



3000 Series PXI Modules

Getting Started with PXI SelfTest

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Introduction

The PXI SelfTest is a Windows-based software application that enables user to test a PXI system with one-button ease.

Note: This is not a calibration tool or a replacement for manual acceptance test.

The PXI SelfTest exercises all RF paths in the digitizer and signal generator, including divider bands, attenuators and modulators, and verifies the status of AWG (Arbitrary Waveform Generation) and triggering facilities. The test results are displayed with coloured LED displays and on-screen text, as well as a log file that can be reviewed by experienced support engineers.

If the PXI system fails the automated test, the user will be asked to follow the on-screen instructions, either to retry or change a module, possibly with external help.

System configuration

PXI system configuration:

PXI system hardware comprises of the following items:

3011 Synthesizer (or 3010 with external 10MHz reference signal)

303x Digitizer (3030, 3030A, 3035, 3030C, or 3035C)

3010 Synthesizer

302x Signal Generator (3020, 3020A, 3025, 3020C, 3021C, 3025C and 3026C)

PXI chassis

PXI embedded controller or External PC with PCI-PXI bridge

Connections between modules are predefined.

3060/3065/3061 is optional.

Note that these modules can be placed in any order in the chassis, as long as they are connected according to the wiring diagram in Fig. 1. However, user must verify resource strings are correctly assigned to each instrument. If there are more than one set of modules in the PXI chassis, the user will have to decide which ones to use and change the resource strings accordingly. Also, if 303x and 302x are not placed in the same PXI segment, the Trigger Test cannot be performed.

PXI software configuration:

NI VISA v 3.3.1 or above

Aeroflex PXI Module software version 6.11.0 or later (if the user chooses not to use PXI SelfTest's built-in driver)

Note: The PXI SelfTest has Aeroflex PXI Module software version 6.11.0 built in.

Operating environment:

Intel-based PC with Pentium processor or equivalent

Windows XP SP2

Installation

Double-click on *PXISelfTest_vx_x_x_x.exe* and follow the instructions.

The default install location is C:\Program Files\Aeroflex\PXI\Self Test Application.

Resource detection

The application automatically detects the available Aeroflex PXI modules present in the PXI chassis, and attempts to assign the resource strings to digitizer or signal generator. The detected resource strings will be displayed in the edit boxes as well as the text area. (See Fig. 1) The user must verify the resource strings are correctly assigned to digitizer and signal generator or make changes if necessary.

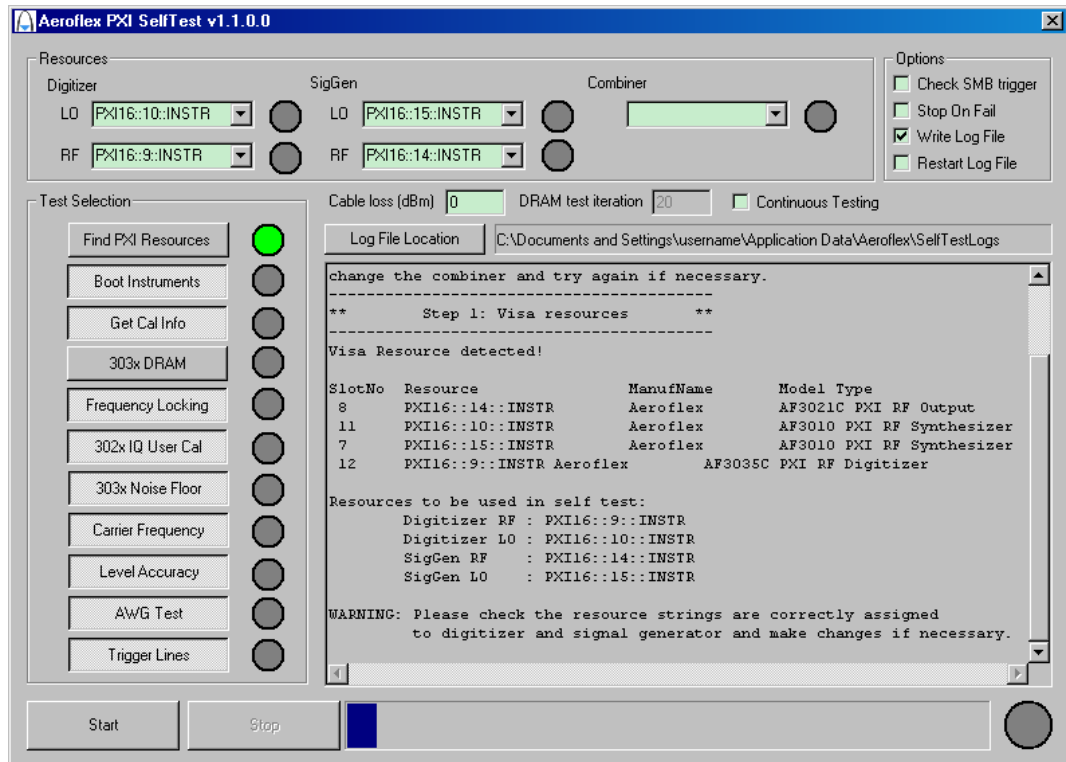


Fig. 2 Resource detection success

If the program fails to detect the PXI resources or is unable to assign the resources to a digitizer or signal generator, the empty resource strings will be displayed (Fig. 3). Resource strings must be supplied to continue testing. A failure to detect any modules indicates problems with either the PXI chassis or the link between the PXI chassis and the PC. Always switch PXI chassis on prior to turning on the controlling PC.

If there are more than one set of modules in the PXI chassis, all available resources will be listed in the result window. However, the user must verify the resource strings assigned to digitizer and signal generator are correct.

Tip: If you wish to change the resource strings, make sure the Find PXI Resources check button is not enabled, otherwise this operation will continue to try to detect the resources and ignore what is entered into the edit boxes.

