00	11.45	150.00			-0.38	0	0.00	
	Mixer	Sample 1 Mixer	-7.50	7.80	7.50	7.32	-67.20	-7.20	11.00	2.59	3.00	-10.20	-36.40	-5.43	0	0.00	
	Filter	Sample 1 LO Reject Filter	-3.00	4.80	3.00	7.45	-70.20	-10.20	150.00	2.59	150.00			-5.43	0	0.00	

Path Builder – Saving and Loading an RF Path



- A. Folder for Detailed SS** – This field displays the path to the save location for the detailed spreadsheet. This spreadsheet must be saved to the Level 1 directory or one of its sub-directories as defined on the Settings Tab. The Level 1 directory is a user created directory typically on the Desktop or in My Documents. To select a save location, click on the folder icon to browse for the Level 1 directory or one of its subdirectories. Once the desired directory has been located, click the *Select Cur Dir* button.
- B. Path File Name** – After a path has been saved or loaded, this field will display the path name with a .pth extension. This file name will also automatically be copied to the *File Name for Detail SS* field with a .xls extension. By default, when the path is exported to Excel, the spreadsheet will be saved under the same name.
- C. Load Path** – To make changes to an existing path, click the *Load Path* button. Browse for the desired path in the dialog box, and click *OK*. The path name will be displayed in the *Path File Name* field.

- D. Save Path** – To save the current path to a text file, click the *Save Path* button. This will create a file with a .pth extension that may be opened in Path Builder. This option will not save an Excel spreadsheet. To save a path that will open properly in Excel, click the *Export to Excel* button.
- E. Export to Excel** – Click the *Export to Excel* button to save a detailed spreadsheet for the current path. This will create a copy of the RFPATemplateX-X.xls with the data for the current path filled in. The Excel file will be automatically saved in the *Folder for Detailed SS* under the *File Name for Detail SS*. By default, this file will close after it has been created. To keep the Excel file open, click on the drop down arrow of the *Export to Excel* button and select *Leave Excel File Open*. Please note that this file may not be opened in RF Path Analysis Toolkit. To edit the RF Path at a later date, save the Path file with a .pth extension using the *Save Path* button.
- F. File Name for for Detail SS** – This field displays the name that the detailed spreadsheet will be saved under. By default, the Path File name is used with a .xls extension. To change the name, simply type the desired name in the field. If a name is not specified, a save dialog box will open when the *Export to Excel* option is selected.
- G. Path Input Parameters Table** – This table displays the file header information for the detailed Excel spreadsheet and the input parameters for the RF path. The input parameters are the initial starting values for the entire path. Each parameter must have a unique named range that corresponds to a cell value in the Template spreadsheet. These parameters are copied to the Detailed Analysis Spreadsheet.



RF Component Library Transmission Line Losses

- [illegible]



Adding a Transmission Line to a Path Cont.

- E. Length** – Enter the length of the transmission line in the units displayed to the right.
- F. Unit** – The length of the transmission line may be entered in either inches or feet. Click on this field to select the desired units.
- G. Loss per Foot** – The *Loss per Foot* of the transmission line for the selected type and frequency will automatically be displayed in this field. This data comes from the Transmission Line Losses sheet.
- H. Total Loss** – The total loss across the entire length of the transmission line will be calculated and displayed here.
- I. Adding/Insert Part** – To add or insert the transmission line to the path, simply click *Add part to End*, *Insert Part*, or *Replace Part*.
- J. Path** – The *Path table* displays the current RF path components as well as a simple analysis of the path. See the Detailed Spreadsheet for a more in depth analysis of the Path.



Path Files

Path files are created in the Path Builder Module of the RF Path Analysis Toolkit. These files contain a user defined list of RF components as well as formatting information that is used to generate the Detailed Analysis Spreadsheet in Excel. Path files are saved as text files with a .pth extension. Three sample path files come with the RF Path Analysis Toolkit for experimentation purposes. These files are located in the C:\Program Files\RFPathAnalysisToolkit\Level 1 Directory\Sample RF Path Files directory.

Path files may be loaded, edited, and saved in the Path Builder module. Individual RF components may be removed, replaced, or moved to a different location in the path. After a path file has been loaded, the path will appear in the table at the bottom of the Path Builder panel. Once a path file has been saved, it may be used in the Path Runner module to analyze the specified RF Path.

LIBREFNO	Part Type	Description	Nominal Gain v	CUM Gain	Noise Figure v	CUM Noise Figure	SIG 1 Power	SIG 2 Power	T.O. O.I.P v	CUM T.O. I.I.P	Pout 1 dB v	SIG 2 DIFF From Comp Point	Device T.O. Spurs	CUM Pin 1 dB
MODULEIN	Marker	Module Input	0.00	0.00	0.00	0.00	-75.00	-15.00	150.00	150.00	150.00			151.00
SAMPLE1S1	Switch	Sample 1 SP3T 60 dB	-0.80	-0.80	0.80	0.80	-75.80	-15.80	28.00	28.80	20.00	-35.80	-87.60	21.80
SAMPLE1FL1	Filter	Sample 1 Prefilter FL1	-1.50	-2.30	1.50	2.30	-77.30	-17.30	150.00	28.80	150.00			21.80
PAD-01.0	Attenuator	Pad/Attenuator [1 dB]	-1.00	-3.30	1.00	3.30	-78.30	-18.30	150.00	28.80	150.00			21.80
SAMPLE1L1	Limiter	Sample 1 Limiter L1	-0.40	-3.70	0.40	3.70	-78.70	-18.70	22.00	23.97	14.00	-32.70	-81.40	16.97
SAMPLE1AR1	Amplifier	Sample 1 Amplifier 1	20.00	16.30	3.50	7.20	-58.70	1.30	28.00	11.45	15.00	-13.70	-53.40	-0.38
SAMPLE1FL5	Filter	Sample 1 LP Filter	-1.00	15.30	1.00	7.21	-59.70	0.30	150.00	11.45	150.00			-0.38
SAMPLE1M1	Mixer	Sample 1 Mixer	-7.50	7.80	7.50	7.32	-67.20	-7.20	11.00	2.59	3.00	-10.20	-36.40	-5.43
SAMPLE1FL2	Filter	Sample 1 LO Reject Filter	-3.00	4.80	3.00	7.45	-70.20	-10.20	150.00	2.59	150.00			-5.43
SAMPLE1AR2	Amplifier	Sample 1 Amplifier 2	20.00	24.80	3.50	7.76	-50.20	9.80	28.00	-0.12	15.00	-5.20	-36.40	-10.44
SAMPLE1AT1	Attenuator	Sample 1 Attenuator 1	-6.70	18.10	6.70	7.77	-56.90	3.10	150.00	-0.12	150.00			-10.44



Sample Path File

Path files may be opened independently of the RF Path Analysis software. These files are tab delineated text files that may be viewed in Notepad, WordPad, or Excel. The example below shows the result of opening Sample3 in Excel.

Microsoft Excel - Sample3

File Edit View Insert Format Tools Data Window Help Adobe PDF



Sub Path Files

Sub path files are used to group common RF components together in a block that may be inserted into a path file. This feature is new to version 1.4, and is extremely useful for creating and maintaining multiple paths that all contain a common block of parts. Previously, to insert or edit a common block of parts in multiple RF paths, each path file had to be updated individually. Every component in the common block had to be inserted separately, and if it was necessary to make a change, every path file had to be edited. This was time consuming and frustrating.

With sub paths, a file containing a common block of components may be created in the Path Builder module. This file, may be inserted into each path file where the common block is used. Now, instead of having to change many path files due to a part change, removal, or addition, only one sub path file must be edited.

Example Sub Path

Example without Sub Paths

Pathfile1.pth

ModuleIn

Amp1

Filter1

CommonModuleIn

Equalizer

Attenuator

CommonModuleOut

ModuleOut

Pathfile2.pth

ModuleIn

Amp2

Filter2

CommonModuleIn

Equalizer

Attenuator

CommonModuleOut

ModuleOut



Both path files utilize the components CommonModuleIn, Equalizer, Attenuator, and CommonModuleOut. If a change is made to any of these four parts, the user will have to edit both path files individually.

Example with Sub Paths

Pathfile1.pth

ModuleIn

Amp1

Filter1

<subpath>CommonModule.pth</subpath>

ModuleOut

Pathfile2.pth

ModuleIn

Amp2

Filter2

<subpath>CommonModule.pth</subpath>

ModuleOut

CommonModule.pth

CommonModuleIn

Equalizer

Attenuator

CommonModuleOut

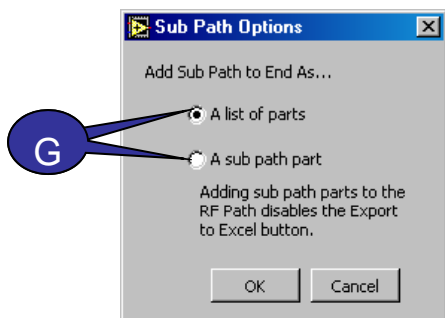
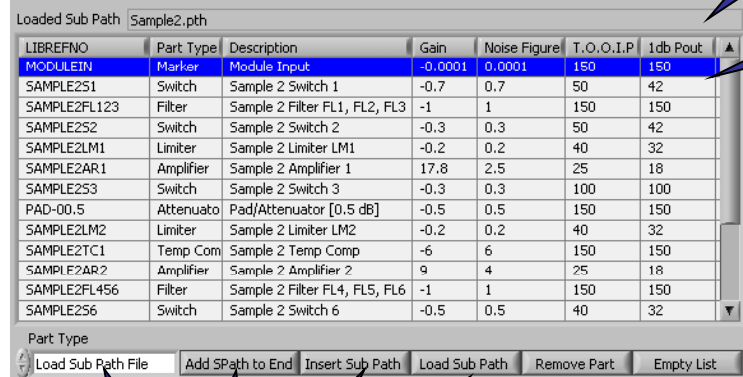
By utilizing the sub path functionality, both Pathfile1 and Pathfile2 link to the sub path 'CommonModule.pth'. Any changes to the parts in the Common Module only have to be made to the Common Module sub path file.



Creating & Inserting a Sub Path File

Sub path files are simply path files that are inserted into other paths. Any existing path file may be treated as a sub path file. To create a new sub path file that contains a common block of components, setup a regular path file in the Path Builder module with the desired parts. Save all sub path files in the Level 1 directory or a Level 2 subdirectory.

- A. To insert a sub path file into a path, open a path file in the Path Builder module. Select the **Load Sub Path File** option from the **Part Type** menu.
- B. Click the **Load Sub Path** button and browse for the desired file.
- C. The components in the sub path file will appear in the **Library Parts Table**.
- D. The name and location of the sub path file will appear in the **Loaded Sub Path** field.
- E. Click **Add SPath to End** to add the entire common block of parts to the end of the current path.
- F. Click **Insert Sub Path** to insert the entire common block of parts above the highlighted row in the **Path table**.
- G. A dialog box will open to query the user to insert the sub path as **a list of parts**, or as **a sub path part**. Select the desired option and click OK to proceed or click Cancel to abort. See the following page for details about these two options.



LIBREFNO	Part Type	Description	Nominal Gain	CUM Gain	Noise Figure	CUM Noise Figure	SIG 1 Power	SIG 2 Power	T.O. O.I.P	CUM T.O. I.I.P	Pout 1 dB	SIG 2 DIFF From Comp Point	Device T.O. Spurs	CUM Pin 1 dB
MODULEIN	Marker	Module Input	0.00	0.00	0.00	0.00	-75.00	-15.00	150.0	150.00	150.0			151.00
SAMPLE1S1	Switch	Sample 1 SP3T 60 dB	-0.80	-0.80	0.80	0.80	-75.80	-15.80	28.0	28.80	20.0	-35.80	-87.60	21.80
SAMPLE1FL1	Filter	Sample 1 Prefilter FL1	-1.50	-2.30	1.50	2.30	-77.30	-17.30	150.0	28.80	150.0			21.80
PAD-01.0	Attenuator	Pad/Attenuator [1 dB]	-1.00	-3.30	1.00	3.30	-78.30	-18.30	150.0	28.80	150.0			21.80
SAMPLE1L1	Limiter	Sample 1 Limiter L1	-0.40	-3.70	0.40	3.70	-78.70	-18.70	22.0	23.97	14.0	-32.70	-81.40	16.97
SAMPLE1AR1	Amplifier	Sample 1 Amplifier 1	20.00	16.30	3.50	7.20	-58.70	1.30	28.0	11.45	15.0	-13.70	-53.40	-0.38
SAMPLE1FL5	Filter	Sample 1 LP Filter	-1.00	15.30	1.00	7.21	-59.70	0.30	150.0	11.45	150.0			-0.38
SAMPLE1M1	Mixer	Sample 1 Mixer	-7.50	7.80	7.50	7.32	-67.20	-7.20	11.0	2.59	3.0	-10.20	-36.40	-5.43
SAMPLE1FL2	Filter	Sample 1 LO Reject Filter	-3.00	4.80	3.00	7.45	-70.20	-10.20	150.0	2.59	150.0			-5.43
SAMPLE1AR2	Amplifier	Sample 1 Amplifier 2	20.00	24.80	3.50	7.76	-50.20	9.80	28.0	-0.12	15.0	-5.20	-36.40	-10.44
SAMPLE1AT1	Attenuator	Sample 1 Attenuator 1	-6.70	18.10	6.70	7.77	-56.90	3.10	150.0	-0.12	150.0			-10.44
SAMPLE1DC1	Coupler	Sample 1 BIT Coupler	-2.00	16.10	2.00	7.77	-58.90	1.10	150.0	-0.12	150.0			-10.44

Inserting a Sub Path File Cont.

Sub paths may be inserted into paths as a list of parts or as a sub path part.

■ A List of Parts

- Inserting a sub path as a list of parts will take all the parts from the loaded sub path and place them individually into the path in the order that they appear. This option provides detailed information about the components in the common block of parts. If the sub path file is updated, however, these individually entered parts will not update automatically.
- Load sub paths as a list of parts when you need to optimize the performance inside the sub path.

