Keysight N5990A SAS Receiver Test

User Guide

KEYSIGHT TECHNOLOGIES

Notices

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Contents

1 Introduction

KEYSIGHT TECHNOLOGIES

What's in this Chapter

The Keysight N5990A Test Automation software is an open and flexible framework for automating electrical compliance tests for digital buses such as PCI Express or USB. It is globally marketed and supported by Keysight Technologies as N5990A

The N5990A for SAS (Serial Attached SCSI) provides automation of the SAS receiver testing for the physical layer. The tests are implemented according to the requirements of the "SAS 12G Receiver (RX) Test Keysight J-BERT High-Performance BERT Systems" document. These tests are designed to determine if a product conforms to specifications defined in the "Working Draft Project American National T10/BSR INCITS 534 Standard", version 3.1. Additionally, N5990A offers some custom characterization tests to provide more details on DUT behavior beyond the limits.

The software supports automatic control of the J-BERT M8020A high-performance serial BERT (Bit Error Ratio Tester). It calibrates the stress conditions and controls all test electronic equipment for automated receiver tolerance tests.

Figure 1and Figure 2 show the examples of Receiver Test setups for the J-BERT M8041A and M8062A system configurations.

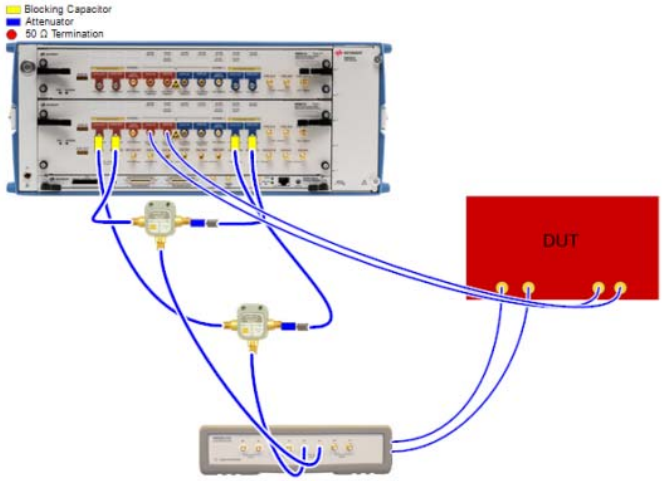

Figure 1 SAS Receiver Test Setup Example (for J-BERT M8041A)

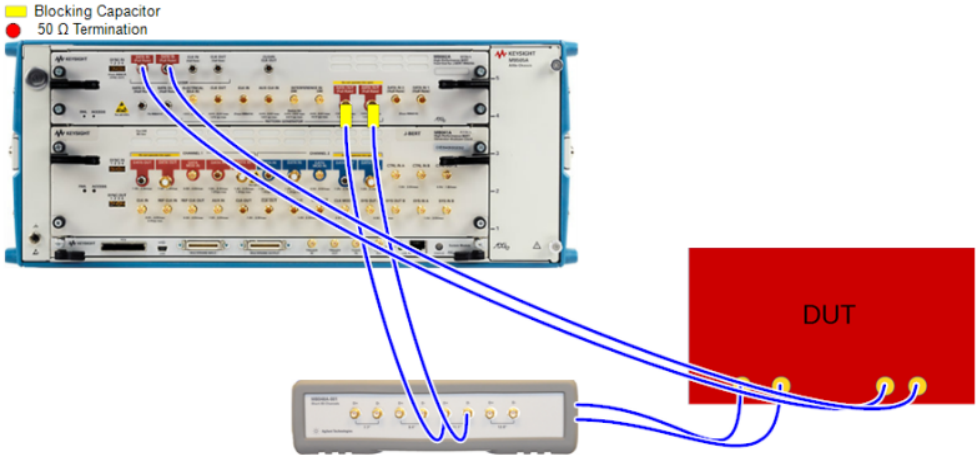

Figure 2 SAS Receiver Test Setup Example (for J-BERT M8062A)

Overview of this Guide

This guide provides a detailed description of the N5990A Test Automation Software Platform.

Document History

First Edition (February, 2018)

The first edition of this user guide describes the functionality of software version 1.0

2 N5990A SAS Station

Refer to the ValiFrame "N5990A Installation Guide" for instructions on how to install and start the N5990A Test Automation software platform. After the software has been installed, two icons are added to the desktop as shown in Figure 5 and Figure 9. One is for the Station Configuration and the other for ValiFrame.

