Radar Target Simulator and Testing in Validation & Production

Ronald Kaempf, WKS Informatik GmbH

Markus Solbach, NOFFZ Technologies

WKS Informatik

With over 20 years of expertise in automation engineering…

… we provide solutions for automated testing needs.

LV 124 Automotive Testing

Industrial Automation

RF / Radar Automotive Testing

over 50 customers worldwide

over 20 years NI Alliance Partner

over 450 testing solutions in use

2 technical innovation awards

over 10 products for automated testing

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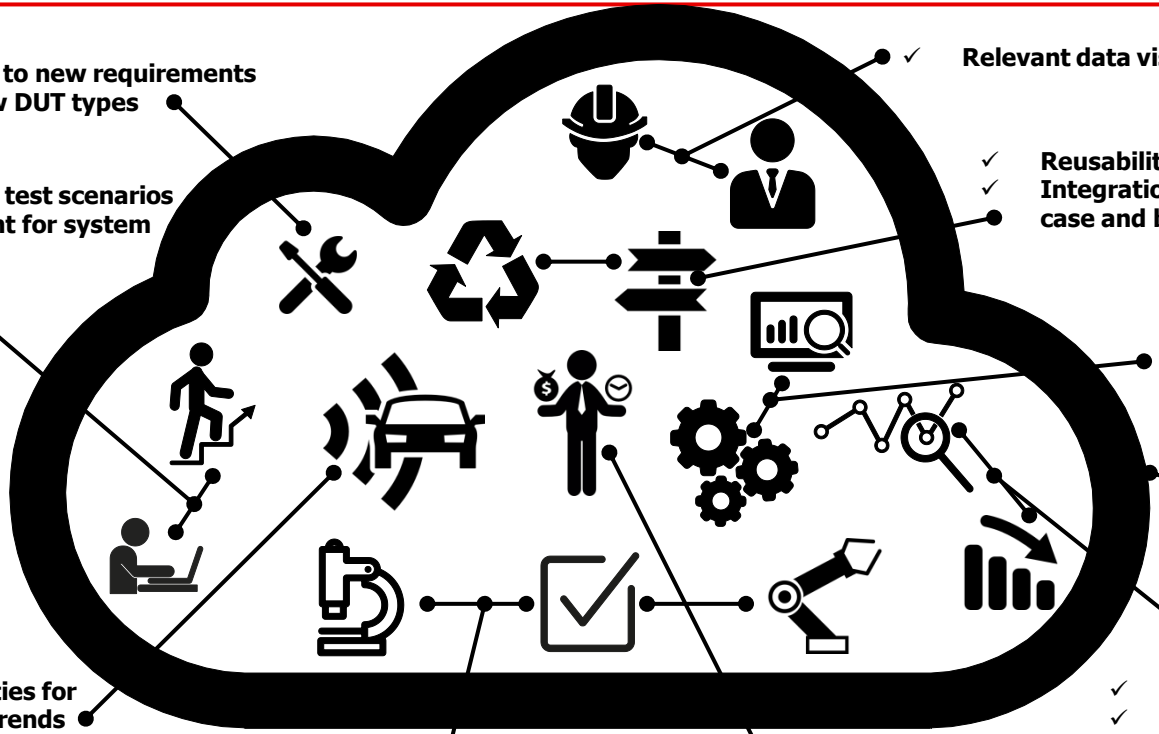
Common needs for testing



- ✓ Quick adjustment to new requirements
- ✓ Scalability for new DUT types
- ✓ Faster development of test scenarios
- ✓ Higher entry-level point for system developers
- ✓ Integration capabilities for newest technology trends
- ✓ Reusability of resources for all product testing levels
- ✓ Relevant data visualization for all company levels
- ✓ Reusability of existing resources
- ✓ Integration of products for flexible use case and better maintainability
- ✓ Time synchronisation
- ✓ Continuous monitoring
- ✓ Connectivity for IoT / Industry 4.0
- ✓ Faster error mining and analysis
- ✓ Reduction of the amount of produced data
- ✓ Money and time constraints

