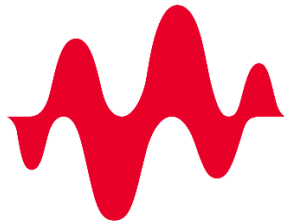


Accelerate Requirements Compliance Verification

Dramatically Improve Time to Design Completion
Through Faster Insights and Reduced Prototyping

Case Study: Keysight Labs Hardware Design



KEYSIGHT LABS

Organization

- Hardware Design Team
- Highly complex hardware designs that involve many specifications and generate large quantities of measurement data
- Designing the next generation of hardware solutions

Challenges

- Highly complex hardware designs that product large amounts of data
- Ad hoc, manual data management of requirements and results
- Error-prone data collection from simulation and test

Solution – Keysight Requirements Verification Suite

- Streamline simulation and measurement analysis for their increasingly complex hardware designs
- Reduce manual data format normalization
- Accelerate insights into requirements compliance and root-cause-analysis
- Supports Keysight native data formats

Results – Reduced data management & analysis by 80%

- Improved data structure and organization
- Accelerated analysis through automation
- Reduced data management time per engineer from 1.5 hours per day to under 15 minutes

Keysight Labs Hardware Design Team

Keysight Labs is the group within Keysight that provides primary research and state-of-the-art technology designs. The Hardware design team includes over 20 designers working on the next generation of MMICs to perform functions like signal conditioning, frequency conversion, and amplification. These chips, sub-system and system designs drive Keysight's industry-leading test and measurement instruments.

Challenge: Complex Hardware Designs Generate Mounds of Data

Working with highly complex technologies, Keysight Labs' hardware design team experiences the same challenges facing the rest of the high-tech industry. Increased performance requirements, miniaturization, standards and regulation constraints all lead to complex designs that generate large amounts of data from both the digital-twin simulation phase and the prototype validation phase. Product complexity has been growing exponentially over the past 25 years and is expected to continue to rise for the next 5, while at the same time decreasing time-to-market demands drive the team to work faster and more efficiently. During this same period, workforce resources have been growing marginally, leaving a considerable resource capacity gap for collecting and analyzing the resulting data that comes with complexity.