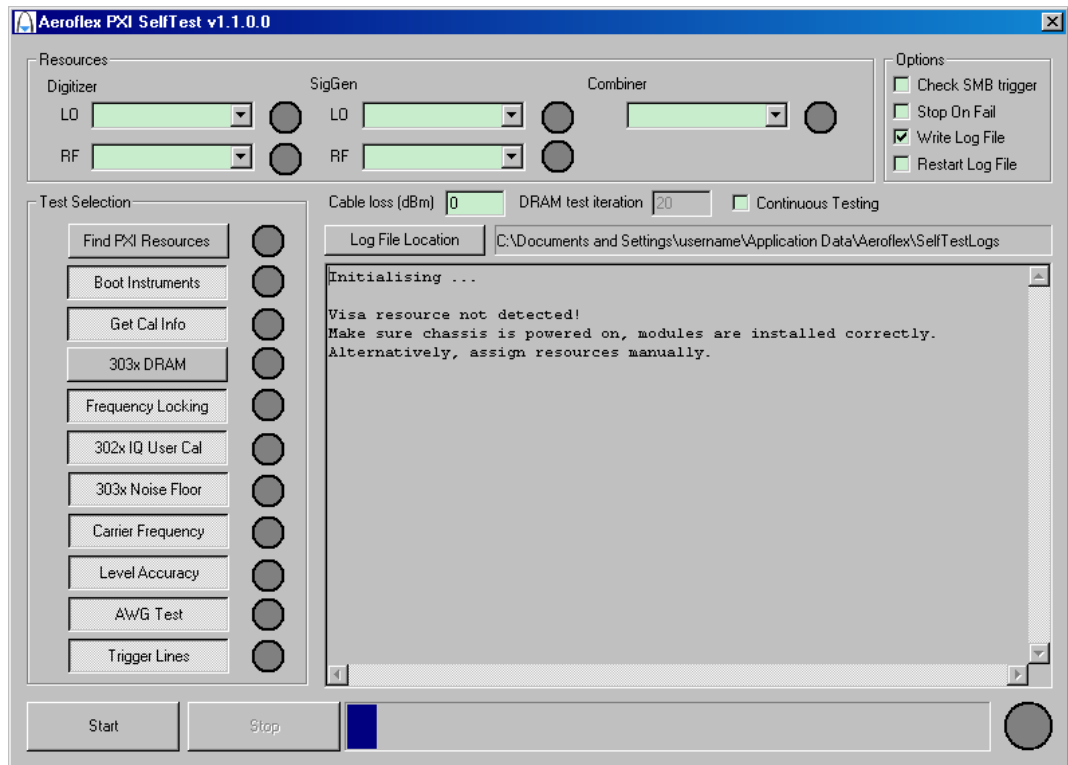


Fig. 3 Resource detection failed

Geotest chassis

If a Geotest PXI chassis is detected, additional information will be displayed such as chassis type, serial number, slot temperatures and power rail voltages (Fig. 4).

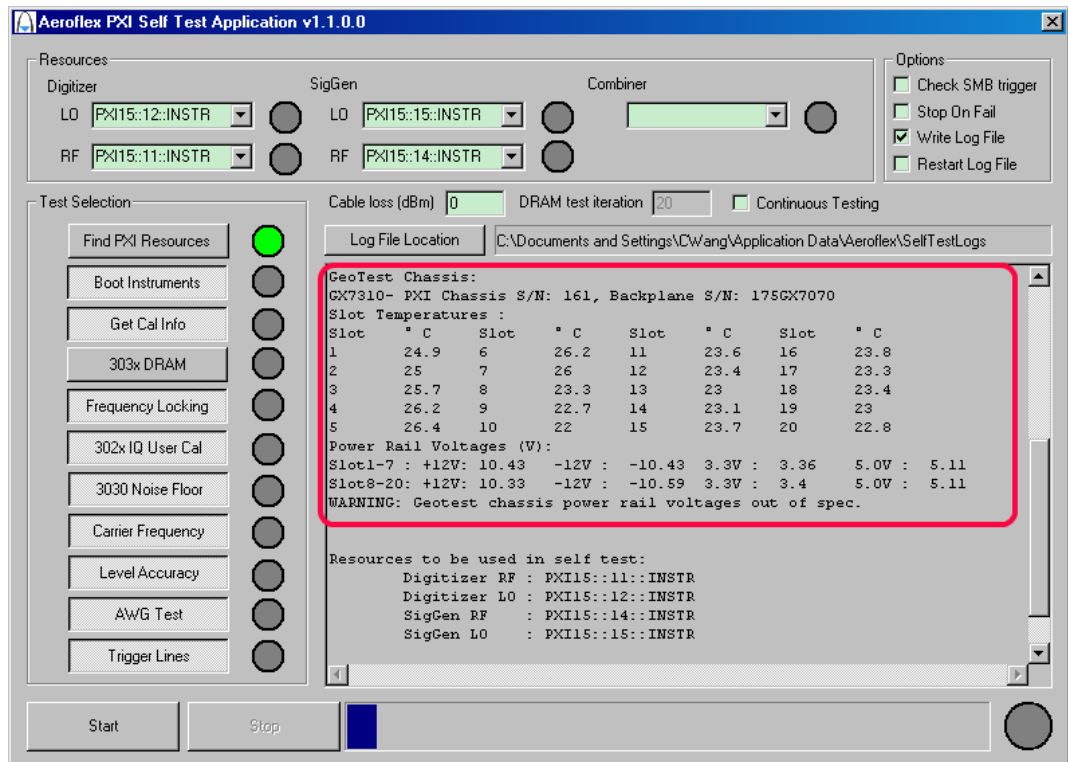


Fig. 4 Geotest chassis information

Performing the automated test

Clicking the **Start** button at the bottom left corner of the graphical user interface begins the automated test sequence. This test sequence includes:

- resource detection
- boot instruments
- read module information
- check frequency reference locking
- 302x IQ user calibration (this takes several minutes)
- check 303x noise floor
- check carrier frequencies
- check level accuracy (including attenuators)
- check AWG functions
- check triggering off trigger bus/SMB (optional).

During the test, the progress bar and LEDs indicate the progress and status of the test. If the test passes, the corresponding LED turns green; otherwise, a red LED is displayed. You can stop the test at any time when it is running. The test stops as soon as the current operation is finished.

You can choose to leave out a number of tests, or run the tests step by step, by pressing the relevant buttons: for example, Fig. 5 Test Item Selection

shows that the 'Find PXI Resources' step is disabled and the 'Boot Instruments' step is enabled. However, it is recommended to perform all tests sequentially, as otherwise misleading results may be given because it is assumed that all tests have been performed in sequence. By default, all tests are selected.

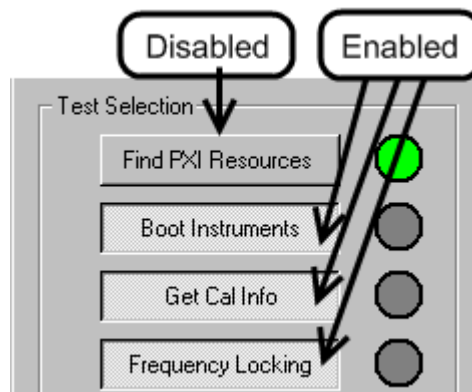


Fig. 5 Test Item Selection

The automated test sequence is set to continue-on-fail by default (Fig.6). All test steps run regardless of the pass/fail status of previous tests (exception Find PXI Resources and Boot Instruments).

If 'Stop On Fail' option is checked, PXI SelfTest would not attempt to execute further tests on detection of a failure. The test sequence stops if any test step fails. A pop-up window is displayed and you can find out which test has failed by looking at the red LED or reading through the log file.

