RF Toolbox™ Release Notes

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RF Toolbox™ Release Notes

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Contents

Summary by Version

This table provides quick access to what's new in each version. For clarification, see "Using Release Notes" on page 1.

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Latest Version V2.4 (R2008b)	Yes Details	No	Bug Reports Includes fixes	Printable Release Notes: PDF Current product documentation
V2.3 (R2008a)	Yes Details	No	Bug Reports Includes fixes	No
V2.2 (R2007b)	Yes Details	No	Bug Reports	No
V2.1 (R2007a)	Yes Details	No	Bug Reports	No
V2.0 (R2006b)	Yes Details	No	Bug Reports	No
V1.3 (R2006a)	Yes Details	No	Bug Reports at Web site	No
V1.2 (R14SP3)	Yes Details	No	Bug Reports at Web site	No
V1.1 (R14SP2)	Yes Details	No	Bug Reports at Web site	No
V1.0.1 (R14+)	No	No	Fixed bugs	No
V1.0 (R14)	Yes Details	No	No bug fixes	No

Using Release Notes

Use release notes when upgrading to a newer version to learn about:

- New features

- Changes

- Potential impact on your existing files and practices

Review the release notes for other MathWorks™ products required for this product (for example, MATLAB® or Simulink®) for enhancements, bugs, and compatibility considerations that also might impact you.

If you are upgrading from a software version other than the most recent one, review the release notes for all interim versions, not just for the version you are installing. For example, when upgrading from V1.0 to V1.2, review the release notes for V1.1 and V1.2.

What's in the Release Notes

New Features and Changes

- New functionality

- Changes to existing functionality

Version Compatibility Considerations

When a new feature or change introduces a reported incompatibility between versions, the **Compatibility Considerations** subsection explains the impact.

Compatibility issues reported after the product is released appear under Bug Reports at the MathWorks Web site. Bug fixes can sometimes result in incompatibilities, so you should also review the fixed bugs in Bug Reports for any compatibility impact.

Fixed Bugs and Known Problems

The MathWorks offers a user-searchable Bug Reports database so you can view Bug Reports. The development team updates this database at release time and as more information becomes available. This includes provisions for any known workarounds or file replacements. Information is available

for bugs existing in or fixed in Release 14SP2 or later. Information is not available for all bugs in earlier releases.

Access Bug Reports using your MathWorks Account.

Version 2.4 (R2008b) RF Toolbox Software

This table summarizes what's new in Version 2.4 (R2008b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes	No	Bug Reports Includes Fixes	Printable Release Notes: PDF Current product documentation

New features and changes introduced in this version are:

- "cascadesparams Function now supports N-port S-parameters" on page 4
- "Improvements to the plotyy Method" on page 4

cascadesparams Function now supports N-port S-parameters

You can now use the cascadesparams function to cascade the S-parameters of an arbitrary number of N-port devices to form a network. The function lets you specify how to connect the ports of each N-port device to the ports of the subsequent N-port device in the cascade. For more information about the function, see the cascadesparams reference page.

Improvements to the plotyy Method

The plotyy method now uses a more intuitive approach when determining how to plot the specified parameters if you do not specify the plot format. For more information about the function, see the plotyy reference page.

Version 2.3 (R2008a) RF Toolbox Software

This table summarizes what's new in Version 2.3 (R2008a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Bug Reports	Printable Release Notes: PDF Current product documentation

New features and changes introduced in this version are:

- "Calculation and Plotting Metrics Added" on page 5
- "Network Parameter Conversion Functions Enhanced" on page 5
- "gammams and gammaml Functions Added" on page 5
- "z2gamma Function Added" on page 6
- "Demos Added and Updated" on page 6
- "M-Help Updated" on page 6

Calculation and Plotting Metrics Added

You can now compute and visualize group delay, voltage gain, and stability factor using the `calculate` and `plot` methods.

Network Parameter Conversion Functions Enhanced

You can now use the `s2sdd`, `s2sdc`, `s2scd`, and `s2scc` functions to perform conversions on network parameters with alternate port arrangements.

gammams and gammaml Functions Added

Use the new `gammams` and `gammaml` functions to compute source and load reflection coefficients required for simultaneous conjugate match.

z2gamma Function Added

Use the new `z2gamma` function to convert impedance values to reflection coefficients.

Demos Added and Updated

A new demo, Writing a Touchstone® File, shows how to write `rfckt` object data to an industry-standard Touchstone data file.

Modeling a High-Speed Backplane (Part 2: 4-Port S-Parameters to a Rational Function Model) now uses the new Communications Toolbox™ eye diagram scope, `commscope.eyediagram`, to plot the eye diagram.