■ A Sub Path Part

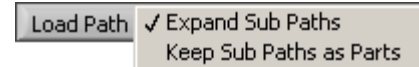
- Inserting a sub path as a sub path part will place a single part representing the entire common block into the path. The sub path part provides the total gain, noise figure, power, ect. for the components in the common block. Although the sub path part does not provide the same details as the list of parts, it links directly to the sub path file. If the sub path file is updated, the sub path part will update by simply loading and re-saving the affected path files in the Path Builder module. Sub path parts may be expanded at a later date if it is necessary to view the individual components. See Loading a Path File with Sub Paths for details.
- Use this option to easily create many path files with a common block of parts.
- Please note that Path files with sub path parts may not be exported to Excel.
- Sub path parts consist of a single line representing the path file that they link to. Sub path parts are named by the path name and the directory that they are located in. For example: Sample3.pth is located in C:\Program Files\RFPathAnalysisToolkit\Level 1 Directory\Sample RF Path Files. This sub path has a sub path part <subpath>Sub Paths\Sample3.</subpath>. Sub paths must be located in the Level 1 directory, or one of its subdirectories. This will ensure that the links to the sub path parts function properly. If a sub path is moved to a different directory, the Level 1 directory must be changed on the Settings tab of the Path Builder module.

LIBREFNO	Part Type	Description	Nominal Gain v	CUM Gain	Noise Figure v	CUM Noise Figure	SIG 1 Power	SIG 2 Power	T.O. O.I.P v	CUM T.O. I.I.P	Pout 1 dB v	SIG 2 DIFF From Comp Point	Device T.O. Spurs	CUM Pin 1 dB	
MODULEIN	Marker	Module Input	0.00	0.00	0.00	0.00	-75.00	-15.00	150.0	150.00	150.0			151.00	
SAMPLE1S1	Switch	Sample 1 SP3T 60 dB	-0.80	-0.80	0.80	0.80	-75.80	-15.80	28.0	28.80	20.0	-35.80	-87.60	21.80	
SAMPLE1FL1	Filter	Sample 1 Prefilter FL1	-1.50	-2.30	1.50	2.30	-77.30	-17.30	150.0	28.80	150.0			21.80	
PAD-01.0	Attenuator	Pad/Attenuator [1 dB]	-1.00	-3.30	1.00	3.30	-78.30	-18.30	150.0	28.80	150.0			21.80	
SAMPLE1L1	Limiter	Sample 1 Limiter L1	-0.40	-3.70	0.40	3.70	-78.70	-18.70	22.0	23.97	14.0	-32.70	-81.40	16.97	
SAMPLE1AR1	Amplifier	Sample 1 Amplifier 1	20.00	16.30	3.50	7.20	-58.70	1.30	28.0	11.45	15.0	-13.70	-53.40	-0.38	
ath>Sample2.pth</subp	Subpath	Sample2.pth	18.90	35.20	5.55	7.25	-39.80	20.20	18.7	-16.48	10.7	9.47	2.94	-23.49	
SAMPLE1FL5	Filter	Sample 1 LP Filter	-1.00	34.20	1.00	7.25	-40.80	19.20	150.0	-16.48	150.0			-23.49	
SAMPLE1M1	Mixer	Sample 1 Mixer	-7.50	26.70	7.50	7.25	-48.30	11.70	11.0	-19.12	3.0	8.70	1.40	-26.12	



Loading a Path File with Sub Path Parts

Path files that contain sub path parts may be loaded into the Path Builder Module using two options. Before loading a path file, select between *Expand Sub Paths* or *Keep Sub Paths as Parts* on the *Load Path* pull down menu.



■ Expand Sub Paths

- This will expand all sub path parts in the loaded path file. Each component in the sub path will be displayed on a separate line of the path. This option provides detailed information about the components in the common block of parts. If the sub path file is updated, however, these individually entered parts will not update automatically.

- For example, if loading the path file samplepath1.pth:

<u>Samplepath1.pth</u>	<u>Samplepath2.pth</u>
MODULEIN	SAMPLEAMP1
SAMPLEFL1	ATTENUATOR2
<subpath>Samplepath2.pth</subpath>	
MODULEOUT	

- The resulting expanded path file will look like this:

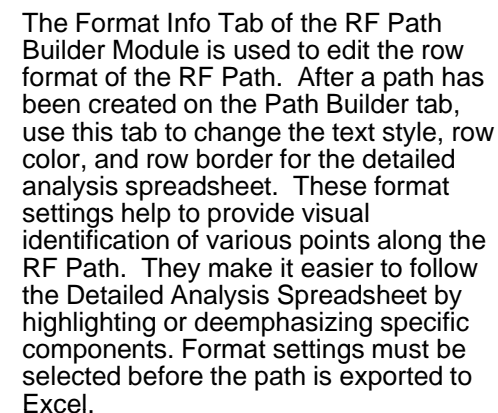
```
MODULEIN
SAMPLEFL1
SAMPLEAMP1
ATTENUATOR2 } SAMPLEAMP1 and ATTENUATOR2 loaded from Samplepath2.pth
MODULEOUT
```

■ Keep Sub Paths as Parts

- This option will preserve all sub path part links. If the sub path file is updated, the sub path part will automatically update.
- For example, loading the example Samplepath1.pth above with the *Keep Sub Paths as Parts* enabled, the resulting file will look like:

```
MODULEIN
SAMPLEFL1
<subpath>Samplepath2.pth</subpath> } Samplepath2.pth kept as a sub path, parts are not expanded into Samplepath1.pth
MODULEOUT
```

- Please note that path files with sub path parts may not be exported to Excel.



- A. Path** – The entire path is displayed in this table. The format of each row may be edited individually. To set a default format for the entire path, see the options on the Settings tab.
- B. Text Style** – The text style of each row may be Plain, Bold, or Italic.
- C. Row Color** – The color of each row may be selected from the color wheel.
- D. Row Border** – The row border may be None, Dashed, or Solid.
- E. Cancel** – This option reverts any changes made to the cell format back to the previous state. This option will only revert changes made while on the Format Info tab. Unless *Cancel* is selected, changes made to this panel are automatically saved when you go to another panel.



Example Detailed Spreadsheet Format

LIBREFNO	Part Type	Description	Text B/P/I	Background Color	Border N/D/S
MODULEIN	Marker	Module Input	Plain		Solid
SAMPLE1S1	Switch	Sample 1 SP3T 60 dB	Plain		Solid
SAMPLE1FL1	Filter	Sample 1 Prefilter FL1	Plain		Solid
PAD-01.0	Attenuator	Pad/Attenuator [1 dB]	Plain		Solid
SAMPLE1L1	Limiter	Sample 1 Limiter L1	Plain		Solid
SAMPLE1AR1	Amplifier	Sample 1 Amplifier 1	Plain		Solid
SAMPLE1FL5	Filter	Sample 1 LP Filter	Plain		Solid
SAMPLE1M1	Mixer	Sample 1 Mixer	Plain		Solid
SAMPLE1FL2	Filter	Sample 1 LO Reject Filter	Plain		Solid
SAMPLE1AR2	Amplifier	Sample 1 Amplifier 2	Plain		Solid
SAMPLE1AT1	Attenuator	Sample 1 Attenuator 1	Plain		Solid
SAMPLE1DC1	Coupler	Sample 1 BIT Coupler	Plain		Solid
TLINE 0.10SLP 0.00	Tline	Transmission Line	Plain		Solid
MODULEOUT	Marker	Module Output	Plain		Solid

The setting to the left were selected on the Format Info tab for Sample 1 Path. The Detailed Spreadsheet below displays the results of this format.

8	Receiver IF BW (MHz)	500																
9																		
10																		
11	COMPONENT		Reference	Spec	Spec													
12	LABEL		Desination	Noise Fig	Noise Fig	Device	Cum	Signal 1	Signal 2	Thermal	Bandwidth	Noise	RF/IF					
13			(dB)	(dB)	(dB)	Gain	Gain	Out	Out	Level	(MHz)	Out	Signal 2					
14	3	2	11	14	15													
15	COMPLABEL	LIB REFNO	REFDES	NOISEFIG70	SGAIN25													
16	INPUT LEVEL >>>							-75	-15									
17																		
18	Module Input	MODULEIN		0.0	0.00	0.0	0.0	-75.0	-15.0	-114.0	500	-87.0	72.0					
19	Sample 1 SP3T 60 dB	SAMPLE1S1		0.8	0.80	-0.8	-0.8	-75.8	-15.8	-114.0	500	-87.0	71.2					
20	Sample 1 Prefilter FL1	SAMPLE1FL1		1.5	2.30	-1.5	-2.3	-77.3	-17.3	-114.0	500	-87.0	69.7					
21	Pad/Attenuator [1 dB]	PAD-01.0		1.0	3.30	-1.0	-3.3	-78.3	-18.3	-114.0	500	-87.0	68.7					
22	Sample 1 Limiter L1	SAMPLE1L1		0.4	3.70	-0.4	-3.7	-78.7	-18.7	-114.0	500	-87.0	68.3					
23	Sample 1 Amplifier 1	SAMPLE1AR1		3.5	7.20	20.0	16.3	-58.7	1.3	-90.5	500	-63.5	64.8					
24	Sample 1 LP Filter	SAMPLE1FL5		1.0	7.21	-1.0	15.3	-59.7	0.3	-91.5	500	-64.5	64.8					
25	Sample 1 Mixer	SAMPLE1M1		7.5	7.32	-7.5	7.8	-67.2	-7.2	-98.9	500	-71.9	64.7					
26	Sample 1 LO Reject Filter	SAMPLE1FL2		3.0	7.45	-3.0	4.8	-70.2	-10.2	-101.8	500	-74.8	64.6					
27	Sample 1 Amplifier 2	SAMPLE1AR2		3.5	7.76	20.0	24.8	-50.2	9.8	-81.4	500	-54.5	64.3					
28	Sample 1 Attenuator 1	SAMPLE1AT1		6.7	7.77	-6.7	18.1	-56.9	3.1	-88.1	500	-61.1	64.2					
29	Sample 1 BIT Coupler	SAMPLE1DC1		2.0	7.77	-2.0	16.1	-58.9	1.1	-90.1	500	-63.1	64.2					
30	Transmission Line	TLINE 0.10SLP 0.00		0.1	7.77	-0.1	16.0	-59.0	1.0	-90.2	500	-63.2	64.2					
31	Module Output	MODULEOUT		0.0	7.77	0.0	16.0	-59.0	1.0	-90.2	500	-63.2	64.2					
32	End of Path	ENDPATH		0.0	7.77	0.0	16.0	-59.0	1.0	-90.2	500	-63.2	64.2					



Path Builder Settings Tab

The screenshot shows the 'RF Path Builder' application window with the 'Settings' tab selected. The 'RF Path Title' is 'SAMPLE 3'. The settings are as follows:

- A:** Library Name: C:\Program Files\RFPathAnalysisToolkit\RFPATLibrary.xls
- B:** Template Name: C:\Program Files\RFPathAnalysisToolkit\RFPATTemplate4-2.xls
- C:** Default Path for Saving Detailed Spreadsheets (Level 1): C:\Program Files\RFPathAnalysisToolkit
- D:** Template Spreadsheet Analysis Sheet Name: Analysis
- E:** LIB WorkSheet Name: RF Component Library
- F:** Transmission Line Sheet Name: Transmission Line Losses
- G:** Default Color for Blank (Unformatted) Cells: T
- H:** Default Text for Blank (Unformatted) Cells: Plain
- I:** Default Border for Blank (Unformatted) Cells: None
- J:** Sig 2 Delta from comp point blanking point: -40
- K:** Default Directory for Saving Path files: Level 1 Directory
- L:** Default Directory for Loading Path files: Level 1 Directory

The Settings Tab on the RF Path Builder module is primarily used to setup the file directory structure and to locate the support files. By default, the fields on this tab correlate to the settings on the Settings tab of the RF Path Analysis Toolkit main page. The file directory settings on this tab only need to be edited if they are different from the settings for the main program.

The settings tab also has options available to set the default format for the RF path cells on the detailed analysis spreadsheet. See the following page for details about the options available on this tab.

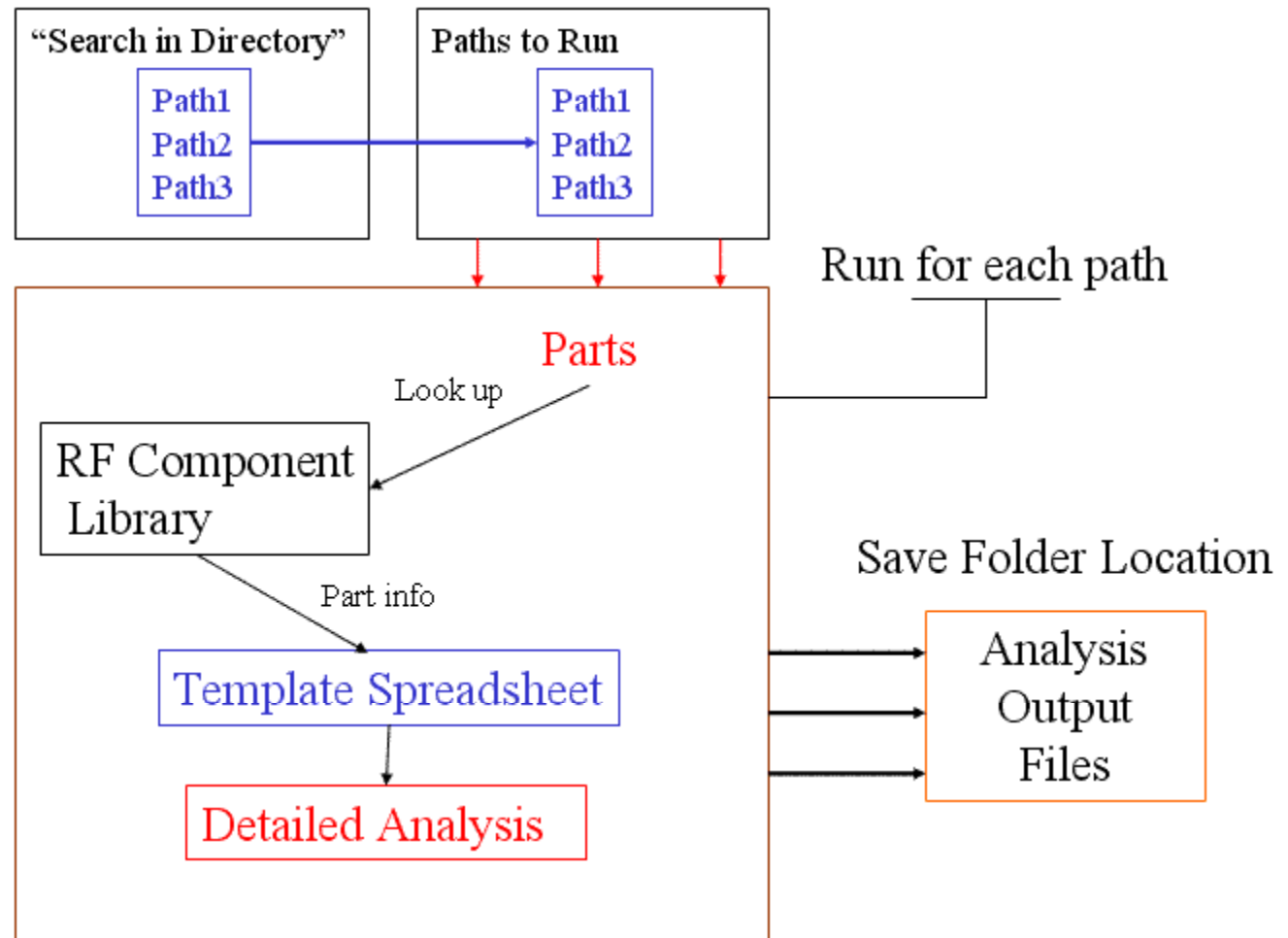


Path Builder Settings Tab Cont.

