RF Blockset™ 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 2.

Version (Release)	New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Latest Version V2.4 (R2009a)	Yes Details	Yes Summary	Bug Reports Includes fixes	Printable Release Notes: PDF Current product documentation
V2.3 (R2008b)	Yes Details	Yes Summary	Bug Reports Includes fixes	No
V2.2 (R2008a)	Yes Details	No	Bug Reports Includes fixes	No
V2.1 (R2007b)	Yes Details	No	Bug Reports	No
V2.0 (R2007a)	Yes Details	No	Bug Reports	No
V1.3.1 (R2006b)	No	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	No bug fixes	No
V1.0.2 (R14SP1)	No	No	List of bug fixes	No
V1.0.1 (R14+)	No	No	Fixed bugs	No
V1.0 (R14)	Yes Details	Not applicable	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 (R2009a) RF Blockset Software

This table summarizes what's new in V2.4 (R2009a):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes	Bug Reports at Web site	Printable Release Notes: PDF Current product documentation

New features and changes introduced in this version are:

- "New Option for Interpreting the Simulink Signal as the Incident Power Wave" on page 4
- "Enhanced Dielectric Loss Model in Three Transmission Line Blocks" on page 4

New Option for Interpreting the Simulink Signal as the Incident Power Wave

The Input Port block now provides the option to interpret the input Simulink signal as the incident power wave. This is the most common RF modeling interpretation. To select this option, use the new **Treat Simulink signal as** parameter.

Enhanced Dielectric Loss Model in Three Transmission Line Blocks

The following blocks now provide a more realistic model for dielectric loss:

- Coaxial Transmission Line
- Two-Wire Transmission Line
- Parallel-Plate Transmission Line

To specify dielectric loss, you use a new parameter, **Loss tangent**. This parameter replaces the **Conductivity in dielectric** parameter.

Compatibility Considerations

Your existing models that include blocks with a nonzero value for the **Conductivity in dielectric** parameter no longer model dielectric loss. Instead, the models issue a warning message and use the default value of zero for the **Loss tangent** parameter when you run the model.

Version 2.3 (R2008b) RF Blockset Software

This table summarizes what's new in V2.3 (R2008b):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Yes	Bug Reports at Web site	Printable Release Notes: PDF Current product documentation

New features and changes introduced in this version are:

- "New Plot Options Added to the Output Port Block" on page 6

- "Enhanced Noise Factor and Noise Temperature Visualization" on page 6

- "Physical Amplifier and Mixer Blocks Now Support Frequency-Dependent, Nonlinear Data" on page 7

- "Enhanced Downconverter Mixers" on page 7

- "Removed GammaMS and GammaML Polar Plot Options" on page 7

New Plot Options Added to the Output Port Block

You can plot the following new parameters from the **Visualization** tab of the Output Port block:

- OIP3 for the XY Plot

- OIP3, NFactor, and NTemp for the Budget Plot

For the definition of each parameter, see "Types of Plots".

Enhanced Noise Factor and Noise Temperature Visualization

You can now plot Noise Factor and Noise Temperature on an XY plot from the **Visualization** tab of all blocks in the Physical library.

Physical Amplifier and Mixer Blocks Now Support Frequency-Dependent, Nonlinear Data

You can now specify frequency-dependent nonlinear data on the **Nonlinearity Data** tab of all physical amplifier and mixer blocks. For more information about how to do this specification, see "Modeling Nonlinearity".

Enhanced Downconverter Mixers

Mixer blocks now model spectral inversion for down-converter physical mixers. As a result, blocks from the Mixers library no longer error out when you set the **Mixer type** parameter to `Downconverter` and the local oscillator frequency (LO) is greater than the input RF frequency.

Removed GammaMS and GammaML Polar Plot Options

You can no longer display GammaMS and GammaML on a Polar Plot from the **Visualization** tab of the Output Port block. These parameters are useful for detailed RF analysis, but not for the system-level RF analysis that RF Blockset™ software supports. In some cases, using RF Blockset software to plot these parameters can lead to incorrect results.

Compatibility Considerations

Your existing models that plot GammaMS and GammaML will not longer plot these parameters. Instead, the models will plot the default parameter for the Polar Plot when you run the model and click the **Plot** button in the **Visualization** tab of the Output Port block. Use RF Toolbox™ software to perform detailed RF analysis.

Version 2.2 (R2008a) RF Blockset Software

This table summarizes what's new in V2.2 (R2008a):

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	Printable Release Notes: PDF Current product documentation

New features and changes introduced in this version are:

- "Baseband-Equivalent Modeling Enhanced" on page 8
- "Demos Updated" on page 9

Baseband-Equivalent Modeling Enhanced

Two new Input Port block parameters provide better control of baseband-equivalent modeling:

- **Fractional bandwidth of guard bands** lets you specify Tukey windowing to reduce ringing and other artifacts in the baseband-equivalent model.

