

Quality Assurance Testing



WHITE PAPER

*How Valkyrie can be used for QA testing
of Ethernet products up to Layer 3*

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INTRODUCTION

Companies manufacturing all sorts of products use Quality assurance (QA) to prevent errors and mistakes in their products and ensure flawless product deliveries to their customers. This will improve customer satisfaction and reduce the need for after-sales troubleshooting and support.

QA give companies get a systematic process to find out if their products meet what is required. QA defines requirements for developing and manufacturing reliable products. A driving force behind QA is the ISO (International Organization for Standardization). ISO has developed the ISO 9000 international standard, on which many companies base their QA system.

QA testing is done during and after development and provides information to developers if changes or improvements are required. During product development the development team will do thorough testing of the product, covering e.g. functional and stress testing of the basic functionality of the product. QA testing of physical products normally includes stress testing of a number of environmental conditions. QA tests that may be conducted include:

- EMC Tests
- Mechanical Tests
- Thermal/Humidity Tests
- Hi-Pot Tests
- Sand and Dust Tests
- Salt Spray Tests

EMC Tests

EMC (ElectroMagnetic compatibility) is emission (EMI) and reception (EMS) of electromagnetic energy.

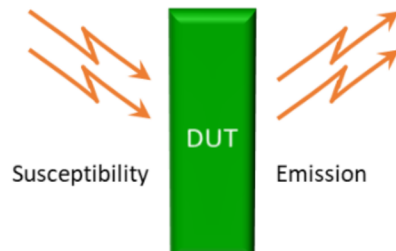


Figure 1: Electromagnetic Susceptibility and Emission

EMI (Electromagnetic Interference) is the emission of electromagnetic energy from a product. It is important because the EMI from one product may affect and harm the functioning of other products.

EMS (Electromagnetic Susceptibility) is how sensitive a product is to electromagnetic energy (EMI) from other devices.

A subset of EMS is the ESD (ElectroStatic Discharge); electrostatic discharge can for instance be caused by an electrostatic charged human touching a product causing the product to fail.

Mechanical Tests

Products will typically be subject to mechanical influences during transportation and sometimes also during normal operation (e.g. aircraft components). It is therefore important to test the fragility of the products to verify that the products can withstand such influences. For transportation it is important to test that the packaging provide adequate protection for the products.

Mechanical tests include vibration and drop from a given height.

Thermal/Humidity Tests

A product will have a temperature and a humidity range in which it can operate and typically a wider range that applies for transportation and storage. Thermal/humidity tests verify that a product can actually operate in the operating range and that it can be used after being exposed to the transportation/storage range. Furthermore humidity testing will accelerate and reveal corrosion issues in a product.

Tests may be conducted with exposed to a constant temperature and humidity or with cycled temperature and humidity.

Hi-Pot Tests

The Hi-Pot (High Potential or high voltage) test determines if the electrical insulation of a product is sufficient for normally occurring high voltage transient. This test is normally run for specific time period to identify products with inadequate insulation, an issue which may be caused by how the product was handled during the manufacturing process.

Sand and Dust Tests

Sand and dust testing are used to check effects from dry sand and dust (fine sand). The dry sand and the dust will be blown against the product to see if that causes malfunctioning.

Salt Spray Tests

The salt spray test is a corrosion test method that checks the corrosion resistance of a product and its surface if the surface is intended to provide protection against corrosion. The Salt spray test accelerates corrosion impacts on the surface of the product. Appearance of rust (or similar) is evaluated after a given time period.

Test Standards

QA test standards are defined by international standardization bodies like the IEC (International Electrotechnical Commission). IEC includes the CISPR (Comité International Spécial des Perturbations Radioélectriques – in English: International Special Committee on Radio Interference), which makes standards regarding electromagnetic

interference in electrical and electronic equipment. Also the ISO (International Organization for Standardization) and other organizations like the ASTM (American Society for Testing and Materials) define QA test standards.