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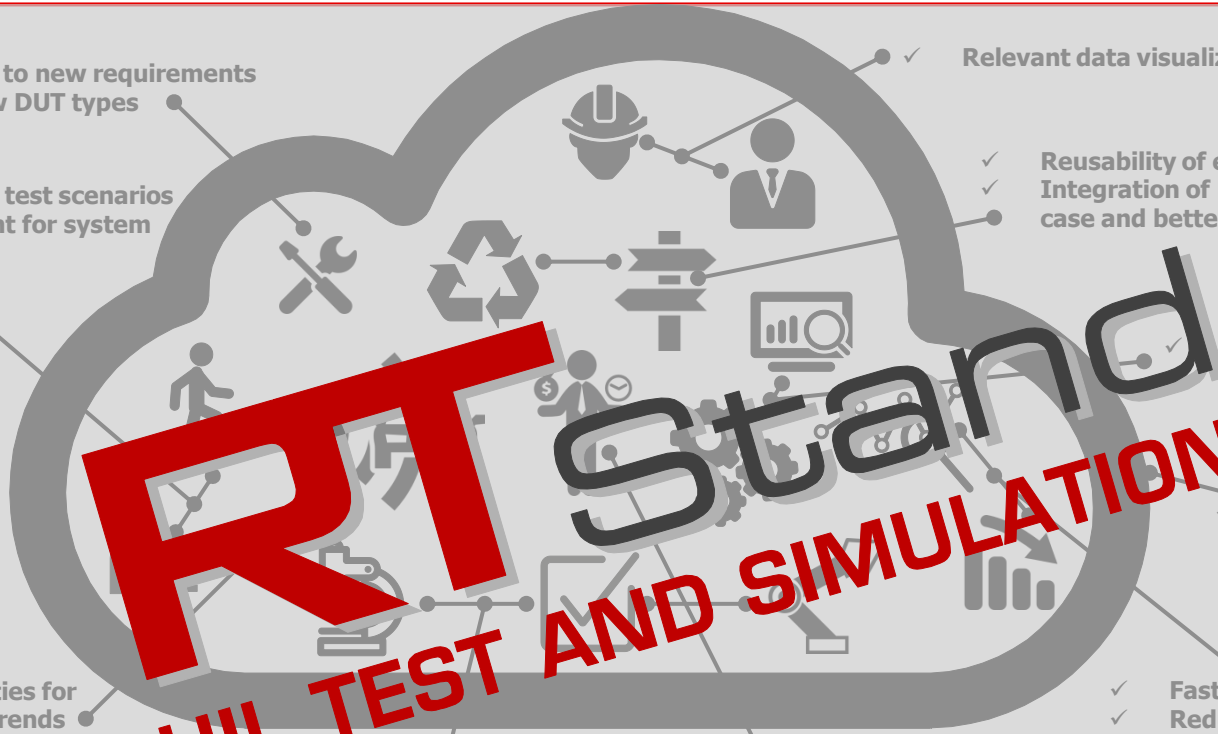
RTStand – open HiL platform



