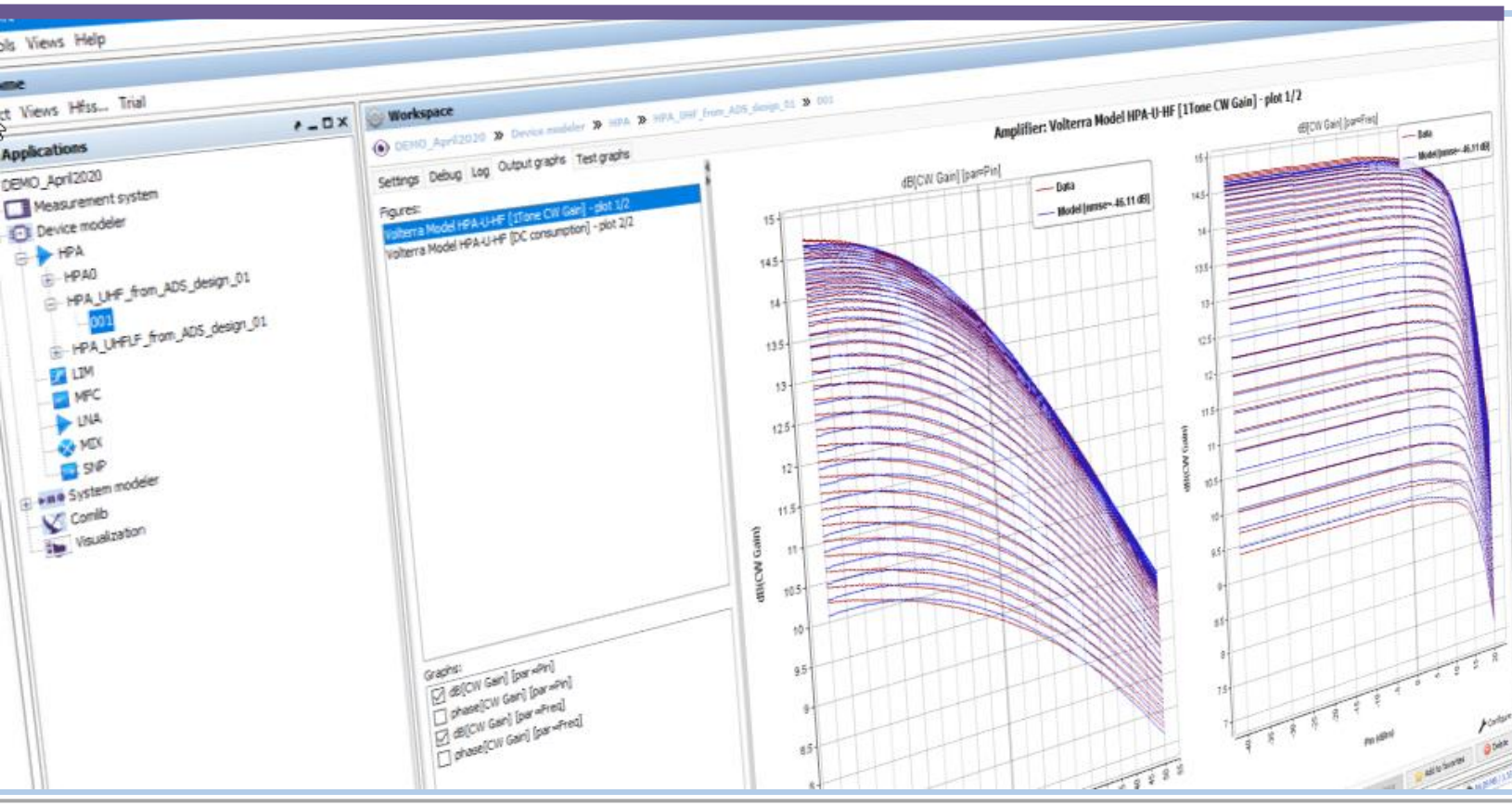
Strengthen, Accelerate and Secure your System Design Flow

VISION

Behavioral Modeling for System Design



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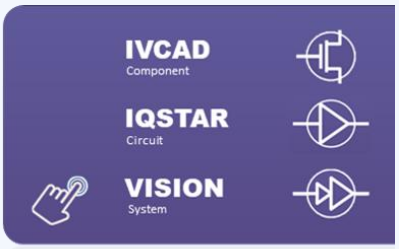
AMCAD Engineering
Advanced Modeling for Computer-Aided Design

VISION

Introduction

VISION is an advanced circuit and system modeling solution for accurate RF & Microwave system design. Building RF systems designed to operate with wideband modulated signals, like 5G and RADAR, or with a large number of circuits, like active antennas, is challenging. From the simulation accuracy standpoint, the limitation is always the quality of the model used by the simulator. Different memory effects can be observed in the behavior of circuits, and yet the model does not include these characteristics.



Vision offers a comprehensive methodology to extract complete and accurate circuit models that consider all observed phenomena for accurate system simulations.

Vision enables leveraging circuit models to design complex system architectures using its schematic editor to ensure a reliable bottom-up design flow process.

Capabilities

Vision software allows extracting behavioral models of RF and microwave circuits for accurate simulation of complex systems using time-domain signal analysis.

These models can be extracted using data generated from:

- A circuit simulation using CAD tools dedicated to RF circuit designs, with S-parameters and Harmonic Balance simulation capabilities
- The characterization measurements using on-the-shelf available circuits.