- **Modeling delay (samples)** lets you specify a delay to ensure that the baseband-equivalent model has a causal response.

For more information about these parameters and how to use them, see the Input Port block reference page and "Creating a Complex Baseband-Equivalent Model".

> **Note** If you create a model using RF Blockset Version 2.2 and run it in previous versions of the software, two things happen:
>
> - The blockset issues warnings indicating that the Input Port block does not have these two parameters.
>
> - The blockset ignores the values of these two parameters, and uses their default values.
>
> To avoid these warnings, use the Simulink **Save As** option to save the model in an earlier format, as described in "Saving a Model in an Earlier Simulink Version" in the Simulink documentation.

Demos Updated

The Touchstone® Data File for 2-Port Bandpass Filter demo now uses more realistic data.

The following demos now show how to display passband frequency values on the Spectrum Scope block:

- Data File for Amplifier
- Intermodulation Analysis of Physical Amplifier

Version 2.1 (R2007b) RF Blockset Software

This table summarizes what's new in V2.1 (R2007b):

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:

- "Series/Shunt RLC Library Added" on page 10
- "Physical Mixer Block Icons Updated" on page 11
- "Demos Added and Updated" on page 11

Series/Shunt RLC Library Added

The Series/Shunt RLC library contains series and shunt RLC blocks for designing lumped element cascades such as filters and matching networks. The library contains these new blocks:

- Series R
- Series L
- Series C
- Shunt R
- Shunt L
- Shunt C

These blocks used to be part of the Ladder Filters library and are now part of the Series/Shunt RLC library:

- Series RLC
- Shunt RLC

Physical Mixer Block Icons Updated

The icons for the blocks in the Mixer library now show the local oscillator that these blocks model. The following blocks have new icons:

- General Mixer
- S-Parameters Mixer
- Y-Parameters Mixer
- Z-Parameters Mixer

Demos Added and Updated

User-Defined Models: Nonlinear Amplifier uses a nonlinear amplifier example to show how to create custom (user-defined) models for RF Blockset software.

An Executable Specification for System Design now uses a more realistic model for the front-end filter and provides better instructions for validating the specification.

Version 2.0 (R2007a) RF Blockset Software

This table summarizes what's new in V2.0 (R2007a):

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

- "Agilent P2D and S2D System-Level Verification Model Support Added" on page 12
- "Dialog Boxes for Physical Blocks Reorganized" on page 13
- "Data File Import Improved" on page 14
- "Noise Specification Options Added" on page 14
- "Nonlinearity Specification Options Added" on page 14
- "Plotting Options Added" on page 14
- "Connection Port Block Added" on page 15
- "Demos Added" on page 15

Agilent P2D and S2D System-Level Verification Model Support Added

The General Amplifier and General Mixer blocks 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

For more information on specifying operating conditions, see "Specifying Operating Conditions".

Dialog Boxes for Physical Blocks Reorganized

The block dialog boxes of the Physical blocks are now organized by tab. All physical block dialog boxes now contain the following tabs:

- **Main** — Specify basic block parameters.

- **Visualization** — Specify plot parameters.

In addition, all physical amplifier and mixer blocks contain the following tabs:

- **Noise data** — Specify thermal noise data.

- **Nonlinearity Data** — Specify third-order intercept or power data.

The General Amplfier and General Mixer block dialog boxes also contain an **Operating Conditions** tab for specifying operating condition information after you import a P2D or S2D file into a block.

For information about the parameters available for a particular block, see the reference page for that block.

Data File Import Improved

For blocks that accept data from a file, the new **Data file** parameter lets you specify the name of the file to import. A new **Browse** button helps you find the file. Previous versions required you to use the RF Toolbox `read` function to import the file into the **RFCKT object** parameter.

Noise Specification Options Added

For physical amplifier and mixer blocks, the following noise specification options are now available:

- Spot noise data imported into the block

- Spot noise data in the block dialog box

- Noise figure, noise factor, or noise temperature value in the block dialog box

For more information on the new noise specification options, see "Modeling Noise".

Nonlinearity Specification Options Added

For physical amplifier and mixer blocks, the following nonlinearity specification options are now available:

- Power data, which consists of output power as a function of input power, imported into the block.

- Third-order intercept data, with or without one or more power parameters, in the block dialog box. The power parameters are gain compression power and output saturation power.

For more information on the new nonlinearity specification options, see "Modeling Nonlinearity".

