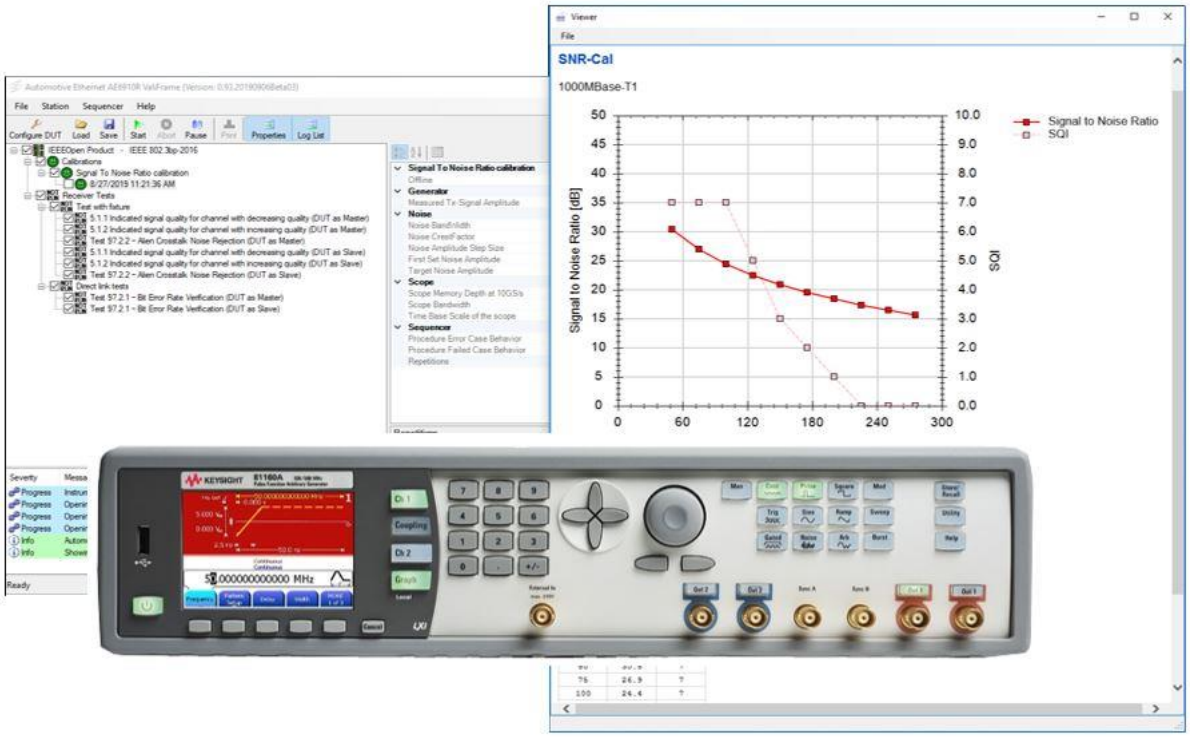
DATA SHEET

Automotive Ethernet 1G Rx Compliance

Easy and repeatable 1000BASE-T1 design validation for receiver components

The Keysight AE6900R automotive Ethernet Rx validation and conformance solution provides you with an easy and accurate way to verify and debug the receiver characteristics of your 1000BASE-T1 designs.



KEYSIGHT TECHNOLOGIES

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Introduction

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

Unlike CAN, LIN or MOST, the IEEE standard for Automotive Ethernet demands rigorous compliance verification using test cases that cover transmitters (Tx), receivers (Rx) and harness/connector assemblies. The requirements include complex measurements that, until recently, have been uncommon in the auto industry: vector network analysis with S-parameters; and bit error rate (BER) testing and protocol analysis of high-speed digital signals.

To help you save time and effort, Keysight offers solutions that automate the testing and validation of Automotive Ethernet designs. Our engineers have invested countless hours in 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 is compliant with the IEEE standard, a faster development cycle, repeatability of testing and less human error.

Validating Receiver Compliance

The AE6900R automotive Ethernet Rx test solution provides an easy and accurate way to verify and debug Automotive Ethernet modules that use IEEE 1000BASE-T1. The heart of the solution is the software, the AE6910R that lets you automatically or semi-automatically execute Ethernet physical-layer (PHY) electrical tests for receiver compliance using IEEE 802.3bp. With capabilities that span test configuration, instrument setup, results calculations and report generation, the AE6910R software will save you hours of time.