Different circuit models can be assembled in a schematic editor to simulate the whole behavior of the subsystem and observe the contribution of each circuit to the overall performance. The fine time-domain analysis of the signal envelope can be made while considering complex parasitic phenomena such as low-frequency memory effects (linked to the signal envelope), high-frequency memory effects (linked to the carrier frequency), and the dynamic influence of temperature. The inter-stage mismatch between different circuits is also accounted for.

Once the system is designed, Vision allows the export of the designed system architecture with the schematic editor as a global macro-model to third-party system simulators.

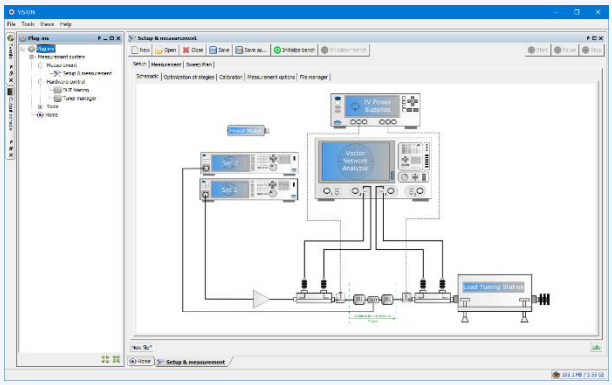
As the exported macro-model integrates its equation solver, the results of the time-domain simulation have the same precision, whatever targeted simulator.

Vision software embeds different options.

VIS100B-1: VISION, MODEL EXTRACTION BENCH CONTROL

The VIS100B-1 module allows the control of standard equipment, generally available in laboratories, to extract the different types of behavioral models supported by Vision.

With an extensive advanced drivers' library, this module allows the control of multiple instruments from different vendors, including vector network analyzers, vector signal generators and analyzers, PXI chassis-based transceivers, and all peripheral instruments (power supplies, power meters, multimeters…). Please contact us to check compatibility with your hardware.



MODEL EXTRACTION BENCH CONTROL

The quality of the measurements depends significantly on the calibration of the measurement system. Therefore, Vision includes an instrument dependent step-by-step calibration wizard.

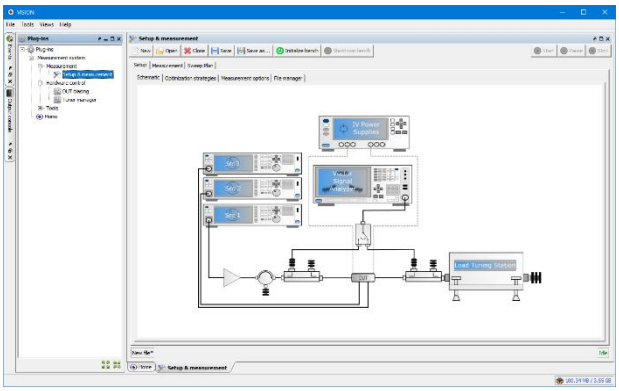
Once the calibration of the system is verified and validated, specific extraction signals, using multi-tones, are used to measure the circuit response and allow the extraction of different models for the circuit under test.

All the measurements are automated as the settings and configurations can be saved and reloaded for each setup, including the calibration files.

VIS100B-2: VISION, MODEL VALIDATION BENCH CONTROL

The VIS100B-2 module allows the control of test benches for the advanced validation of circuits' behavioral models.

During a system-level data-flow simulation, the system designer analyzes each circuit's response carefully. Therefore, he needs to evaluate the direct impact of the non-ideal response of each circuit on different criteria used to evaluate the performance of the system under a modulated signal (EVM, ACPR, NPR).



MODEL VALIDATION BENCH CONTROL

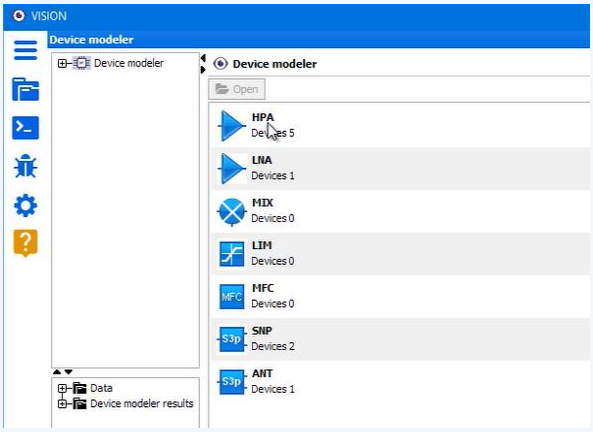
On top of the model extraction, Vision offers a specific bench control module to help measure the circuit performances when excited with a modulated signal like the one used for the final application.

Consequently, the designer can compare the simulation results with measurement data and, if needed, refine the model to have a better agreement.

VIS100C-1: VISION, DEVICE MODELER

The Device Modeler extracts behavioral models for different types of circuits to allow time-domain simulations.

