Automotive SerDes Receiver Test Application

The Keysight AE2000R Automotive SerDes Receiver Test solution provides you with an easy and accurate way to verify and characterize the receiver in your MIPI A-PHY designs

KEYSIGHT

At a Glance

High-speed digital standards are quickly evolving to keep pace with emerging technologies such as 5G, Internet of Things (IoT), Artificial Intelligence (AI), Virtual Reality (VR), and autonomous vehicles.

Each generational change introduces new test challenges for your digital designs. You need to test your high-speed digital designs across all product development stages — from design and simulation, analysis, debug, and compliance test. The Valiframe software solutions (AE2010R / AE6920/ AE6910 / N5992A / AE2010A) anticipates test challenges, optimizes performance, and accelerates time-to-market of your high-speed computing interfaces, data center connections, and consumer electronics.

- Supported standards, which include MIPI A-PHY, Automotive Multigig Ethernet, Automotive MultiGBase-T1, PCIe, SAS, SATA, USB, HDMI, DisplayPort, MIPI M-PHY, MIPI C-PHY and D-PHY. Other standards will be continuously added to the requirements for higher data-speed testing.
- Guided setup with automated fast stress signal calibration and compliance measurement functions.
- Modern look and feel with enhanced functionalities.
- System modularity allows the user to enable only required functionalities.
- HTML reports
- Node-locked and transportable licenses
- Characterization mode for in-depth testing
- Single-lane and multi-lane device testing

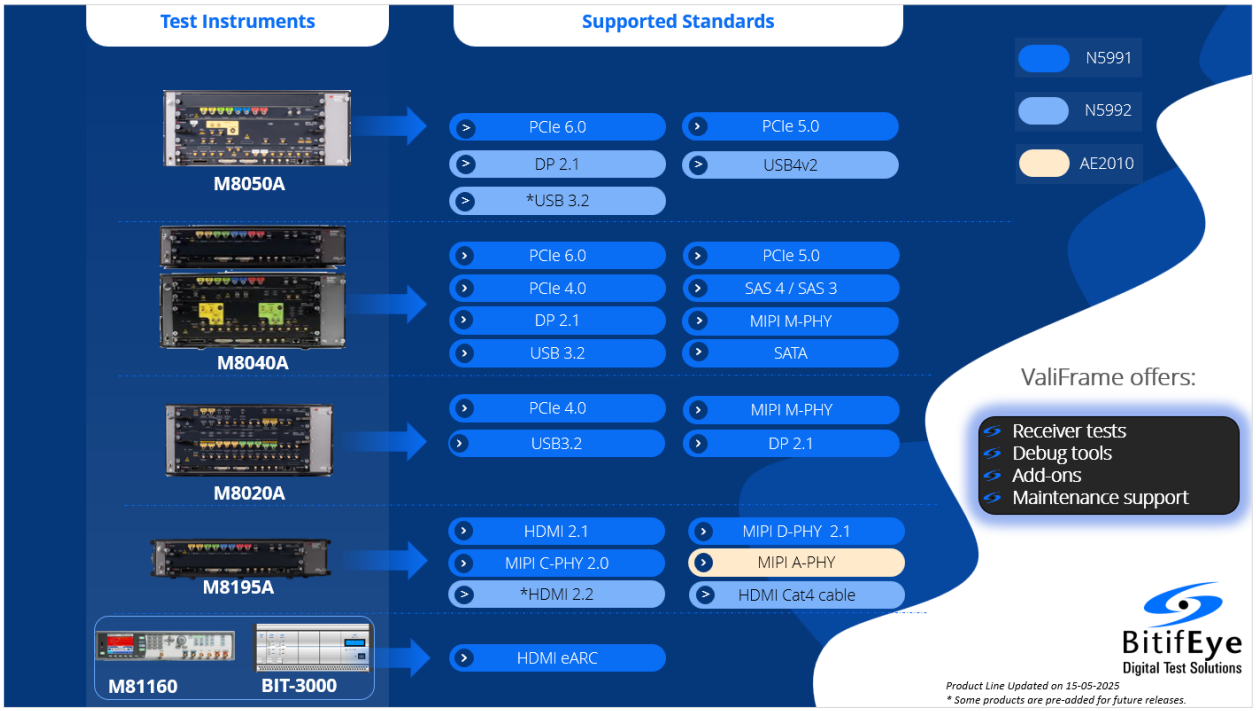


Figure 1. Valiframe Software Solution Path

Note: This datasheet outlines the covered tests, instrument requirements and requirements for the PC the test automation software is running on.