- A. Library Name** – This field should contain the path to the RF Component Library Excel file. By default, this file is located in the C:\Program Files\RFPATHAnalysisToolkit directory under the name “RFPATLibrary2.0.xls”. If the default directory or name have been changed, click on the folder icon to the left of the field to browse for the new file.
- B. Template Name** – This is the worksheet name for the main sheet in the RFPATTemplateX-X.xls file. By default, the worksheet is named “Analysis.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Template Name* field.
- C. Default Path for Saving Detailed Spreadsheets (Level 1)** – This field should contain the path to the directory in which the Detailed Spreadsheets will be saved to by default. It is recommended that an RF Path Analysis Toolkit folder be created in My Documents or on the Desktop for this purpose. This directory is the Level 1 program folder (see File Directory Structure) that is referenced by the program in the Path Builder, and the Path Runner modules. Click on the folder icon to the left of the field to browse for the default directory. Use the *Select Cur Dir* button once you have found the desired folder.
- D. Template Spreadsheet Analysis Sheet Name** – This is the worksheet name for the main sheet in the RFPATTemplateX-X.xls file. By default, the worksheet is named “Analysis.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Template Spreadsheet Analysis Sheet Name* field.
- E. LIB Worksheet Name** – This is the worksheet name for the main sheet in the RFPATLibrary2.0.xls file. By default, the worksheet is named “RF Component Library.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *LIB Sheet Name* field.
- F. Transmission Line Sheet Name** – This is the worksheet name for the second sheet in the RFPATLibrary2.0.xls file. By default, the worksheet is named “Transmission Line Losses.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Transmission Line Sheet Name* field.
- G. Default Color for Blank (Unformatted) Cells** – Click the color box to select a default cell color for the unformatted path cells. This color will fill the rows of any path components that have not been formatted on the Format Info tab. This color option must be selected before viewing the individual cell formats on the Format Info tab.
- H. Default Text for Blank (Unformatted) Cells** – The default text style may be Plain, Bold, or Italic. Changing this option will set the default style for all unformatted cells. Cells that have been edited on the Format Info tab will not be affected by this change. This option must be selected before viewing the individual cell formats on the Format Info tab.
- I. Default Border for Blank (Unformatted) Cells** – The default border style may be None, Dashed, or Solid. Changing this option will set the default style for all unformatted cells. Cells that have been edited on the Format Info tab will not be affected by this change. This option must be selected before viewing the individual cell formats on the Format Info tab.
- J. Sig 2 Delta from comp point blanking point** – Set this value to reduce visual noise in the path file. SIG 2 DIFF From Comp Point values below this set point will not be displayed in the *Path table*. By default, this value is set to -40. If the SIG 2 DIFF From Comp Point is less than -40, the values will not be shown.
- K. Default Directory for Saving Path files** – Path files may be saved in the Level 1 directory or any of its subdirectories. Use this option to set a default save location. Any time the *Save Path* option is selected, the browsing window will automatically open this folder.
- L. Default Directory for Loading Path files** – Use this option to set the default location for loading path files. Any time the *Load Path* option is selected, this folder will open in the browsing window.

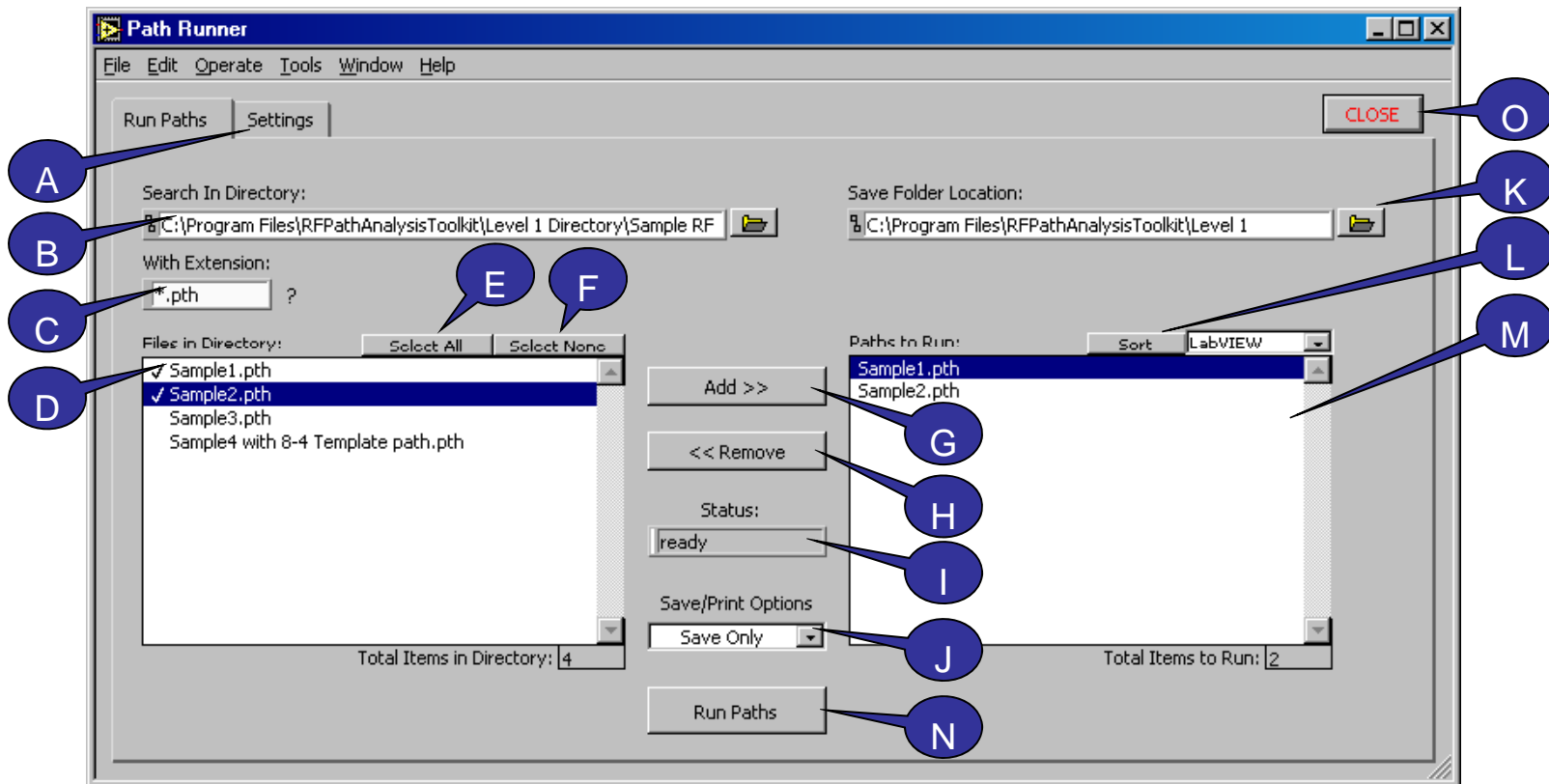
Path Runner

The Path Runner module is used to run RF paths in a batch setting. Multiple paths may be automatically run in order to reduce the time required for individual analyzes. This may be useful when an update to an RF Component causes multiple RF paths to be out of date. The diagram to the right displays the program flow for the Path Runner module.



Run Paths Tab

Use the Run Paths tab to select a sequence of paths to be analyzed. Each analysis will create a detailed analysis spreadsheet in Excel that may be saved and/or printed. See the following page for details about the options available on this tab.





Path Runner Continued

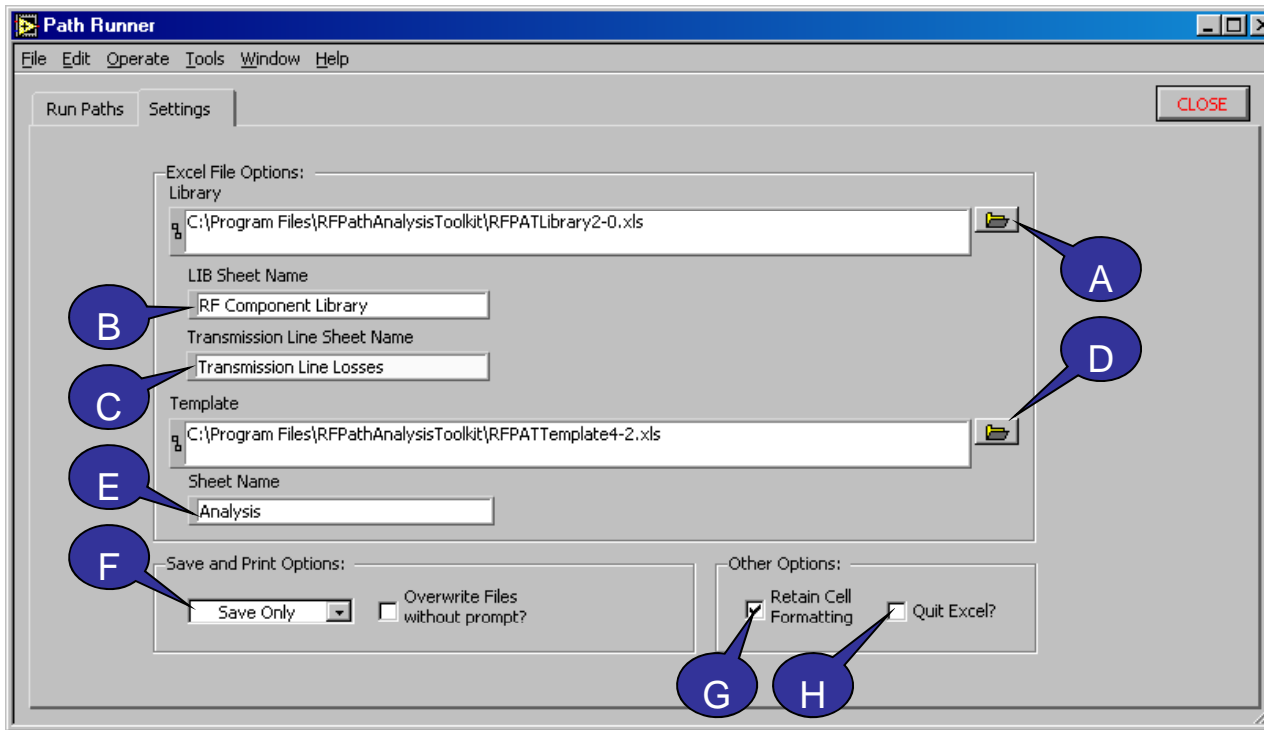
- A. Settings Tab** – The Settings tab should be used at the start of the Path Runner module to setup the file directory structure and to select other preference options.
- B. Search In Directory** – Click on the folder icon to the right of this field to browse for the folder in which the desired paths are located. Once the desired directory is found, click on the *Select Cur Dir* button. All paths should be located in the Level 1 directory, or one of its subdirectories.
- C. With Extension** – This field refines the search within the above directory to only files with the given extension. Extensions are formatted with a single asterisk (*) followed by a period(.) and the extension name (*.extension). Leaving this field blank will cause all files located in the above directory to be displayed. By default, this field is set to *.pth because all path files created in the Path Builder module are saved with this extension.
- D. Files in Directory** – This table displays all files in the *Search in Directory* with the file extension as indicated.
- E. Select All** – To run all paths from the *Files in Directory*, click *Select All*. All files will show up in the *Paths to Run table*.
- F. Select None** – Click *Select None* to clear the *Paths to Run table*. All files will be removed from the list to analyze.
- G. Add** – To add a single path to the *Paths to Run table*, highlight the desired path file in the *Files in Directory table* and click *Add*.
- H. Remove** – To remove a single path, highlight the desired path in the *Paths to Run table* and click *Remove*.
- I. Status** – Indicates the current program operation.
- J. Save/Print Options** – The detailed spreadsheets that are created during the analysis in Path Runner may be saved and/or printed. Select from the following options before the analysis is run: *None*, *Save Only*, *Print Only*, *Save & Print*. Please note that this option will automatically update from the preference selected on the Settings tab.
- K. Save Folder Location** – Click on the folder icon to the right of this field to select a directory to save the detailed analysis spreadsheets to. If the save option above has been selected, all Detailed Spreadsheets will automatically be saved to this location after the analysis. This folder must be setup before the analysis is run.
- L. Sort** – Click *Sort* to organize the *Paths to Run table* in alphabetic order.
- M. Paths to Run** – This table indicates the selected path files.
- N. Run Paths** – After all settings have been set as desired, click the *Run Paths* button to analyze the selected paths. A Detailed Analysis Spreadsheet will be created for each path.
- O. Close** – Click *Close* to return to the RF Path Analysis Toolkit. *File>>Exit* will close the entire program, not just the current module.

Run Path Settings Tab

The Settings Tab on the RF Path Runner module is primarily used to setup the file directory structure and to locate the support files. By default, the fields on this tab correlate to the settings on the Settings tab of the RF Path Analysis Toolkit main page. The file directory settings on this tab only need to be edited if they are different from the settings for the main program.

The settings tab also has save and print options as well as Excel formatting options. See the descriptions below as well as on the following page for details about the options available on this tab.