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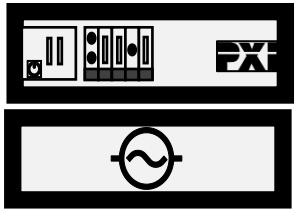
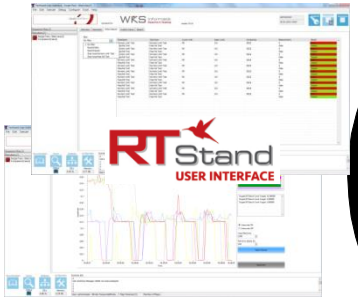
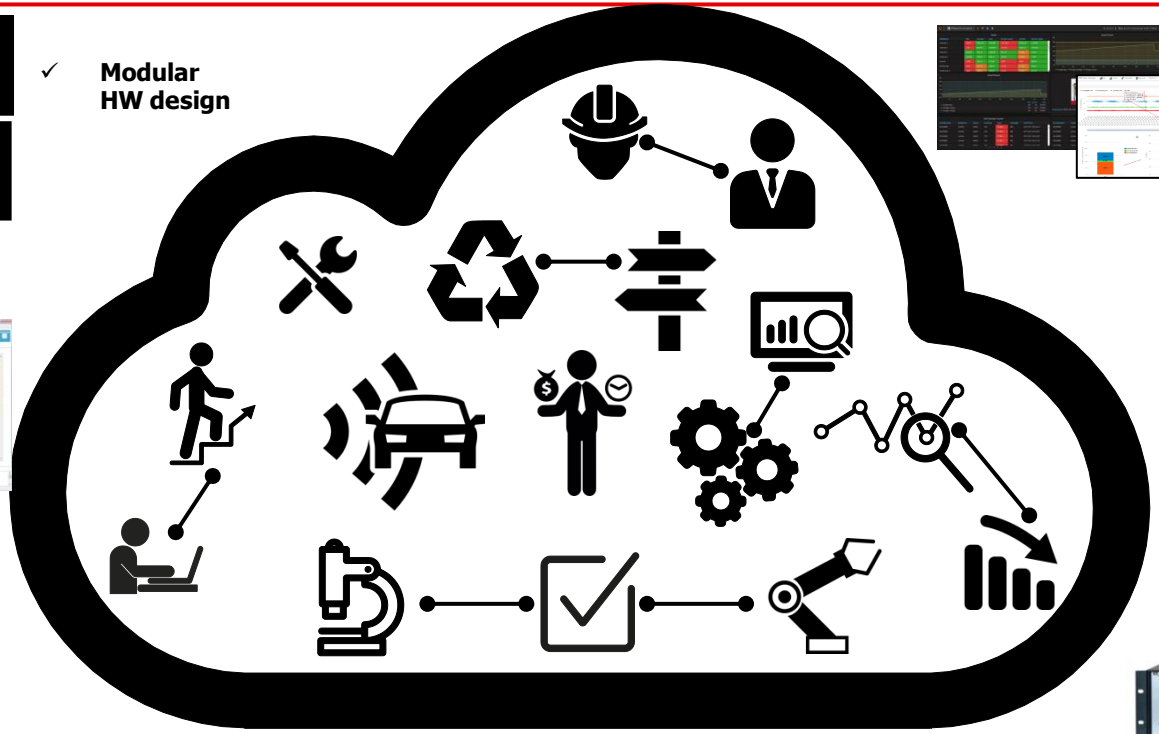


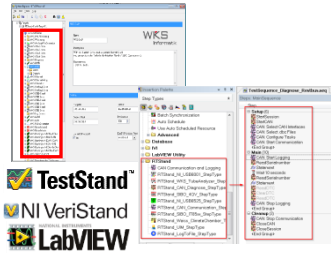
✓ **Modular HW design**

✓ **PlugIns for IoT**



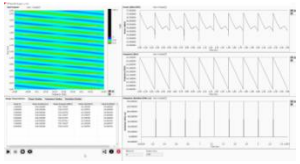
✓ **RTStand User Interface**





✓ **Modular RTStand Library**

✓ **LV 124 solutions**



✓ **Radar/RF solutions**

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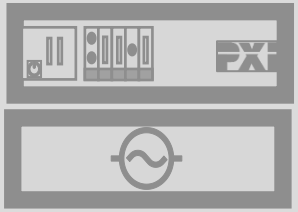
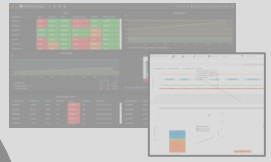
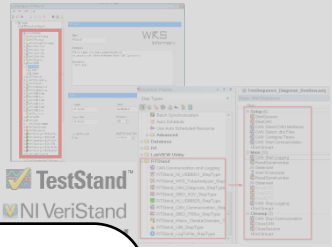
RTStand – open HiL platform



✓ Modular HW design

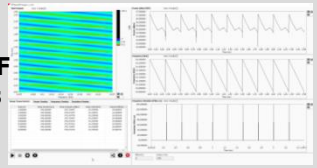


✓ PlugIns for IoT



✓ RTStand User Interface

Why do we need Radar / RF solutions?



