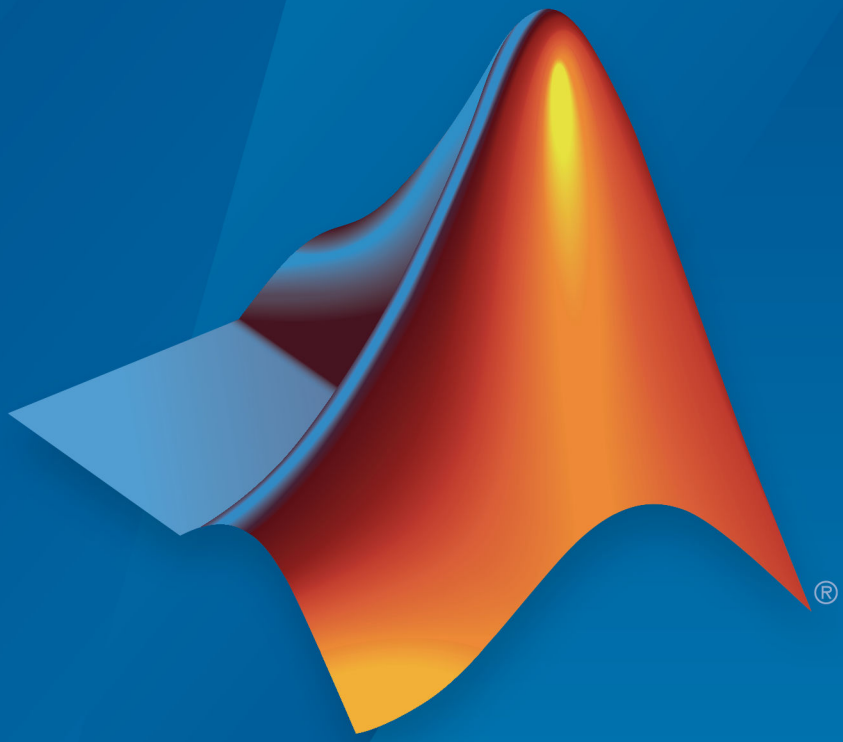
WLAN Toolbox™ Release Notes



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The MathWorks, Inc.
1 Apple Hill Drive
Natick, MA 01760-2098

WLAN Toolbox™ Release Notes

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R2019a

Version: 2.1

New Features

IEEE 802.11ax Signal Recovery Functions: Decode L-SIG and HE-SIG-A fields

You can now decode the L-SIG and HE-SIG-A fields for IEEE® 802.11ax™ format. The “802.11ax Signal Recovery with Preamble Decoding” example shows how to recover single-user and multi-user 802.11ax signals by using the `wlanHERecoveryConfig` object and the `wlanLSIGBitRecover` and `wlanHESIGABitRecover` functions.

IEEE 802.11ay Support: Simulate 802.11ay propagation conditions

Use the `wlanTGayChannel` System object™ to simulate 802.11ay™ propagation conditions as demonstrated in the “802.11ad Packet Error Rate Single Carrier PHY Simulation with TGay Channel” example. The ray-tracing-based channel model, described by Task Group ay, supports antenna array specification, SU-SISO and SU-MIMO, unpolarized and polarized signals, and beamforming. For more information, see “WLAN Channel Models” and “Propagation Channel Models”.

Wireless Waveform Generator App Updates

With the **Wireless Waveform Generator** app, you can now:

- Create WLAN waveforms that are compliant with 802.11ax modulation schemes.
- Generate a waveform that you can transmit with a connected lab test instrument. The Wireless Waveform Generator app can generate waveforms for instruments supported by the `rfsiggen` function. Use of the transmit feature in the Wireless Waveform Generator app requires Instrument Control Toolbox™.

MAC Frame Parser Functions: Deaggregate A-MPDUs and decode MPDUs

You can now parse WLAN medium access control (MAC) frames. Decode MAC protocol data units (MPDUs) with the `wlanMPDUDecode` function and deaggregate aggregated MPDUs (A-MPDUs) with the `wlanAMPDUDeaggregate` function.

This feature is demonstrated in the added “802.11 MAC Frame Decoding” example and the updated “802.11 OFDM Beacon Receiver with Live Data” example.

IEEE 802.11ax Draft 3.1 Support

With the added IEEE 802.11ax support, you can:

- Generate HE-format WLAN MAC frames compliant with IEEE 802.11ax Draft 3.1 using the `wlanMACFrame` function.
- Simulate an HE-MU packet with more than 16 HE-SIG-B symbols.
- Generate HE packets containing a PSDU of up to 6,500,631 bytes.

