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5G Systems with AWR Software

Communications standards library supports simulation and modeling of 5G systems

The 5G library, inclusive of testbenches and phased array development features, works seamlessly with the Cadence® AWR Design Environment® platform. From beamsteering and multiple-input and multiple-output (MIMO)-based antenna systems to new modulation waveforms, 5G has adopted many new technologies to achieve its high data capacity and low-latency performance goals. Simulation and modeling plays an important role in the development of these new technologies driving 5G products. Software solutions for phased array antenna development, along with access to standards-based signals and preconfigured virtual testbenches for 5G uplink/downlink communication systems, are needed to help component and system developers simulate real-world operating conditions.

5G Advantage

The 5G library gives Cadence AWR® Visual System Simulator™ (VSS) software users access to current 5G candidate signals, implemented as a fully parameterized block with source subcircuits that provide adjustable parameters such as carrier frequency, subcarrier spacing, number of subcarriers, filtering, and subcarrier mapping.

The library also includes the powerful phased array antenna generator wizard for developing MIMO and beamsteering arrays and feed networks. It works with AWR VSS software to support accurate link-budget analysis, inclusive of over-the-air (OTA) channel effects for spectral interference mitigation, and component performance specifications.
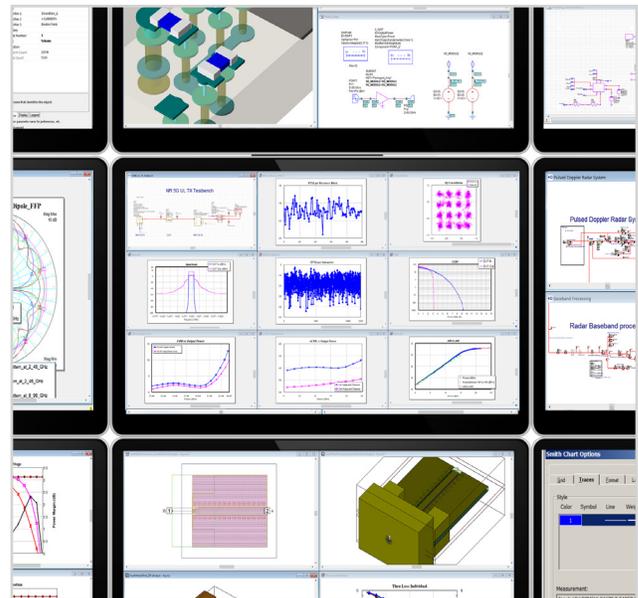
Product Strengths

Waveforms

The library for 5G NR provides designers with a simulation model with a 3GPP standard-compliant interface featuring modulation/coding details for an RF waveform with accuracy to support radio circuit-level evaluations. The choice of radio waveform is the core physical-layer decision for any wireless access technology. After assessments of all the waveform proposals, 3GPP adopted OFDM with a cyclic-prefix for both DL and UL transmissions, currently implemented in the library. Like all of the communications standards incorporated within AWR VSS software, the library provides specification of the channel coding, multi-plexing, and mapping to physical channels for 5G NR.

Testbenches

The library offers pre-configured testbenches for the latest 5G signals and frameworks proposed by various industry groups. With AWR VSS software, systems engineers can optimize the performance of RF front-end components, such as power amplifiers, based upon PAR, ACLR, EVM, or any number of performance metrics.

The software enables designers to evaluate the in-situ performance of other devices in the system, not just for 5G FR1 and FR2, but also for all current cellular standards. EVM measurements can be made on individual sub-carriers and/or over the OFDM symbol. Adjacent channel interference analysis can also be easily performed. AWR VSS users can insert their 5G component or subsystem designs into the testbenches and evaluate their performance under 5G systems requirements.

Phased Arrays

The library provides a framework supporting phases of phased array design configuration, analysis, and optimi-zation. Antenna radiation data from simulation/measured data can be imported into the phase array generator wizard, allowing designers to use the same antenna response as they optimize the array configuration and develop the feed network. The wizard generates the entire phased array component in a hierarchical network that includes the feed structure (combiner/divider), amplitude/phase control per radiating element, and the antenna array itself—ready for EM analysis.

Features

Highlights

- ‣ Standards-based signal-generation models
  - – UL/DL mapping to physical channels
  - – Calculates a cyclic redundancy code (CRC) for a binary input stream
  - – Code-block segmentation
  - – Channel coding, polar coding, and low-density parity check coding for 3GPP NR (5G) standard
  - – Previous 5G candidate waveforms (OFDM, GFDM, FBMC)
- ‣ Pre-configured virtual testbenches
  - – Low-data rate communication systems such as NB-IoT
  - – For standalone, in-guard, and in-band operation modes
- ‣ Phased array generator wizard
  - – 2D-array geometry using predefined lattice or circular
  - – Characteristics of the feed network
  - – EM structure representing an individual antenna element
  - – Specify settings for the RF links, gain and phase tapers, and element failures for example

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