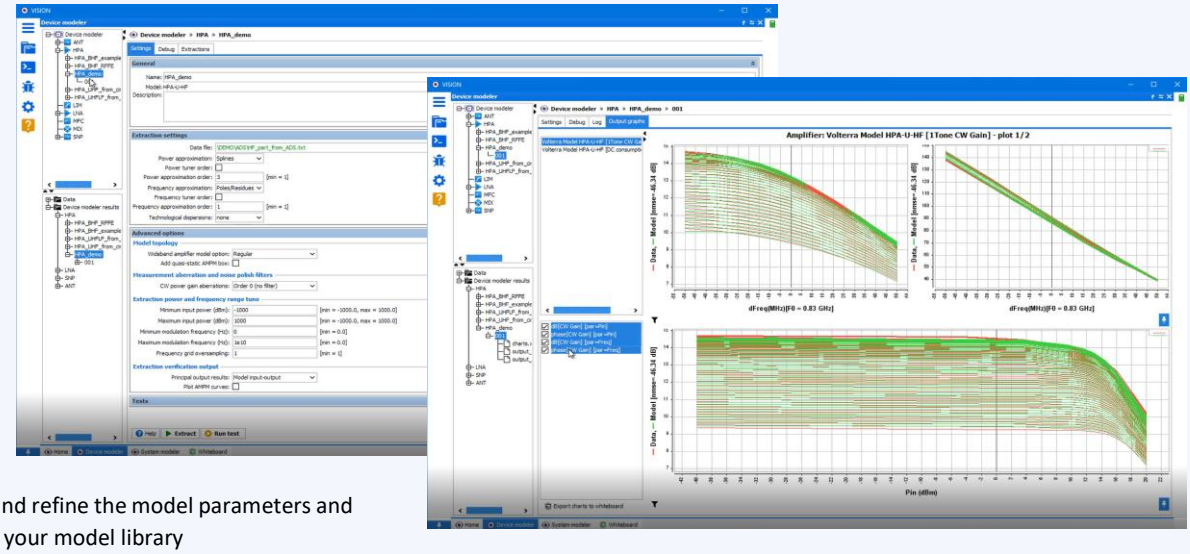
- LIMITER MODELER (non-linear model of power limiters)
- MIXER MODELER (non-linear model for mixers, configurable in frequency and power)
- PASSIVE MODELER (model of passive components / filters / attenuators)
- LNA MODELER (bilateral model of Low Noise Amplifier)
- HPA MODELER (model of High Power Amplifier integrating high-frequency memory effects and mismatch effects)



DEVICE MODELER

	Nonlinear	Mismatch	In-band Memory	Low frequency Memory	NF (noise)
LIMITER MODELER	✓	N.A.	✓	N.A.	N.A.
MIXER MODELER	✓	N.Av	✓	N.A.	✓
PASSIVE MODELER	N.A.	✓	✓	N.A.	✓
LNA MODELER	✓	✓	✓	N.Av.	✓
HPA MODELER	✓	✓	✓	N.Av.	N.A.

N.A. : Non Applicable / N.Av. : Non available



Tune and refine the model parameters and create your model library

Passive and MFC modelers allow extracting a behavioral model from frequency-domain characterization (s2p file, citifile etc.) suitable for a time-domain simulator.

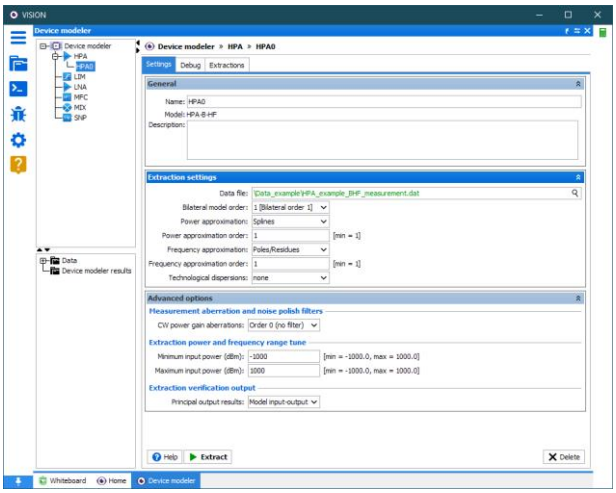
VIS100C-2: VISION, DEVICE MODELER ADD-ON

The Device Modeler Add-On allows more advanced behavioral models extraction for different circuit types :

- MFC MODELER (models of multifunction circuits, integrating commands defining the state of the component)

- HPA-B-HF-T° MODELER (bilateral and nonlinear model of a power amplifier with high-frequency memory effects linked to the carrier frequency of the modulation and, considering the temperature dependency using an equivalent RC Cell definition)

- HPA-U-HF-LF MODELER (bilateral and nonlinear model of a power amplifier with both high-frequency memory effects linked to the carrier frequency of the modulation and low-frequency memory effects linked to the modulation frequency of the envelope)