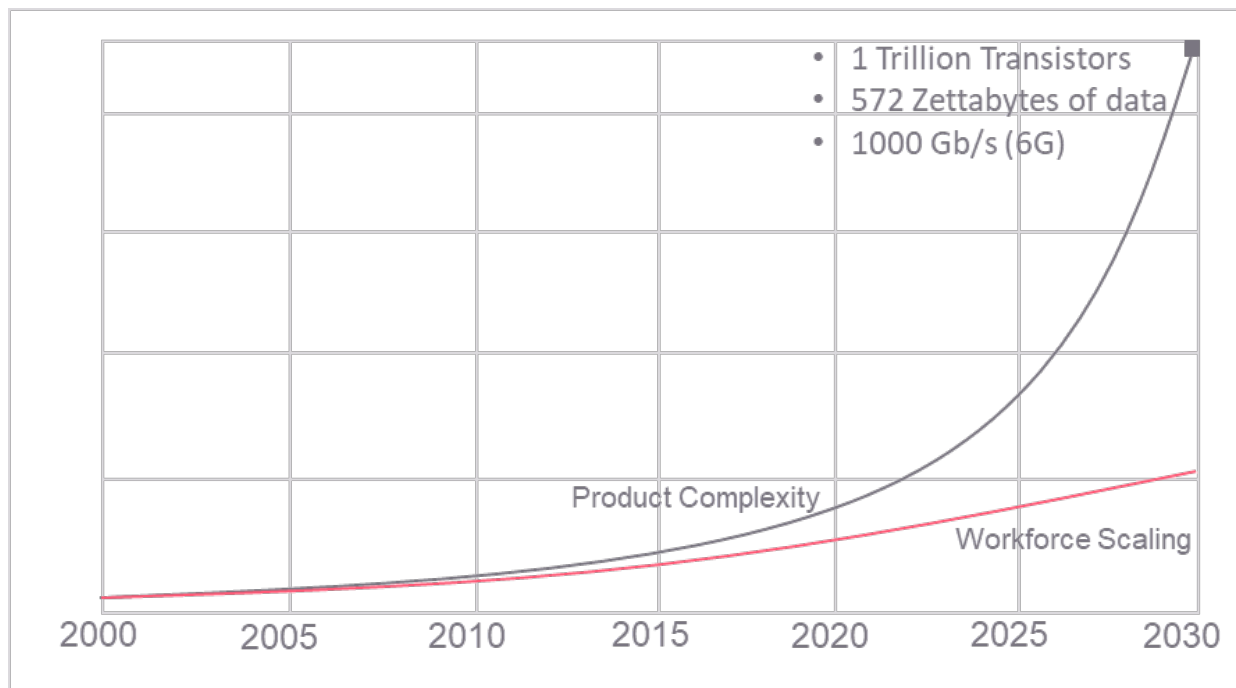


Figure 1. Exponential product complexity vs. slower workforce growth (2000–2025)

In October 2023, Keysight commissioned Dimensional Research to conduct a global survey with 301 electronic design professionals and leaders from diverse sectors such as semiconductors, aerospace, automotive, and telecommunications.

The survey results highlighted the following:

- Design engineers are entrenched in workflow inefficiency, with an alarming average of 3 hours per day being consumed by manual tasks.
- 70% of companies risk losing their time-to-market advantage due to months' long design and test data correlation cycles.

- Disconnected, manual workflows cost an average 10-person design team over \$1.7 million per year.
- The same-size team can recover the workload equivalent to 3.5 full-time employees by adopting automation and integrated workflows, thus addressing the semiconductor talent shortfall.
- 74% of organizations use spreadsheets to keep critical design data, which often lack sophisticated security measures
- 72% still use paper notes or emails to share data

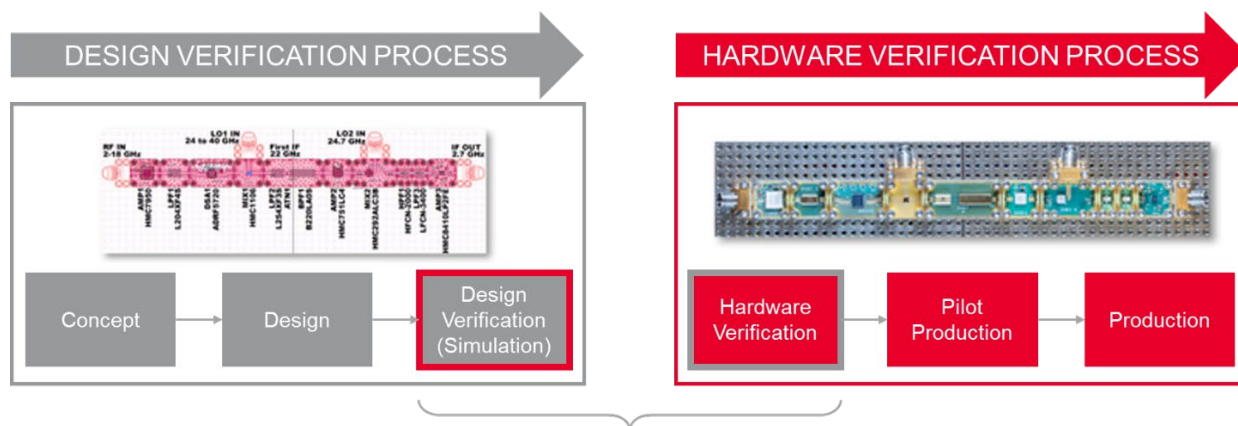


Figure 2. Up to 67% of product development time is spent on verification

Source: Dimensional data research

Keysight Labs: Challenges Driving the Need for Change

In addition to the challenges facing modern hardware design, Keysight Labs' team was faced with the growing amount of data being produced. Each engineer spent on average roughly 1.5 hours per day collecting and formatting data that allowed for some basic analysis.

The processes and tools that worked in the past were beginning to fail under the strain:

- Increased set of complex requirements for new designs
- Growing volumes of measurement data collected
- Increasing team size, making collaboration harder
- Reliance on excel spreadsheets for data collection and email for collaboration and distribution.