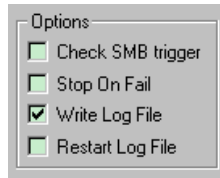


Fig. 6 Stop On Fail / SMB trigger and other options

Note that since not all modules support SMB triggers, and not all systems make use of the SMB trigger connectors, the SMB trigger test is left as an optional test. The 'Check SMB trigger' checkbox enables/disables the test if both digitizer and signal generator have SMB connectors fitted (Fig.6).

Continuous testing option (Fig.7) can be enabled to capture intermittent faults. When enabled, all selected tests will be executed repeatedly until the 'Stop' button is clicked. Pass/fail count is displayed and all test results will be appended to the same test log, unless 'Restart Log File' is checked.

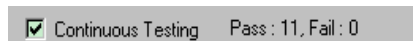


Fig. 7 Continuous Testing checkbox and Pass/Fail count

Report and log file

Test reports are displayed on-screen as well as written to a log file in your application directory or a directory defined by the user (Fig. 8). For example:

C:\Documents and Settings\username\Application Data\Aeroflex\SelfTestLogs

If this directory is not available, the application attempts to place the log files in the local working directory.

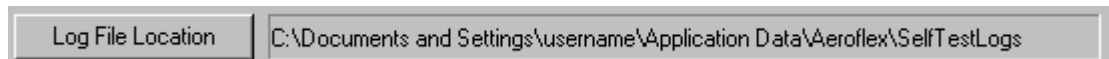


Fig. 8 Log file directory display

If the user decides to choose a directory where the log files are to be written, then they will press the 'Log File Location' button. Once pressed the 'Log File Location' button, a popup dialog will be displayed (Fig 9) to allow user to select a new folder for storing the log files.

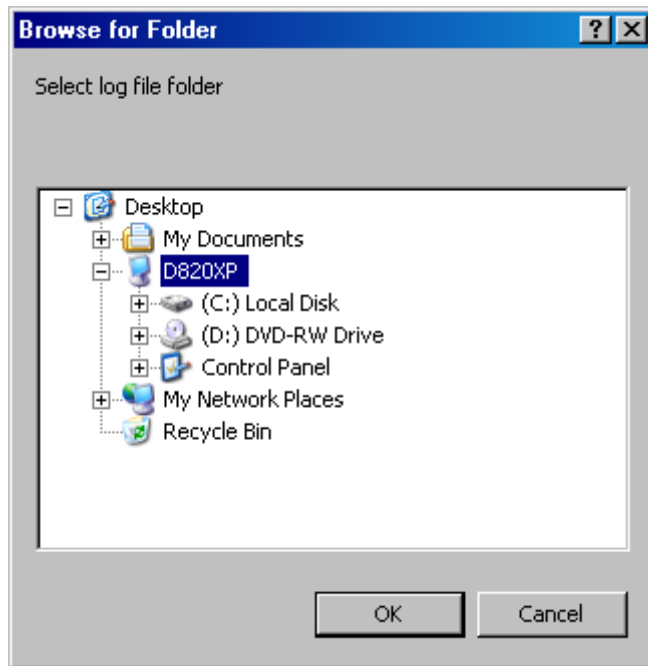


Fig. 9 Select log file directory

The on-screen results display only the results from the last run. The log files store accumulated results since program start-up. If you wish to have a new log file for every time 'Start' button is pressed, check 'Restart log file' checkbox (Fig.6).

The log file names start with Self Test and contain the time stamp when the program was started, such as 'Self Test_20070620_14-42.log' (Fig. 10).

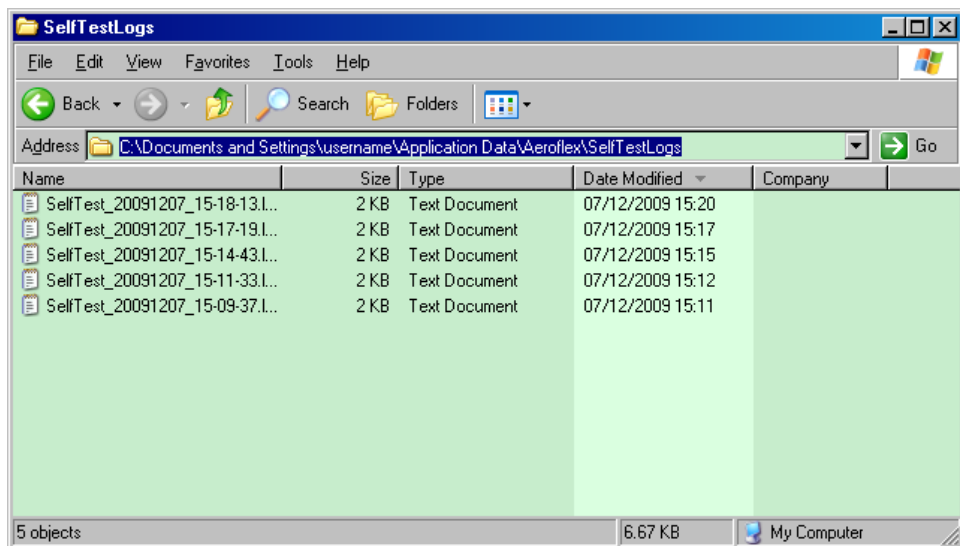


Fig. 10 Log files

Log file writing can be turned off by unchecking the 'Write Log File' checkbox (Fig.6).

Note: Log files contain essential information about the system under test. So they must be supplied when seeking advice from Aeroflex application support team.

When things go wrong

Failure due to warm up

Aeroflex PXI modules require a minimum warm-up period of 20 minutes. If PXI SelfTest is performed immediately after powering up a PXI system, failures are more likely to occur.

PXI SelfTest assumes that the user is running the test immediately after powering up the system, and starts a timer as soon as all modules are booted. Should a failure occur before the warm-up time is reached, a warning is displayed (Fig.11), on the screen and in the test log, to remind the user that more time is needed for the modules to operate to spec. The time remaining until a valid test can be performed is also shown in the warning.

If such a warning is displayed, do the following things:

- do not shut down the PXI SelfTest (otherwise the timer will be re-set)
- wait the length of time indicated by PXI SelfTest
- re-run the test
- Should the test fails again, take appropriate actions in the following sections.

It is worth pointing out that the warm-up process only starts after the modules are first booted. Simply powering up the chassis does not count.