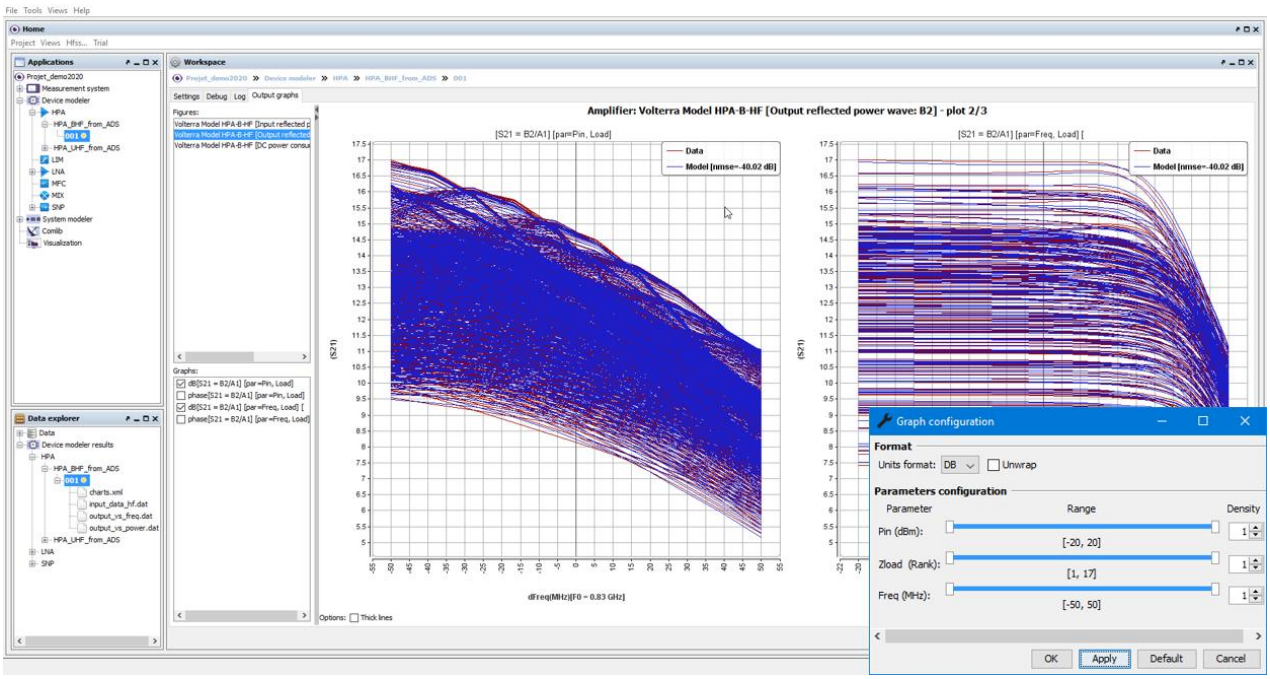
DEVICE MODELER ADD-ON

- ANTENNA MODELER (An SnP block represents the antenna model to consider the mutual coupling between different unitary radiating elements of the array. Vision can calculate the incident and reflected signal at each port of the antenna array, allowing accurate calculation of the radiation pattern and taking into account the behavior of each front-end circuit.)

Bilateral models consider the phenomena of mismatches between circuits, even during a data-flow type simulation. Whether in the " DEVICE MODELER " or " DEVICE MODELER ADD-ON," the user can adjust the model extraction parameters (Power approximation order, frequency approximation order, bilateral model order…), and see almost immediately the influence of each parameter on the ability of the model to agree with the reference data.

	Nonlinear	Mismatch	In-band Memory	Low frequency Memory	NF (noise)
MULTI FUNCTION CHIP MODELER	N.Av.	✓	✓	N.Av.	N.Av.
HPA T° MODELER	✓	✓	✓	T°	N.A.
HPA HF-LF MODELER	✓	N.Av	✓	✓	N.A.
ANTENNA MODELER *	N.A.	✓	✓	N.A.	✓

N.A. : Non Applicable / N.Av. : Non available / T° : Thermal RC cells can be defined to model the thermal behavior



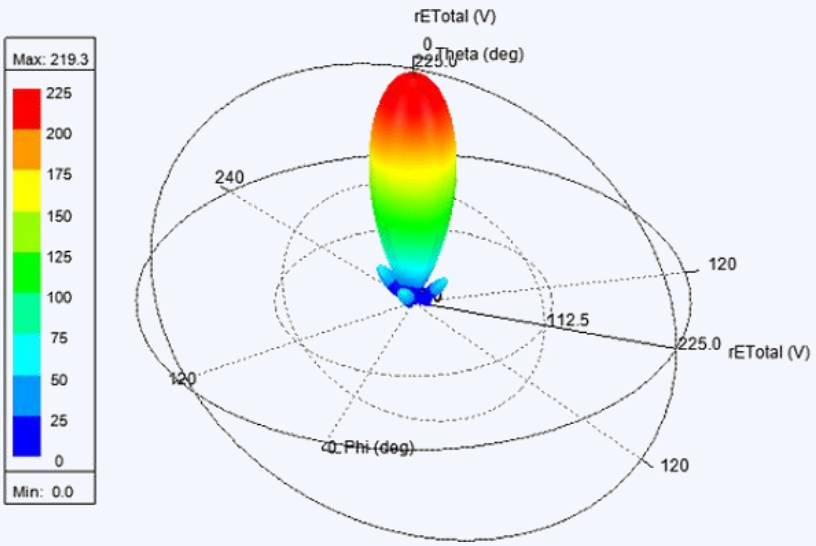
CIRCUIT MODEL EVALUATION VS INPUT DATA

Before exporting the model to the system modeler, a test plan can be programmed to check the behavior of the model on a wide range of operating conditions (carrier frequency, envelope modulation, power), allowing thus to validate the robustness of the model before its use in the final design.

VIS100D: VISION, EM LINK

The "EM Link" module enables exporting to an external 3rd party electromagnetic simulator such as HFSS, the magnitude and phase of the signal emitted by each front-end circuit at every port of the antenna array.

For a given beam steering, the electromagnetic simulator can then calculate the true radiation pattern taking into account all the interactions between the different RF front-end circuits and the multi-port antenna.