N5990A SAS Station Configuration

You need to start the N5990A Station Configuration prior to N5990A. It allows you to select the application (that is, SAS, PCI Express, HDMI ...) and the set of instruments used for it. To start the software, double-click the left mouse button on the **ValiFrame SAS Station Configuration** icon (see Figure 3) or alternatively, go to "**All Programs >BitifEye >SAS >ValiFrame SAS Station Configuration**".

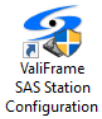

Figure 3 Keysight SAS Station Configuration Icon

When the software is started, the **Station Selection** window appears as shown in Figure 4. Here, **SAS Station** is selected by default.

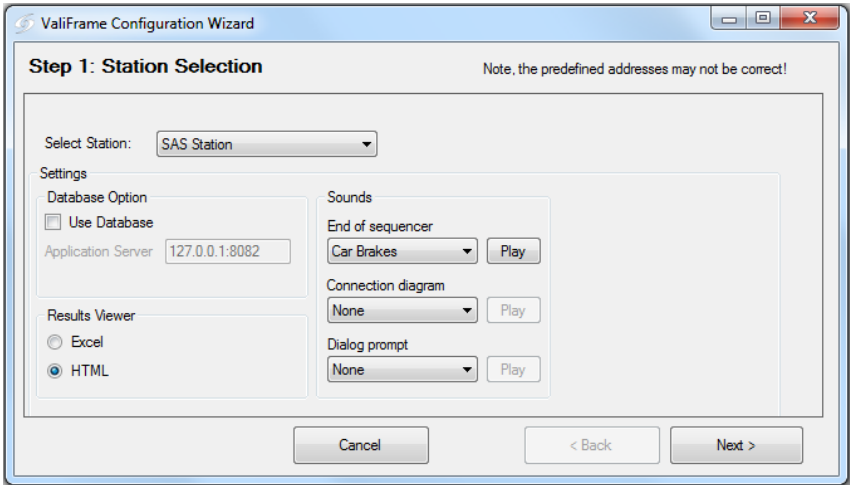

Figure 4 SAS Station Selection Window

In the **Settings** section, the following options are available:

Database Option

In case the option N5990A opt. 001 was purchased, the interface to SQL databases (and web browsers) is available. To establish a connection to the database application server, clear the default **Use Database** check box and enter the IP address of the server.

Results Viewer

Here, you can select the viewer for test results from the following options:

- Microsoft Excel
- HTML

Sounds

A warning sound can be activated in different states of program:

- End of Sequencer plays the selected sound at the end of a sequence.
- Connection diagram plays the selected sound every time a connection diagram pops up.
- Dialog Prompt plays the selected sound at each dialog prompt.

There are different sounds available for selection:

- None (deactivates the sound)
- Car brake
- Feep Feep
- Ringing
- TaDa
- Tut

To hear the selected sound, click **Play** before you set the sound of your choice.

After the station has been selected, click **Next** to continue. The **Station Configuration** window is displayed as shown in Figure 5. It shows possible instrument combinations that can be used for SAS testing. It contains options such as:

1 Data Generator
2 Aggressor Generator

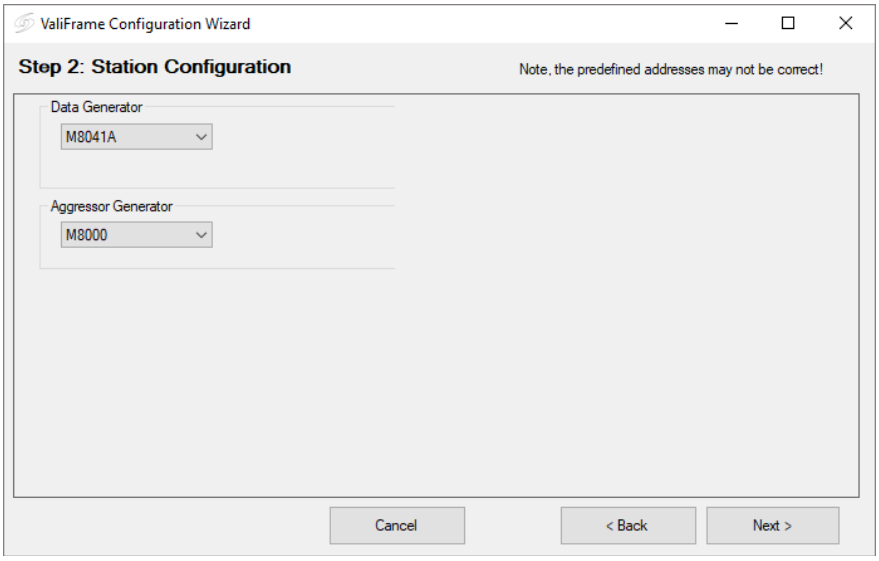

Figure 5 SAS Configuration Window

Data Generator

The data generator can be selected as:

- M8041A
- M8062A

The **M8041A** BERT module can generate data rates up to 16GT/s and is used for Gen3 testing. For Gen 4 testing, it is necessary to choose the **M8062A** BERT module that allows generation of data rates up to 32GT/s.

Aggressor Generator

This option allows you to select the source used to generate the crosstalk aggressor signal. It can be selected as:

M8000

The second pattern generator of the **M8041A** BERT module can be used as an aggressor since the **M8041A** pattern generators have independent jitter injection.

Custom Device

This applies only when the **M8041A** is selected. For SAS Gen4, when the **M8062A** BERT module is chosen, the crosstalk is not added to the signal.

Once the SAS station is configured, you must set the instrument addresses. An example for **Instrument Configuration** is set as shown in Figure 6.

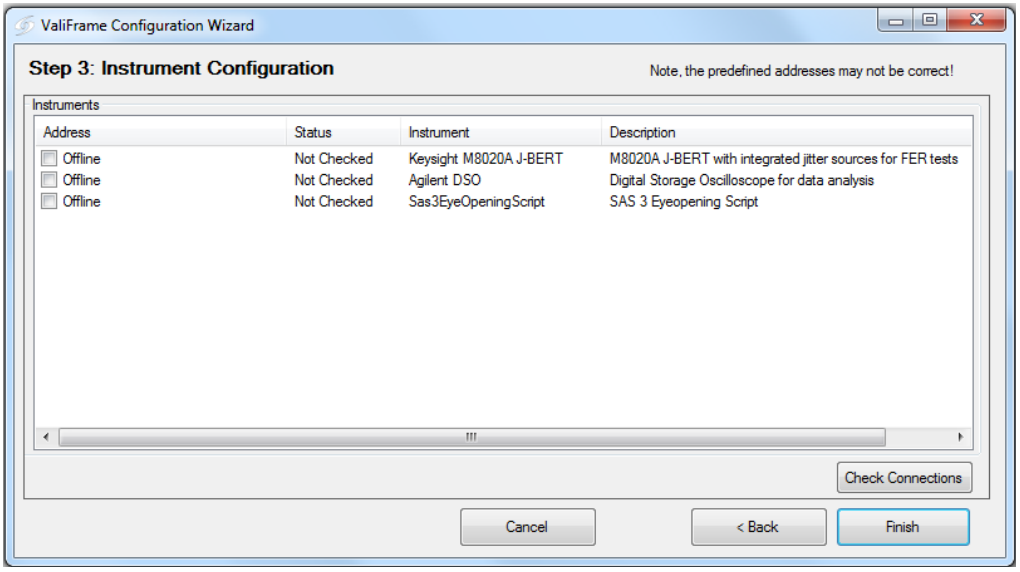

Figure 6 SAS Instrument Configuration Window

After the installation process, all instruments are configured by default in **Offline** mode. In this simulation mode, the hardware does not need to be physically connected to the test controller PC. N5990A cannot connect to any instrument in this mode. In order to control the instruments that are

connected to the PC, the instrument address must be entered. The address depends on the bus type used for the connection, for example, GPIB (General Purpose Interface Bus) or LAN (Local Area Network). Most of the instruments used in the SAS station require a VISA (Virtual Instrument System Architecture) connection. To determine the VISA address, perform the following steps:

1. Run the *VISA Connection Expert*. to access the VISA Connection Expert, right-click the *Keysight IO Libraries Suite* icon in the task bar.
2. Select the first entry *Connection Expert*.
3. Enter the instrument addresses in the **Station Configuration Wizard**, for example, by copying and pasting the address strings from the Connection Expert entries.
4. Click **Apply Address** before selecting the **Offline** check box to set the instruments needed to be Online.
5. Click **Check Connections** to verify that the connections for the instruments are established successfully.