Solution: Keysight Requirements Verification Suite

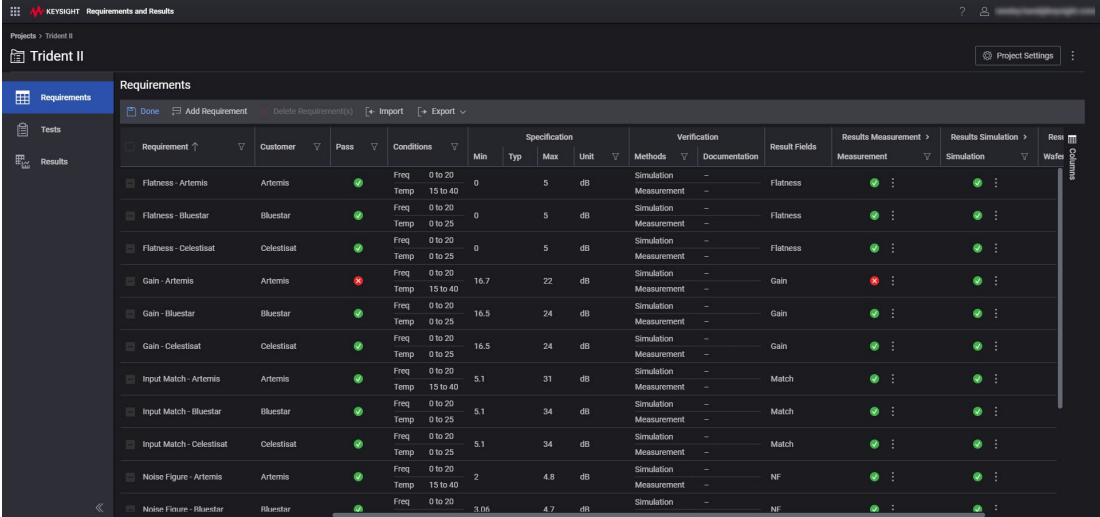
KRVS workflow integration has addressed the need for increased structure and automation in the design validation workflow. It supports Keysight native file formats, units, and provides workflow optimization, data visualizations and scripts-based automated workflows specific to Keysight Labs Hardware team's data.

This is reflected in the following capabilities:

- Web-based user experience, allowing access to the requirements and results from any computer on the network.
- Manages requirements and validates compliance of the design to the requirements
- Flags non-compliant requirements and the conditions correlating to the non-compliance
- Tailored integration of KRVS into existing workflow and tool chains.
- Security protocols in place to protect the integrity of and access to sensitive data
- Custom training for engineers on best practices and features available
- Increased use of automation for measurement data collection and formatting

Requirements and Results

KRVS Requirements and Results component provides a cockpit to manage requirements throughout the verification process from design to test. It imports requirements from CSV or other formats, drives product verification plans used by both simulation and test. The application automates the status of compliance checking, flags items not verified and stores pass/fail determinations along with the results data for future analysis. Data is meta-data tagged for traceability.



Requirement	Customer	Pass	Conditions	Min	Typ	Max	Unit	Methods	Documentation	Result Fields	Results Measurement	Results Simulation
Flatness - Artemis	Artemis	✓	Freq 0 to 20 Temp 15 to 40	0		5	dB	Simulation Measurement	-	Flatness	✓	✓
Flatness - Bluestar	Bluestar	✓	Freq 0 to 20 Temp 0 to 25	0		5	dB	Simulation Measurement	-	Flatness	✓	✓
Flatness - Celestisat	Celestisat	✓	Freq 0 to 20 Temp 0 to 25	0		5	dB	Simulation Measurement	-	Flatness	✓	✓
Gain - Artemis	Artemis	✗	Freq 0 to 20 Temp 15 to 40	16.7		22	dB	Simulation Measurement	-	Gain	✗	✓
Gain - Bluestar	Bluestar	✓	Freq 0 to 20 Temp 0 to 25	16.5		24	dB	Simulation Measurement	-	Gain	✓	✓
Gain - Celestisat	Celestisat	✓	Freq 0 to 20 Temp 0 to 25	16.5		24	dB	Simulation Measurement	-	Gain	✓	✓
Input Match - Artemis	Artemis	✓	Freq 0 to 20 Temp 15 to 40	5.1		31	dB	Simulation Measurement	-	Match	✓	✓
Input Match - Bluestar	Bluestar	✓	Freq 0 to 20 Temp 0 to 25	5.1		34	dB	Simulation Measurement	-	Match	✓	✓
Input Match - Celestisat	Celestisat	✓	Freq 0 to 20 Temp 0 to 25	5.1		34	dB	Simulation Measurement	-	Match	✓	✓
Noise Figure - Artemis	Artemis	✓	Freq 0 to 20 Temp 15 to 40	2		4.8	dB	Simulation Measurement	-	NF	✓	✓
Noise Figure - Bluestar	Bluestar	✓	Freq 0 to 20	3.06		4.7	dB	Simulation	-	NF	✓	✓