To meet signal-quality requirements, your design must pass conformance testing. When testing and validating the receiver components of your automotive Ethernet module or switch, the software provides three overall automatic tests: Bit Error Rate Verification, for alien crosstalk noise rejection, and indicated signal qualify for the channel.

The AE6910R displays the results in a HTML or –xls format. In addition to the measurement data, the report includes pass/fail limits for each test.

Using the Keysight AE6910R Rx Compliance Application Software greatly simplifies 1G Automotive Ethernet receiver compliance testing. The software automatically configures the required test equipment, reducing the overall test time.

The software is available as part of the overall solution AE6900R. The software comes as a node-locked perpetual license and has an optional SW maintenance available in 12-month increments.

The software is installed on a separate PC. The test setup includes an 81160A, a test fixture and 'golden DUT' as described on the following page of test setup. The software comes as part of the overall solution AE6900R.

Outlining the Receiver Specifications

The AE6910R Automotive Ethernet Rx Compliance Test Software covers the following test specifications.

Physical layer receiver specifications for automotive Ethernet

Standards body	Parameter	Description
1000BASET1_ IOP_24a / b in "OpenAlliance1000BASE-T1 Interoperability Test Suite Specification	5.1.1 and 5.1.2	Signal Quality Indicator
IEEE 802.3bp	97.5.4.1	Bit Error Ratio test
IEEE Std. 802.3bp	97.5.4.2	Alien Crosstalk Noise Rejection

Table 1. Conformance tests performed by the AE6910R compliance application software as described in IEEE 802.3bp.

Saving Time with the AE6910R Rx compliance software

The AE6910R Rx test software saves you time by setting the stage for automatic execution of 1000BASE-T1 required receiver tests. Some of the difficulties in performing these tests for 1000BASE-T1 are: properly understanding the specification, configuring/ running the instrument/s and then analysing the measured results by comparing them to limits published in the specification. The AE6910R 1000BASE-T1 electrical test software does much of this work for you.

The AE6910R Rx test software automatically configures the 81160A for the test and provides an informative results report that includes a BER measurement, Signal Quality Indicator (SQI) and Alien Crosstalk Noise Rejection as well as a pass/fail limit. See Table 1 for a list of the measurements and specifications tested in the AE6910R.

The test specifications software offers several features to simplify the validation of automotive Ethernet designs:

The AE6910R Software:

- Guides you how to make connections to the device under test.
- Helps you to quickly check for proper instrument configuration.
- Enables a quick way to communicate with your DUT.
- Automatically sets up the test equipment for each test.
- Runs the tests automatically and mostly unattended.
- Provides detailed information of each test that has been run.
- Creates a printable text report of the tests that have been run.

Test Selection

The test automation software platform lets you select tests from an intuitive tree structure with multiple levels of detail. A key element of the platform is the test sequencer. This lets you select the tests which you want to run, for example for in depth product characterization and the number of repetitions (loops).