- A. Library** – This field should contain the path to the RF Component Library Excel file. By default, this file is located in the C:\Program Files\RFPathAnalysisToolkit directory under the name “RFPATLibrary2.0.xls”. If the default directory or name have been changed, click on the folder icon to the left of the field to browse for the new file.



- B. LIB Sheet Name** – This is the worksheet name for the main sheet in the RFPATLibrary2.0.xls file. By default, the worksheet is named “RF Component Library.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *LIB Sheet Name* field.



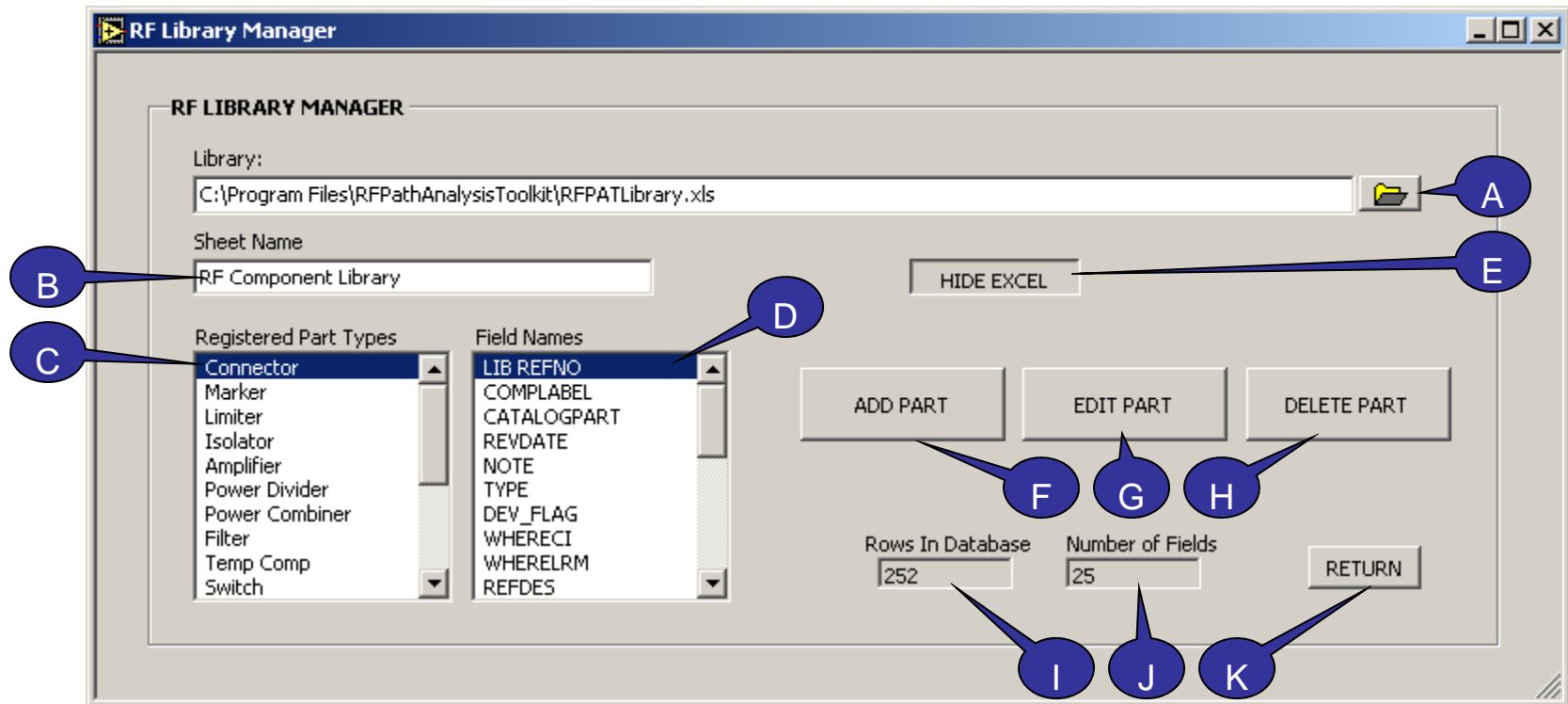
Run Paths Settings Tab Cont.

- C. Transmission Line Sheet Name** – This is the worksheet name for the second sheet in the RFPATLibrary2.0.xls file. By default, the worksheet is named “Transmission Line Losses.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Transmission Line Sheet Name* field.
- D. Template** – This is the worksheet name for the main sheet in the RFPATTemplateX-X.xls file. By default, the worksheet is named “Analysis.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Template* field.
- E. Sheet Name** – This is the worksheet name for the main sheet in the RFPATTemplateX-X.xls file. By default, the worksheet is named “Analysis.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Sheet Name* field.
- F. Save and Print Options** – The Detailed Spreadsheets that are created during the analysis in Path Runner may be saved and/or printed. Select from the following options before the analysis is run: *None, Save Only, Print Only, Save & Print*. Please note that this option will automatically update the field on the Run Paths tab.
- G. Retain Cell Formatting** – Select this option to preserve the cell color, text style, and border style that were setup in the Path Builder module. If this option is left unchecked, the Detailed Analysis Spreadsheets will be white with plain text and no borders.
- H. Quit Excel?** – Check this box to automatically close Excel after all analyzes have been run. Excel will remain open if this box is left unchecked.

Library Manager

The Library Manager is used to edit and create components in the RF Path Analysis Component Library. When the Library Manager module is opened, the RF Component Library Excel file will open in the background. It is important to leave this file open throughout the operation of this module. When the Library Manager module is closed, the Excel file will automatically close.

This module allows you to make changes to the parts in the RFPATLibrary2.0.xls Excel file without worrying about affecting the formatting or compatibility of the document. Although the Excel file may be edited directly, it is not recommended as it is possible to inadvertently create errors in the document that affect the program operation. See the following pages for details about the options available in this module.





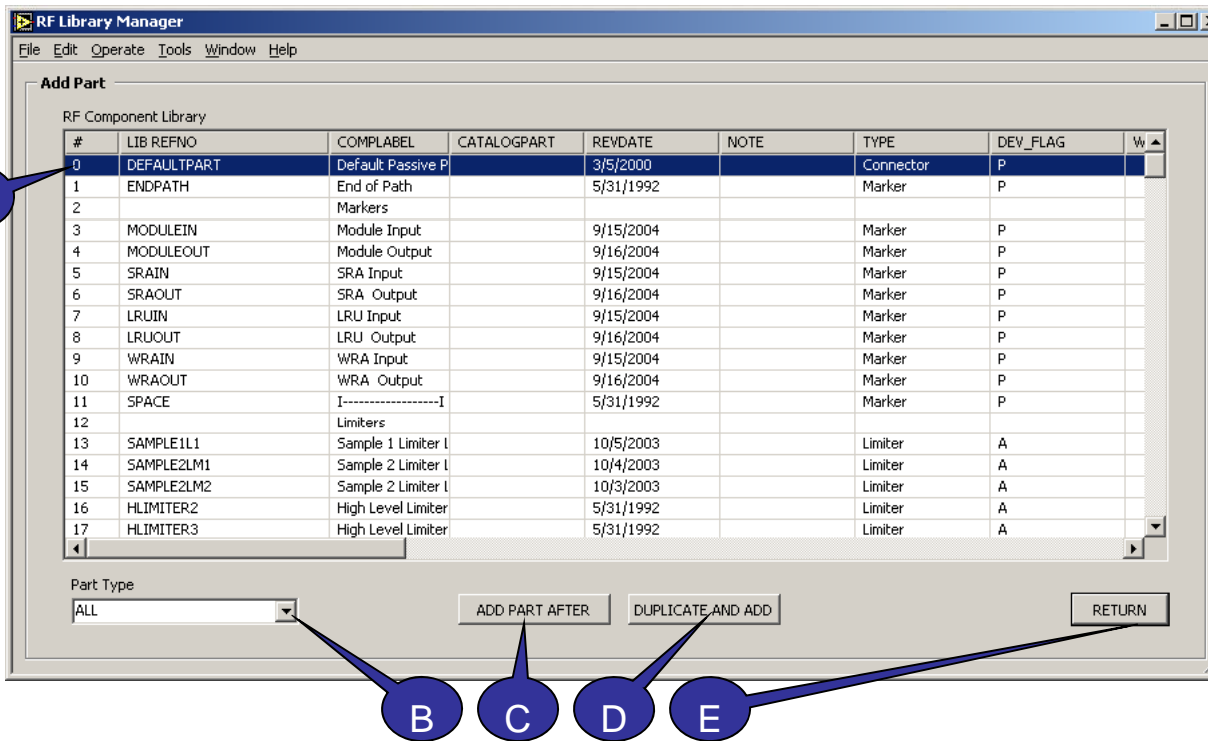
Library Manager Cont.

- A. Library** – This field defines the RF Component Library to be edited. By default, the RFPATLibrary2.0.xls file is selected. To locate a different library, click on the folder icon to browse for the desired file.
- B. Sheet Name** – This is the worksheet name for the main sheet in the RFPATTemplateX-X.xls file. By default, the worksheet is named “Analysis.” It is recommended that this setting remain unchanged. For advanced users, if this name has been changed, type the new name in the *Sheet Name* field
- C. Registered Part Types** – This table lists the type of parts found in the selected RF Component Library.
- D. Field Names** – This table lists the column names in the RF Component Library. These categories are used to define the component specifications.
- E. Hide/Show Excel** – This toggle switch may be used to hide or show the Excel RF Component Library. The Library may be minimized, but is important that it remains open during the program operation.
- F. Add Part** – Click *Add Part* to open the Add Part panel. This panel will allow you to copy existing components or insert new components into the selected RF Component Library without worrying about affecting the formatting or equations within the document.
- G. Edit Part** – Click *Edit Part* to open the Edit Part panel. This panel will allow you to make changes to existing components in the selected RF Component Library.
- H. Delete Part** – Click *Delete Part* to open the Delete Part panel. This panel will allow you to remove an existing part from the RF Component Library without affecting the equations or formatting of the Excel file.
- I. Rows In Database** – Displays the number of rows in the selected Component Library. Each row represents a different RF component.
- J. Number of Fields** – Displays the number of Field Names in the selected RF Component Library.
- K. Return** – Click *Return* to close the Library Manager module and return to the RF Path Analysis Toolkit main panel.

Add New Part

The Add New Part panel allows you to insert or duplicate parts in the RF Component Library without inadvertently changing the equations or formatting of the Excel file.

- A. RF Component Library** – This table displays all components and identifying parameters in the RF Component Library that are of the selected *Part Type*.
- B. Part Type** – Select a part type from the *Part Type* pull down menu to sort the *RF Component Library table*. This will make it easier to find the desired insertion point or component to duplicate.
- C. Add Part After** – Click the *Add Part After* button to insert a component after the highlighted row in the *RF Component Library table*. This will open a panel in which the new part may be defined. See the following page for details about defining the new part.



#	LIB REFNO	COMPLABEL	CATALOGPART	REVDATE	NOTE	TYPE	DEV_FLAG	W
0	DEFAULTPART	Default Passive P		3/5/2000		Connector	P	
1	ENDPATH	End of Path		5/31/1992		Marker	P	
2		Markers						
3	MODULEIN	Module Input		9/15/2004		Marker	P	
4	MODULEOUT	Module Output		9/16/2004		Marker	P	
5	SRAIN	SRA Input		9/15/2004		Marker	P	
6	SRAOUT	SRA Output		9/16/2004		Marker	P	
7	LRUIN	LRU Input		9/15/2004		Marker	P	
8	LRUOUT	LRU Output		9/16/2004		Marker	P	
9	WRAIN	WRA Input		9/15/2004		Marker	P	
10	WRAOUT	WRA Output		9/16/2004		Marker	P	
11	SPACE	I-----I		5/31/1992		Marker	P	
12		Limiters						
13	SAMPLE1L1	Sample 1 Limiter L		10/5/2003		Limiter	A	
14	SAMPLE2LM1	Sample 2 Limiter L		10/4/2003		Limiter	A	
15	SAMPLE2LM2	Sample 2 Limiter L		10/3/2003		Limiter	A	
16	HLIMITER2	High Level Limiter		5/31/1992		Limiter	A	
17	HLIMITER3	High Level Limiter		5/31/1992		Limiter	A	

Part Type: ALL

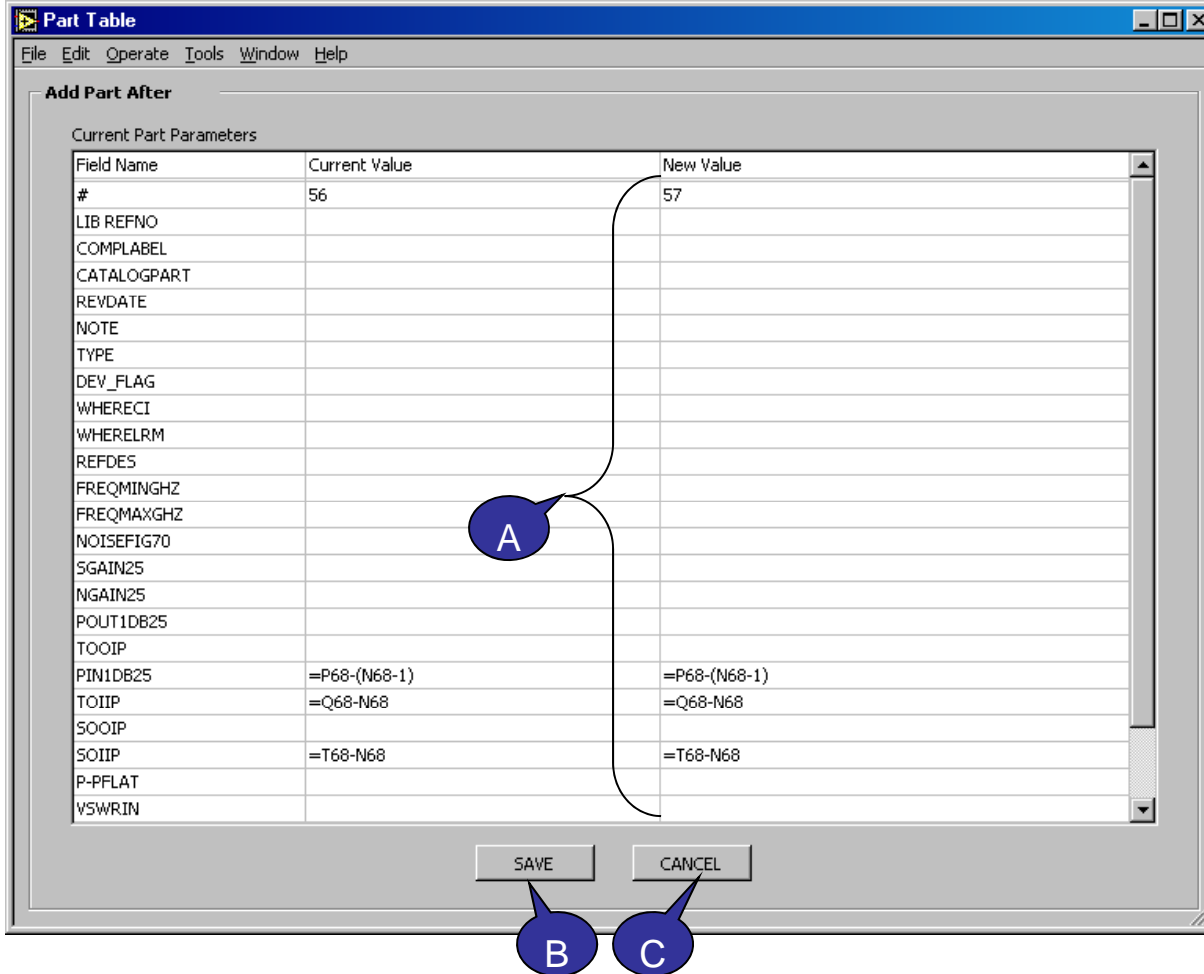
ADD PART AFTER DUPLICATE AND ADD RETURN

- D. Duplicate And Add** – Click the *Duplicate And Add* button to copy the parameters from the selected component in the *RF Component Library table*. This will open a panel in which the copied part may be edited. This part will be inserted below the selected row in the table. See the following page for details about defining the copied part.