M-Help Updated

The M-help for objects and packages has been reorganized and now includes descriptions of all properties and links to all relevant methods.

Version 2.2 (R2007b) RF Toolbox Software

This table summarizes what's new in Version 2.2 (R2007b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Bug Reports	No

New features and changes introduced in this version are:

- "snp2smp Function Added" on page 7
- "circle Method Added" on page 7
- "powergain Function Added" on page 7
- "Smith Chart Enhanced" on page 8
- "Demos Added and Updated" on page 8

snp2smp Function Added

Use the new `snp2smp` function to convert N-port S-parameter data and termination impedances to M-port S-parameters.

circle Method Added

Use the new `circle` method to place circles on a Smith® Chart to depict stability regions and display constant gain, noise figure, reflection, and immitance circles.

powergain Function Added

Use the new `powergain` function to compute various power gains of a 2-port network.

Smith Chart Enhanced

The `smith` method now lets you plot the network parameters of devices with more than two ports on a Smith Chart.

Demos Added and Updated

Modeling a High-Speed Backplane (Part 1: Measured 16-Port S-Parameters to 4-Port S-Parameters) is the new first part of a four-part demo on "Modeling a High-Speed Backplane." The new demo shows how to extract 4-port S-parameter data from 16-port S-parameter data. The original three parts of the demo are now parts 2, 3, and 4.

The following demos replace the "Designing Impedance Matching Networks" and "Placing Circles on a Smith Chart" demos, respectively, and show how to use the new `circle` method:

- Designing Matching Networks (Part 1: Networks with an LNA and Lumped Elements) uses the available gain design technique to design a low-noise amplifier for a wireless communication system.

- Designing Matching Networks (Part 2: Single Stub Transmission Lines) shows how to design input and output matching networks for an amplifier.

Version 2.1 (R2007a) RF Toolbox Software

This table summarizes what's new in Version 2.1 (R2007a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Bug Reports	No

New features and changes introduced in this version are

- "Agilent P2D and S2D System-Level Verification Model Support Added" on page 9
- "Mixer Spur Analysis Added" on page 10
- "timeresp Method Added" on page 10
- "Plotting Methods Added" on page 10
- "gamma2z Function Added" on page 11
- "Tab Completion Added" on page 11
- "Data Tips Added" on page 11
- "Demos Added and Updated" on page 11

Agilent P2D and S2D System-Level Verification Model Support Added

The `rfckt.amplifier` and `rfckt.mixer` objects now let you import system-level verification models of amplifiers and mixers, respectively, using data from Agilent® P2D and S2D files.

Use P2D files to specify the following data for multiple operating conditions, such as temperature and bias values:

- Small-signal network parameters
- Power-dependent network parameters

- Noise data

- Intermodulation tables

Use S2D files to specify the following data for multiple operating conditions:

- Small-signal network parameters

- Gain compression (1 dB)

- Third-order intercept point (IP3)

- Power-dependent S_{21} parameters

- Noise data

- Intermodulation tables

Use the following methods to work with operating condition data after you import a P2D or S2D file into an RF object:

- `setop` — Use this method to set operating condition values or to list all available values.

- `getop` — Use this method to display the selected operating condition values.

Mixer Spur Analysis Added

You can import an intermodulation table into an `rfckt.mixer` object. The object's `plot` method has a new option for plotting mixer spur data.

timeresp Method Added

Use the new `timeresp` method of the `rfmodel.rational` object to compute the time response of an `rfmodel` object to a specified input signal. Use this method rather than computing impulse response with the `impulse` method and then convolving that response with the input signal because the `timeresp` method generally gives a more accurate output signal for a given input signal.

Plotting Methods Added

Four new plotting methods provide additional plotting options:

- Use the `plotyy` method of the `rfckt` class to create a plot that contains RF circuit object data on both the left and right Y-axes.

- Use the `loglog` method of the `rfckt` class to plot RF circuit object data on a log-log scale.

- Use the `semilogx` method of the `rfckt` class to plot RF circuit object data using a logarithmic scale for the X-axis.

- Use the `semilogy` method of the `rfckt` class to plot RF circuit object data using a logarithmic scale for the Y-axis.

gamma2z Function Added

Use the new `gamma2z` function to compute input impedance from a reflection coefficient.

Tab Completion Added

Tab completion is now available in the MATLAB command window for all functions and methods. For more information on tab completion, see "Completing Statements in the Command Window — Tab Completion" in the MATLAB documentation.