Turn your instruments into a solution

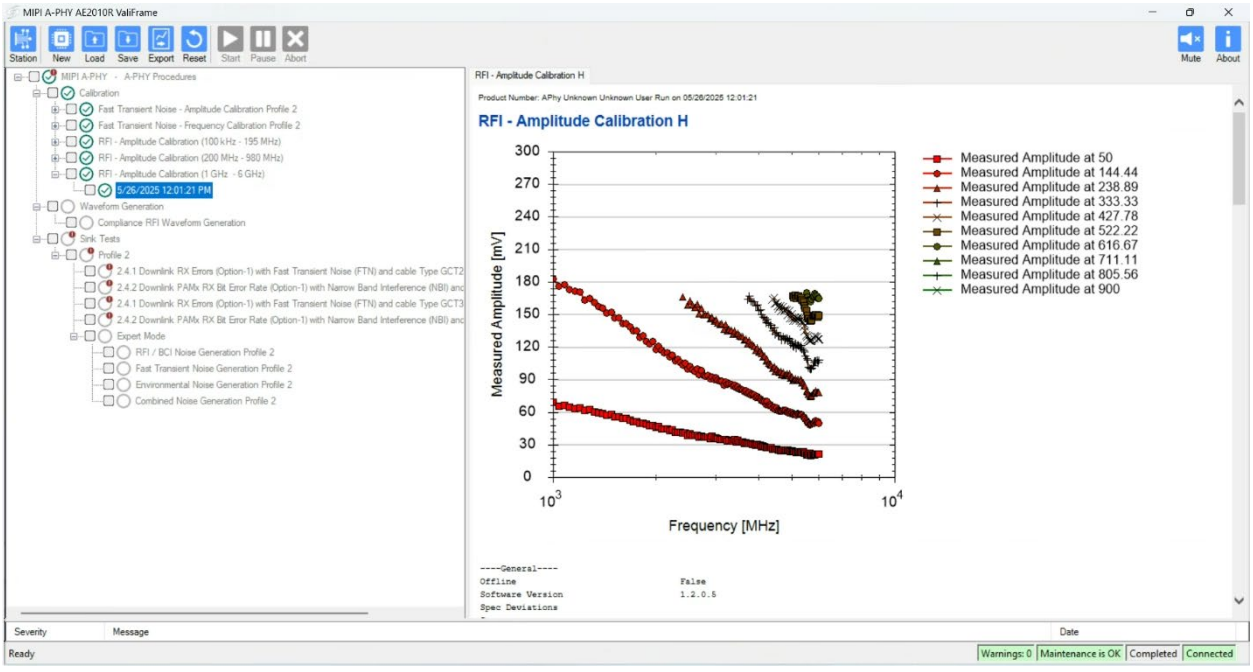
An efficient test strategy is a proven competitive advantage. The Keysight Technologies Valiframe test automation software platform combines the performance of your instruments with the convenience of your PC. The system's software provides unprecedented test integration, high-throughput, and ease-of-use for a wide range of stimulus and response systems, providing a level of control that transforms a collection of instruments into a universal, user-friendly and highly productive test solution.

Standardize your tests

The AE2010 receiver-test options provide dedicated receiver compliance tests for popular and emerging digital buses. The user can choose compliance mode for fast reassurance, or characterization mode for in-depth analysis. The Receiver Test Automation Platform's compliance testing capabilities have been repeatedly proven at interoperability workshops ("plug fests"). The AE2010 builds on the success of previous generations to deliver significant gains in productivity. Like its predecessor, the N5990A, the new system makes it easy to test multiple buses by using the same interface for all available standards. It delivers additional gains by using familiar HTML for reporting results.

Test selection and test results

The test automation software platform lets you select tests from an intuitive tree structure with multiple levels of detail. Select the tests you want to run, as well as the number of repetitions. Test results are provided in HTML format. When you measure a parameter range, it delivers a specific graph and a related data table (see Figure 2).



Compliance Testing of Receivers

Next-generation ADAS systems require camera and radar systems with increasingly high resolution. That means new requirements for speed and bandwidth. Automotive SerDes enables faster data communication to meet the demands of today's vehicles and the connected vehicles of the future.