System-Level Simulation Examples: Simulate a WLAN network

These examples show you how to simulate 802.11™ networks by simulating individual links between different nodes:

- “802.11ax PHY-Focused System-Level Simulation”
- “Multi-Node 802.11a Network Modeling with PHY and MAC”

R2018b

Version: 2.0

New Features

Bug Fixes

IEEE 802.11ax Support: Generate IEEE 802.11ax (Draft 2.0) high-efficiency (HE) waveforms and simulate end-to-end links

WLAN Toolbox now supports 802.11ax Draft 2.0 waveform generation and link-level simulation of single user (HE-SU, HE-EXT-SU) and multi-user (HE-MU) formats.

The 802.11ax Packet Error Rate Simulation for Uplink Trigger-Based Format example shows how to measure the packet error rate of an uplink trigger-based (HE-TB) format link.

Wireless Waveform Generator App: Create, impair, visualize, and export modulated waveforms

Using the **Wireless Waveform Generator** app you can:

- Create OFDM, QAM, or PSK modulated waveforms or a sine wave test waveform.
- Create WLAN waveforms that are compliant with various 802.11 modulation schemes (a/b/g/j/p/n/ac/ad/ah).
- Add RF impairments to your waveforms.
- Plot waveforms in constellation diagram, spectrum analyzer, and time scopes.
- Export waveforms from the app to your MATLAB® workspace or a file.

MAC Frame Support: Generate data, management, and control frames

This release adds support for inbuilt MAC Frame generation. This feature includes the following functions:

- `wlanMACFrame`: WLAN MAC frame generation (MPDU or A-MPDU)
- `wlanMSDULengths`: Returns a vector of MSDU lengths required to generate a MAC frame of given length, MAC configuration, and PHY configuration.
- `wlanMACFrameConfig`: MAC frame configuration object with properties relevant to the IEEE 802.11 MAC frame.
- `wlanMACManagementConfig`: MAC management configuration object with properties relevant to the IEEE 802.11 MAC management frame body.

IEEE TGay Channel Model Example: Simulate an end-to-end, DMG format WLAN link over a TGay millimeter wave channel

The 802.11ad Packet Error Rate Single Carrier PHY Simulation with TGay Channel example shows how to determine the packet error rate for an 802.11ad™ SC link with a TGay fading channel at a selection of SNR points.

IEEE 802.11ad RF Beamforming Example: Simulate an end-to-end, DMG format WLAN link with RF beamforming

The 802.11ad Single Carrier Link with RF Beamforming in Simulink example shows how to model an IEEE 802.11ad single carrier link with RF beamforming. This example also displays the packet error rate after processing each packet, the equalized symbol constellation, and EVM measurements.

IEEE 802.11p V2V Link Example: Simulate an end-to-end link over a vehicular channel model

The 802.11p Packet Error Rate Simulation for a Vehicular Channel example shows how to measure the packet error rate of an IEEE 802.11p™ link with a V2V fading channel and additive white Gaussian noise.

Functionality Being Removed or Changed

The `wlanGeneratorConfig` object has been removed. Use `Name, Value` pair syntax of `wlanWaveformGenerator` for parameterizing the `wlanWaveformGenerator` function. See `wlanWaveformGenerator` for the recommended parameter `Name,Value` pair syntax.

R2018a

Version: 1.5

New Features

IEEE 802.11ax Examples: Generate IEEE 802.11ax high efficiency (HE) waveforms and simulate downlink end-to-end links

This release adds three examples which show how WLAN System Toolbox functions can be used to simulate IEEE 802.11ax Draft 1.1:

- 802.11ax Parameterization for Waveform Generation and Simulation shows how to parameterize and generate different types of IEEE 802.11ax high efficiency (HE) formats.
- 802.11ax Packet Error Rate Simulation for Single User Format shows how to measure the packet error rate of an IEEE 802.11ax high efficiency (HE) single user format link.
- 802.11ax OFDMA and Multi-User MIMO Throughput Simulation shows the transmit and receive processing for an IEEE 802.11ax multi-user downlink transmission over a TGax indoor fading channel. Three transmission modes are simulated: OFDMA, MU-MIMO, and a combination of OFDMA and MU-MIMO.