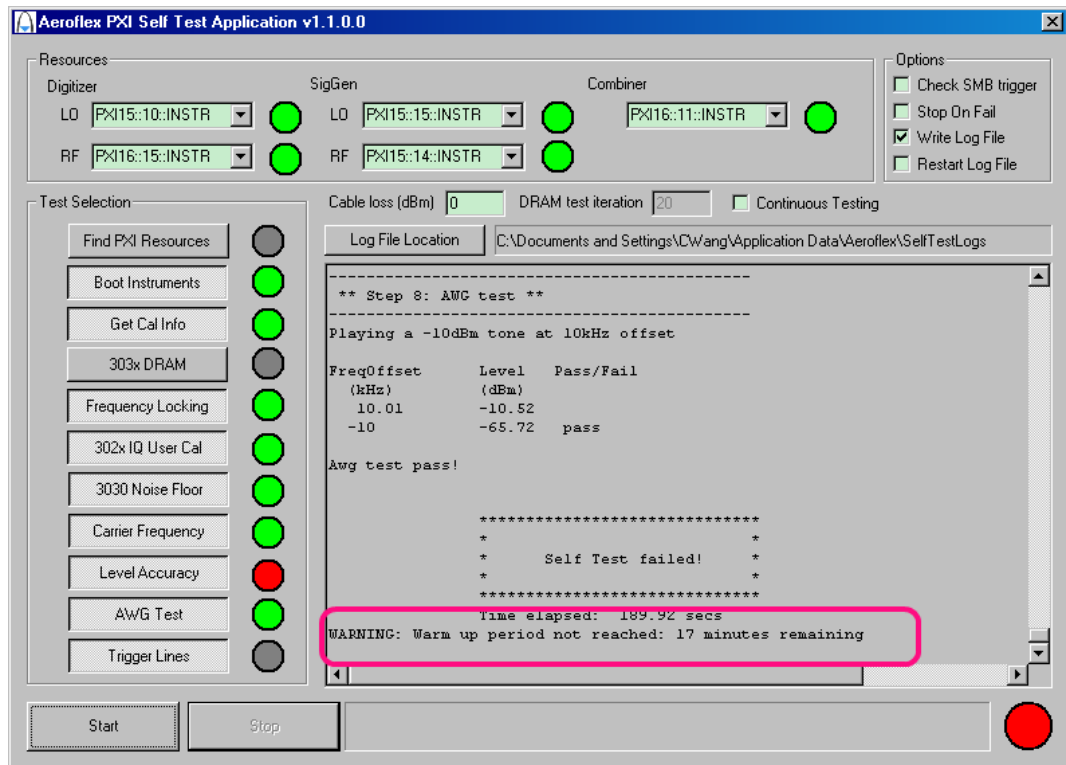


Fig. 11 Warm-up period not reached warning

Failure due to cable loss

The test is based on a nominal 0 dB cable loss between signal generator and digitizer. If the cables used to connect the modules have a significant loss, or if there are external attenuators connected to the RF modules, the tests can potentially fail even when the modules meet performance criteria.

An edit box (Fig. 12) can be used to enter any additional losses in the RF path between the signal generator output and the digitizer RF IN. This value is used to adjust measured power levels to give more accurate measurement.



Fig. 12 Cable loss entry box

Failure due to driver software versions

PXI SelfTest has a version of PXI Module Software built into the application. It also allows user to use the driver software installed on the local PC instead. (Fig.1)

If the driver version used with PXI SelfTest is not suitable for the modules under test, then failures are more likely to occur. It is always recommended to use PXI SelfTest's built-in driver. It is very important that the driver software version info is provided when seeking assistance from our support team.

Failure due to RF cables and connections

Always make sure good quality cables are used with performing PXI SelfTest. Make sure there is no damage or loose wire on the cables.

All connectors should be torqued to the required strength (See operating manual). This excludes any noise picked up by the cables and connectors, especially when measuring low power level signals.

Find PXI resources

Should PXI SelfTest failed to detect PXI resources (Fig.3), no further test can be run. The following actions should be taken to identify the cause of the problem:

- Check the PXI modules are inserted into the chassis correctly.
- Check the MXI link is established between the chassis and controlling PC.
- Power up chassis before turning on the controlling PC.
- Check PXI Module Software is correctly installed.
- Check NI-Visa software and MXI driver software are installed correctly.
- Use Aeroflex Signal Generator SFP and Digitizer SFP to check for presence of any PXI modules. Alternatively, use NI Measurement and Automation software.
- Make sure all PXI modules appear in Window Device Manager under NI-VISA PXI Devices.

Successful running of PXI SelfTest require at least one signal generator and one digitizer module with their LOs. If any module is missing, the application would report error, and no further tests can be performed.

If module variants other than listed in this document is presented to PXI SelfTest, the following error message is displayed, no further action can be performed(Fig.13).

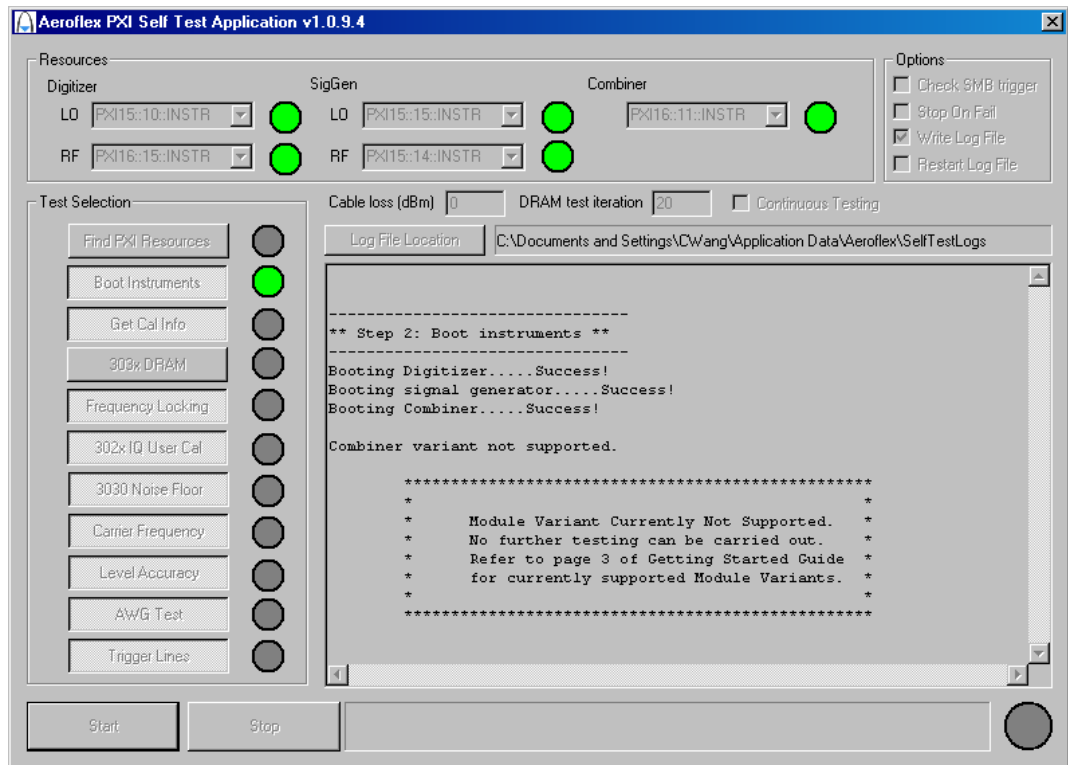


Fig. 13 Module variant unsupported

Boot Instruments

If boot instruments failed, check resource strings are assigned correctly. Pay attention to the error and warning messages. They give clues to the cause of the problem.