Data Tips Added

Data tips are now available for any RF plot. For more information on data tips, see "Data Cursor — Displaying Data Values Interactively" in the MATLAB documentation.

Demos Added and Updated

Visualizing Mixer Spurs shows how to use the toolbox to perform mixer spur analysis using data from an intermodulation table and then plot the output power spectrum of the desired signal and the undesired spurs.

Modeling a High-Speed Backplane (Part 1: Measured 4-Port S-Parameters to a Rational Function Model) now uses the `timeresp` method to compute the time-domain response of a system characterized by measured data.

Modeling a High-Speed Backplane (Part 2: Rational Function Model to Simulink Model) now includes code that you can use to generate a Simulink model for any `rfmodel.rational` object.

Version 2.0 (R2006b) RF Toolbox Software

This table summarizes what's new in Version 2.0 (R2006b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Bug Reports	No

Version 2.0 (R2006b) lets you create a rational function model from measured network parameters. This type of model is useful to signal integrity engineers, whose goal is to reliably connect high-speed semiconductor devices with, for example, multi-Gbit/s serial data streams across backplanes and printed circuit boards. New features and changes introduced in this version are described in this section.

S-Parameter Conversion Function Added

Use the s2tf function to convert 2-port scattering parameters into a transfer function that represents the normalized voltage gain of a 2-port network.

rfmodel Class Added

Use objects from the rfmodel class to represent components and networks with mathematical equations. The rfmodel.rational object stores a rational function model of a component or network.

rationalfit Function Added

Use the rationalfit function to fit a rational function to passive data that represents an RF component or network and then store the result in an rfmodel.rational object.

freqresp and impulse Functions Added

Use the freqresp method of the rfmodel class to compute the frequency response of an rfmodel object.

Use the `impulse` method of the `rfmodel` class to compute the impulse response of an `rfmodel` object.

Support for Exporting Verilog-A Models Added

Use the `writeva` method of the `rfmodel` class to export a description of an RF component or network for use in a time-domain circuit simulator.

Demos Added

"Modeling a High-Speed Backplane (Part 1: Measured 4-Port S-Parameters to a Rational Function Model)" shows how to use the toolbox to model a differential high-speed backplane using rational functions.

"Modeling a High-Speed Backplane (Part 2: Rational Function Model to a Verilog-A Module)" shows how to use toolbox functions to generate a Verilog-A module that models the high-level behavior of a high-speed backplane.

"Modeling a Differential High-Speed Backplane in Simulink" shows how to use Simulink to simulate a differential high-speed backplane.

Version 1.3 (R2006a) RF Toolbox Software

This table summarizes what's new in Version 1.3 (R2006a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Bug Reports at Web site	No

New features and changes introduced in this version are

S-Parameter Conversion Functions Added

Use the s2scc function to convert 4-port, single-ended S-parameters to 2-port, common mode S-parameters.

Use the s2scd function to convert 4-port, single-ended S-parameters to 2-port, cross mode S-parameters.

Use the s2sdc function to convert 4-port, single-ended S-parameters to 2-port, cross mode S-parameters.

Use the s2sdd function to convert 4-port, single-ended S-parameters to 2-port, differential mode S-parameters.

Version 1.2 (R14SP3) RF Toolbox Software

This table summarizes what's new in Version 1.2 (R14SP3):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Bug Reports at Web site	No

New features and changes introduced in this version are

extract Function Added

Use the `extract` function to extract specified network parameters from a circuit or data object and return the result in an array.

Circuit Object Added

Use `rfckt.rlcgline` to construct an RLCG transmission line object.

Transmission Line Object Improved

The new `Freq` property of the circuit object, `rfckt.txline`, is a vector of positive frequencies at which the parameter values are known.

The `Loss`, `PV`, and `ZO` properties of the circuit object, `rfckt.txline`, can now be vectors of line loss, phase velocity, and characteristic impedance values that correspond to the frequencies specified in the `Freq` property.

The new `IntpType` property of the circuit object, `rfckt.txline`, is the interpolation method used to calculate the parameter values between the known frequencies.

Touchstone Data File Support Improved

You can now read data from Touchstone data files that contain comments and spaces between sections of data.

Demos Improved

The demos have new documentation and can be accessed using an improved interface.

Command Window Help for Functions That Act on Circuit Objects Added

You can access help for functions that act on circuit objects by using the syntax `help` *functionname* at the MATLAB command prompt.