- E. Return** – Click *Return* to close the Add New Part panel and return to the Library Manager module.

Add Part After Part Table

This panel will open after the Add Part After button has been selected on the Add New Part panel of the Library Manager module.



Part Table

File Edit Operate Tools Window Help

Add Part After

Current Part Parameters

Field Name	Current Value	New Value
#	56	57
LIB REFNO		
COMPLABEL		
CATALOGPART		
REVDATE		
NOTE		
TYPE		
DEV_FLAG		
WHERECI		
WHERELRM		
REFDES		
FREQMINGHZ		
FREQMAXGHZ		
NOISEFIG70		
SGAIN25		
NGAIN25		
POUT1DB25		
TOOIP		
PIN1DB25	=P68-(N68-1)	=P68-(N68-1)
TOIIP	=Q68-N68	=Q68-N68
SOOIP		
SOIIP	=T68-N68	=T68-N68
P-PFLAT		
V5WRIN		

SAVE CANCEL

A. New Value – To setup the component parameters for the new part, type the desired values in the *New Value* column of the *Add Part After* table. Do not change any cells that start with equal signs '=' as these are formulas that depend on the values entered in other cells. All formulas will automatically update as needed.

B. Save – To save the new part, click Save. All changes will not only be saved in the Library Manager module, but will also be saved in the RF Component Library Excel file. After changes have been saved, the *Add Part After* table will close. You will return to the Add Part panel.

C. Cancel – Click Cancel to exit the *Add Part After* table without saving changes. You will return to the Add Part panel. Please note that using *File>>Exit* will close the entire RF Path Analysis Toolkit and not just the current panel.

Duplicate And Add Part Table

This panel will open after the Duplicate And Add button has been selected on the Add New Part panel of the Library Manager module.

Part Table

File Edit Operate Tools Window Help

Duplicate And Add

Current Part Parameters

Field Name	Current Value	New Value
#	57	58
LIB REFNO	AC1525C	AC1525C
COMPLABEL	5 to 1500 MHz SMA amp	5 to 1500 MHz SMA amp
CATALOGPART	AC1525C	AC1525C
REVDATE	5/4/2000	5/4/2000
NOTE		
TYPE	Amplifier	Amplifier
DEV_FLAG	A	A
WHERECI		
WHERELRM		
REFDES		
FREQMINGHZ		
FREQMAXGHZ		
NOISEFIG70	3.8	3.8
SGAIN25	13.6	13.6
NGAIN25	13.6	13.6
POUT1DB25	9.5	9.5
TOOIP	23	23
PIN1DB25	=P68-(N68-1)	=P69-(N69-1)
TOIIP	=Q68-N68	=Q69-N69
SOOIP	32	32
SOIIP	=T68-N68	=T69-N69
P-PFLAT	0.6	0.6
VSWRIN	1.6	1.6

SAVE CANCEL

A. New Value – To modify the duplicated part, type the desired values in the New Value column of the Duplicate And Add Table. The LIB REFNO must be unique for each duplicated part. Do not change any cells that start with equal signs '=' as these are formulas that depend on the values entered in other cells. All formulas will automatically update as needed.

B. Save – To save the new part, click **Save**. All changes will not only be saved in the Library Manager module, but will also be saved in the RF Component Library Excel file. After changes have been saved, the *Duplicate And Add table* will close. You will return to the Add Part panel.

C. Cancel – Click *Cancel* to exit the *Duplicate And Add table* without saving changes. You will return to the Add Part panel. Please note that using *File>>Exit* will close the entire RF Path Analysis Toolkit and not just the current panel.



Component Parameter Named Ranges

The RF Path Analysis Toolkit requires the following Component Parameter Labels in the Comp_para_title Named Range:

- LIB REFNO
- TYPE
- COMPLABEL
- SGAIN25
- NOISEFIG70
- NOISEFIG25
- TOOIP
- POUT1DB25
- NGAIN25
- CSLOPE
- CGAINLOW
- CGAINHIGH



Path Parameter Named Ranges

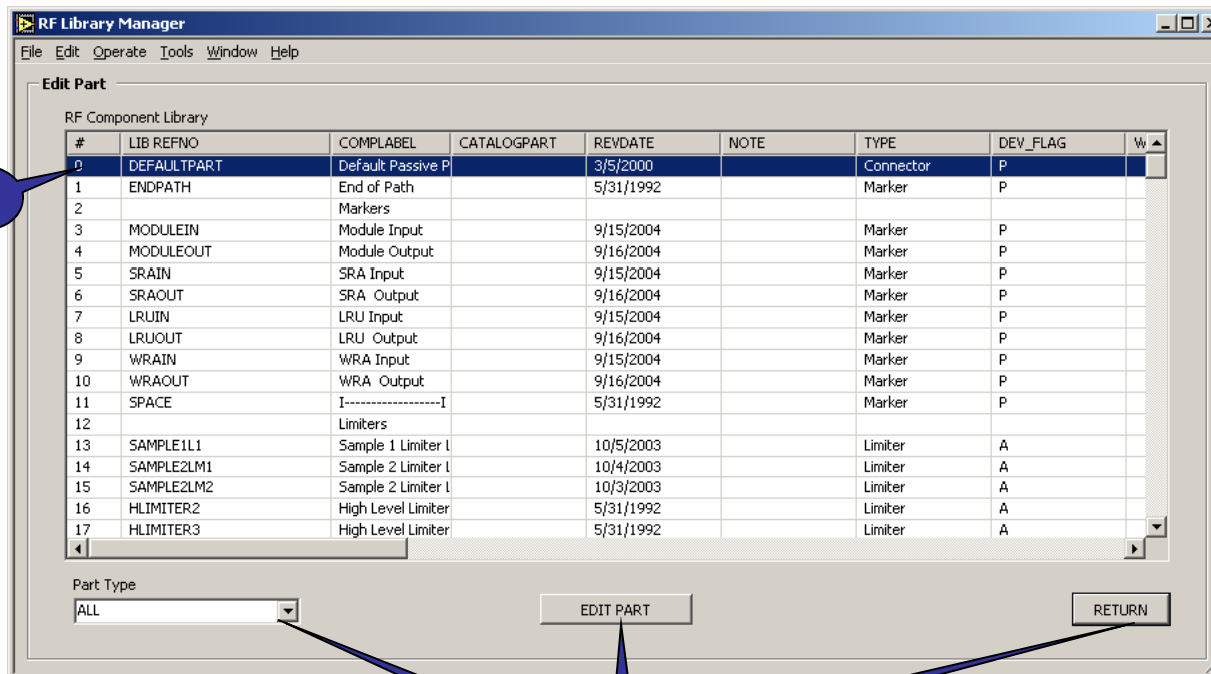
The following Named Ranges are Required for Path Parameters in the Analysis Sheet:

- Path_Folder
- File_Name
- Path_Title
- Path_name

Edit Part

The Edit Part panel allows you to modify an existing part in the RF Component Library without inadvertently changing the equations or formatting of the Excel file.

- A. RF Component Library** – This table displays all components and identifying parameters in the RF Component Library that are of the selected *Part Type*.
- B. Part Type** – Select a part type from the *Part Type* pull down menu to sort the *RF Component Library table*. This will make it easier to find the component to edit.

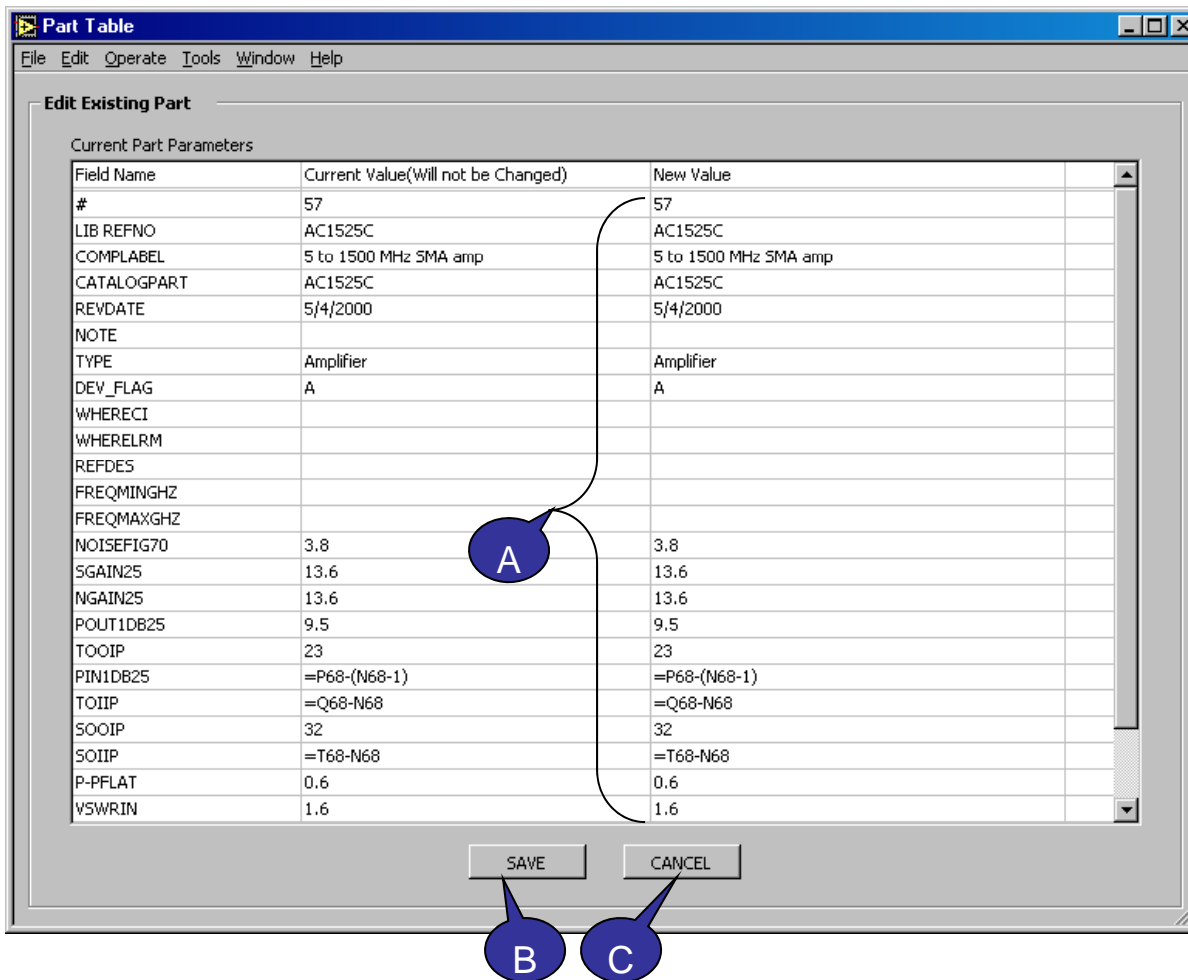


- C. Edit Part** – Click the *Edit Part* button to modify the highlighted part in the *RF Component Library table*. This will open a panel in which the existing part parameters may be edited. See the following page for details about editing the part.

- D. Return** – Click *Return* to close the Edit New Part panel and return to the Library Manager module.

Edit Existing Part Table

This panel will open after the Edit Part button has been selected on the Edit Part panel of the Library Manager module.



Field Name	Current Value(Will not be Changed)	New Value
#	57	57
LIB REFNO	AC1525C	AC1525C
COMPLABEL	5 to 1500 MHz SMA amp	5 to 1500 MHz SMA amp
CATALOGPART	AC1525C	AC1525C
REVDATE	5/4/2000	5/4/2000
NOTE		
TYPE	Amplifier	Amplifier
DEV_FLAG	A	A
WHERECI		
WHERELRM		
REFDES		
FREQMINGHZ		
FREQMAXGHZ		
NOISEFIG70	3.8	3.8
SGAIN25	13.6	13.6
NGAIN25	13.6	13.6
POUT1DB25	9.5	9.5
TOOIP	23	23
PIN1DB25	=P68-(N68-1)	=P68-(N68-1)
TOIIP	=Q68-N68	=Q68-N68
SOOIP	32	32
SOIIP	=T68-N68	=T68-N68
P-PFLAT	0.6	0.6
VSWRIN	1.6	1.6

SAVE CANCEL

A. New Value – To modify the existing part parameters, type the desired values in the *New Value* column of the *Edit Existing Part table*. Do not change any cells that start with equal signs '=' as these are formulas that depend on the values entered in other cells. All formulas will automatically update as needed.