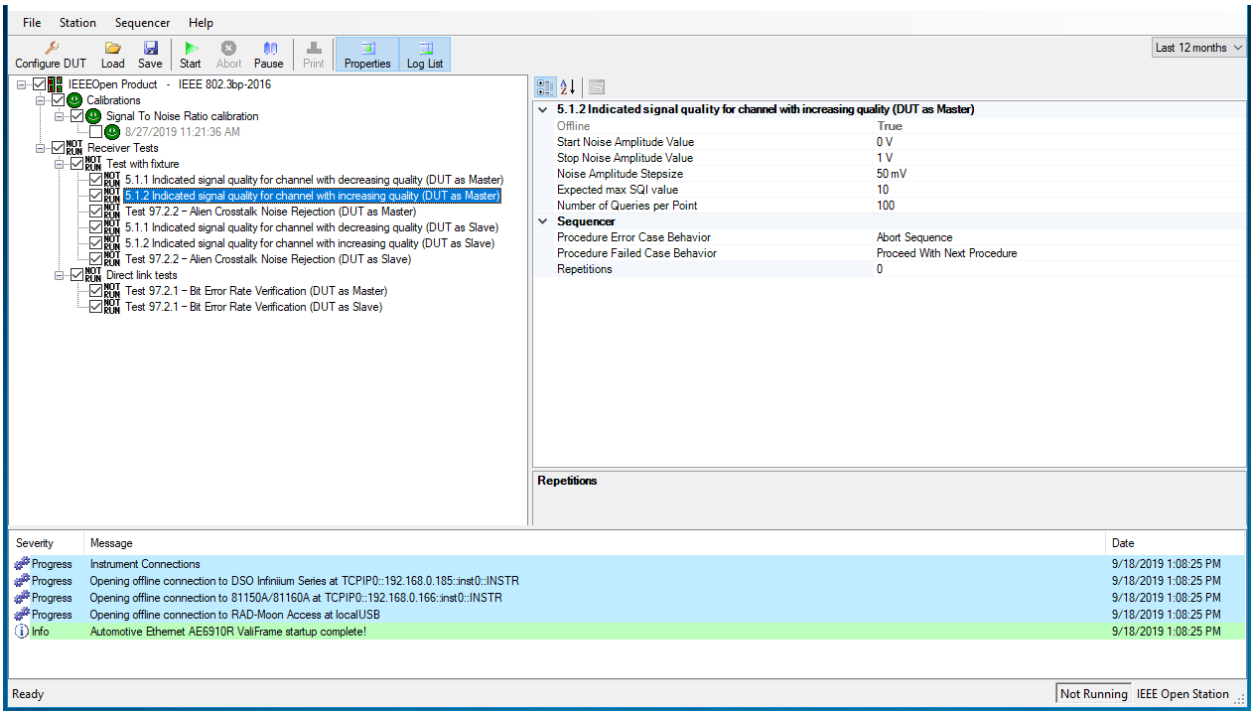


Figure 1. The main screen of the AE6910R ValiFrame environment

In figure 1 above, the window on the right provides details of the selected test. while the window across the bottom provides the current status of the tests being run as well as immediate feedback on if a test passed or failed.

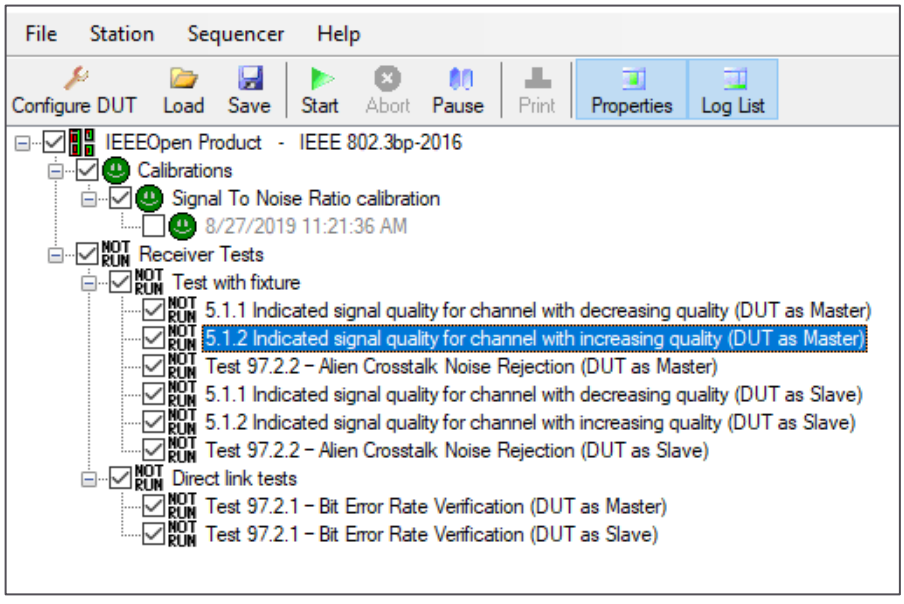


Figure 2 Zoomed in view of the main test sequencing window.

Applying Configurability and Guided Connections

It can be difficult to build the bit error rate verification system to characterize the Rx signals and get an accurate BER count. Keysight takes the complexity away and offers a clear validation of the BER count objectively. This saves you time and hassle in understanding the specifications, setting up the tests and interpreting the results.