It's recommended to use Digitizer SFP and Siggen SFP to verify the failure (Fig.14 to 16).

Manual Verification 1

Launch RF Digitizer Soft Front Panel. (Fig.14)

Click 'Boot' button.

Click AF303x 'Select' button, and choose the correct digitizer resource. Click 'OK'.

Click LO synth 'Select' button, and choose the correct synthesizer resource. Click 'OK'.

Click 'Boot Instrument' button.

Record any error/warning messages generated during this operation.

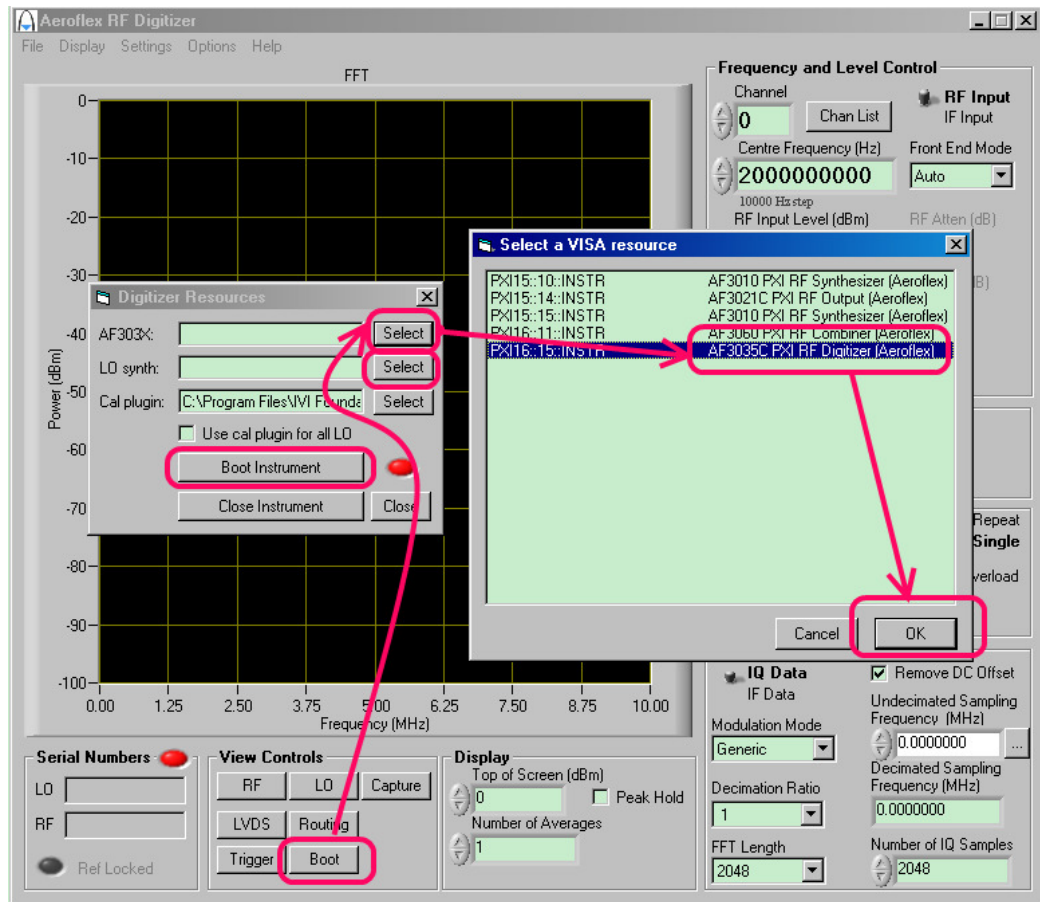


Fig. 14 Boot Digitizer

Similarly, use RF Signal Generator and AF3060 Soft Front Panel to boot the SigGen and Combiner (if one is fitted). (Fig.15 and 16)

Record any error/warning messages during this operation.

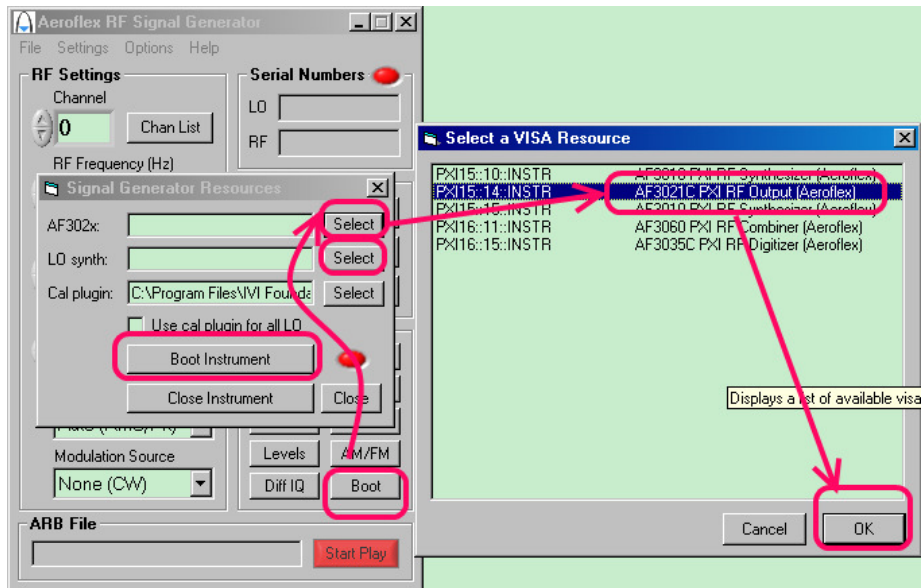


Fig. 15 Boot SigGen

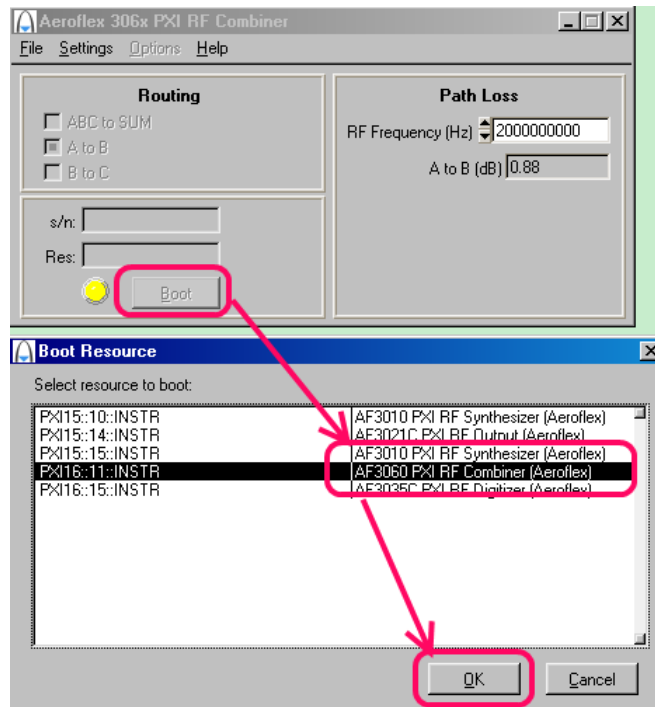


Fig. 16 Boot Combiner

Get Cal Info

Mismatch of driver version can cause GetCalInfo to fail. Make sure to use PXI SelfTest's built-in driver when possible.