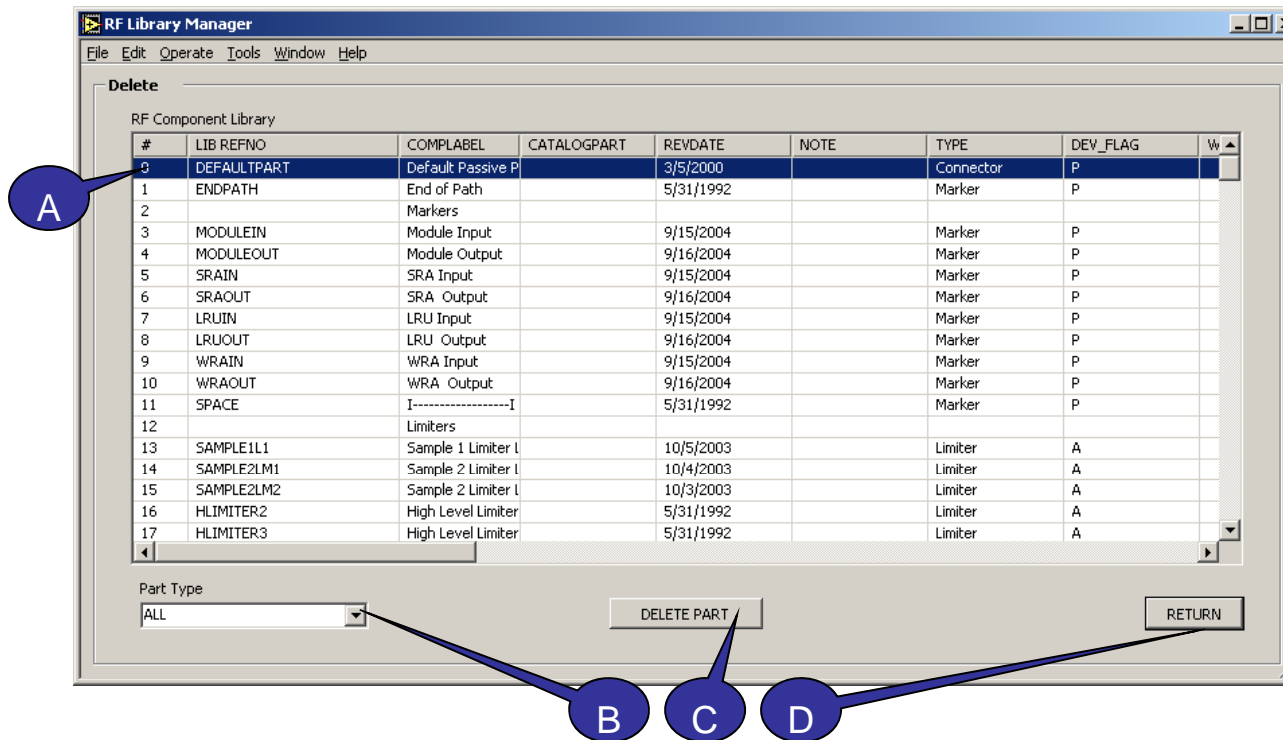
B. Save – To save changes made to the existing part, click *Save*. All changes will not only be saved in the Library Manager module, but will also be saved in the RF Component Library Excel file. After changes have been saved, the *Edit Existing Part table* will close. You will return to the Edit Part panel.

C. Cancel – Click *Cancel* to exit the *Edit Existing Part table* without saving changes. You will return to the Edit Part panel. Please note that using *File>>Exit* will close the entire RF Path Analysis Toolkit and not just the current panel.

Delete Part

The Delete Part panel allows you to remove an existing part from the RF Component Library without inadvertently changing the equations or formatting of the Excel file.

- A. RF Component Library** – This table displays all components and identifying parameters in the RF Component Library that are of the selected *Part Type*.
- B. Part Type** – Select a part type from the *Part Type* pull down menu to sort the *RF Component Library table*. This will make it easier to find the component to delete.



- C. Delete Part** – Click the *Delete Part* button to remove the highlighted part in the *RF Component Library table*. This will not only remove the part from the Library Manager Module, it will also remove the part from the RF Component Library Excel file. Be careful when deleting parts as they may not be restored. It is recommended that a backup file of the RFPATLibrary2.0.xls be made before deleting parts.

- D. Return** – Click *Return* to close the Delete Part panel and return to the Library Manager module.



RF Component Library

The RF Component Library is an Excel database of parts and their associated parameter specifications. A sample database of components is included with the RF Path Analysis Toolkit. This sample database may be modified to suite the needs of your analysis. New columns may be inserted to add additional specifications to identify components by. Make sure columns are inserted within the worksheet limits that are identified by thick black borders. To modify individual components and specifications, see the Library Manager module.

Microsoft Excel - RFPATLibrary																
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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
		min/max Units	Part #	Date	Note	Type	A=Active	CI	LRM	Desig	Freq	Freq	Max (dB)	Nominal (dB)	Nominal (dB)	Min (dBm)
7																
8	LIB REFNO	COMPLABEL	CATALOGPART	REVDATE	NOTE	TYPE	DEV_FLAG	WHERECI	HERELR	REFDES	EQMINGREQ	EQMAXGH	NOISEFG70	SGAIN25	NGAIN25	POUTIDE
9	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
10	DEFAULTPART	Default Passive Part		03/06/00		Connector	P						0.00	0.00	0.00	150.00
11	ENDPATH	End of Path		06/01/92		Marker	P						0.00	0.00	0.00	99.00
12	Markers															
13																
14	MODULEIN	Module Input		09/16/04		Marker	P						0.00	0.00	0.00	150.00
15	MODULEOUT	Module Output		09/17/04		Marker	P						0.00	0.00	0.00	150.00
16	SRAIN	SRA Input		09/16/04		Marker	P						0.00	0.00	0.00	150.00
17	SRAOUT	SRA Output		09/17/04		Marker	P						0.00	0.00	0.00	150.00
18	LRAIN	LRA Input		09/16/04		Marker	P						0.00	0.00	0.00	150.00
19	LRAOUT	LRA Output		09/17/04		Marker	P						0.00	0.00	0.00	150.00
20	WRAIN	WRA Input		09/16/04		Marker	P						0.00	0.00	0.00	150.00
21	WRAOUT	WRA Output		09/17/04		Marker	P						0.00	0.00	0.00	150.00
22	SPACE	-----		06/01/92		Marker	P						0.00	0.00	0.00	99.00
23	Limiters															
24	SAMPLE1L1	Sample 1 Limiter L1		10/06/03		Limiter	A						0.40	-0.40	-0.40	14.00
25	SAMPLE2LM1	Sample 2 Limiter LM1		10/05/03		Limiter	A						0.20	-0.20	-0.20	32.00
26	SAMPLE2LM2	Sample 2 Limiter LM2		10/04/03		Limiter	A						0.20	-0.20	-0.20	32.00
27	HLIMITER2	High Level Limiter B2		06/01/92		Limiter	A				2000	6000	1.00	-1.00	-1.00	28.00
28	HLIMITER3	High Level Limiter B3		06/01/92		Limiter	A				6000	10000	1.30	-1.30	-1.30	28.00
29	HLIMITER4	High Level Limiter B4		06/01/92		Limiter	A				10000	18000	1.50	-1.50	-1.50	28.00
30	LLIMITER2	Low Level Limiter B2		06/01/92		Limiter	A				2000	6000	0.50	-0.50	-0.50	28.00
31	LLIMITER3	Low Level Limiter B3		06/01/92		Limiter	A				6000	10000	0.80	-0.80	-0.80	28.00
32	LLIMITER4	Low Level Limiter B4		06/01/92		Limiter	A				10000	18000	1.00	-1.00	-1.00	28.00
33	Isolators															
34	ISOLATOR2	Isolator B2		05/04/00		Isolator	P				2000	6000	0.70	-0.70	-0.70	150.00
35	ISOLATOR3	Isolator B3		05/04/00		Isolator	P				6000	10000	0.80	-0.80	-0.80	150.00
36	ISOLATOR4	Isolator B4	DMI6018	05/04/00		Isolator	P				10000	18000	1.00	-1.00	-1.00	150.00
37	ISOLATOR-BB	Isolator		03/06/00		Isolator	P				2000	6000	0.80	-0.80	-0.80	100.00
38	ISOLATOR-LB	Isolator		03/06/00		Isolator	P				1000	2000	0.60	-0.60	-0.60	30.00
39	Amplifiers															
40	SAMPLE1AR1	Sample 1 Amplifier 1		09/15/04		Amplifier	A						3.50	20.00	20.00	15.00
41	SAMPLE2AR1	Sample 2 Amplifier 1		09/14/04		Amplifier	A						2.50	17.80	17.80	18.00
42	SAMPLE2AR2	Sample 2 Amplifier 2		09/13/04		Amplifier	A						4.00	9.00	9.00	18.00
43	SAMPLE2AR3	Sample 2 Amplifier 3		09/12/04		Amplifier	A						3.50	11.50	11.50	15.00
44	SAMPLE1AR2	Sample 1 Amplifier 2		09/14/04		Amplifier	A						3.50	20.00	20.00	15.00
45	QBH101	Q-Bit QBH-101	Q-Bit QBH-101	09/16/04		Amplifier	A						3.00	13.00	13.00	6.00
46	QBH102	Q-Bit QBH-102	Q-Bit QBH-102	09/15/04		Amplifier	A						7.00	12.50	12.50	21.00
47	QBH124	Q-Bit QBH-124	Q-Bit QBH-124	09/15/04		Amplifier	A						3.50	20.00	20.00	17.00
48	QBH125	Q-Bit QBH-125	Q-Bit QBH-125	09/14/04		Amplifier	A						4.50	19.50	19.50	24.00
49	AVANUT0543	Avantek UTO-543	Avantek UTO-543	09/15/04		Amplifier	A						2.50	10.50	10.50	6.00
50	AVANUT0545	Avantek UTO-545	Avantek UTO-545	09/14/04		Amplifier	A						5.00	11.50	11.50	17.00
51	AMP6054-1U	Amplifier, Cougar	Ab054-1U			Amplifier	A						3.50	18.00	18.00	18.00
52	AMPCOU6054	Cougar 6054 amplifier	AS6054	12/13/00		Amplifier	A						4.80	17.00	17.00	17.50
53	AMPCOU6063	Cougar 6063 amplifier	AS6063	03/06/00		Amplifier	A						4.20	15.50	15.50	20.00
54	AMPCOU61309	Cougar APS1309 amplifier	APS1309	03/21/00		Amplifier	A						3.00	12.00	12.00	22.00
RF Component Library - Transmission Line 1																
Ready Calculate NUM																



Library Named Ranges

The following Named Ranges are required on the RF Component Library Spreadsheet:

- Library Worksheet
 - REFNO
 - Comp_para_title
 - Database
 - Comp_para_header
- Transmission Line Worksheet
 - Cable_loss



The template spreadsheet is a basic guide for creating the detailed analysis spreadsheet. This template contains all formulas for calculations, path parameters, and graphs.

After a path file has been created, it may be exported to Excel to create the detailed analysis spreadsheet. RF Path Analysis Toolkit automatically creates this file by filling in the path component parameters in the template spreadsheet.

Two template spreadsheets are included with the RF Path Analysis software.

- **RFPATTemplate4-2.xls** is a simplified (but still very useful) RF path analysis spreadsheet for receivers and transmitters. Antenna gains can not be accurately incorporated into the model. Sensitivity calculations are based on the receiver RF components only.
- **RFPATTemplate6-2.xls** is a more advanced RF path analysis spreadsheet. This template allows for separate RF component “signal gain” and “noise gain” parameters. This allows the spreadsheet to show radiated sensitivity because antenna gains can be taken into account (antennas have “signal gain” but no “noise gain”). Basic RF components have the same “signal gain” and noise gain.”

The template spreadsheet may be modified to display custom path parameters or to calculate additional values.

52

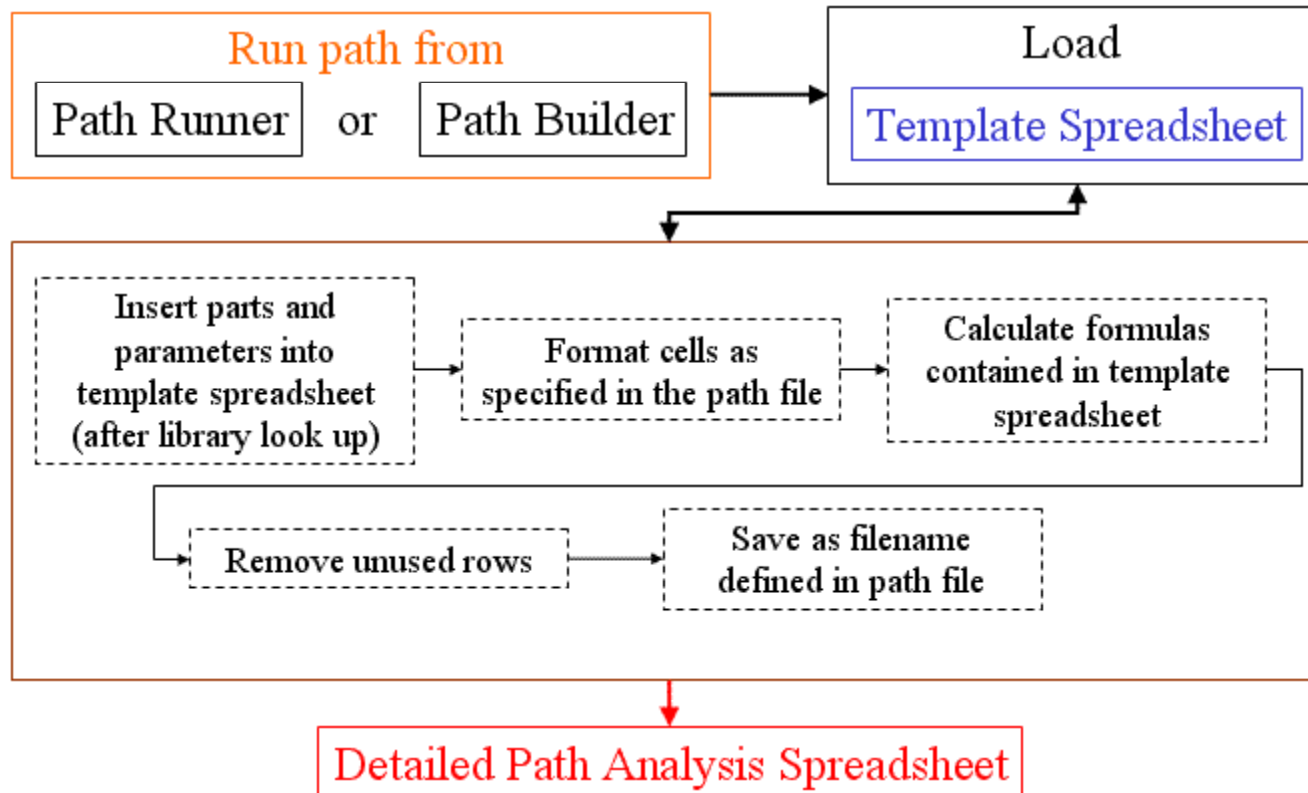


Template Named Ranges

The following Named Ranges are required for the template:

- Components Sheet
 - Comp_Database_Top_Left
- Analysis Sheet
 - First_Row
 - Last_Row
 - Template Specific
 - Rev_Date
 - Signal_1_dBm
 - Signal_2_dBm
 - SNR_Required
 - Rec_BW_Mhz
 - Signal_3_dBm

Creating Detailed Spreadsheets Diagram



The Template Spreadsheet becomes the Analysis Spreadsheet after the above steps have been preformed. The final output may be opened in Excel and edited independently.