Version 1.1 (R14SP2) RF Toolbox Software

This table summarizes what's new in Version 1.1 (R14SP2):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	Bug Reports at Web site	No

New features and changes introduced in this version are

- "Plot Figures Integrated into the RF Tool GUI" on page 18
- "Five Objects Added" on page 18
- "Three Circuit Objects Added" on page 18
- "Methods Added" on page 19
- "Method Enhanced" on page 19
- "Functions Added" on page 19
- "General Enhancements" on page 19

Plot Figures Integrated into the RF Tool GUI

In earlier versions, a plot figure would appear in a separate window after clicking the **Plot** button. In this version, plot figures are integrated into the GUI itself.

Five Objects Added

These objects can be used to store rfdata such as network parameters, noise figure, power, IP3, and spot noise.

Three Circuit Objects Added

Use rfckt.delay to model delay lines, rfckt.hybridg to model hybrid G connected networks, and rfckt.passive to model RF passive networks.

Methods Added

The new `write` method allows saving of RF network data into files for all `rfckt` objects.

The new methods, `read` and `restore`, read and restore data for `rfckt.datafile`, `rfckt.amplifier`, and `rfckt.mixer`.

Method Enhanced

The `analyze` method now takes three additional optional inputs for the load, source, and reference impedances.

Functions Added

The functions `stabilitymu` and `stabilityk` calculate the stability factors μ and k.

The functions `h2g` and `g2h` convert between hybrid G and hybrid H parameters.

General Enhancements

It is now possible to create the objects `rfckt.amplifier` and `rfckt.mixer` from a MATLAB variable.

The frequency-dependent NF and IP3 data types were added to the AMP format.

Version 1.0.1 (R14+) RF Toolbox Software

This table summarizes what's new in Version 1.0.1 (R14+):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
No	No	Fixed bugs	No

Version 1.0 (R14) RF Toolbox Software

This table summarizes what's new in Version 1.0 (R14):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	No	No bug fixes	No

New features and changes introduced in this version are

- "Introduction to RF Toolbox Software" on page 21
- "RF Circuits" on page 21
- "Data Visualization" on page 22
- "Data Format Support" on page 22
- "RF Analysis GUI" on page 22

Introduction to RF Toolbox Software

RF Toolbox™ software lets you create and combine RF circuits for simulation in the frequency domain with support for both nonlinear and noise data. You can read, write, analyze, combine, and visualize RF network parameters. The toolbox enables you to

- Work directly with network parameter data.
- Model RF networks.
- Analyze circuits interactively.

RF Circuits

The toolbox provides classes that let you model these circuit objects and networks.

- Passive networks
- Amplifiers and mixers

- Transmission lines: coaxial, coplanar waveguide, general transmission, microstrip, parallel-plate, and two-wire

- SeriesRLC and shuntRLC circuits

- LC ladder filters: LC bandpass pi, LC bandpass tee, LC bandstop pi, LC bandstop tee, LC highpass pi, LC highpass tee, LC lowpass pi, and LC lowpass tee

- Networks: cascade, hybrid, parallel, and series

You can also model general circuit elements from data files.

Data Visualization

The toolbox lets you plot the network parameters of the circuits you create.

You can generate an X-Y plane plot, polar plane plot, or Smith Chart of one or more selected network parameters directly from your data. You can also generate these plots from circuit objects you create using the toolbox. See "RF Circuit Objects" and "RF Data Objects" for information.

Data Format Support

The toolbox supports the Touchstone SnP, YnP, ZnP, and HnP data file formats. It also introduces the MathWorks AMP format for amplifier data. For more information about this format, see "AMP File Format".

RF Analysis GUI

RF Tool is an RF analysis GUI that provides a visual interface for creating and analyzing RF (radio frequency) components and networks. You can create RF circuits quickly with the GUI. You can also import and export circuits from the MATLAB workspace and RF data files.

RF Tool also provides the ability to set circuit parameters, analyze circuits, view their resulting S-parameter data, and visualize the data using X-Y plane plots, polar plane plots, and Smith Charts.

Compatibility Summary for RF Toolbox Software

This table summarizes new features and changes that might cause incompatibilities when you upgrade from an earlier version, or when you use files on multiple versions. Details are provided in the description of the new feature or change.

Version (Release)	New Features and Changes with Version Compatibility Impact
Latest Version V2.4 (R2008b)	None
V2.3 (R2008a)	None
V2.2 (R2007b)	None
V2.1 (R2007a)	None
V2.0 (R2006b)	None
V1.3 (R2006a)	None
V1.2 (R14SP3)	None
V1.1 (R14SP2)	None
V1.0.1 (R14+)	None
V1.0 (R14)	None