303x DRAM

This test repeatedly boots 303x and check for DRAM initialization issues. The number of test iterations is entered via an edit box (Fig.17).



Fig. 17 Cable loss entry box

When a failure is detected,

- Shut down the PXI SelfTest:
- Restart PXI SelfTest and make sure 'Use built-in driver' checkbox is checked (Fig.1).
- Re-run DRAM test.

This is to ensure that the PXI SelfTest is launched with the built-in driver version, therefore remove possible software issues.

Frequency Locking Test

If the PXI SelfTest is run on a newly powered-up system, the frequency locking test may fail. A retry should allow a pass.

If there are additional 3010 modules in the same chassis, make sure to use 3010 SFP to set them to the correct reference state (do not leave them in internal reference), so as not to disturb the modules under test.

Manual Verification 2

Launch RF Digitizer Soft Front Panel and boot instrument. (**Manual Verification 1**)

Click 'LO' button, and select appropriate Reference mode. If 3011 is associated with digitizer, then select 'OCXO', otherwise choose 'External – Terminated'. (Fig.18)

Then click 'RF' button, and select 'Lock To 10MHz'.

Watch the colour of 'Ref Locked' LED on the bottom left corner of Digitizer Soft Front Panel:

- Green : Locked
- Black : Not locked

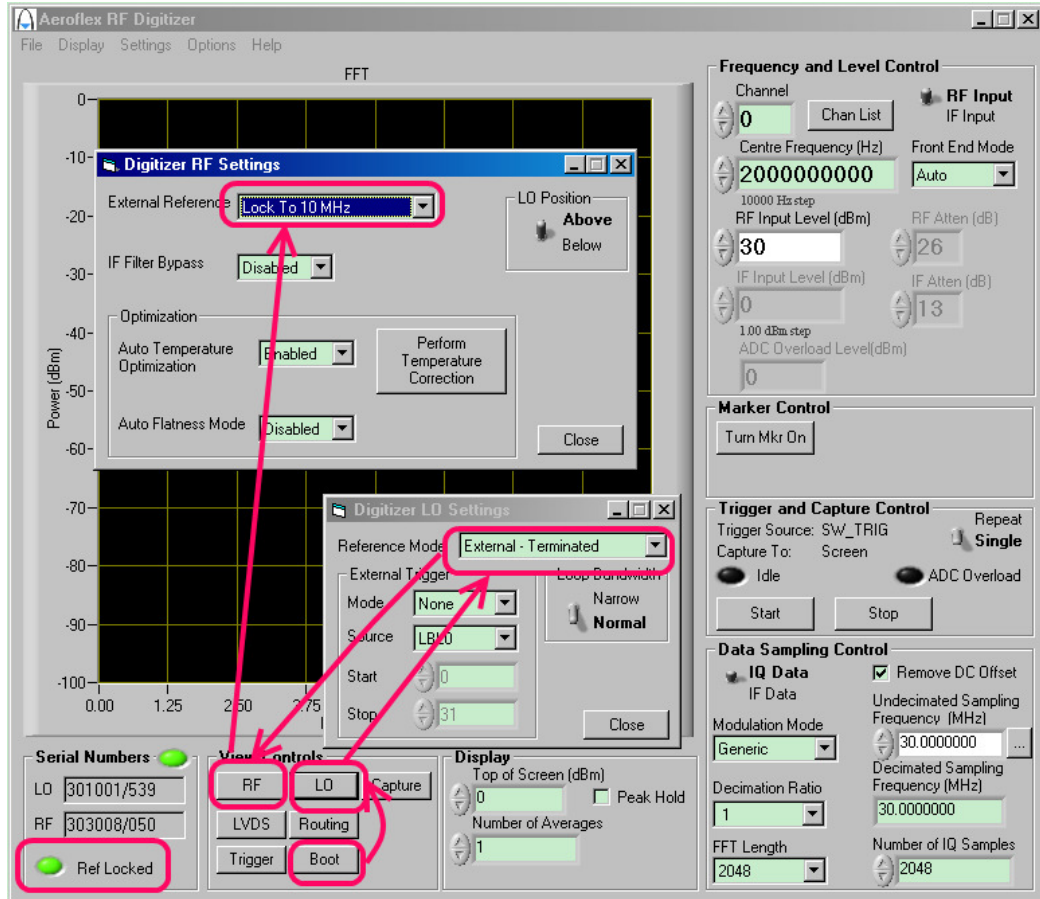


Fig. 18 Setup 10MHz reference - Digitizer

Launch RF Signal Generator Soft Front Panel. (**Manual Verification 1**)

Click 'LO' button and select appropriate Reference Mode. (If 3011 is associated with the signal generator, then select OCXO. Otherwise, choose 'External Terminated'). (Fig.19)

Then Click 'VCO' button and check 'External Reference' checkbox.

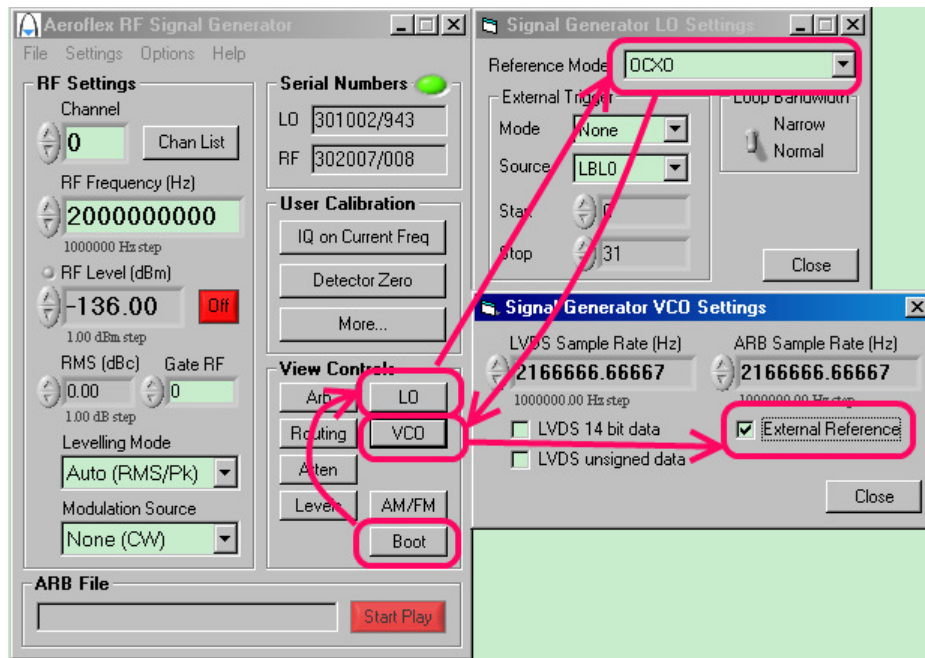


Fig. 19 Setup 10MHz reference - SigGen

Record any error/warning messages generated during this operation and the colour of 'Ref Locked' LED on the Digitizer Soft Front Panel.