Detailed Analysis Spreadsheet

The Detailed Analysis Spreadsheet is created from the Template Spreadsheet and the path file. This sheet contains information about performance, the noise figure, and the sensitivity. In addition to the output spreadsheet, several graphs are created as separate tabs within the Excel workbook. See the following pages for example output graphics. Once complete, the detailed analysis spreadsheets can be independently opened and printed.

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R55															
1	Path Filename	Sample1.pth												Path Filename	Sample1.pth
2	Path Folder	C:\Program Files\RFPathAnalysis\Toolkit												Path Folder	C:\Program Files\RFPathAnalysis\Toolkit
3	Excel Filename	SAMPLE1.xls												Excel Filename	SAMPLE1.xls
4	Revision Date	10/14/2004												Revision Date	8/22/2004
5	Signal 1 Input (dBm):	-75												Signal 1 Input (dBm):	-75
6	Signal 2 Input (dBm):	-15												Signal 2 Input (dBm):	-15
7	RF SNR Required (dB)	10												RF SNR Required (dB)	10
8	Receiver IF BW (MHz)	500												Receiver IF BW (MHz)	500
SAMPLE 1 PATH															
Noise Figure/Signal Levels															
10	COMPONENT		Reference	Spec	Spec	Device	Cum	Signal 1	Signal 2	Thermal	Noise	RF/IF	COMPONENT		Refer
11	LABEL		Desination	Noise Fig	Noise Fig	Gain	Gain	Out	Out	Noise Level	Power	SNR at	LABEL		Desir
12			(dB)	(dB)	(dB)	(dB)	(dB)	(dBm)	(dBm)	(dBm/MHz)	(MHz)	(dBm)			
13	3	2	11	14	15								3	2	1
14	COMPLABEL	LIB REFNO	REFDES	NOISEFIG70	SGAIN25								COMPLABEL	LIB REFNO	REF
15	INPUT LEVEL >>>							-75	-15						
16															
17															
18	Module Input	MODULEIN		0.0	0.00	0.0	0.0	-75.0	-15.0	-114.0	500	-87.0	72.0	Module Input	MODULEIN
19	Sample 1 SP3T 60 dB	SAMPLE1S1		0.8	0.80	-0.8	-0.8	-75.8	-15.8	-114.0	500	-87.0	71.2	Sample 1 SP3T 60 dB	SAMPLE1S1
20	Sample 1 Prefilter FL1	SAMPLE1FL1		1.5	2.30	-1.5	-2.3	-77.3	-17.3	-114.0	500	-87.0	69.7	Sample 1 Prefilter FL1	SAMPLE1FL1
21	Pad/Attenuator [1 dB]	PAD-01.0		1.0	3.30	-1.0	-3.3	-78.3	-18.3	-114.0	500	-87.0	68.7	Pad/Attenuator [1 dB]	PAD-01.0
22	Sample 1 Limiter L1	SAMPLE1L1		0.4	3.70	-0.4	-3.7	-78.7	-18.7	-114.0	500	-87.0	68.3	Sample 1 Limiter L1	SAMPLE1L1
23	Sample 1 Amplifier 1	SAMPLE1AR1		3.5	7.20	20.0	16.3	-58.7	1.3	-90.5	500	-63.5	64.8	Sample 1 Amplifier 1	SAMPLE1AR1
24	Sample 1 LP Filter	SAMPLE1FL5		1.0	7.21	-1.0	15.3	-59.7	0.3	-91.5	500	-64.5	64.8	Sample 1 LP Filter	SAMPLE1FL5
25	Sample 1 Mixer	SAMPLE1M1		7.5	7.32	-7.5	7.8	-67.2	-7.2	-98.9	500	-71.9	64.7	Sample 1 Mixer	SAMPLE1M1
26	Sample 1 LO Reject Filter	SAMPLE1FL2		2.0	7.46	-2.0	4.9	-70.2	-10.2	-101.9	500	-74.9	64.6	Sample 1 LO Reject Filter	SAMPLE1FL2
27	Sample 1 Amplifier 2	SAMPLE1AR2		3.5	7.76	20.0	24.8	-50.2	9.8	-81.4	500	-54.5	64.3	Sample 1 Amplifier 2	SAMPLE1AR2
28	Sample 1 Attenuator 1	SAMPLE1AT1		6.7	7.77	-6.7	18.1	-56.9	3.1	-88.1	500	-61.1	64.2	Sample 1 Attenuator 1	SAMPLE1AT1
29	Sample 1 BIT Coupler	SAMPLE1DC1		2.0	7.77	-2.0	16.1	-58.9	1.1	-90.1	500	-63.1	64.2	Sample 1 BIT Coupler	SAMPLE1DC1
30	Transmission Line	TLINE 0.10SLP 0.00		0.1	7.77	-0.1	16.0	-59.0	1.0	-90.2	500	-63.2	64.2	Transmission Line	TLINE 0.10SLP 0.00
31	Module Output	MODULEOUT		0.0	7.77	0.0	16.0	-59.0	1.0	-90.2	500	-63.2	64.2	Module Output	MODULEOUT
32	End of Path	ENDPATH		0.0	7.77	0.0	16.0	-59.0	1.0	-90.2	500	-63.2	64.2	End of Path	ENDPATH
33															
34	Receiver Performance				7.77		16.00	-59.00	1.00		500	-63.24	64.24		
35															
36	Receiver Noise Figure:			7.77	dB									Receiver Sensitivity:	
37	Receiver Sensitivity:			-69.24	dBm									Receiver Linear Dynamic Range (approx):	
38														Two Tone Third Order Spur Free Dynamic Range:	
39														Two Tone Third Order Spur Free Top Dynamic Range:	
40														Two Tone Second Order Spur Free Dynamic Range:	
41														Two Tone Second Order Spur Free Top Dynamic Range:	
42															



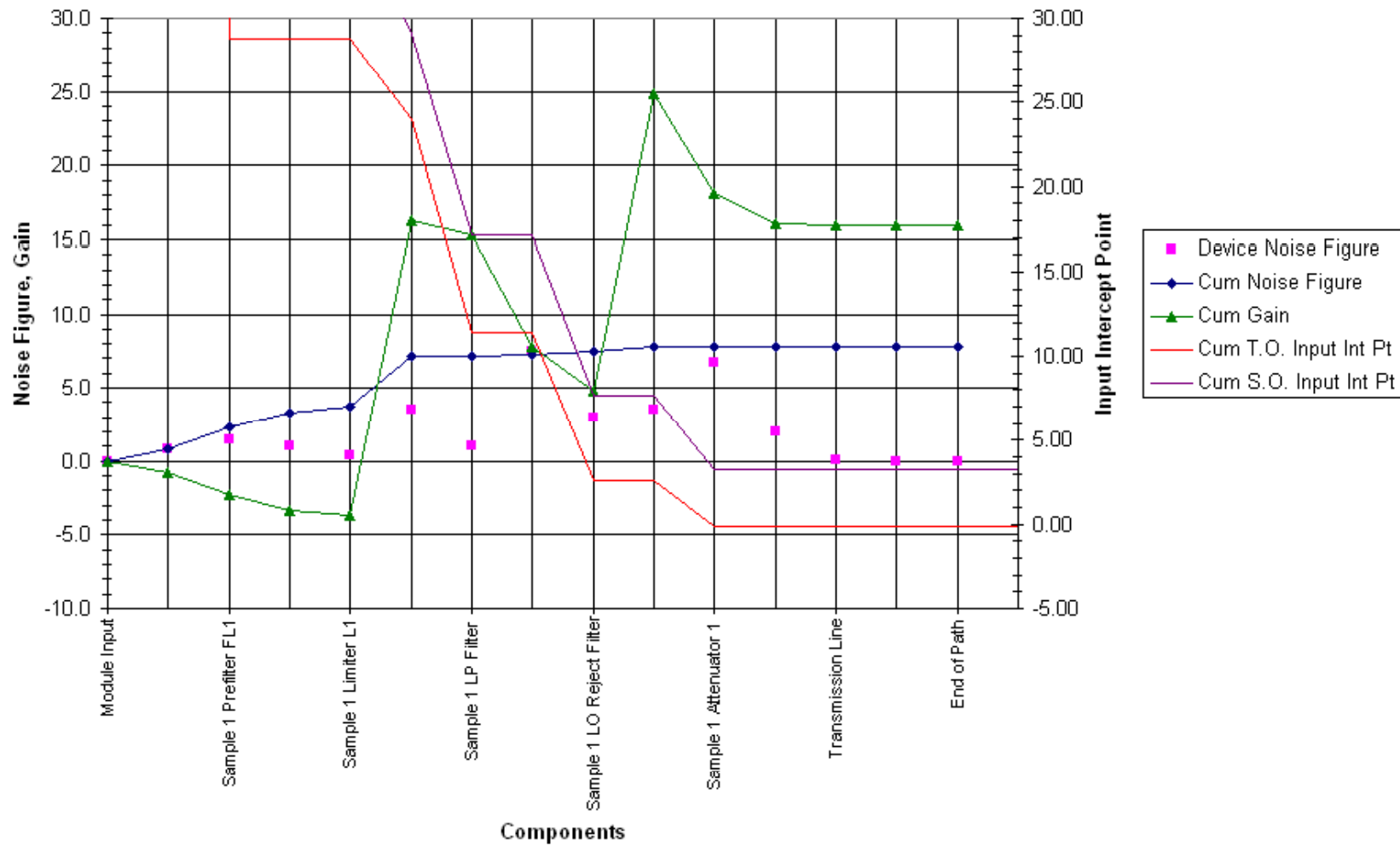
Components Sheet

The components sheet of the Detailed Analysis workbook displays the part specifications for the components in the RF path.

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A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
12							Device Flag						70	25	2
13	Lib Ref No	Device Name	Catalog	Rev	Rev	Device	P=Passive	Where Used	Where Used	REF	Minimum	Maximum	Noise Fig	Sig Gain	Noise
14		min/max	Part #	Date	Note	Type	A=Active	CI	LRM	Desig	Freq	Freq	Max	Nominal	Non
15		Units											(dB)	(dB)	(d
16	LIB REFNO	COMPLABEL	CATALOGPART	REVDATE	NOTE	TYPE	DEV_FLAG	WHERECI	WHERELRM	REFDES	REOMINGH	REOMAXGH	NOISEFIG70	SGAIN25	NGA
17	v	v	v	v	v	v	v						v	v	v
18	MODULEIN	Module Input		36784		Marker	P						0.0001	-0.0001	-0.0
19	SAMPLE1S1	Sample 1 SP3T 60 dB		36798		Switch	A						0.8	-0.8	-0.0
20	SAMPLE1FL1	Sample 1 Prefilter FL1		36798		Filter	P						1.5	-1.5	-1.0
21	PAD-01.0	Pad/Attenuator [1 dB]		35020		Attenuator	P				50	18000	1	-1	-1.0
22	SAMPLE1L1	Sample 1 Limiter L1		36438		Limiter	A						0.4	-0.4	-0.0
23	SAMPLE1AR1	Sample 1 Amplifier 1		36783		Amplifier	A						3.5	20	2.0
24	SAMPLE1FL5	Sample 1 LP Filter		36797		Filter	P						1	-1	-1.0
25	SAMPLE1M1	Sample 1 Mixer		36782		Mixer	A						7.5	-7.5	-7.0
26	SAMPLE1FL2	Sample 1 LO Reject Filter		36797		Filter	P						3	-3	-3.0
27	SAMPLE1AR2	Sample 1 Amplifier 2		36782		Amplifier	A						3.5	20	2.0
28	SAMPLE1AT1	Sample 1 Attenuator 1		35495		Attenuator	P				50	18000	6.7	-6.7	-6.0
29	SAMPLE1DC1	Sample 1 BIT Coupler		36437		Coupler	P						2	-2	-2.0
30	TLINE 0.10SLP 0.00	Transmission Line		35129		Connector	P						0.1000	-0.1000	-0.1
31	MODULEOUT	Module Output		36785		Marker	P						0.0001	-0.0001	-0.0
32	ENDPATH	End of Path		32294		Marker	P						0.0001	-0.0001	-0.0
33															
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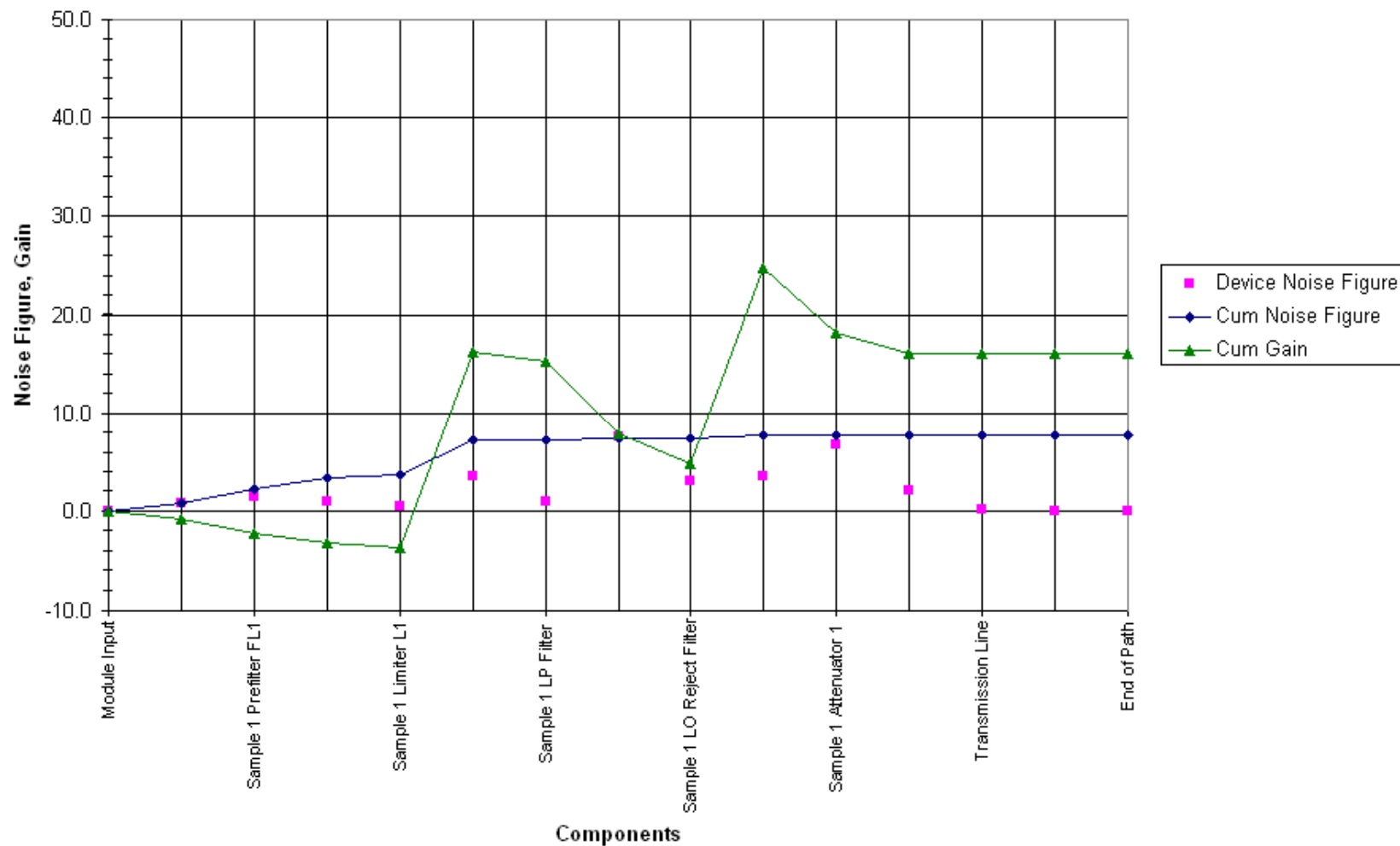
Receiver Chart