✓ Radar/RF solutions

✓ LV 124 solutions

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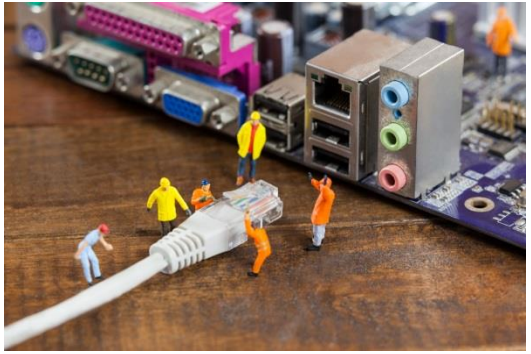
Autonomous driving

Autonomous driving brings many advantages…



… but **the robustness and safety requirements** also need a lot more complex test scenarios for all stages of ECU testing…

Development tests

Validation/Functional tests

Production/EoL tests

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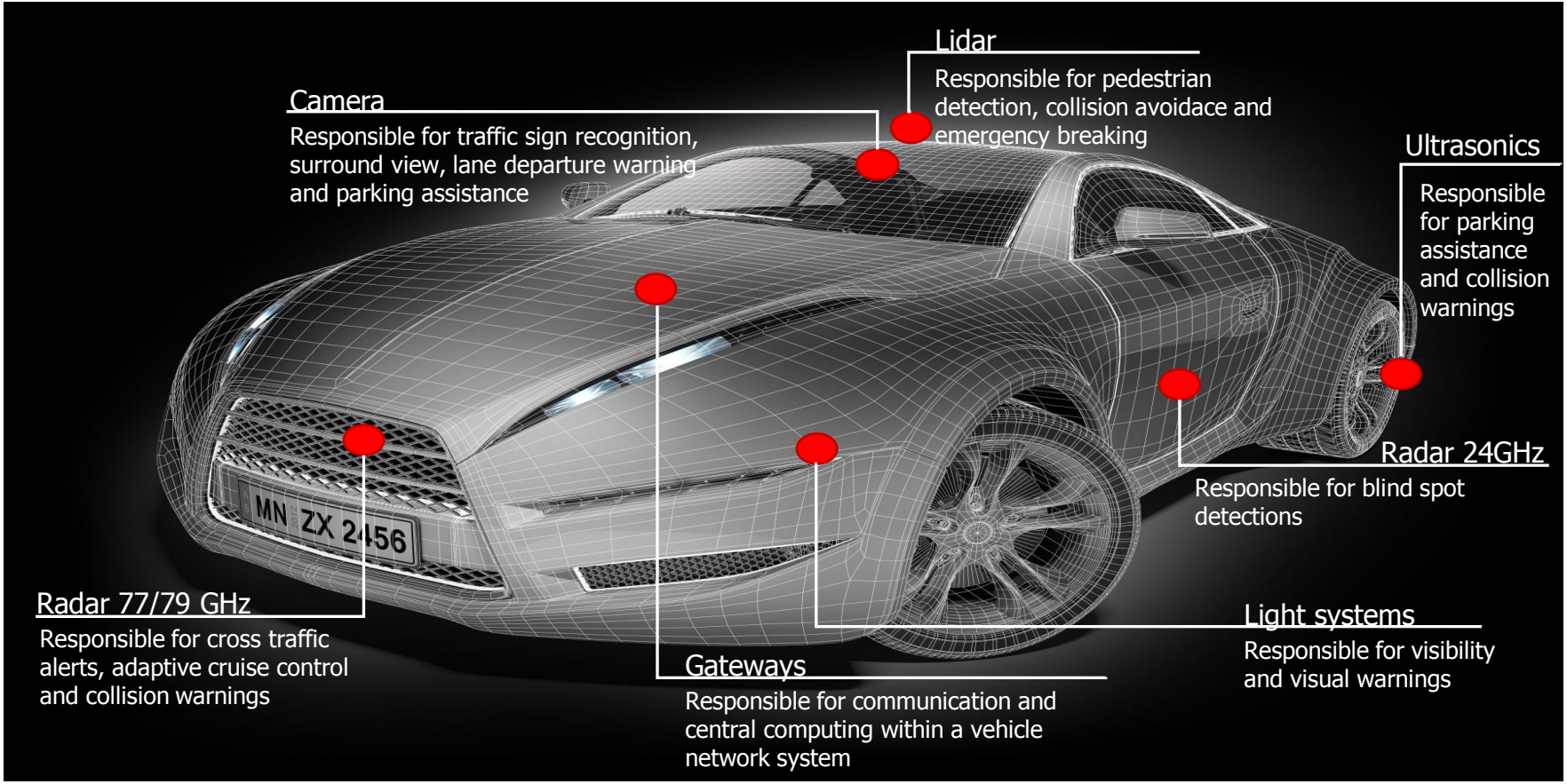
Sensors in autonomous driving