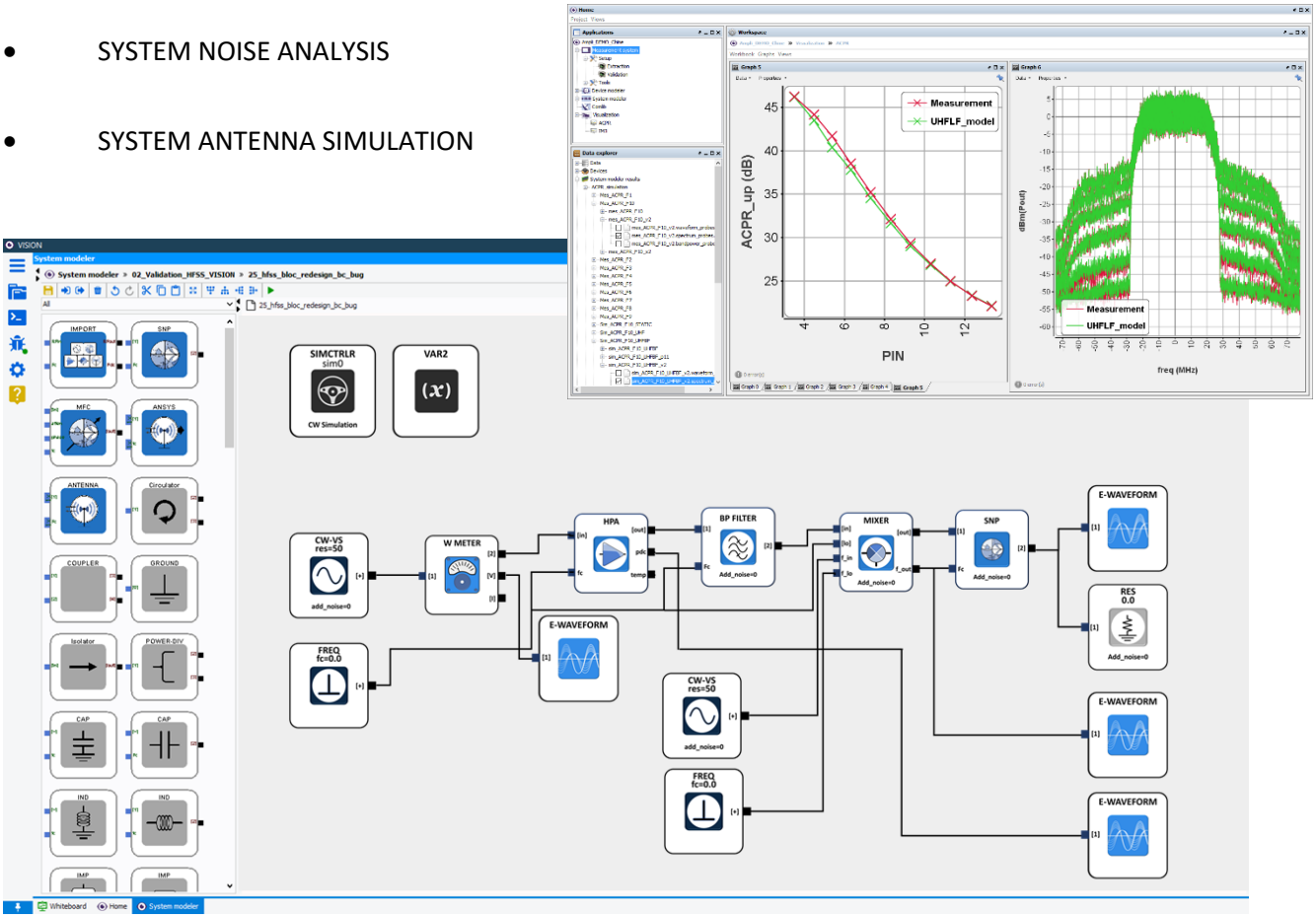


VIS100E: VISION, SYSTEM ARCHITECT

In the System Architect, the designer can design its architecture using different blocks representing different circuit models, extracted from the DEVICE MODELER. A palette of control blocks (signal sources, probes, waveforms, spectrum, DC supplies, Simulation controls…) are available to run a time-domain simulation and assess the overall response. For architectures with many circuits, as for active antennas, the schematic editor allows the description of the system at different hierarchical levels, making it possible to represent a set of circuits by a single element. For example, a block can represent several hundred amplifiers, simplifying the representation of the system greatly while offering the possibility of carrying out a fine and individual analysis of the behavior of each circuit.

Based on the time-domain simulation, several types of analysis are available:

- SYSTEM SWEEP ANALYSIS
- SYSTEM STATISTICAL ANALYSIS
- SYSTEM NOISE ANALYSIS
- SYSTEM ANTENNA SIMULATION



RF FRONT-END ARCHITECTURE SIMULATION

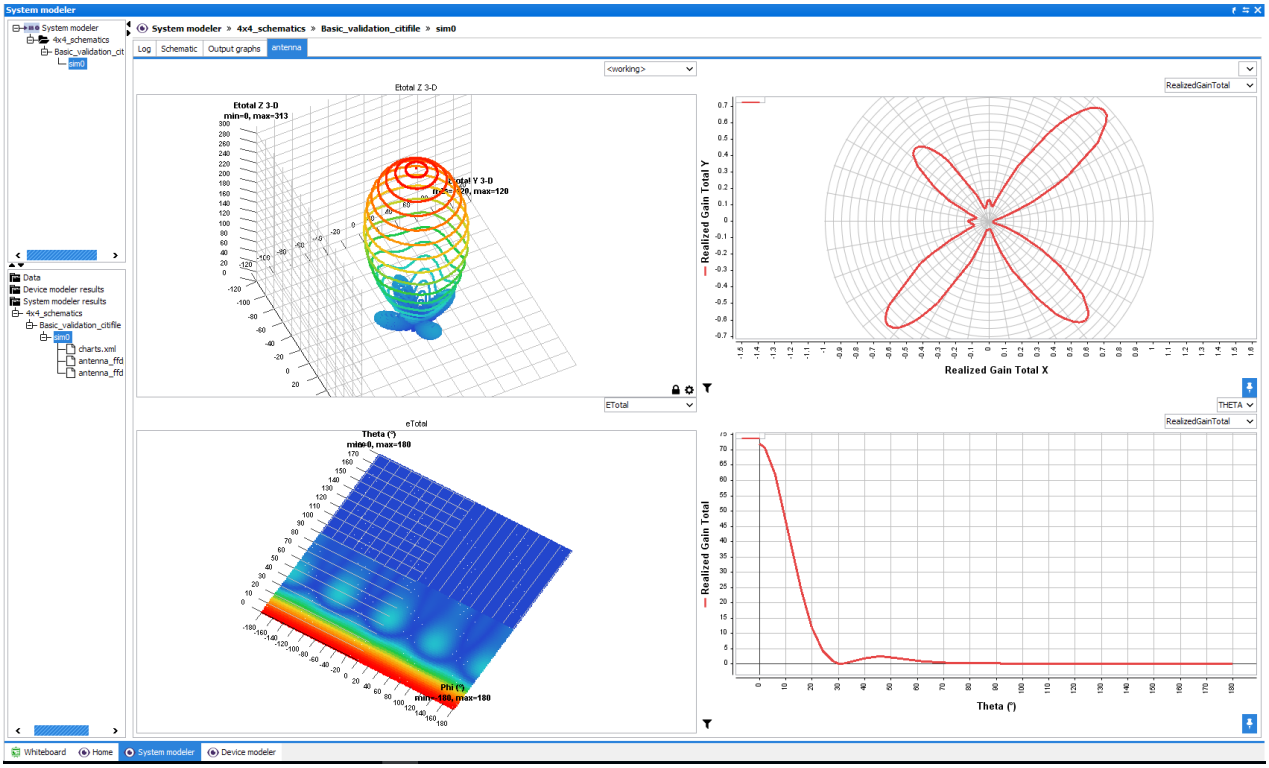
The SYSTEM MODELER helps to build RF subsystem architecture and to simulate its overall performance through a time-domain simulation.

Signal source block enables the specification of the power range, the carrier frequency, and IQ file representing the envelope modulation.

Probes are used to measure the performances of the system at various nodes in the architecture, using standard figure-of-merit (instantaneous power in the time domain, average power, efficiency, consumption, ACPR, …).

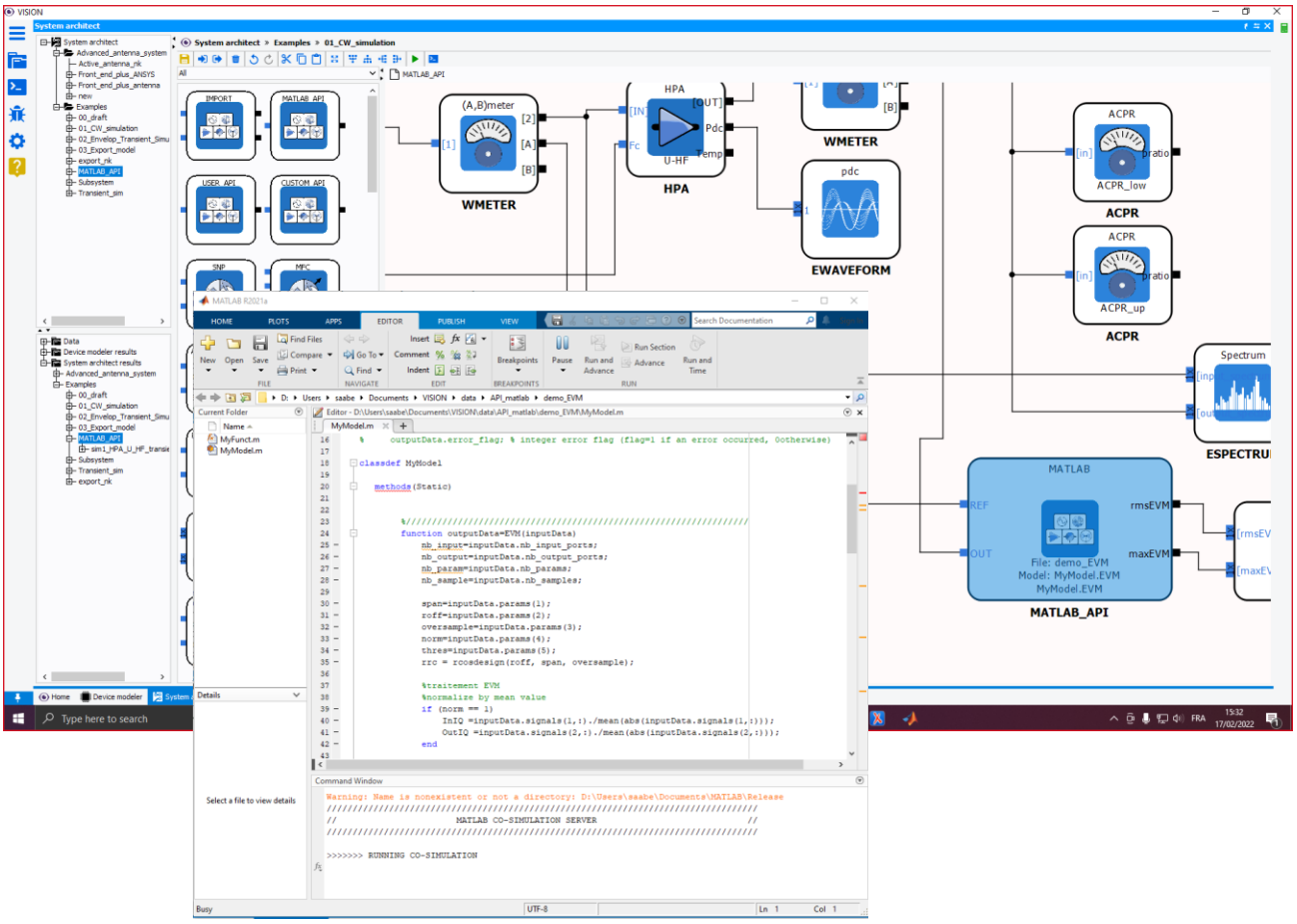
Once the subsystem performance agrees with the global specifications, it is possible to concatenate the models of different circuits used in the architecture into a single macro-model representing the entire RF subsystem.