RF Path Parameters - Sensitivity and Dynamic Range



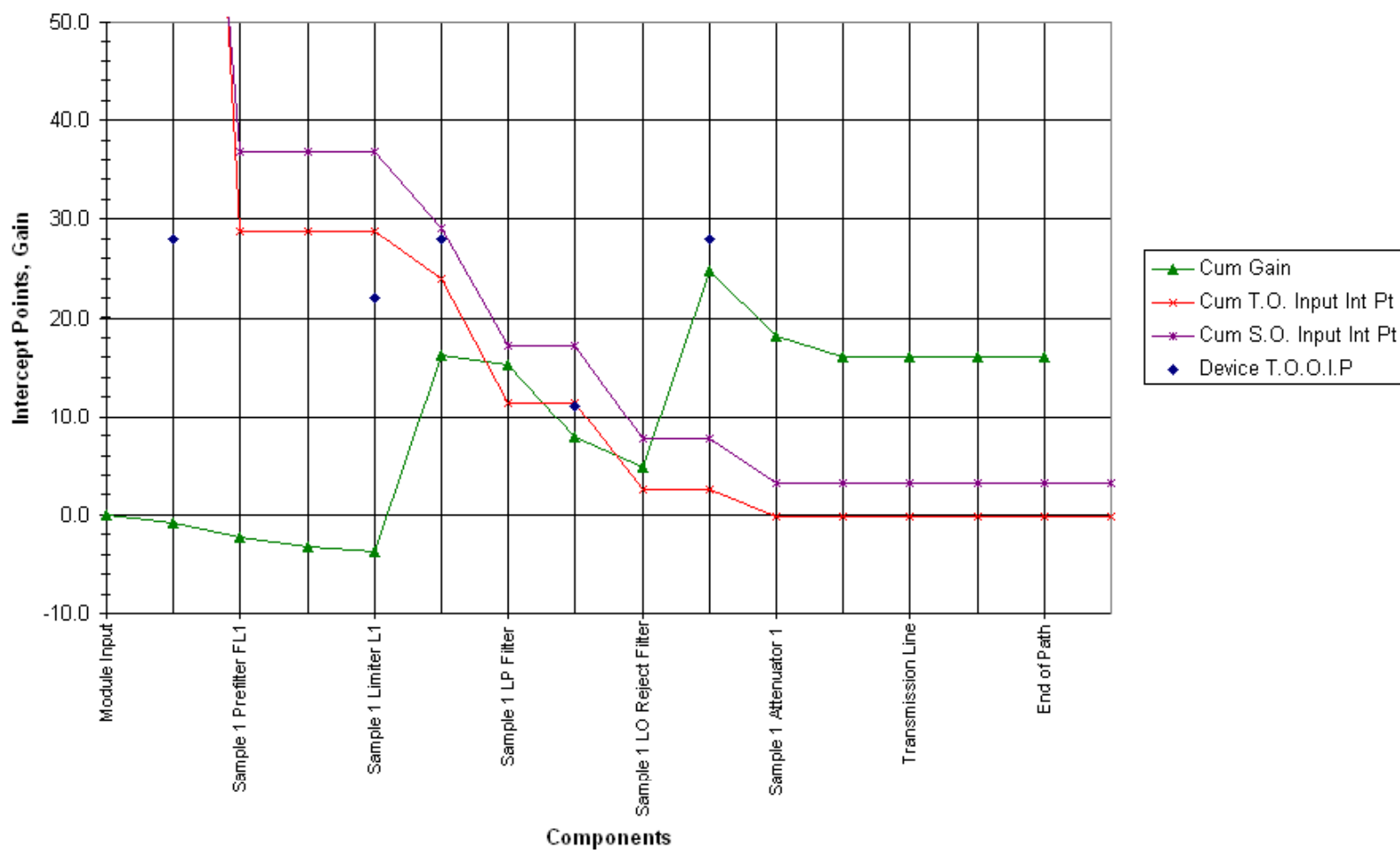
Receiver Chart – Noise Figure

RF Path Parameters - Sensitivity



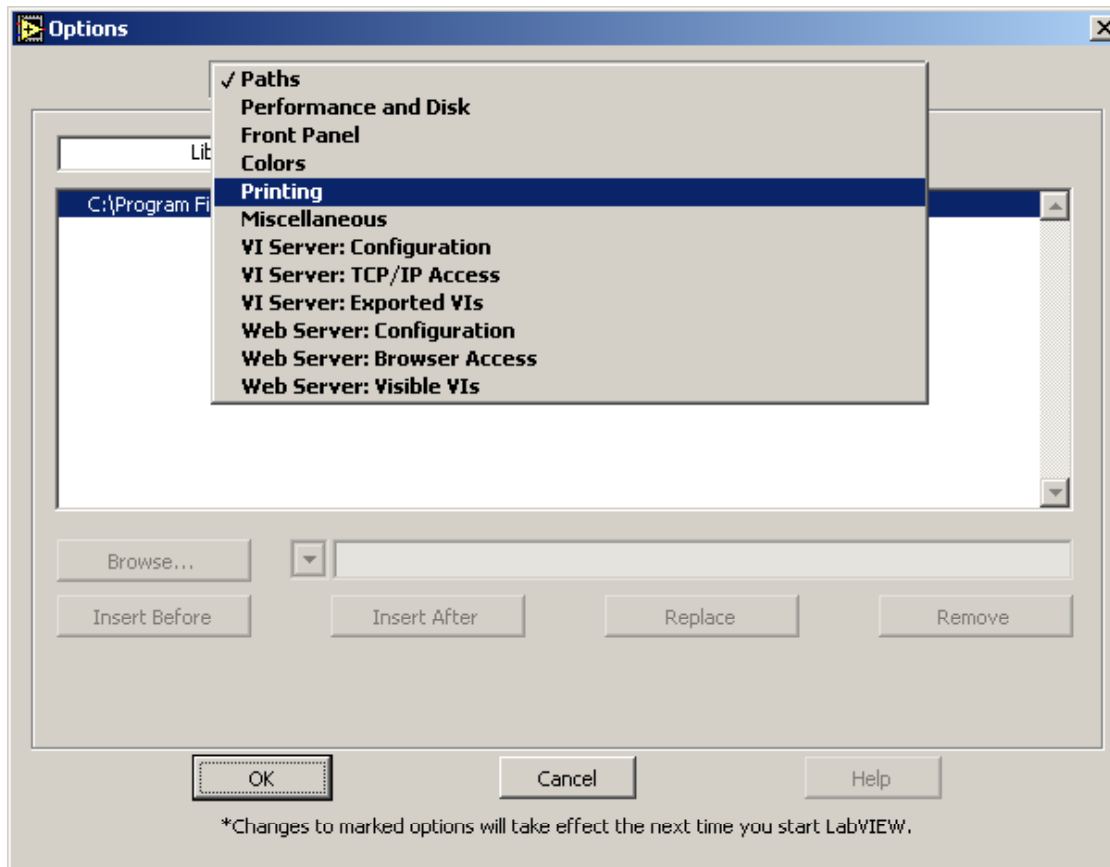
Receiver Chart – Int Point

RF Path Parameters - Dynamic Range



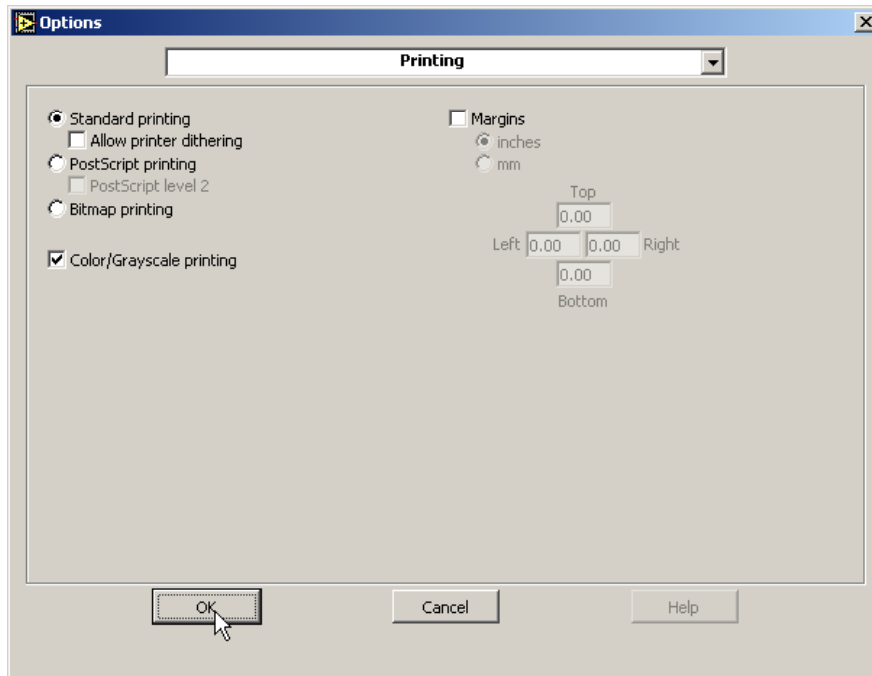
Printing

- 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**.

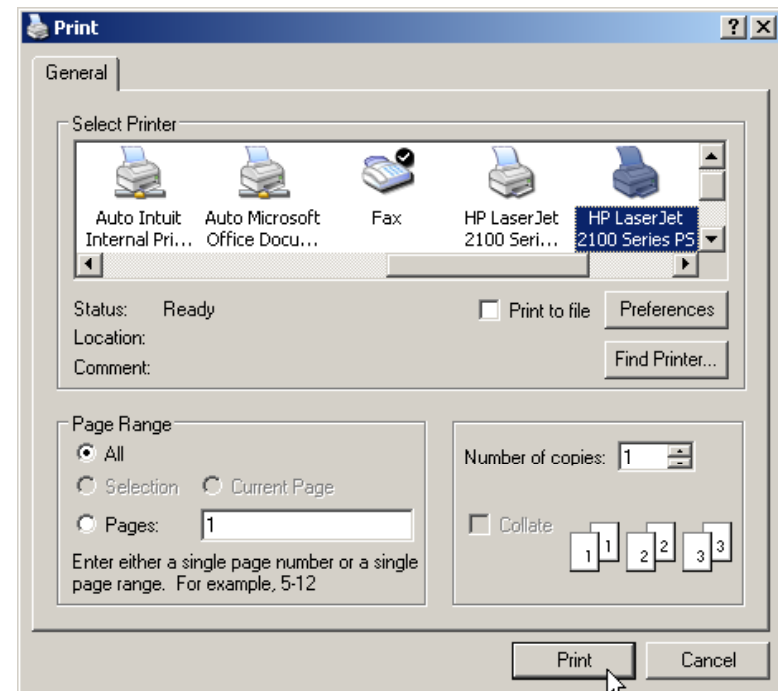


Printing Cont.

- 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

- For information on the latest and up to date features available in RF Path Analysis Toolkit visit our online documentation effort at: <http://helprfpathanalysis2.rawood.com/tiki-index.php>
- 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 to contact us any time at 315-735-4217 or rawood@rawood.com



Purchasing Information

- We currently offer several methods for purchasing our software products:
 - Select the desired method from within the program itself (recommended for single purchases)
 - Use the PayPal Forms on our software download page : http://rawood.com/software_products/purchase_software.html (useful for purchasing multiple programs)
 - Fill out the WWW form
 - 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.