Test	Examples of QA test standards
EMC	CISPR 32/EN 55032 (EMI), EN 61326-1 (EMS)
Mechanical	EN/IEC 60068-2
Thermal/Humidity	EN/IEC 60068 - 2 / ISO 16474-3
Hi-Pot	IEC 60950
Sand and Dust	MIL STD 810 G
Salt Spray	ASTM B117, ISO9227, JIS Z 2371 and ASTM G85.

Table 1: Examples of QA test standards

QA TEST SCENARIO

Test chambers (or dedicated test rooms) will typically be used when environmental QA tests are conducted. In the test chamber the required test conditions regarding EMC, temperature, vibration etc. will be applied in a well-defined, accurate, consistent and repeatable manner. Test chambers are made specifically for each (sub) test: For EMC test you will typically have 3 different test chambers/rooms, one for EMI, one for EMS and one for ESD.

For test of a DUT (Device Under Test) in operational condition additional equipment may be required. If the DUT is an Ethernet network device like a switch, router or similar it may be a requirement that the DUT works error free or below a pre-defined error limit during the QA test. To verify that you can use an Ethernet traffic generator – located outside the test chamber – to generate Ethernet traffic that goes through the DUT in the test chamber. By analyzing the traffic goes through the DUT the traffic generator can verify that the DUT behaves as required.

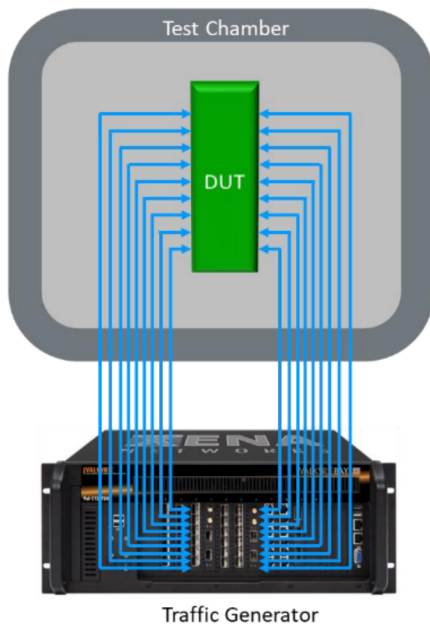


Figure 2: Traffic Generator with multiple links to the DUT in the test chamber

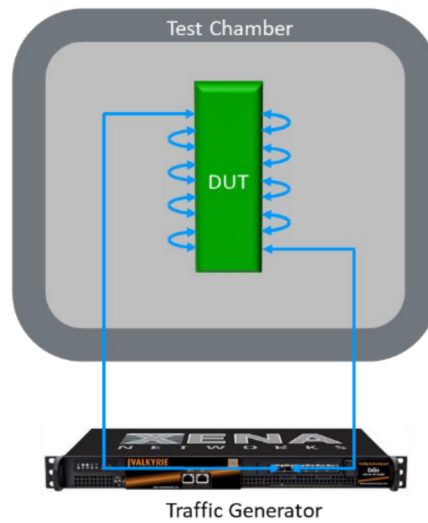


Figure 3: Traffic Generator with two links to the “snake connected” DUT in the test chamber

Standardized test suites like RFC 2544 may be used for the testing. It is however often important that events detected by the traffic generator can be correlated to change of conditions in the test chamber and (if available) information provided by the DUT. This can be achieved by time stamping test results in the Ethernet traffic generator.

Automation

QA tests can be time consuming and include repeated testing. In many cases a QA test bed will include a controller device – typically a PC – that controls the test chamber, the DUT, the traffic generator and other equipment if that is included in the test setup. The controller device will run the required tests and provide documentation of the outcome of the test. This type of test automation may run unattended overnight, saving manpower for the test. Test automation also ensures uniformity and reproduceable results.

Test automation requires that a test script, defining the test sequence, is developed. This is typically done in the Python scripting language; other scripting languages that may be used include Tcl, Perl and Bash.