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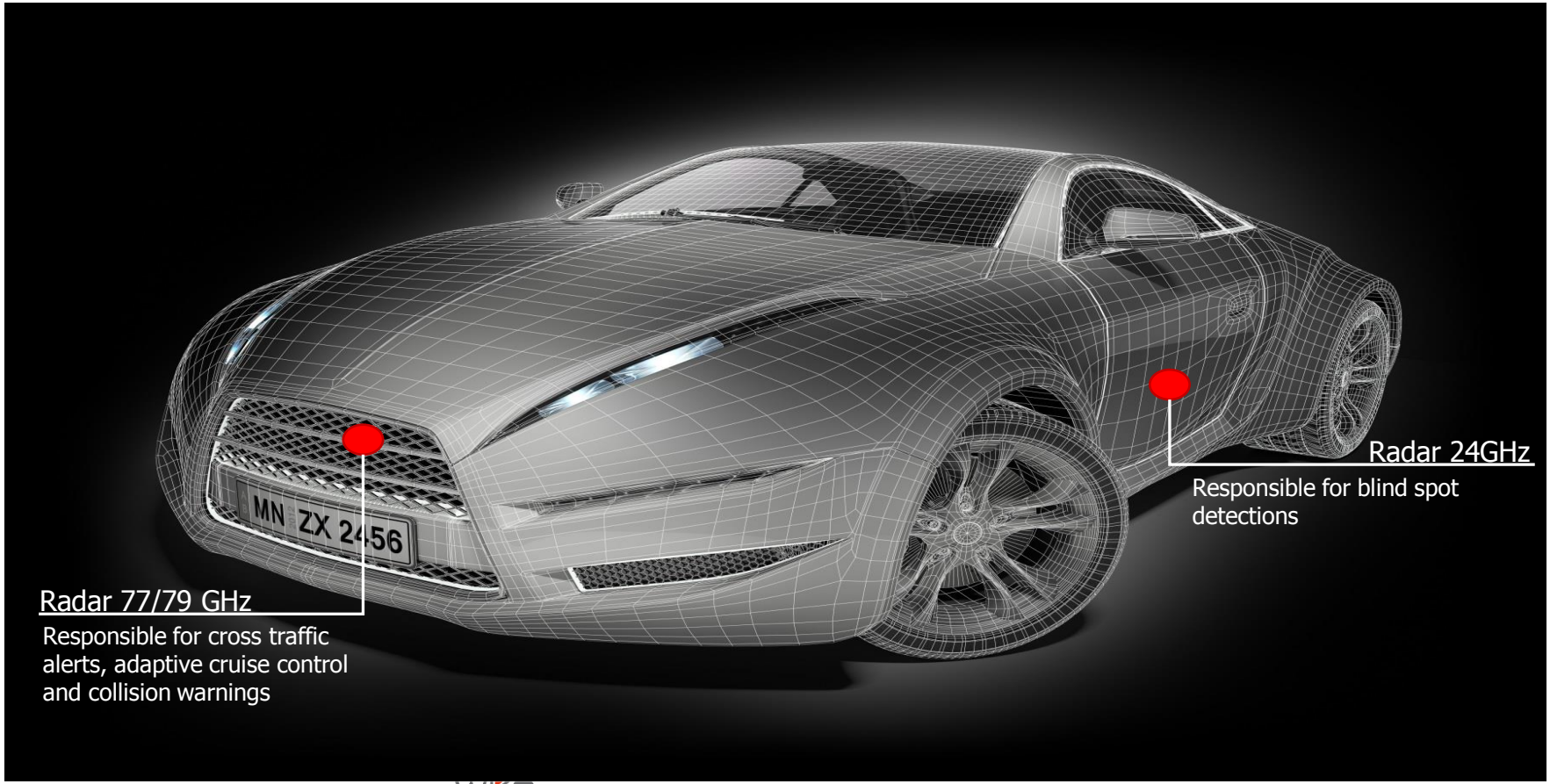
Radar testing



