

Datasheet:

5G Library: Standards-Compliant Models, Test Benches and Phased-Array Generation Wizard

Overview

From beam-steering and MIMO-based antenna systems to new modulation waveforms, 5G will adopt many new technologies to achieve its high data capacity and low-latency performance goals. Simulation and modeling will play 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 pre-configured virtual test benches for 5G uplink/downlink communication systems, are needed to help component and system developers simulate real-world operating conditions.

The 5G modulation waveforms library (5GW), inclusive of test benches and phased-array development features, works seamlessly with Visual System Simulator™ (VSS) system-level design software. This 5G library gives VSS 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 beam-steering arrays and feed networks. The W5G library works with VSS software to support accurate link-budget analysis, inclusive of over-the-air (OTA) channel effects for spectral interference mitigation, and component performance specifications.

Features at a Glance

- 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 test benches
 - 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



Waveforms

VSS software for 5G NR provides designers with a simulation model with a 3GPP standard-compliant interface featuring modulation and coding details for an RF waveform with the 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 (CP) for both DL and UL transmissions, currently implemented in the W5G library. Like all of the communications standards incorporated within VSS software, the W5G library provides specification of the channel coding, multiplexing, and mapping to physical channels for 5G NR.

Test Benches

VSS software offers pre-configured test benches for many of the latest 5G signals and frameworks proposed by various industry groups, including the Verizon 5G Technology Forum (5gtaf.org), a partnership between a number of industry leaders in the 5G area focused on 28/39 GHz fixed wireless applications. With VSS for 5G NR, systems engineers can readily optimize the performance of RF front-end components, such as a power amplifier, based upon PAR, ACLR, EVM, or any number of performance metrics.

The software also enables designers to effectively evaluate the in-situ performance of other devices in the system, not just for 5G FR1 (410 MHz - 7125 MHz) and FR2 (24250 MHz - 52600 MHz), but also for all other current cellular standards. EVM measurements can be made on individual sub-carriers and/or over the entire OFDM symbol.

Adjacent channel interference (ACI) analysis can also be easily performed. Furthermore, there is no need to start with complicated and difficult-to-understand test benches in order to obtain critical performance measurements as VSS can extend simulation analyses to include a DUT in the laboratory via the use of LabVIEW and/or TestWave software. VSS users can insert their 5G component or sub-system designs into the test benches and evaluate their performance under the requirements of 5G systems.

Phased Arrays

Phased-array antennas are made up of multiple individual radiating elements (antennas), each fed with an RF signal controlled through phase shifters in such a way that the radio waves from the separate antennas add together to increase the radiation, forming a beam in a desired direction, while suppressing radiation in undesired directions. The W5G library works with the NI AWR Design Environment platform to provide a framework supporting all phases of phased-array design configuration, analysis and optimization. Antenna radiation data from simulation or 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 then 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.