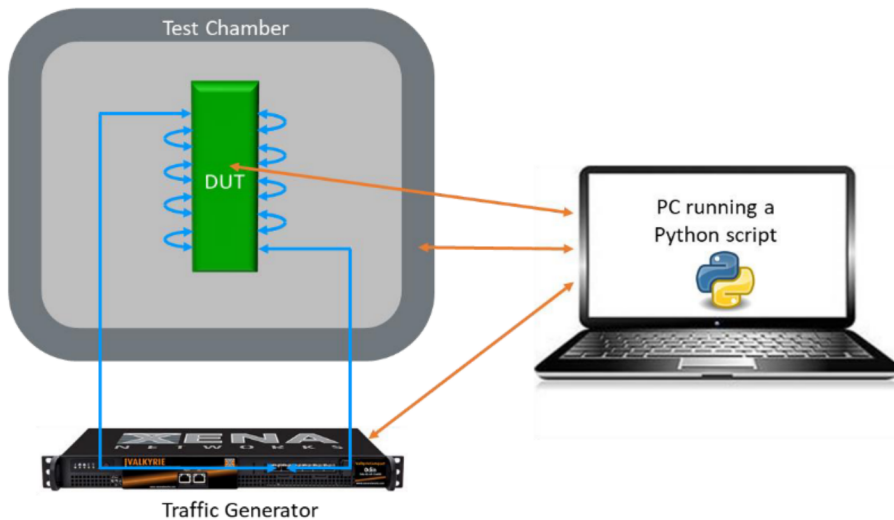


Figure 4: QA test automation with a PC controlling the QA test bed

XENA NETWORKS SOLUTIONS FOR QA TESTING

Xena Networks test solutions can of course be used for QA testing. Testing up to layer 3 is supported by the [ValkyrieBay](#) and [ValkyrieCompact](#) test chassis equipped with relevant test modules, which can support data rates up to 400 Gbps. Up to 12 test modules can be installed in the [ValkyrieBay](#) chassis.



Figure 5: The versatile and powerful Xena Networks Layer 2-3 testers ValkyrieBay and ValkyrieCompact

Based on Xena's advanced architecture, [ValkyrieBay](#) and [ValkyrieCompact](#) equipped with relevant test modules are proven solutions for Ethernet testing at layers 2 and 3. Advanced test scenarios can be performed using the free Xena test applications:

- [ValkyrieManager](#) test software is used to configure and generate streams of Ethernet traffic between Xena test equipment and Devices Under Test (DUTs) and analyze the results. [ValkyrieManager](#) can generate reports with the test results and provide a log of statistical counters with time stamps for sub sections of the test period.

- [Valkyrie2544](#) offers full support for the 4 test types specified in RFC 2544: Throughput, Latency, Frame loss and Back-to-back frames; Jitter (Frame Delay Variation) is also supported.
Valkyrie2544 includes reporting of test results and logging with time stamps of the steps in the tests
- [Valkyrie2889](#) is an application for benchmarking the performance of Layer 2 LAN switches in accordance with RFC 2889
- [Valkyrie3918](#) makes it easy to create, edit and execute all test types specified in RFC 3918. RFC 3918 describes tests for measuring and reporting the throughput, forwarding, latency and IGMP group membership characteristics of devices that support IP multicast protocols
- [Valkyrie1564](#) provides full support for both the configuration and performance test types described in Y.1564 for complete validation of Ethernet Service Level Agreements (SLAs) in a single test

Test Automation with Xena Valkyrie Products

Valkyrie Command Line Interface

The Xena Networks Valkyrie test solutions have a scripting Command Line Interface (CLI). With this the user can create a script, which defines a test sequence that can be repeated as often as required, providing reproducible results and reducing labor cost. The CLI scripting API makes test automation easier for test engineers:

- Ideal for test automation of e.g. production environments
- Controls [ValkyrieBay](#) and [ValkyrieCompact](#) chassis with installed test modules
- Powerful CLI approach from any TCP/IP capable tool environment
- Unified syntax for CLI- and GUI-generated test port configurations makes it easy to learn
- Script examples of Tcl, Perl, Java, Ruby, Bash and Python are available
- Intelligent console tool [ValkyrieCLI](#) bundled free with valkyrieManager-2G

The [ValkyrieBay](#) and [ValkyrieCompact](#) chassis are typically controlled using [ValkyrieManager](#), the free GUI application provided by Xena Networks. Everything you can do with [ValkyrieManager](#) can also be done via simple CLI text commands.