IEEE TGax Indoor Channel Model: Simulate indoor 802.11ax propagation conditions for both single and multiuser scenario

In this release, WLAN System Toolbox™ provides the channel model described by the TGax task group. Use the `wlanTGaxChannel` System object to model 802.11ax indoor propagation conditions. For more information, see WLAN Channel Models and Propagation Channel.

IEEE 802.11ad Single Carrier PHY Example: Simulate an end-to-end, DMG format WLAN link over an AWGN with synchronization and equalization

This example enables you to study synchronization and equalization techniques in an end-to-end IEEE 802.11ad Single Carrier PHY link.

IEEE 802.11ad Extended MCS Support: Generate IEEE 802.11ad waveforms with the extended modulation and coding schemes (MCS) for the single carrier PHY

The toolbox now supports the extended modulation and coding schemes (MCS) for the IEEE 802.11ad single carrier PHY as specified in IEEE 802.11-2016.

R2017b

Version: 1.4

New Features

IEEE 802.11ad Receiver: Demodulate and decode directional multi-gigabit waveforms

This release adds support for IEEE 802.11ad demodulation and decoding steps. The 802.11ad specification defines the WLAN directional multi-gigabit (DMG) format.

This feature is contained in these functions:

- `wlanDMGDataBitRecover`: Recovers data bits from DMG Data field.
- `wlanDMGHeaderBitRecover`: Recovers header bits from DMG Header field.

Three new IEEE 802.11ad examples explain how to perform an end-to-end simulation in the different PHY types.

IEEE 802.11ah Example: Simulate an end-to-end sub 1 GHz link with the TGah channel model

802.11ah Packet Error Rate Simulation for 2x2 TGah Channel shows how to measure the packet error rate of an IEEE 802.11ah™ S1G short preamble link with a fading TGah indoor channel model and additive white Gaussian noise.

Simulink Example: Model a WLAN link in Simulink

WLAN Link Modeling in Simulink: Use the end-to-end 802.11n™ HT link example to explore the capabilities of WLAN System Toolbox in Simulink®.

Bit-Level Processing Functions: Explore standard-compliant bit-level algorithms

WLAN Toolbox includes standard compliant bit-level functions:

- `wlanScramble`: Scramble and descramble binary input.
- `wlanBCCInterleave` and `wlanBCCDeinterleave`: Interleave and deinterleave binary convolutionally encoded input.
- `wlanBCCEncode` and `wlanBCCDecode`: Convolutionally encode and decode input.
- `wlanStreamParse` and `wlanStreamDeparse`: Stream-parse and deparse binary input.

- `wlanSegmentParseBits` and `wlanSegmentDeparseBits`: Segment-parse and deparse binary input.
- `wlanSegmentParseSymbols` and `wlanSegmentDeparseSymbols`: Segment-parse and deparse symbols.
- `wlanConstellationMap` and `wlanConstellationDemap`: Modulate and demodulate input.

You can explore these functions and customize their algorithms and functionality.

R2017a

Version: 1.3

New Features

Bug Fixes

Compatibility Considerations

IEEE 802.11ad Support: Generate IEEE 802.11ad compliant waveforms

This release adds support for IEEE 802.11ad waveform generation. The 802.11ad specification defines the WLAN directional multi-gigabit (DMG) format. For details, see `wlanDMGConfig`.

IEEE TGah Indoor Channel Model: Simulate 802.11ah propagation conditions

In this release, WLAN System Toolbox provides the channel model described by the TGah task group. Use the `wlanTGahChannel` System object to model 802.11ah propagation conditions. For more information, see WLAN Channel Models and Propagation Channel.

OFDM Timing Synchronization: Detect and estimate symbol timing offsets in a received OFDM signal

A WLAN OFDM timing synchronization function,`wlanSymbolTimingEstimate`, returns the symbol timing estimate of a received OFDM waveform.

MATLAB Compiler Support: Compile WLAN models into standalone applications

WLAN System Toolbox now supports MATLAB Compiler™ enabling you to produce standalone executables. For details, see Code Generation and Deployment.

Scrambler Bit Mapping Change: Mapping of scrambler initialization seed is swapped

The scrambling operation now swaps the MSB-to-LSB mapping for the initialization seed for all supported WLAN packet formats. This change aligns the scrambler operation with the mapping indicated for 802.11ad. These functions perform the scrambling operation `wlanWaveformGenerator`, `wlanNonHTData`, `wlanHTData`, and `wlanVHTData`.