If anything is wrong with the **Instrument Address**, a window is displayed with a message describing the problem.

Starting the N5990A SAS

To start the N5990A SAS, double click the **N5990A SAS** icon that appears on your desktop as shown in Figure 7. Alternatively, go to **Start > All Programs > BitifEye > SAS > ValiFrame SAS**.

Figure 7 Keysight M-PHY SAS Icon

Starting the N5990A SAS opens the following window (Figure 8).

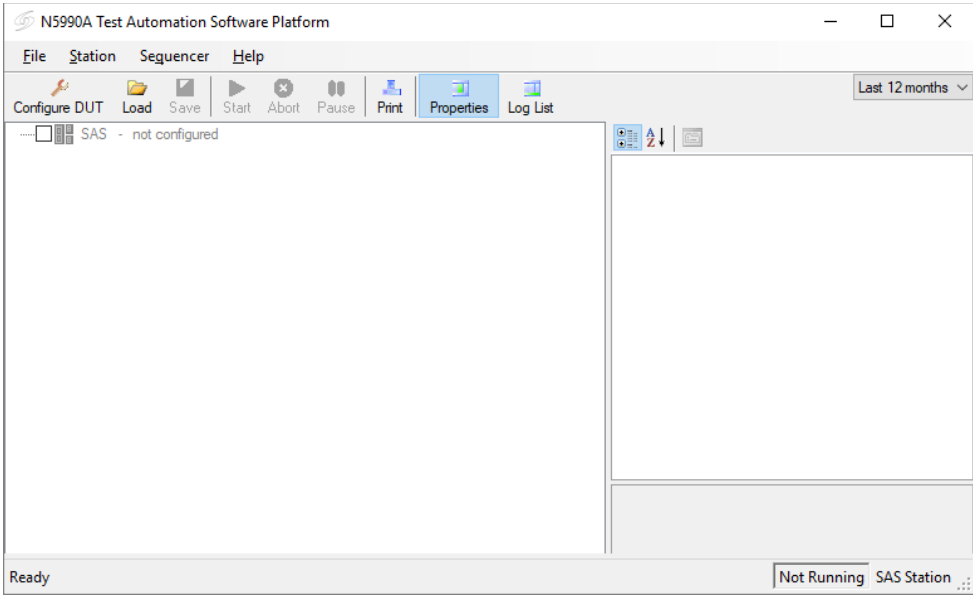

Figure 8 ValiFrame SAS User Interface

The test parameters need to be configured before running any test or calibration procedure. Click **Configure DUT** to pop up the **Configure Product** window (see Figure 9).

Configuring the DUT

In the **Configure DUT** panel (see Figure 9), you can select DUT parameters such as **DUT Type**, **Spec Vers.**, as well as parameters related to the receiver test configuration. The selected parameters are later used in calibration and test procedures shown in the ValiFrame main window.

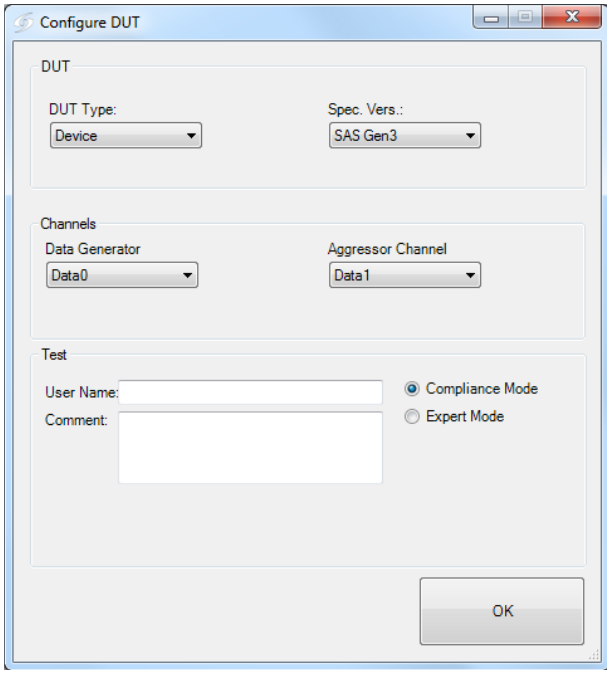

Figure 9 Configure DUT Panel

DUT Parameters

The DUT Parameters are listed in Table 1.