Plotting Options Added

For the X-Y plane plot, the following options are now available in the **Visualization** tab:

- You can specify the scale of the *x*- and *y*-axes. The scale of each axis can be linear or logarithmic.

- You can create a plot that contains data on both the left and right *y*-axes.

For more information on the new plotting options, see "Plotting Model Data".

Connection Port Block Added

Use the Connection Port block in a subsystem composed of RF Blockset blocks to add an RF Blockset physical modeling connector port to the subsystem.

Demos Added

Power in Simulink Sources and Signals uses several Simulink and RF Blockset models to show how to set the amplitude of a source to achieve the desired power level and how to display the power and power spectrum of a Simulink signal.

An Executable Specification for System Design shows how to use the Model-Based Design methodology with the blockset to build an executable specification that helps to tightly couple interactions between the various design teams that are involved in the system-level design.

Version 1.3.1 (R2006b) RF Blockset Software

This table summarizes what's new in V1.3.1 (R2006b):

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

Version 1.3 (R2006a) RF Blockset Software

This table summarizes what's new in V1.3 (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 described here:

Upper and Lower Power Limit Parameters Added to the Mathematical Amplifier Block

Two parameters have been added to the Amplifier block in the Mathematical sublibrary. The **Upper input power limit for AM/PM conversion (dBm)** and **Lower input power limit for AM/PM conversion (dBm)** specify the maximum and minimum input power for which AM/PM conversion scales linearly with input power value. Beyond these limits, AM/PM conversion is constant at the values corresponding to the upper and lower input power limits

Version 1.2 (R14SP3) RF Blockset Software

This table summarizes what's new in V1.2 (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:

- "RLCG Transmission Line Block Added" on page 18

- "Frequency-Dependent Parameters Now Supported for the Transmission Line Block" on page 18

- "Budget Plots Now Supported for the Output Port Block" on page 19

- "Consistency Checking Added for Pin/Pout Data" on page 19

- "Parameter Specifying the Impulse Response Length Renamed" on page 19

- "Error Messages Improved" on page 19

- "Demos Improved" on page 19

RLCG Transmission Line Block Added

An RLCG Transmission Line block has been added to the Transmission Lines sublibrary of the Physical library. This block lets you model RLCG transmission lines.

Frequency-Dependent Parameters Now Supported for the Transmission Line Block

The Transmission Line block's **Characteristic impedance**, **Phase velocity (m/s)**, and **Loss (dB/m)** parameters can now be frequency dependent.

Budget Plots Now Supported for the Output Port Block

You can now create system budget plots from the Output Port block.

Consistency Checking Added for Pin/Pout Data

The blockset checks that the small signal gain calculated from the Pin/Pout data is the same as the gain (S_{21}) calculated from the S-parameters. If it is not, the blockset adjusts the Pin/Pout curve so that the small signal gain is the same as S_{21}.

Parameter Specifying the Impulse Response Length Renamed

The **Max length of impulse response** parameter has been renamed to **Finite impulse response filter length**. This change affects the Input Port, Lowpass RF Filter, Highpass RF Filter, Bandpass RF Filter, and Bandstop RF Filter blocks. The block behavior remains the same.

Error Messages Improved

The error and warning messages issued by the blockset are more descriptive.

Demos Improved

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

Version 1.1 (R14SP2) RF Blockset Software

This table summarizes what's new in V1.1 (R14SP2):

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 described here:

Series RLC Block Added

A Series RLC block has been added to the Ladder Filters sublibrary of the Physical library. This block lets you model a series RLC network.

Shunt RLC Block Added

A Shunt RLC block has been added to the Ladder Filters sublibrary of the Physical library. This block lets you model a shunt RLC network.

Output for Generic Real-Time (GRT) Targets Now Supported

You can use Real-Time Workshop® software with RF Blockset software to generate standalone executables for GRT targets.

Nonlinear Modeling of Physical Mixers and Amplifers Improved

Previously, the nonlinear algorithm that was used by the physical mixer and amplifier blocks was appropriate only for high-powered amplifiers (HPAs), which operate close to the saturation point. The new nonlinear algorithm can also be used for mixers and amplifiers that operate far below the saturation point and yield very weak intermodulation products.

As with the old algorithm, the saturated output power of the new algorithm is 8.3 dB below the third-order output intercept point (OIP3).

Where the previous algorithm was piecewise linear, the new nonlinear algorithm uses a linear plus cubic curve of amplitude-in versus amplitude-out to simulate the behavior of systems that operate far below the saturation point. Where the previous algorithm assumed a third-order intercept point (IP3) reference impedance of 50 ohm that was irrespective of the S-parameter reference impedance, the new algorithm assumes that the S-parameter reference impedance is the same as the IP3 reference impedance used to convert from IP3 to the amplitude-related constants in the model.