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Challenges for Radar testing

Development:

- Characterization of radar sensors and coverages
- Analysis of chirp linearity
- Spectrum, EIRP power & frequency analysis

- Non-linearities in the chirp cause distance and speed effects in the radar
- Higher radar resolution distinguishes better between multiple targets
- The better the power, the better the detection range

Validation & Functional testing:

- Simulation of dynamical driving scenarios (e.g. overtaking, reeving, following etc.)
- LV 124 / LV 148 compliance

- LV 124 / 148 tests: checks the Radar behavior under various driving circumstances – critical validation norm

Production:

- Several targets over the whole distance range
- Sensor calibration
- Distance to target in mm precision
- Target size with a precision < 1dB
- Bandwidth and power measurements
- < 30s cycle times

- Low cycle times allow higher production figures
- Precise calibration ensures correct Radar functionality

24 / 77 / 79 GHz:

- Support of all bands

- 24 GHz technology is still used in various vehicle classes
- 24/77 GHz Band is highly regulated worldwide
- The future belongs to the 79 GHz technology

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Partnership for Radar testing

Point of contact
Automated testing solutions
RF Adapter

Radar Target Simulator
24 & 77 GHz

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Solutions for Radar testing

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Experts in Testing

perisens GmbH

RT Stand RADAR
HIL TEST AND SIMULATION

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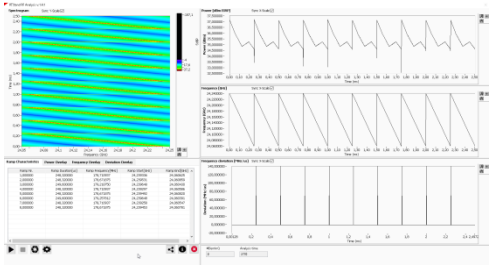

\+ RT Stand HIL - TEST AND SIMULATION

24/77 GHz Radar Target Simulator | NI VST technology | RTStand RF Analysis | HiL platform

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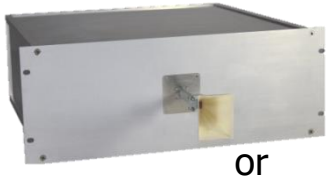
Solutions for Radar testing

- **24 GHz Radar Target Simulator**
- Full bandwidth support
- Minimum range between the RTS antenna and the Radar sensor: ca. 50cm
- Simulation range: 5-100m typical, more also possible
- Range increments: 10cm or lower
- Doppler simulation
- Dynamic range: 60 dB typical
- Simulated target: one moving target or several static targets