3020 IQ User Cal

Failed to converge

If the PXI SelfTest is run on a newly powered-up system, the IQ User Cal test may fail to converge. Wait until the warm-up time has reached as indicated by PXI SelfTest then try again.

This test requires the presence of 3010's LO signal to operate correctly. Make sure the 3010's LO OUT is connected to 302x's LO IN using a good quality RF cable.

Failed to load 3010 plugin

3010 plug in (af3010_plugin.dll) is required to carry out IQ User Cal. The DLL is normally installed by PXI Module Software, in the following two locations:

- C:\Program Files\IVI Foundation\VISA\WinNT\af3020\plugins
- C:\VXIPNP\WinNT\af3020\plugins

Zero IQ Cal band

If the 302x module has not been calibrated, or had lost its calibration data, PXI SelfTest would not be able to perform IQ User Cal. This can also happen if there is an issue with the PXI Chassis' power supply. Faulty power supply can cause the modules to operate incorrectly.

Manual Verification 3

Launch RF Signal Generator Soft Front Panel.

Click 'Boot' button to boot instrument. (**Manual Verification 1**)

Then click 'More'->'All Bands'. (Fig.20)

Record pass/fail and any error or warning messages generated during this operation.

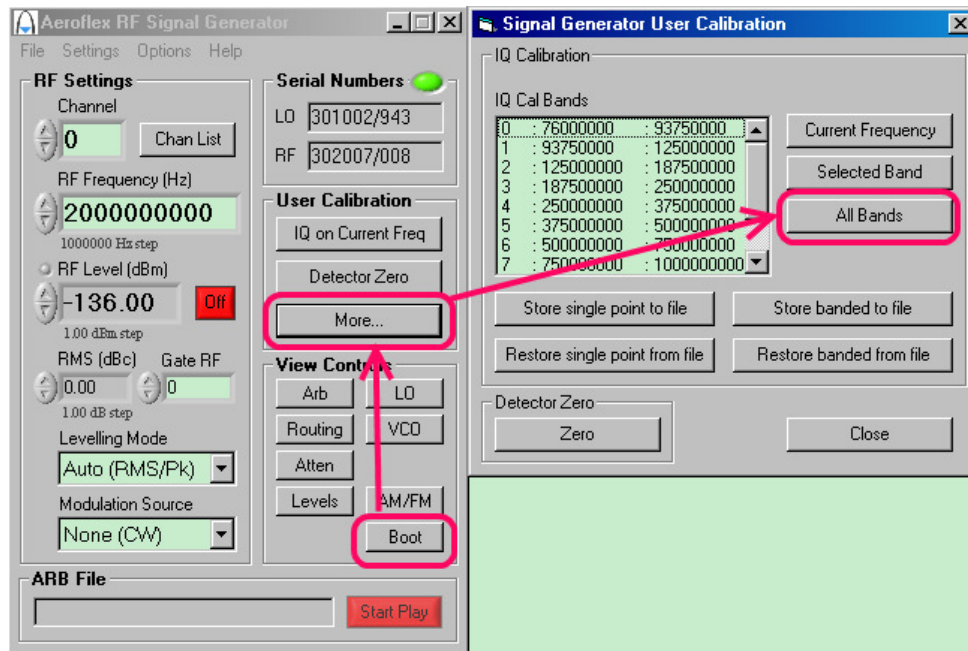


Fig.20 Cable loss entry box

Carrier Frequency Test

This test is influenced by the following factors:

- Module warm-up
- 10MHz Frequency locking
- External losses.

Manual Verification 4

Launch Digitizer and Signal Generator Soft Front Panel, boot instrument. (**Manual Verification 1**)

Set up frequency standard. (**Manual Verification 2**)

Set up SigGen: (Fig.21)

- RF frequency to the failed frequency point (F1)
- Set RF level to -10dBm
- Turn RF ON

Set up combiner (if fitted)

- Mode : A to B
- RF frequency to F1
- Record the loss value (Ls)

Set up Digitizer:

- RF frequency to the failed frequency point
- RF Input Level to 0dBm
- Click Turn Mkr On button
- In the Marker Frequency edit box, enter the chosen RF frequency.
- Change capture mode to Repeat
- Set Undecimated Sampling Frequency to 0.1MHz

- Set FFT length to 65536
- Click 'Start' button
- Record the marker level L1

Calculate the level error:

$$\text{Error} = L1 + 10 + Ls$$

If the error is more than 10dB, it is an indication of a problem.