R2016b

Version: 1.2

New Features

IEEE 802.11ah Support: Generate IEEE 802.11ah compliant waveforms

This release adds support for IEEE 802.11ah waveform generation. For details, see `wlanS1GConfig` and 802.11ah Waveform Generation.

Multiuser-MIMO Receiver: Decode and analyze 802.11ac multiuser waveforms

This release adds support for IEEE 802.11ac™ MU-MIMO receiver. For details, see 802.11ac Multi-User MIMO Precoding.

LDPC Channel Coding: Analyze the performance of 802.11ac/n links using low-density parity-check (LDPC) channel coding techniques

This release adds LDPC support for IEEE 802.11ac and 802.11n. For details, see 802.11n Packet Error Rate Simulation for 2x2 TGn Channel.

Beacon Frame Generation Example: Create Beacon frames for receiver testing and over-the-air transmission

This release adds an example that creates and transmits a WLAN OFDM Beacon. You can transmit Beacon frames using an SDR platform, and then receive and view the Beacon using a standard Wi-Fi® device. For details, see 802.11 OFDM Beacon Receiver with USRP Hardware.

Productize functions

WLAN packet detection and format detection functions are productized in this release.

- Packet detection — Use the function `wlanPacketDetect` to return the offset from the start of the input waveform to the start of the detected preamble.
- Format detection — Use the function `wlanFormatDetect` to detect and return the packet format for the specified received signal.

R2016a

Version: 1.1

New Features

Bug Fixes

Support for 802.11p Standard: Simulate 802.11p systems to analyze Intelligent Transportation Systems (ITS) applications

The toolbox now supports IEEE 802.11p communications systems. Transmit and receive OFDM functions now include options for 10 MHz or 5 MHz channel bandwidth. For examples on how to use the 802.11p standard, see:

- 802.11p and 802.11a Packet Error Rate Simulations — Measures packet error rates in 802.11p and 802.11a™ links using an end-to-end simulation with a fading channel and AWGN.
- 802.11p Spectral Emission Mask Testing — Performs spectrum emission mask tests for an 802.11p transmitted waveform.

Support for 802.11j Standard: Simulate 802.11j systems to analyze Japanese WiFi market applications

Support is enabled for IEEE 802.11j™ communications systems. Transmit and receive OFDM functions now provide option for 10 MHz channel bandwidth.

Functionality Being Removed or Changed

Use of the `wlanGeneratorConfig` object is discouraged for parameterizing the `wlanWaveformGenerator` function. See `wlanWaveformGenerator` for the recommended parameter `Name,Value` pair syntax.

Functionality	Result	Use Instead	Compatibility Considerations
`wlanWaveformGenerator(bits,cfgFormat,cfgWaveGen)` where `cfgWaveGen` is a `wlanGeneratorConfig` object.	Still runs	`wlanWaveformGenerator(bits,cfgFormat,Name,Value,...,NameN,ValueN)`	Replace all instances of old function syntax with new function syntax.

R2015b+

Version: 1.0

New Features

IEEE 802.11ac and 802.11b/a/g/n standard-compliant physical layer models

WLAN System Toolbox provides standard-compliant functions for the design, simulation, and verification of IEEE 802.11 b/a/g/n/ac communications systems.

Very high throughput (VHT), high throughput (HT-mixed), and legacy (non-HT) waveform generation

WLAN System Toolbox provides 802.11 standard-compliant waveform generation for VHT, HT, and non-HT formats.

For more information, see Waveform Generation and Signal Transmission.

Channel coding, modulation (OFDM, DSSS, CCK), spatial stream mapping, and MIMO receivers

WLAN System Toolbox provides 802.11 standard-compliant functions for individual preamble field creation and decoding, OFDM demodulation and channel estimation, carrier frequency offset estimation, and data recovery. Single input single output (SISO) and multiple input multiple output (MIMO) antenna configurations are supported.

For more information, see Packet Recovery and Signal Reception.

Channel models, including TGac and TGn

WLAN System Toolbox provides channel models described by the TGac and TGn task groups. For more information, see WLAN Channel Models and Propagation Channel.

Measurements including channel power, spectrum mask, EVM, PER, and occupied bandwidth

WLAN System Toolbox examples show how to measure signal characteristics and system performance.

Waveform transmission and reception with radio devices and instruments

When coupled with a radio hardware support package, WLAN System Toolbox functions enable transmission and reception of packet contents with radio devices and instruments.

C code generation support

All WLAN System Toolbox functions support C code generation. Also, you can access the underlying code to customize the algorithms and functions.