By connecting Vision to a third-party electromagnetic simulation tool, it is possible to simulate directly from Vision the overall performance of large radiating systems, including the antenna characteristics, and to plot the radiation pattern, taking into account the mutual coupling between the elements and the mismatch effect between the antenna and the front-end.



ANTENNA MODEL WITH FAR FIELD POST PROCESSING

API MATLAB feature allows to perform custom models and/or signal processing by integrating user-defined MATLAB script directly in VISION simulator.



WHIT-1: VISION & WHITEBOARD EDITOR BUNDLE

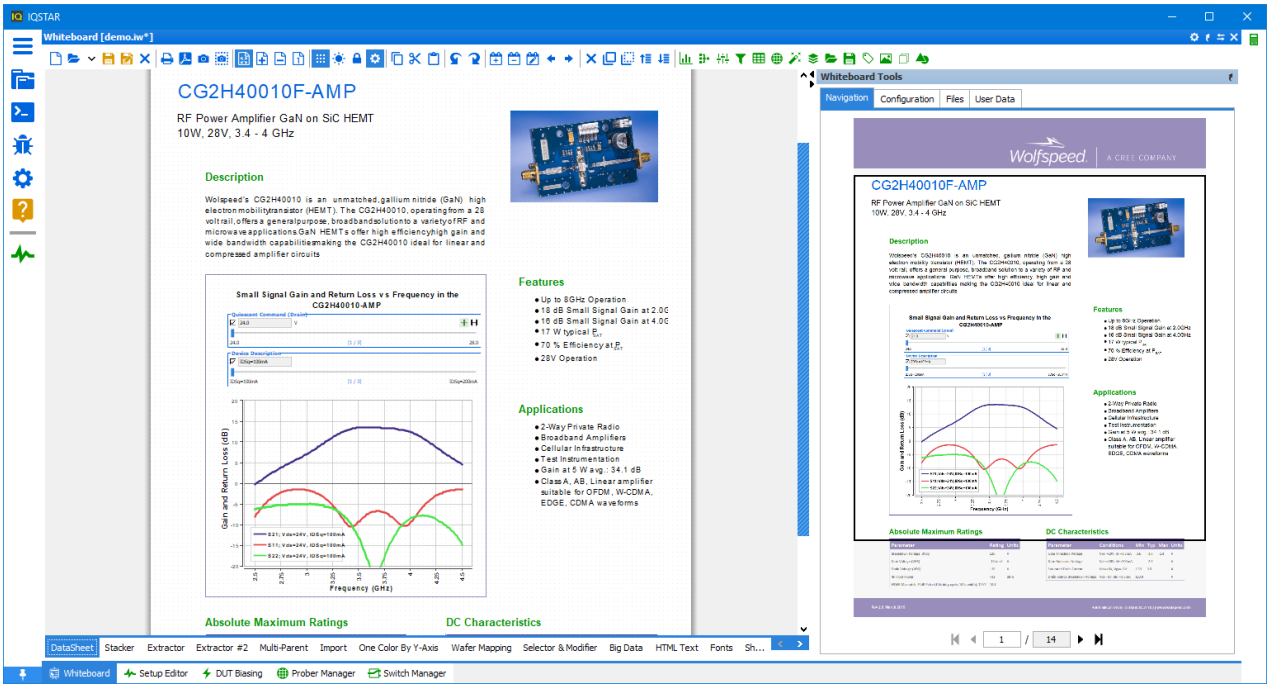
The Whiteboard tool allows the analysis of as much simulation data as possible without compromising flexibility. Circuit or system designers generally wish to import measurement or simulation data into a suitable environment to verify their design and/or verify the agreement between simulated results, measured performances, and reference data. If they don't have dedicated tools, they use homemade ones, which are generally costly in development time, workforce, and maintenance.

This Whiteboard module allows the user to create and customize as many graphics as necessary and position them into a user-defined template. It is possible to incorporate texts and images. An interactive display, including tables and graphics, can be generated using different filters or sliders.

The data can be analyzed in a raw format or be processed via an equation editor, allowing to customize the analysis. By customizing his analysis environment, with a few clicks, the user can reload new measurement or simulation data in a predefined analysis environment.

This tool is essential for the in-depth analysis of RF systems simulations results. The simulated quantities, the variables used, and the size of the data can be parameterized at any time.

Using the "Whiteboard Editor" (included in the Vision & Whiteboard bundle), the user can choose to analyze all the data on a single page or on multiple pages to create customized simulation reports.