Figure 3. Keysight Requirements Verification Suite – Requirements and results compliance

Results Analysis & Analytics

KRVS results analysis provides interactive charts of aggregated measurements collected through test automation or manually collected and imported from CSV files. It provides filters, data splitting and custom chart configurations. The workflow is guided for ease of use to detect outliers quickly and accurately. Data overlay and reference test limits can be set for benchmarking against simulation results or golden unit test results.



Figure 4. Keysight Requirements Verification Suite – Analysis

Third-Party Integration

Teams typically have unique design and verification processes. KRVS offers a powerful REST API—giving the freedom to automate data input, import, and analysis using the third-party tools already in use, known and trusted.

requirements		
POST	/projects/{project_id}/requirements	Create Requirement
PATCH	/projects/{project_id}/requirements	Patch Requirements
GET	/projects/{project_id}/requirements	List Requirements
DELETE	/projects/{project_id}/requirements/{requirement_id}	Delete Requirement
PATCH	/projects/{project_id}/requirements/{requirement_id}	Patch Requirement
GET	/projects/{project_id}/requirements/{requirement_id}	Get Requirement
POST	/projects/{project_id}/requirements:ids	List Requirements By Ids
GET	/projects/{project_id}/requirements/download	Download Requirements
results		
POST	/projects/{project_id}/results:summary	List Results Summary
POST	/projects/{project_id}/results:list	List Results
POST	/projects/{project_id}/results:list_v2	List Results
POST	/projects/{project_id}/results:exclusion	List Results Exclusion
other		
GET	/ping	Ping

Figure 5. Keysight Requirements Verification Suite – REST API

Results: 80% Reduction in Data Management and Analysis

The Labs team monitored their previous data collection and management processes in order to establish a baseline of time spent in these activities. On average, each engineer spent at least 1.5 hours per day performing data management and analysis tasks with their established tools. Additional time is typically required to re-evaluate and analyze data when the designs are particularly complex, as well as time spent making the data sharable with others on the team.

With the adoption of KRVS into their workflow, an experienced user was able to reduce this time to approximately 10-15 minutes per day, per user. KRVS data management and visualization capabilities have accelerated most design reviewer data analysis responsibilities by using its RESTful API to help automate these tasks.

- **Efficiency Gains** - The resulting efficiency gains from 1.5 hours to under 15 minutes represent over 80% reduction in time for these tasks.
- **Collaboration Advantages** – By storing the data in a well-organized database that is accessible by everyone, the team has established new collaboration best practices and is able share insights more effectively.
- **Accuracy Improvements** – Errors caused by data transformation processes have been eliminated, increasing reliability in the results

"KRVS directly addresses our need for increased structure and automation in the design validation workflow. The existing manual processes simply do not scale to support the higher levels of integration and design complexity we face today."

Jason Horn

Keysight Labs Test Solutions Architect

Conclusion

Design complexity will undoubtedly continue to increase. How do teams close the chasm between design and test, and shift-left towards more efficient design processes using digital twins? How can they improve design productivity with more actionable data insights?

Executives are increasingly recognizing the strategic need for increased productivity through agility. 60% of industry leaders assert that an optimized design process is not just beneficial but vital for maintaining the competitive edge necessary in today's market. It's a fundamental component in the quest to accelerate time-to-market — a goal that 63% of executives identify as directly influenced by the integration of software across the design and testing lifecycle.

Keysight Requirements Verification Suite is the automated way to optimize workflows across digital and physical design verification. On its own or integrated with in-house tools, the Suite helps drive process transformation by weaving together simulation predictions, prototype measurements, analytics, and people. Collaborate with Keysight and take control of your product destiny.

Related Information

[Keysight Requirements Verification Suite Home Page](#)

[Keysight Requirements Verification Suite Solution Brief](#)

Learn More

For more information on Keysight Requirements Verification Suite, please contact Keysight at [KRVS Sales](#) or www.keysight.com/find/contactus



Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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