Serializers and De-serializers (SerDes) are common in virtually all high-speed digital bus technologies. They are responsible for taking various digital inputs and sending them over a distance using high-speed serial links. Typically, SerDes are asymmetrical, employing a high-speed downlink for data transport, for example, from a camera to the central CPU, and a slower uplink to serve less demanding requirements, including device monitoring and control. Remote sensors in the vehicle that demand high-speed outputs but should ideally limit implementation complexity, power requirements, and cost are well suited for this type of link. The requirements include measurements of the BER of the receiver that, until recently, have been uncommon for anyone implementing an in-vehicle network.

To help you save time and effort, Keysight offers solutions that automate the testing and validation of Automotive SerDes designs. Our engineers have invested countless hours learning the standards and creating automated compliance tests. These proven applications help ensure proper test configuration and valid, repeatable measurement results. The net result: you'll have greater confidence that your device complies with the standard, a faster development cycle, repeatability of testing and less human error.

The Keysight AE2010R MIPI A-PHY Receiver Test Software lets you execute physical-layer (PHY) BER tests for receiver compliance using the MIPI A-PHY Compliance Test Specification (CTS). In addition to the measurement data, the report provides a margin analysis that shows how closely your device passed or failed each test.

The AE2010R MIPI A-PHY Receiver Test Software performs various electrical tests required to meet the current MIPI A-PHY receiver specifications. The software runs on a Keysight AWG embedded controller or separate PC and is available with a node-locked or transportable license type. 12 or 36 months of support and maintenance are available for each. Please see the ordering information for additional software license types and terms details.

Overview of benefits

The AE2010R MIPI A-PHY Receiver Test Software extends the powerful advantages of Keysight's AWG to testing MIPI A-PHY receiver designs. The AE2010R MIPI A-PHY Receiver Test Software greatly simplifies testing, offering the following benefits.

- Test performance of Automotive MIPI A-PHY receivers in the presence of injected noise
- Includes all required hardware coupling and amplification fixturing
- Accurate and repeatable results with Keysight AWG
- Test framework with automated report generation
- Includes required noise profiles from MIPI A-PHY specification
- Characterization and debugging modes with editable frequency and amplitude.

Outlining the Receiver Specifications

The point of receiver testing at the PHY layer stresses the receiver and validates its operation in the car's noisy and inherently harsh environment. Receiver tests ensure the quality of the digital transmission by measuring the receiver's ability to recover data from an impaired input signal. The primary metric is the bit error ratio, which indicates the relative frequency of bit errors in the receiver due to an impaired input signal.

The AE2010R MIPI A-PHY Automotive SerDes Receiver Test software is a solution that includes control software for the Arbitrary Waveform Generator (AWG) to generate noise profiles defined in the MIPI A-PHY specification. The receiver's clock recovery and error correction mechanisms are stressed while link performance is monitored. The software can emulate (as required by the specification) different noise sources present in a vehicle, including broadband, spectrally shaped noise profiles, and dynamic, transient events operating in specific frequency bands for finite periods.

The software ultimately allows for repeatable in-lab testing of real-world signals, creating confidence in the receiver. The repeatability of these test methods and limits fosters broad-scale interoperability and allows implementers to minimize risk of failure in the field, ensuring the safety of all.

The AE2010R MIPI A-PHY Receiver Test Software includes the following noise profiles. [1]

- Car noise
- Alien cable bundle cross-talk
- Fast transient
- Radio frequency ingress (RFI)/ Bulk current injection (BCI)
- PoC ripple (power over cable)

Implementing the following downlink receiver BER tests:

- RFI Noise Generation
- Fast Transient Noise Generation
- Combined Noise Generation

[1] Each allows for the configuration and generation of noise profiles defined by the MIPI A-PHY v1.0 CTS Section 2 PMD Electrical Specification Tests.

Test Selection

The test automation software platform lets you select tests from an intuitive tree structure with multiple levels of detail. This lets you select the tests you would like to run, for in-depth product characterization over multiple repetitions, changing the amplitude and frequency to test the limits of the device.