Note The corresponding Z and Y algorithms still assume a fixed 50-ohm conversion factor from specified power to modeled amplitude.

Version 1.0.2 (R14SP1) RF Blockset Software

This table summarizes what's new in V1.0.2 (R14SP1):

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

This version only includes bug fixes, listed here.

Physical Block Behavior in Saved Models Corrected

In RF Blockset software 1.0.1, if you ran a model that you had previously run and saved, RF physical blocks that were part of a subsystem in that model sometimes did not produce the correct results. In Version 1.0.2, this problem has been fixed.

Version 1.0.1 (R14+) RF Blockset Software

This table summarizes what's new in V1.0.1 (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 Blockset Software

This table summarizes what's new in V1.0 (R14):

New Features and Changes	Version Compatibility Considerations	Fixed Bugs and Known Problems	Related Documentation at Web Site
Yes Details below	Not applicable	No bug fixes	No

RF Blockset software includes these features:

Introduction to RF Blockset Software

RF Blockset software is a tool for design, analysis, and simulation of RF communications systems. It uses baseband-equivalent behavioral modeling to model and analyze RF systems in the time domain.

The blockset lets you assemble complex RF systems from libraries of RF components such as ladder filters, transmission lines, black box elements, amplifiers, and mixers. You can include Simulink, Signal Processing Blockset™, and Communications Blockset™ blocks in your model, as well as blocks from other MathWorks blocksets.

RF Blockset software works with RF Toolbox software. You can create complex topologies with the toolbox, and then use them in RF Blockset blocks for inclusion in an RF model.

RF Blockset Libraries

In RF Blockset software, blocks are divided into two categories:

- Physical — Blocks that model physical and electrical components in terms of geometry, physical interactions, and measured data

- Mathematical — Blocks that model components in terms of mathematical relationships

The Physical library includes the following sublibraries. Use blocks from these libraries to model the physical or electrical structure of portions of an RF system.

- Amplifiers — RF amplifiers described by S-, Y-, or Z-parameters, noise figure, and IP3, or a data file containing these parameters

- Ladder Filters — RF filters whose network parameters can be calculated from their topologies

- Mixers — RF mixers described by S-, Y-, or Z-parameters and phase noise, or a data file containing these parameters

- Transmission Lines — RF filters whose network parameters can be calculated from their geometry

- Black Box Elements — Passive RF components described by S-, Y-, or Z-parameters, or a data file containing these parameters

- Input/Output Ports — Blocks that connect mathematical portions of the model to the physical portions. Mathematical portions of the model may also include blocks from Simulink and other blocksets that describe components in mathematical terms.

Note You must use the Input Port and the Output Port blocks to bound a physical system. They convert mathematical Simulink signals to and from the RF Blockset physical modeling environment. This lets you include physical and mathematical blocks in the same model.

The Mathematical library includes amplifier, mixer, and filter blocks. These blocks provide mathematical equivalents of the RF components. Mathematical portions of an RF model may also include other Simulink blocks that describe components mathematically.

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Data Visualization

RF Blockset software lets you plot the network parameters of the component blocks in the Physical library. For each such block, you can generate an X-Y plane plot, polar plane plot, or Smith® Chart of selected network parameters in a specified frequency range. The dialog box for each block contains the parameters you need to specify the plot.

The blockset also provides a composite plot which includes four separate plots in one figure. This predefined combination of plots differs based on the type of block.

Data Format Support

RF Blockset software supports the Touchstone S2P, Y2P, Z2P, and H2P data file formats. It also introduces the MathWorks AMP format for amplifier data. The AMP format is intended for use as input to the General Amplifier block. For more information about the AMP format, see "AMP File Format" in the RF Toolbox documentation.

Demos

Demos are available on the **Demos** tab of the MATLAB Help browser. These demos show examples of linear filtering and nonlinear amplification, as well as transmitters and receivers.

Compatibility Summary for RF Blockset 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 (R2009a)	See the **Compatibility Considerations** subheading for this new feature or change: • "Enhanced Dielectric Loss Model in Three Transmission Line Blocks" on page 4
V2.3 (R2008b)	See the **Compatibility Considerations** subheading for this new feature or change: • "Removed GammaMS and GammaML Polar Plot Options" on page 7
V2.2 (R2008a)	None
V2.1 (R2007b)	None
V2.0 (R2007a)	None
V1.3.1 (R2006b)	None
V1.3 (R2006a)	None
V1.2 (R14SP3)	None
V1.1 (R14SP2)	None
V1.0.2 (R14SP1)	None
V1.0.1 (R14+)	None
V1.0 (R14)	None