The AE6900R solution utilizes the AE6910R Rx software to extend the Keysight 81160A and a media converter to enable testing of SQI, Alien Crosstalk Noise Rejection and bit error rate. The Keysight AE6910R quickly walks you through the steps required to set up the tests, perform the tests, and view the results.

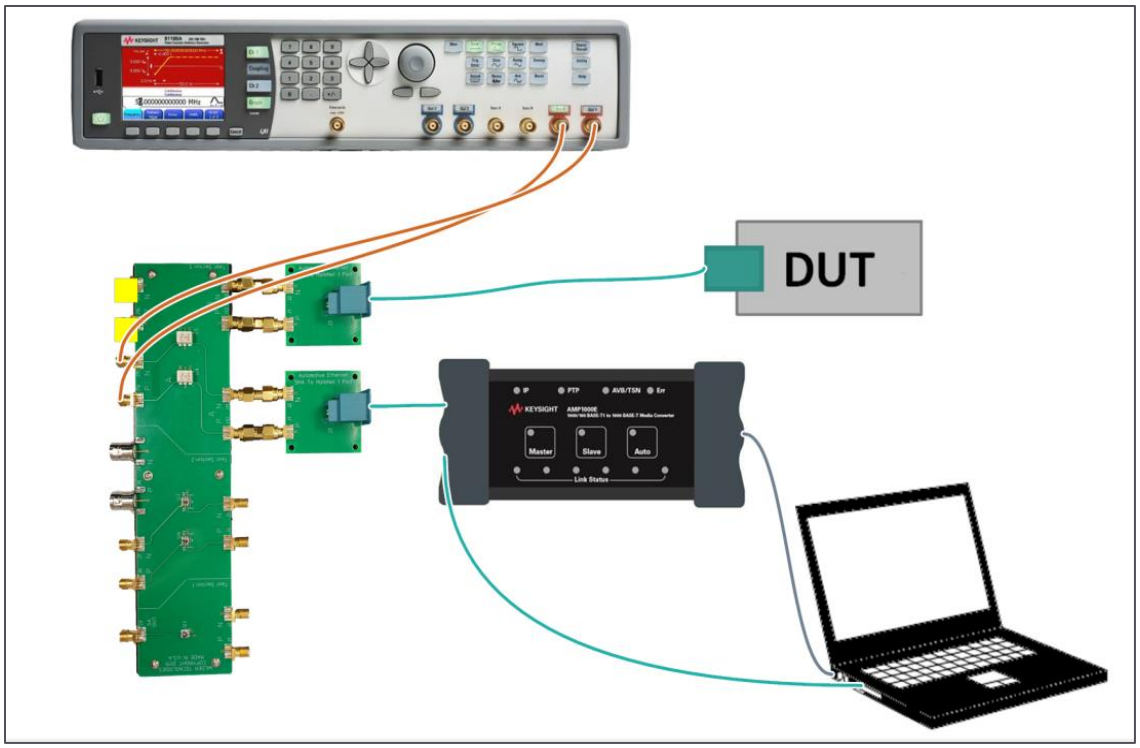


Figure 3. Test Setup of the AE6900R includes the 81160A, AE6941A test fixture, AE6942A or AE6943A adapter board, APM1000E media converter and cables to connect it all together.

Generating Pass/Fail Reports

In addition to giving you measurement results, the AE6910R Automotive Ethernet Rx Compliance Software also provides a report format that shows you if your product passes or fails. The test automation software platform provides test results in HTML or Microsoft Excel format. When you measure parameter curves, it delivers both the curves (see Figure 5) and a data table. The AE6910R displays and updates all the results on-line. After stopping or pausing the sequencer, you can access any result for analysis at your convenience

Compliance and characterization modes

In compliance mode, you run individual tests as specified by the applicable standards. In characterization mode, experienced users have access to test properties such as frequency range, frequency step width and limits. This makes it easy to perform margin tests.

Automated and repeatable

Some of the tests require alot of interaction and steps with the DUT. AE6910R allows you to run those long-lasting tests unattended overnight. The tests are easily repeated and can be run exactly the same multiple times, enabling the run under various conditions (climate chamber, EMV and more).