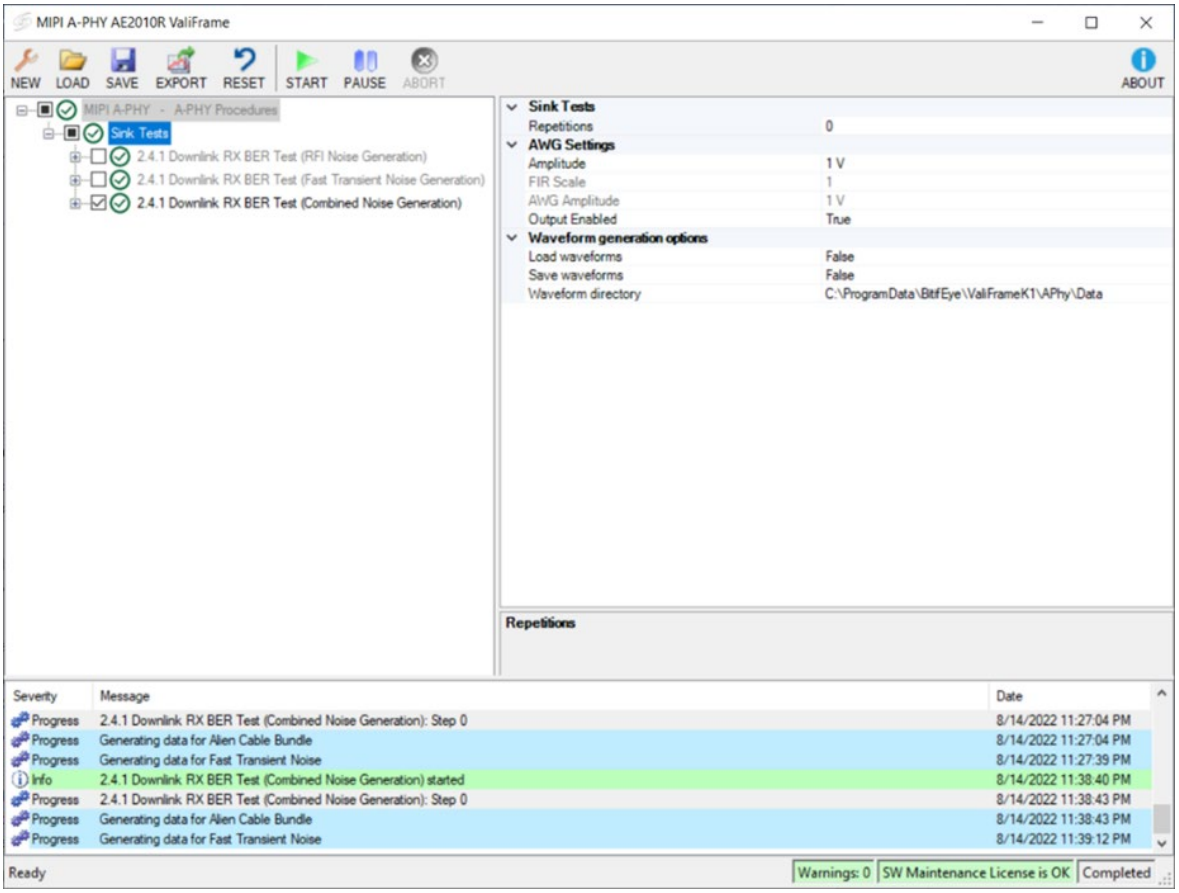


Figure 1. Test Selection for downlink receiver tests in this screen the window on the right provides details of the selected test, while the status of the tests run as well as immediate feedback on if a test passed or failed is seen across the bottom.

Figure 2. Zoomed in view of the test selection window.

Applying Configurability

Electrical systems that operate inside the automobile must overcome the presence of several different noise sources. Certain environmental noise sources are always present and are modeled as broadband, spectrally shaped noise profiles; other noise sources are dynamic, transient events operating in specific frequency bands for finite periods of time. The combined effect of these noise sources must not overwhelm the receiver's ability to interpret incoming data.

In addition to running the specified tests with limits described in the standard, the software offers the ability to customize the frequency and amplitude of the AWG output outside of specification to truly characterize the operational boundaries of your device under test.