Table 1 DUT Parameter List

Parameter Name	Parameter Description
Product	
DUT Type	The DUT type can be selected as: ▪ Host ▪ Device
Spec. Vers.	The Spec version can be selected as: ▪ SAS Gen3 ▪ SAS Gen4
Data Generator	Select here the output of the data generator used as victim channel. ▪ For M8041A channel 0 or 1 can be selected. ▪ For M8062A only channel 0 can be selected.
Aggressor Channel	Select here the output of the data generator used as aggressor channel. ▪ For M8041A channel 0 or 1 can be selected. ▪ For M8062A this option is not available.
Test	
User Name	A user name can be added to the test information.
Comment	A comment can be added to the test information.
Compliance Mode	In this mode, the tests are conducted as mandated by the CTS, the test parameters used in the calibration and test procedures are shown but cannot be modified by the user.
Expert Mode	Calibrations and tests can be conducted beyond the limits and constraints of the CTS; the test parameters used in the calibration and test procedures are shown and can be modified by the user.

3 Calibration and Test Procedures

During the execution of all calibration and test procedures, results are displayed automatically in a data table as well as graphically. The viewer can be either a **MS-Excel** or a **HTML** worksheet; this can be chosen during **Station Configuration** (see Figure 4). Once a specific calibration or test procedure is finished, the **MS-Excel**/**HTML** worksheet is closed. To re-open it at any time, double click on the respective procedure in the respective tree.

To save a calibration data worksheet in a workbook, go to **File > Save Results as Workbook**...at any time. It is recommended that you carry out this step at least at the end of each N5990A run.

If you conduct calibration and test procedures several times during the same N5990A run, the result worksheets are combined in the workbook. If you conduct a test procedure without prior execution of calibration procedures in the same test run, only the test results will be saved to the workbook. As a safety feature, all calibration and test results are saved by default to the ValiFrame "Tmp" directory (refer to the "Keysight N5990A Test Automation Software Platform Installation Guide"). The sub-folder "Results/SAS Station" contains the Excel files of the final results measured at each calibration and test procedure. In addition to calibration data worksheets, the calibration data files are generated. These files are saved by default to the N5990A calibrations folder. If these calibrations are run again,

the data file will be overwritten. In order to save the calibration data files at each configuration, you must copy the files from the directory: C:\ ProgramData\BitifEye\ValiFrame\Calibrations\SAS and save them manually in any folder before re-running the calibrations.

Example of SAS Calibration / Test Procedure

All calibration and test procedures are included in the respective groups. For most procedures, you can set some specific parameters in **Expert Mode**. In Figure 10, the Random Jitter Calibration is highlighted as an example. The respective parameters are shown on the right side of the N5990A User Interface. This is achieved by clicking the calibration/test name. To start one or more procedures, do the following:

1. Select the Check box for the corresponding procedure. The **Start** button is enabled and colored in green.
2. Click **Start** to run the procedure.
3. Once all procedures are run, click **Save** to save the N5990A configuration as a single ".vfp" file. You can also click **Load** to recall an N5990A configuration. In this way, you can run the DUT again without configuring it.