VISION & WHITEBOARD EDITOR BUNDLE SOLUTION

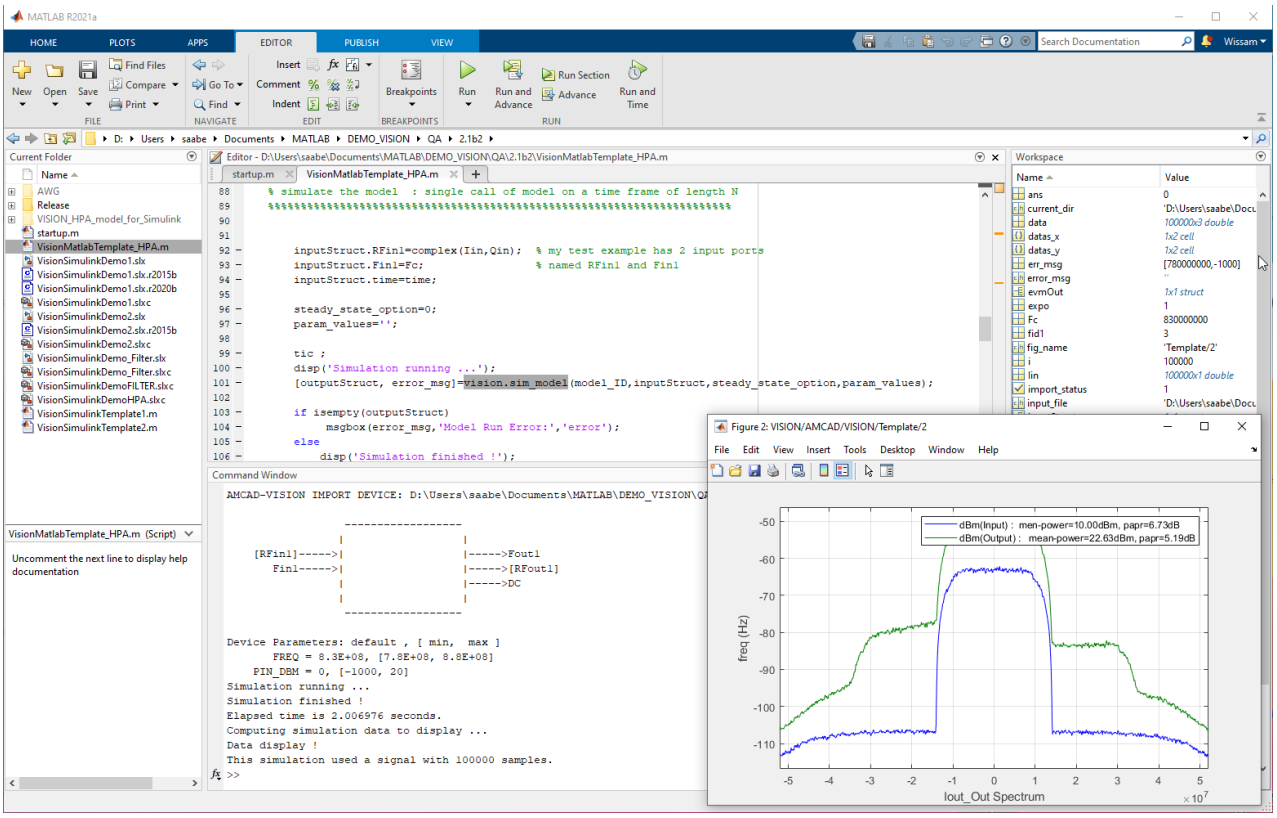
VIS100F: VISION, SYSTEM MODEL EXPORT LICENCE*

This option allows the export of the model of the entire system represented in the SYSTEM ARCHITECT schematic editor, to an external system simulator, in the form of a Macro-model.

This Macro-model embeds its equation solver, which allows keeping the same precision in the target system simulator, even if the latter is not natively equipped with an equation solver as powerful as Vision in 'data-flow' mode, for example, to take into account the phenomena of mismatches between circuits.

In that matter, Vision is indeed a unique tool, which allows unifying a global design process, from measurement or simulation at the circuit level to system simulation.

A specific VISION toolbox is used to facilitate the use of advanced model in MATLAB. This can also be used in 3rd party system simulator that embeds co-simulation with MATLAB.



* The number of exports is unlimited, but only available for licences under maintenance program.

TRAINING

Although we intend to make circuit modeling and system simulation very intuitive and easy for our customers, we strongly recommend taking full advantage of VISION through advanced training provided by our highly skilled application engineers.

This training, when carried out at AMCAD, can also include measurement work on predefined circuits for model extraction in our laboratories. Alternatively, this training can be delivered at the customer's international site.

A 3 or 5 days domestic training or customer site training program is available on-demand

- VIS-CST3 (3 Days training at Customer site)
- VIS-CST5 (5 Days training at Customer site)
- VIS-OST3 (3 Days training at AMCAD site)
- VIS-OST5 (5 Days training at AMCAD site)

LICENSE TYPE

The software license is provided in the form of a node-locked perpetual licence attached to a USB Key. This USB Key can be used on different computers. This formula offers a flexible solution when the software need to be shared amoung different users within a small design team.

The software license is provided in the form of a floating licence installed on the serveur of the company. This solution is more secure when a larger design team need to share the licences for a given number of seats. Costs about 30% more than node-locked perpetual license

When companies need to optimize their cash-flow, a rental program is also proposed based on a 3, 6, or 12 months period. For a 12 months program, Costs are about 1/3 of a perpetual license, including support.

MAINTENANCE

AMCAD Engineering considers maintenance a critical asset for its customers to provide a premium assistance program for one year from the date of delivery. After this initial period, you will be kindly invited to extend this maintenance through a support agreement.

Three different maintenance programs are available :

- One-year maintenance and support agreement
- Two-years maintenance and support agreement
- Three-years maintenance and support agreement

Also, with ongoing customer support, this maintenance program keeps your software version up-to-date, so you can take benefit from all the improvements and fixes which are available with the latest release.

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