RADAR RTStand HIL TEST AND SIMULATION



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24/77 GHz Radar Target Simulator

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NI VST technology

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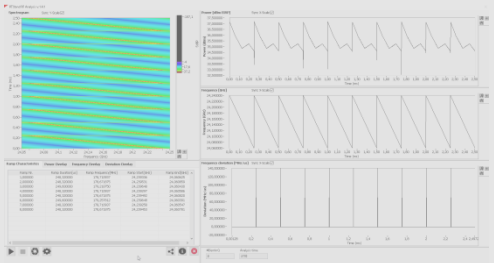

RTStand RF Analysis

+ RTStand HIL - TEST AND SIMULATION

HiL platform

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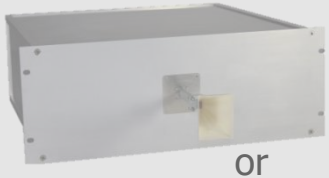
Solutions for Radar testing

- Combination of: signal generator, signal analyzer, high-speed digital interface, and user- programmable FPGA in a single PXI module

RADAR RTStand HIL TEST AND SIMULATION



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24/77 GHz Radar Target Simulator

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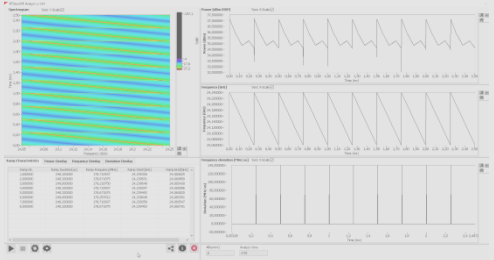

RTStand RF Analysis

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HiL platform

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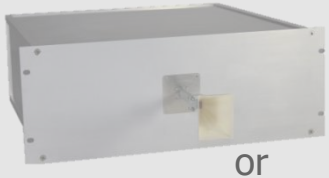
Solutions for Radar testing

- Support of both 24 and 77/79 GHz Radar Target Simulators
- **FMCW Chirp analysis with liniarity evaluation – 2GHz bandwidth with 1kHz accuracy**
- Spectrum, EIRP power, frequency and frequency deviation displays
- Chirp overlay displays
- Continuous and snapshot modi

RADAR
RTStand
HIL TEST AND SIMULATION



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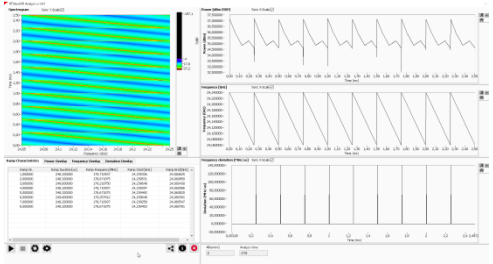

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24/77 GHz Radar Target Simulator

NI VST technology

RTStand RF Analysis

HiL platform

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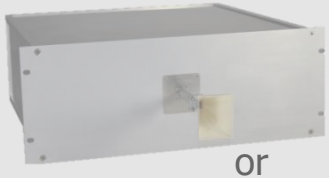
Solutions for Radar testing

- Open platform - **from development, over validation to production tests**
- Power measurements, bandwidth measurements, frequency and out-of-band (OOB) measurements as well as signal/jitter measurements for determining the radiation characteristic
- **Reporting of production figures such as shift management and yields**
- **LV 124 / LV 148 tests**
- **Integration of RTStand RF Analysis for chirp and liniarity analysis**
- **Support of both 24 and 77/79 GHz Radar Target Simulators**

RADAR RTStand HIL TEST AND SIMULATION



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24/77 GHz Radar Target Simulator

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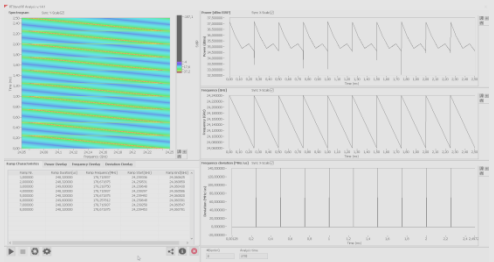