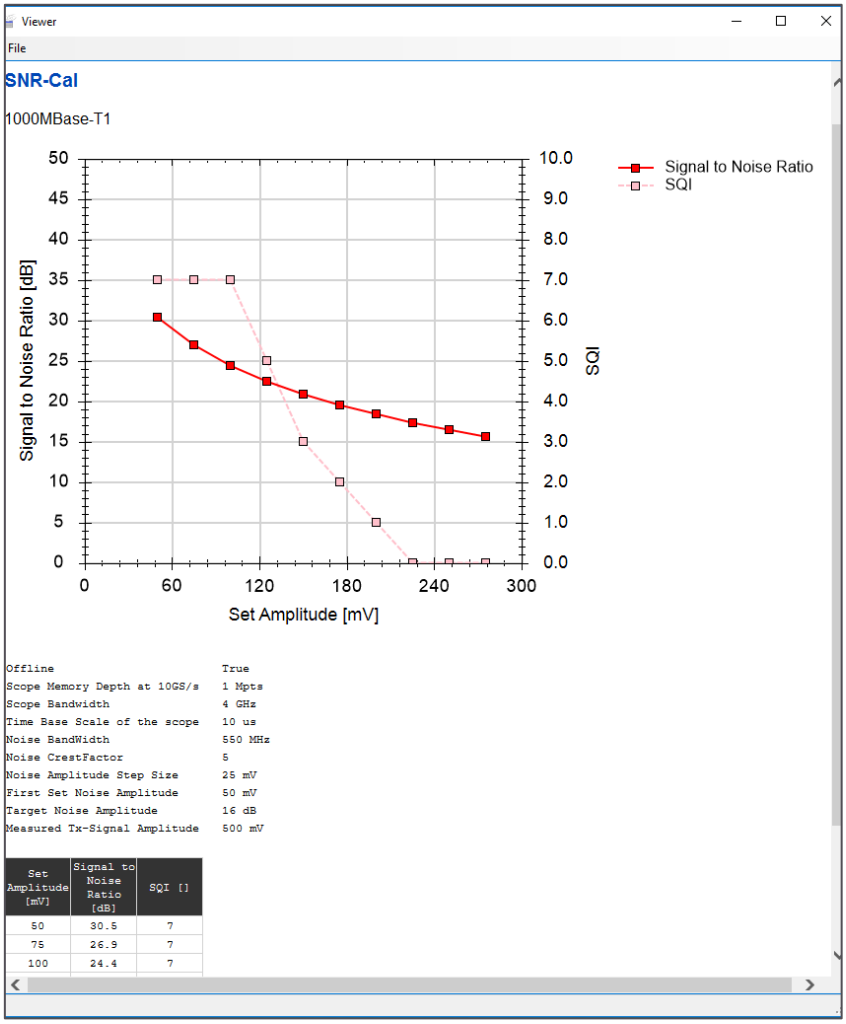


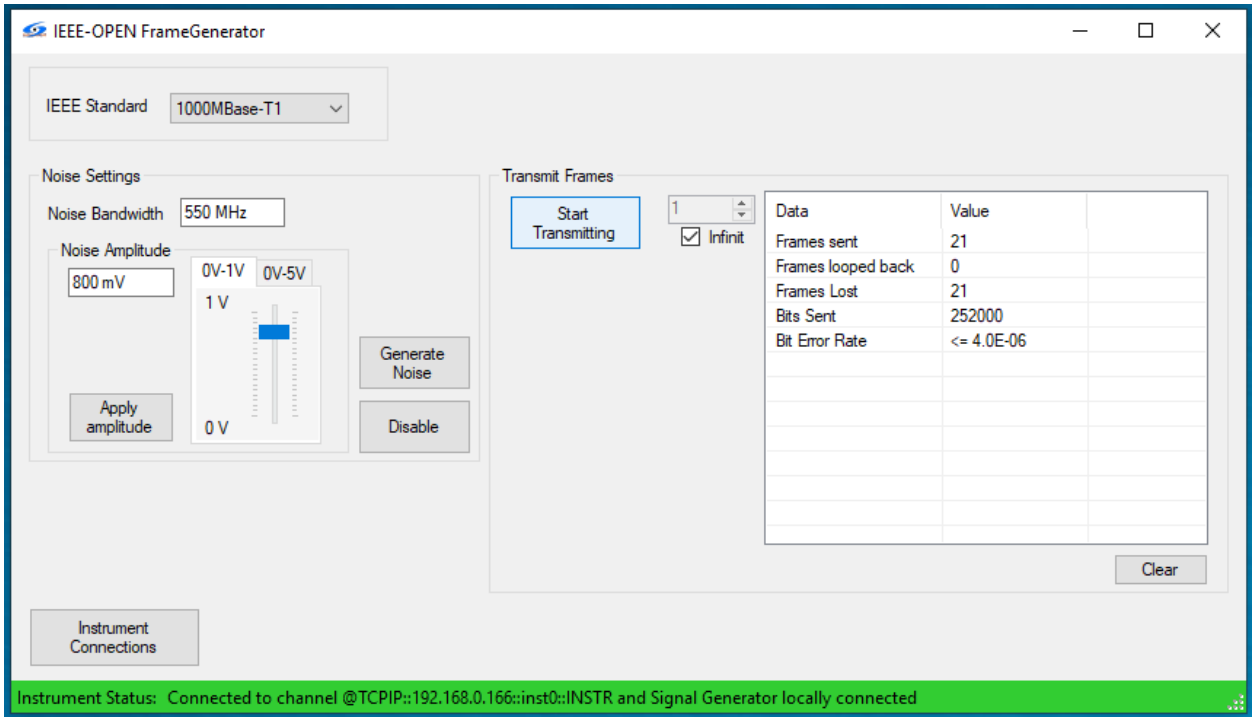
Figure 5.Typical test result

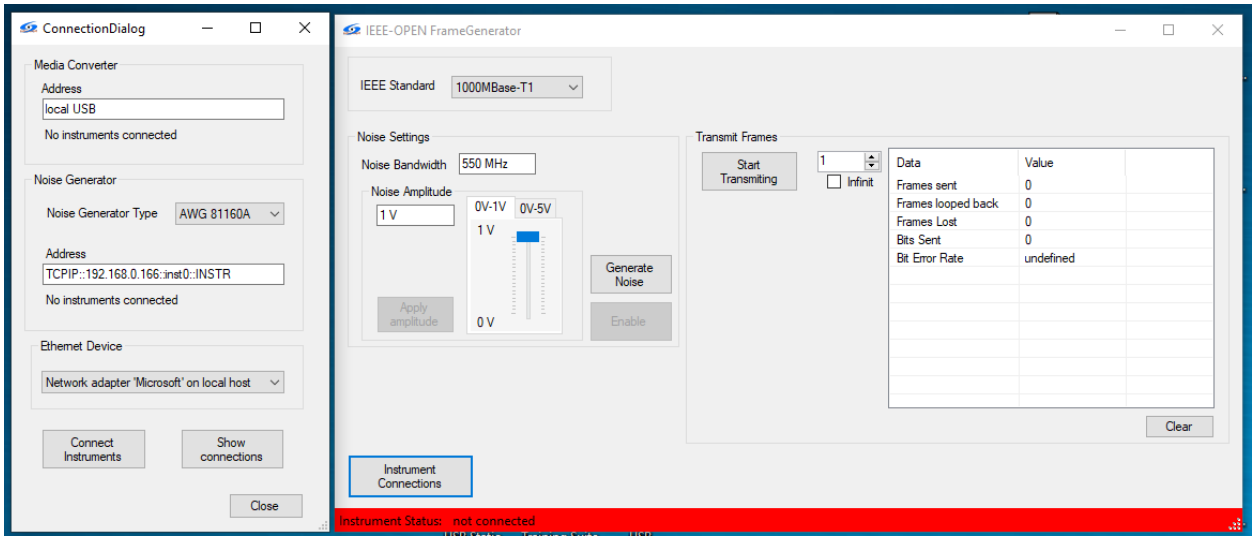
Interface to your specific DUT

AE6910R provides you a powerful interface to your specific DUT. It is based on a simple scripting approach and can be easily adapted to any kind of chip. Keysight offers example scripts for specific chip vendors.