Valkyrie REST API

In addition to the CLI the Xena Networks Valkyrie test solutions also provide a REST API that can be used instead of the CLI. The Valkyrie REST API:

- is a client-less, language-agnostic, out-of-the-box, chassis embedded REST server.
- let you build automation scripts with your choice of language, tool and client environment.
- supports all Valkyrie CLI commands and adds many more abstract operations (like returning statistics as ready-to-consume JSON) that simplify and speed up automation development.

A full Python object-oriented REST client is also available, enabling Python developers to simply pip install it and start building automation scripts without spending time on developing the traffic generator layer.

For more information see: [How to build client apps using Valkyrie REST Server](#)

[ValkyrieManager](#) Scheduler

[ValkyrieManager](#) supports scheduling – a sequence of operations activated with a single mouse click – to make testing easier.

The [ValkyrieManager](#) Scheduler can be used to start-and-stop traffic, change packet rate, change operations orders, add loop section, etc. For simple test procedures it provides a quick and easy way to automate tests, not requiring development of a script in e.g. Python.

Figure 6 shows a very simple Schedule that start traffic, let it run for 10 minutes, stop the traffic, wait 10 seconds and then go back to start the traffic for another 10 minutes etc. The detailed definition of the traffic will have to be done before starting the schedule. Both the traffic definition and the schedule itself can be saved and then reloaded at a later time, making it very easy to repeat tests after they have been configured.

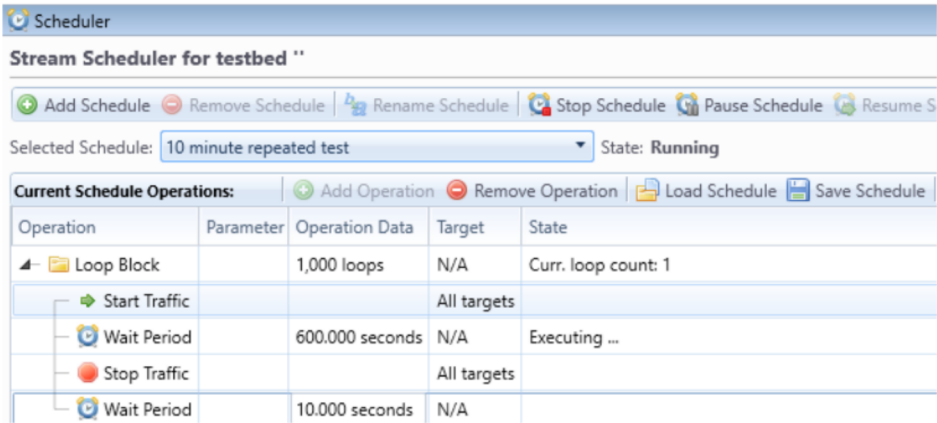


Figure 6: Simple and easy automation using the ValkyrieManager Scheduler

CONCLUSION

With Quality assurance (QA) companies can prevent errors and mistakes in their products and ensure flawless product deliveries to their customers, improving customer satisfaction and reducing the need for after-sales troubleshooting and support.

During product development the development team will do thorough testing of the product, covering e.g. functional and stress testing of the basic functionality of the product. QA testing of physical products normally includes stress testing of a number of environmental conditions, e.g. EMC tests, mechanical drop and shock tests, heat and humidity tests.

A test chamber will typically be used for environmental QA testing. In the test chamber the required conditions regarding EMC, temperature, vibration etc. will be applied in a well-defined, accurate, consistent and repeatable manner.

Test automation will often be relevant for QA testing to ensure uniformity and reproduceable test results and at the same time reduce labor cost for the test.

Xena Networks test solutions are ideal for QA testing. Testing of Ethernet products up to layer 3 is supported by the [ValkyrieBay](#) and [ValkyrieCompact](#) test chassis equipped with relevant test modules, which can support data rates up to 400 Gbps. Using the scripting Command Line Interface (CLI), the REST API or the [ValkyrieManager](#) Scheduler provided with the [Xena Valkyrie test solutions](#) the user can create test scripts and test automation for the QA tests.

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