RTStand RF Analysis

+ RTStand HIL - TEST AND SIMULATION

HiL platform

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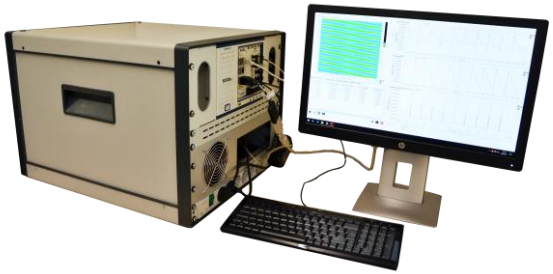
Integration

24 GHz → 77/79 GHz

Development tests



Validation & Functional tests

Production/EoL tests

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NOFFZ Solution UTP 6010 with RF Adapter

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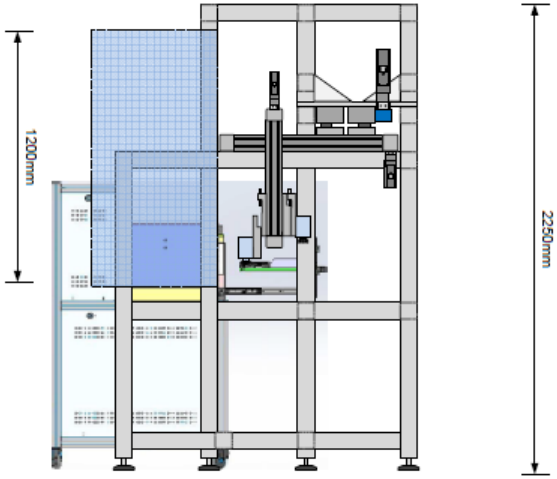
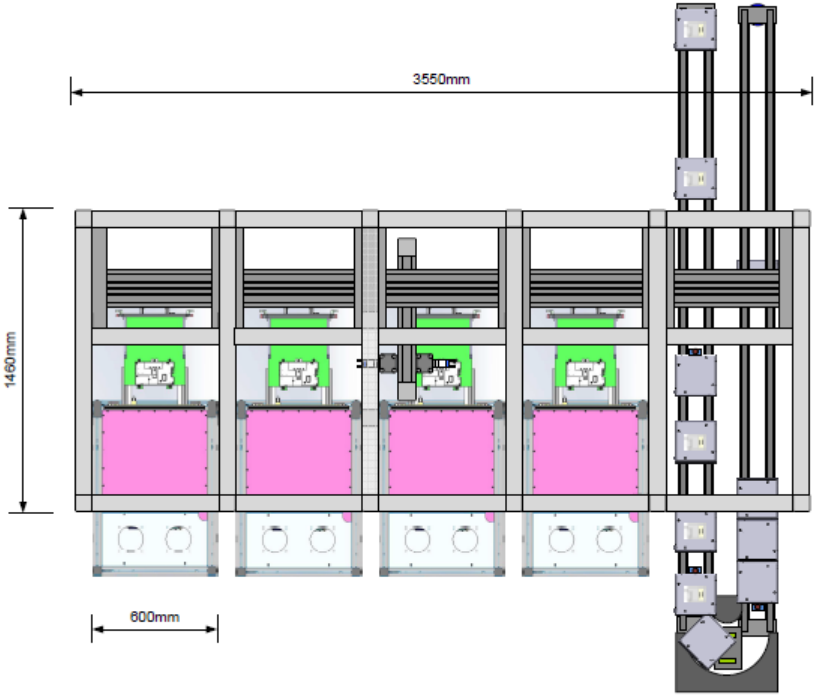
System Layout of Automated Line with UTP 6010 & RF Adapter UTP 5060 & UPT 9085 Portal System





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Our social channels:

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