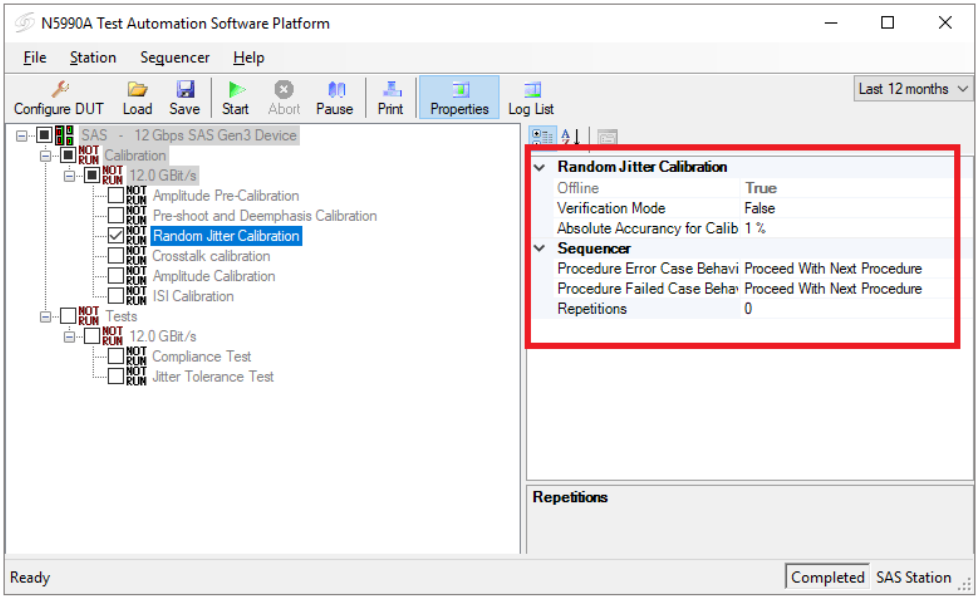

Figure 10 Example of SAS Calibration / Test Procedure

CAUTION

Before executing calibration or test procedures, ensure that the SAS Station Configuration is conducted properly with all necessary instruments such as the Infiniium oscilloscope set to "Online". All calibrations can be run in Offline mode, that is, without any instrument connected. The Offline mode is intended for product demonstrations with simulated data. CALIBRATIONS RUN IN OFFLINE MODE DO NOT GENERATE VALID CALIBRATION DATA.

Connection Diagram

To display the connection diagram, right-click the desired test or calibration and select **Show Connection** as shown in Figure 11. Alternatively, the connection diagram is displayed automatically when you start the selected procedure.

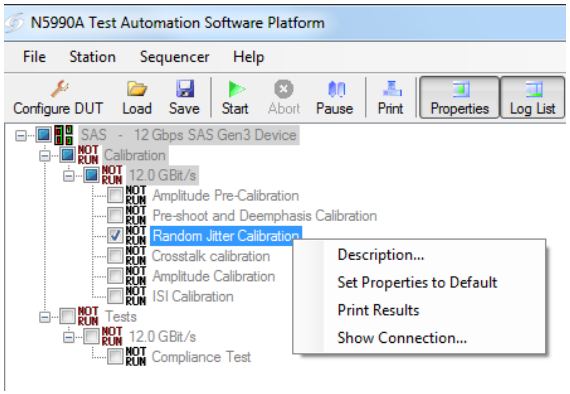

Figure 11 Show Connection Diagrams

Result Description

Once the selected procedures are run, the smiley at the individual procedure indicates the result (Pass / Fail / Incomplete) by displaying it's face in specific ways as given below (see Table 2.

Table 2 Smiley's Result Description Table

Smiley	Description
	Indicates that the procedure passed successfully at the previous run and the results are available.
	Indicates that the procedure was passed in offline mode previously and the results are available.
	Indicates that the procedure passed successfully at the present run.
	Indicates that the procedure was aborted/disturbed somehow and failed at the previous run.
	Indicates that the procedure was aborted/disturbed somehow and failed at the present run.
	Indicates that the procedure failed at the previous run.
	Indicates that the procedure failed at the present run.
	Generally this kind of smiley displays two results such as the first half indicates that the result of the present run and the second half shows the result of the previous run. In this example, the first half indicates that the procedure passed successfully at the present run and the second half means that it was not completely run at the previous run.

SAS Parameters

SAS parameters are of three types:

1. Sequencer parameters
2. Group parameters
3. Procedure parameters

Sequencer Parameters

Sequencer parameters control the flow of the test sequencer, not the behavior of individual procedures. They are identical across all versions of N5990A. One of them, Repetitions, is available for all procedures and groups in the procedure tree. The others are only available for procedures. Like all other parameters, sequencer parameters are shown on the right side of the N5990A user interface and they can be changed by you as illustrated in Figure 12.