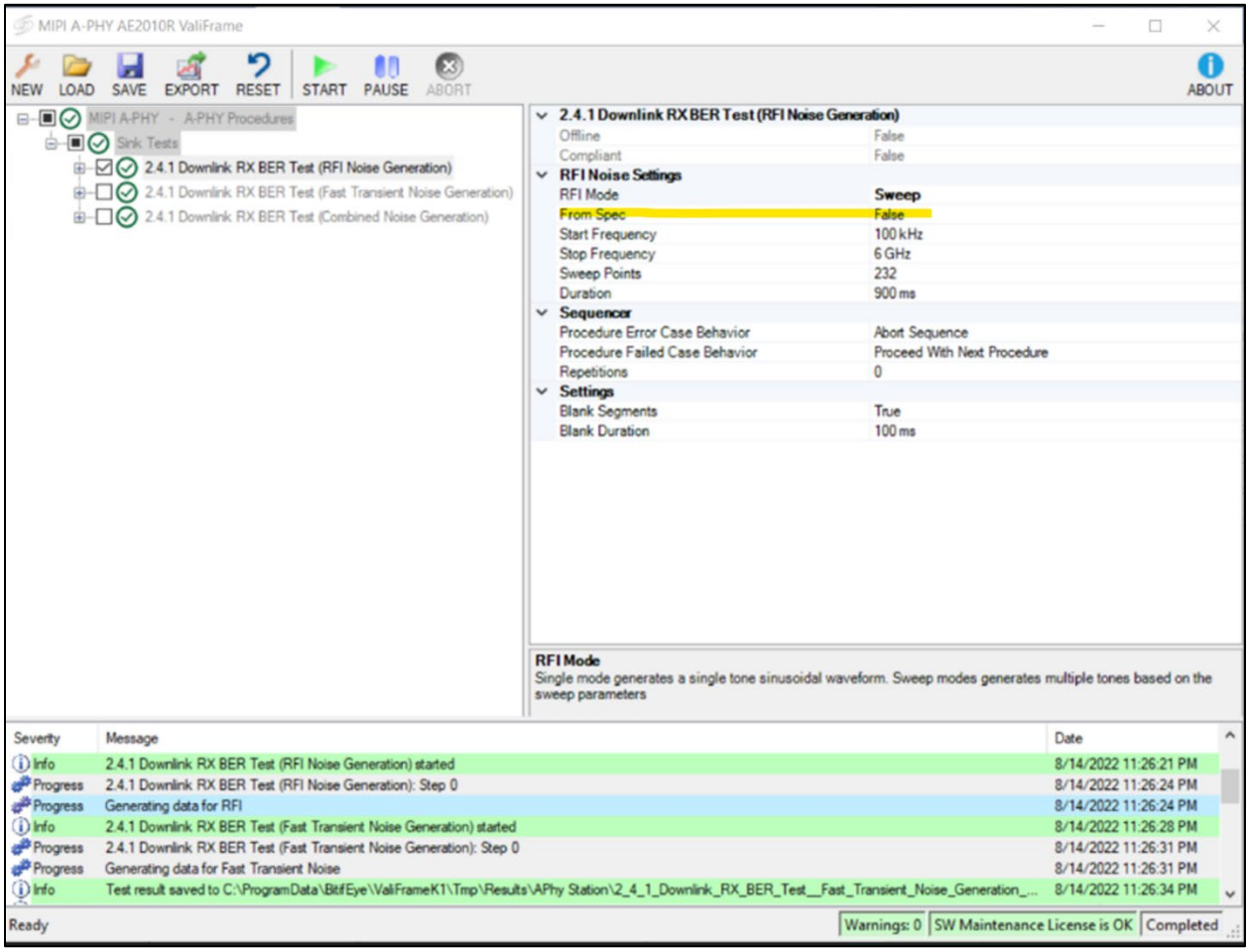
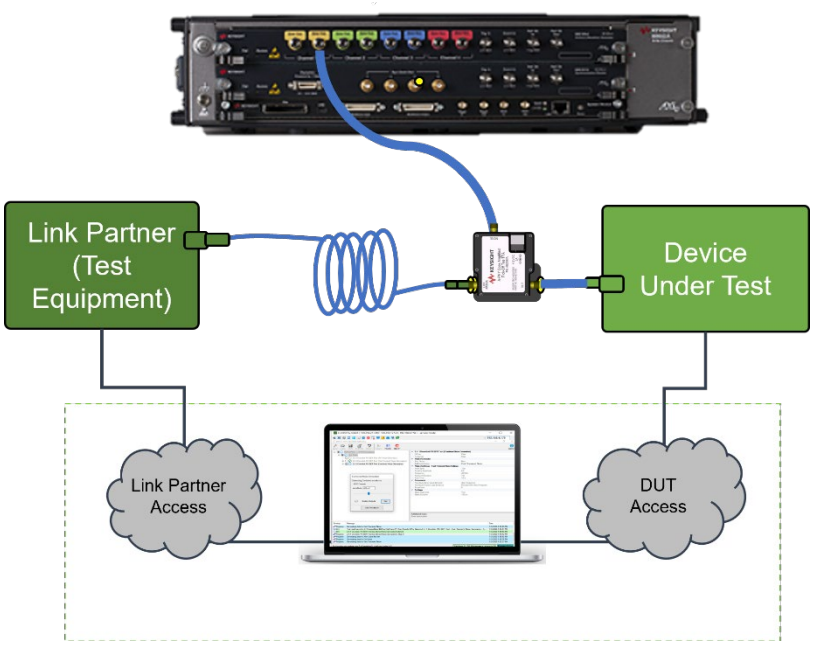


Figure 3. Toggling the selection from Spec between true (specification) and false provide an opportunity to configure specific amplitude and frequency settings.