Debugging Capabilities

The AE6910R Rx test software also comes with a second tool called, FrameGenerator. FrameGenerator software enables a quick and easy way to send information to your DUT and is ideal for trouble-shooting and debugging. It allows the user to observe the DUT response after sending a selectable number of frames with varying noise signal injected. The built in Frame Generator function runs with all supported configurations.





Integration into your own test world

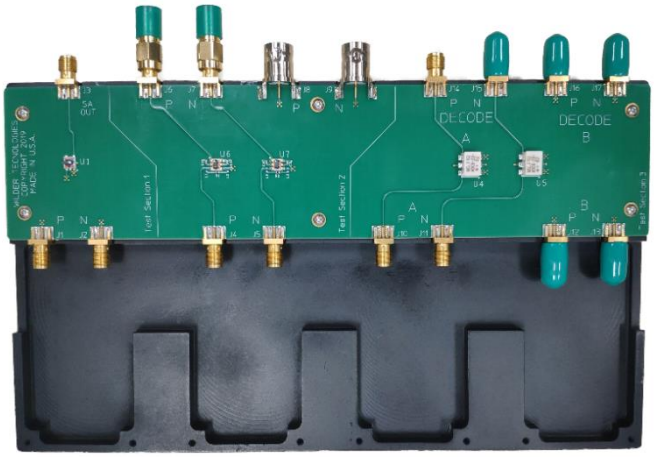
AE6910R provides the possibility to programmatically control ValiFrame from another program through the ValiFrame remote interface. For further information, please check

https://bitifeye.com/wp-content/uploads/Download_Manuals/SW%20Manuals/N5990A_Remote_Programming_Description.pdf

Requirements: Instruments & Accessories

The AE6910R software runs on a separate computer and controls the instruments. The primary hardware on which the solution is built on is the Keysight 81160A Pulse Function Arbitrary Noise Generator along with a media converter.

81160A Pulse Function Arbitrary Noise Generator



The Keysight AE6941A automotive Ethernet test fixture is used with AE6943A SMA to MATEnet adapter or the AE6942A SMA to Molex/Mini-50 to inject noise into the DUT.

Keysight APM1000E media converter standard Ethernet 1000BASETx to Automotive Ethernet 1000BASE-T1.

Ordering Information

	Description	Option number through AE6900R	Standalone part number
	Automotive Ethernet Rx Compliance Test Software	AE6910R	
	Automotive Ethernet compliance test fixture	AE6900R-FXT	AE6941A
Adapter of choice Qty 2	SMA to Molex/Mini-50 adapter board	AE6900R-MOL	AE6942A
	SMA to MATEnet adapter board	AE6900R-MAT	AE6943A
	Media converter; Automotive Ethernet 1000/100 BASET1 to standard Ethernet 1000BASETX	AE6900R-M1E	APM1000E
	MATEnet to MATEnet cable	AE6900R-105	NA
	Molex/mini-50 to Molex/mini-50 cable	AE6900R-109	NA
	SMA cable SMA (m) – SMA (m)	AE6900R-104	8121-3118
	BNC to SMA adapter	AE6900T-102	54855-67604
	2 channel, arbitrary waveform generator 81160A	AE6900R-160	81160A

To calibrate the 81160A and AE6941A test fixture an oscilloscope is needed. Infiniium S-sereis is recommended.

For example

A completely configured order for full compliance with one part number	*A completely configured order for full compliance with standalone part numbers:*
Qty (1) AE6910R opt Qty (1) AE6910R-1FP Qty (1) AE6900R-FXT Qty (2) Either AE6900R-MOL or AE6900R-MAT Qty (1) AE6900R-M1E Qty (1) AE6900R-105 Qty (1) AE6900R-104 Qty (1) AE6900T-102 Qty (1)AE6900R-160	Qty (1) AE6910R opt Qty (1) AE6910R-1FP Qty (1) AE6941A Either Qty (2) AE6942A or AE6943A Qty (1) APM1000E Qty (1) AE6900R-105 *(not available standalone)* Qty (1) 8121-3118 Qty (1) 54855-67604 Qty (1) 81160A opt opt 002 Qty (1) 2 channel

For more information, please visit www.keysight.com/find/AE6900R

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