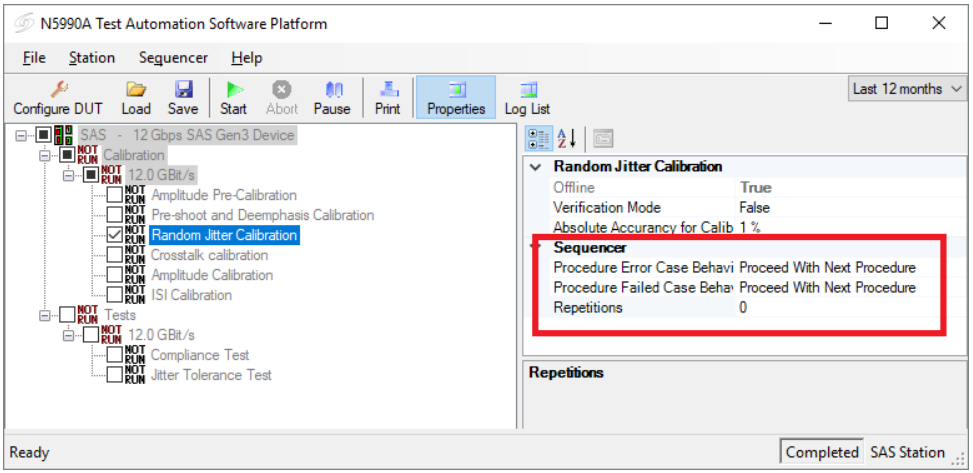

Figure 12 SAS Sequencer Parameters

All sequencer parameters are listed in alphabetical order in Table 3.

Table 3 SAS Sequencer Parameters

Parameter Name	Parameter Description
Procedure Error Case Behavior	Proceed With Next Procedure: If an error occurs in the current test or calibration procedure, continue by running the next procedure in the sequence. Abort Sequence: Abort the execution of the sequence.
Procedure Failed Case Behavior	Proceed With Next Procedure: If the current test or calibration procedure fails, continue by running the next procedure in the sequence. Abort Sequence: Abort the execution of the sequence.
Repetitions	The number of times the group or procedure is going to be repeated. If the value is '0', it runs only once.

Group Parameters

Group parameters are used for several related calibration or test procedures. They are shown on the right side of the N5990A user interface when the selected entry of the procedure tree on the left is a group instead of an individual procedure.

The SAS Receiver Test Software has some group parameters (in addition to "Repetitions") on the top-level entry of the procedure tree as shown in Figure 13. These will be common for all N5990A procedures.

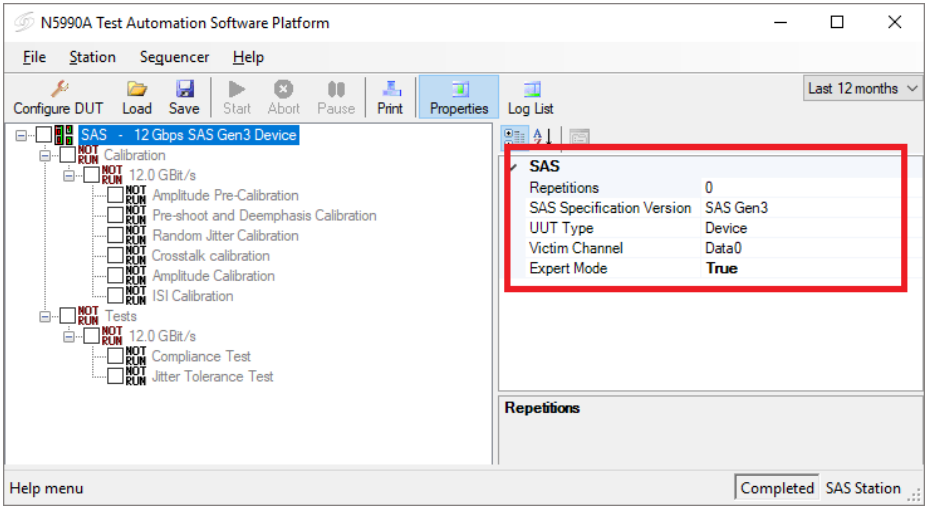

Figure 13 SAS Group Parameters

Table 4 describes the group parameters.

Table 4 SAS Group Parameters

Parameter Name	Parameter Description
SAS Specification Version	It shows the spec version that has been selected (SAS Gen3 or SAS Gen4).

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