Requirements: Instruments and Accessories

The AE2010R software runs on a separate computer which controls the instruments. The primary hardware is the Keysight M8195A AWG, a coupling fixture, and HFM adapters.



M8195A AWG: 16 GHz, 4 channels

AE2090B MIPI A-PHY Receiver test coaxial noise injection fixture

AE6962A HFM adapters

Ordering Information

Qty / type	Part number	Description
1	M8195A	AWG
	M8195A-001	1 channel, 65 GSa/s, 2 GSa per module
	M8195A-SEQ	Memory sequencer
	M8195A-16G	16G memory
	M8195A-BU2 [1]	Bundle consisting of one M9502A 2-slot AXIe Chassis with USB option
1	AE2090B	MIPI A-PHY Receiver test coaxial noise injection fixture
2	15443A	Matched cable pair
1 of each type of adapter	AE6962A-HFS	
	AE6962A-HFK	
1 of the software options	AE2010R-1FP	Node-locked
	AE2010R-1TP	Transportable
1 option of support and maintenance	AE2010R-SFM	12 months node locked SW maintenance
	AE2010R-STM	12 months transportable SW maintenance
	AE2010R-SF3	SW maintenance 3 years 1FP
	AE2010R-ST3	SW maintenance 3 years 1TP

For Example, a fully configurated solution includes:

Quantity	Part number
1	AE2010R-1TP
1	AE2010R-SFM
1	AE2090B
1	AE6962A-HFS
1	AE6962A-HFK
1	15443A
1	M8195A
1	M8195A-001
1	M8195A-SEQ
1	M8195A-16G
1	M8195A-BU2

For additional information, please go to: http://www.keysight.com/find/AE2000R

1. Or M8195A- BU3 (2 s lot is enough, 5 s lot will work but is not required) you will need chassis plus a controller BU2 omits the PC controller, but you would then need a separate PC.

System Requirements

Visit BitifEye Download Hub and read the changelog of the current software release for detailed information on software and hardware requirements.

Software

Requirements

- OS: Windows 10
- Microsoft .NET
- Keysight IO Libraries Suite
- Exact versions of software requirements are listed in the respective changelog file.

Recommendation

- Microsoft Office Excel, English version

Hardware

Requirement

- Connectivity hardware for instrumentation, depending on configuration e.g. USB3, Ethernet

Recommendations

- Multicore processor with 12 logical processors or more
- 32GB RAM or higher

Application Programming Interface (API)

The AE2010 ValiFrame remote interface allows ValiFrame functionality (such as test setup information, calibration, and test procedures, and results) to be accessed from external programming environments. Remote interface does not need a special license to be used, it is included in the base product of standards. The remote interface can thus be used to control the AE2010 with external software.

In typical use, a top-level external test sequencer takes advantage of ValiFrame functionality.

Software Maintenance

The purchase of one -SFM maintenance license for -1FP product licenses or one -STM maintenance license for -1TP product licenses provides the ability to install updates for one year.

A software maintenance license is always valid for the respective RX test or Debug Tool e.g., Link Training Suite or Frame Generator product only.

Software Maintenance includes updates to newer instrument firmware as well as procedure and test limit changes for the test specifications covered by the products the software maintenance license belongs to. Upgrades to a different test specification are not covered.

Products which do not have a software maintenance offering and are not an Add-On cannot be updated but are operational still when using the last version for which software maintenance was available.

Software without any extra software maintenance product associated with it, will have a maintenance expiration date of the license issue date + 14 days as a starting point. The software itself will still work, even if the maintenance is expired. If software maintenance has expired a new software maintenance license can be purchased for this product. But the new software maintenance will not grant coverage starting from the purchase date but from the date the previous software maintenance coverage expired. For example, the software maintenance expired on April 30th, 2020, and a new 1-year software maintenance is purchased on August 1st, 2020, the purchased coverage will take May 1st, 2020, and will end on April 30th, 2021.