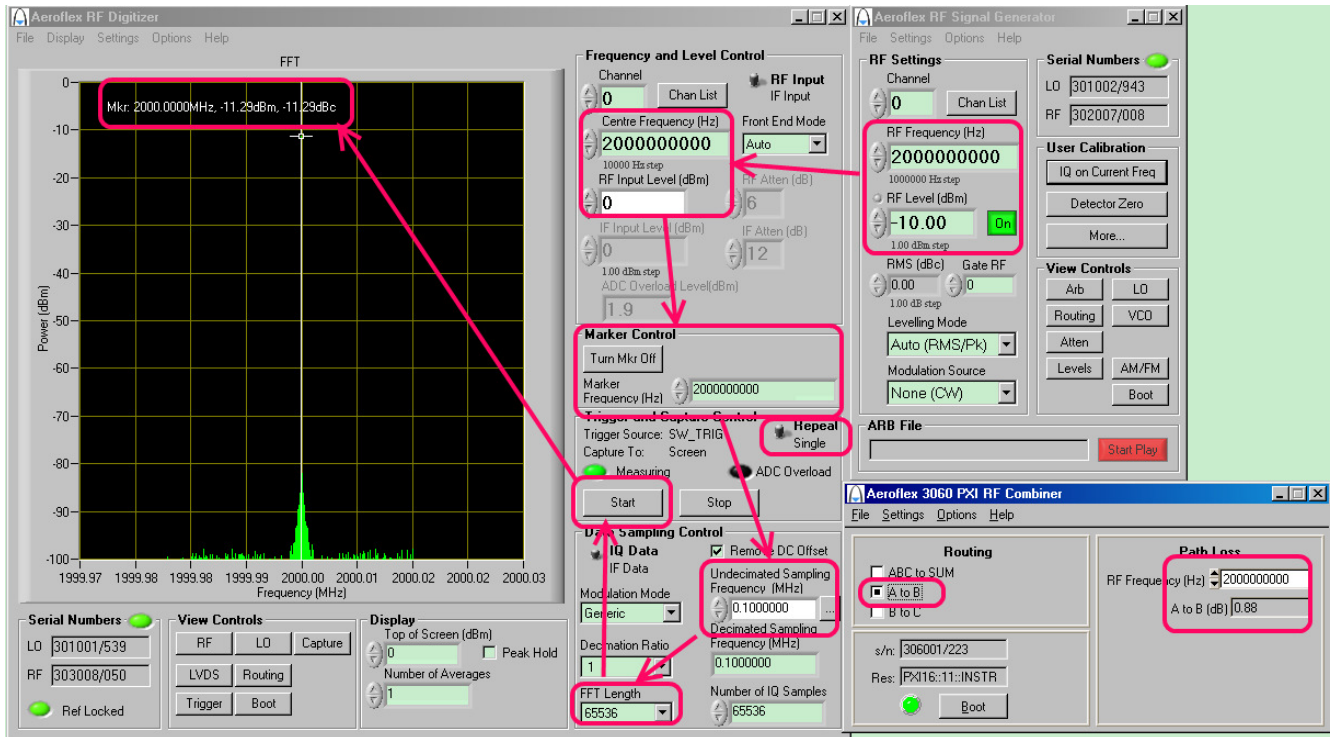


Fig.21 Carrier Frequency Manual Verification

In the above screenshot example,

$$\text{Error} = -11.29 + 10 + 0.88 = -0.41$$

Level Accuracy

Level Accuracy Test is comprised of the following four tests:

- Level Accuracy
- Digitizer Attenuator
- SigGen level loop
- SigGen Attenuator

Manual Verification 4

Launch Digitizer and Signal Generator Soft Front Panel, boot instrument. (**Manual Verification 1**)

Set up frequency standard. (**Manual Verification 2**)

Set up SigGen: (Fig.22)

- RF frequency to the failed frequency point (F1)
- Set RF level to the failed power level (L0)

- Turn RF ON

Set up combiner (if fitted)

- Mode : A to B
- RF frequency to F1
- Record the loss value (Ls)

Set up Digitizer:

- RF frequency to F1
- RF Input Level to (L0 + 10)dBm
- Click Turn Mkr On button
- In the Marker Frequency edit box, enter F1.
- Change capture mode to Repeat
- Set Undecimated Sampling Frequency to 0.5MHz
- Set FFT length to 65536
- Click 'Start' button
- Record the marker level L1

Calculate the level error:

$$\text{Error} = L1 - L0 + Ls$$

The limit can be found in PXI SelfTest's on-screen display or in the log file next the failed result.

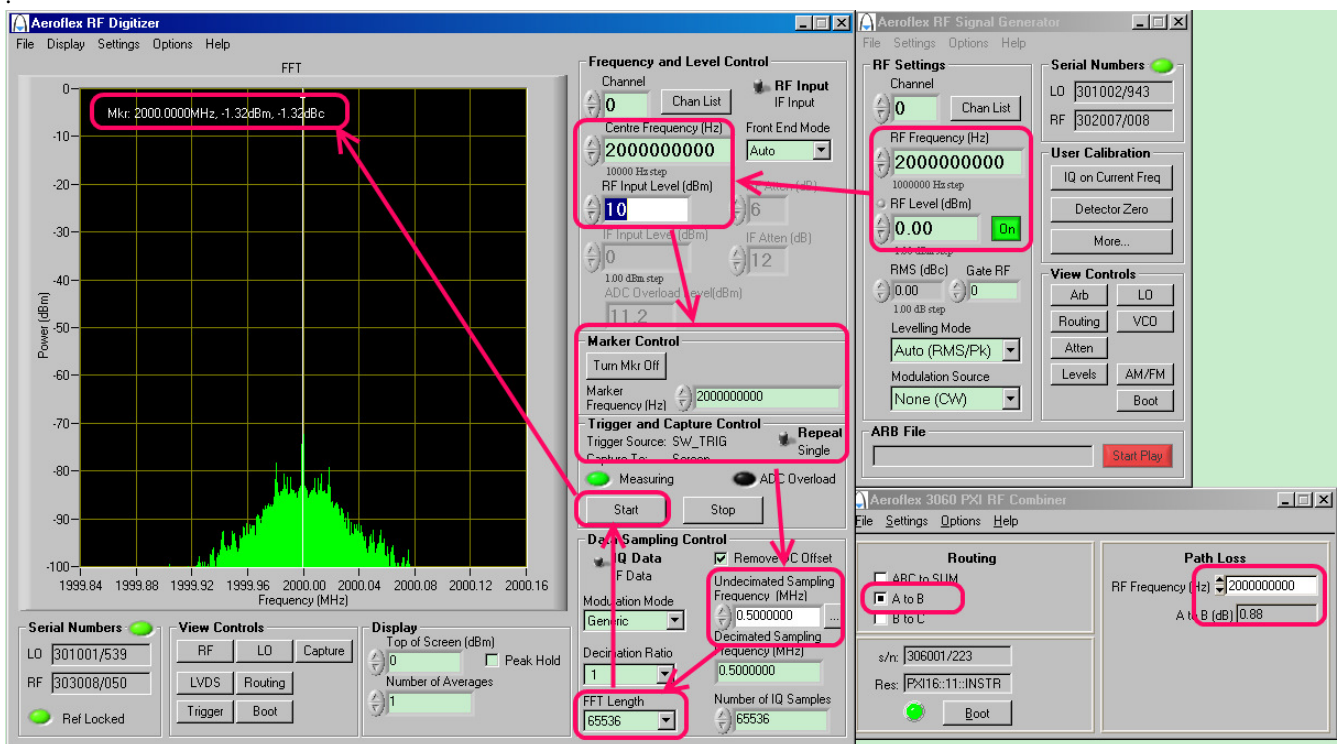


Fig.22 Level Accuracy Manual Verification

In the above screenshot example,

$$\text{Error} = -1.32 - 0 + 0.88 = -0.44$$

The limit is +/-1.2, therefore it is a pass.

AWG Test

The test checks the AWG(Arbitrary Waveform Generation) and Intermod performance of the signal generator. It is influenced by the following factors:

- Warm-up
- 10MHz Frequency locking
- Siggen ARB modulation
- Siggen level accuracy
- Digitizer level accuracy

Failure of Trigger Test

This test is invalid unless PXI modules are on a common PXI trigger bus segment. 302x/303x front panel SMB trigger test requires SMB to SMB cable to be fitted between module TTL trigger ports.

If 302x and 303x modules are placed in different PXI bus segment, then the following error message (Fig.23) shall be displayed on the screen.

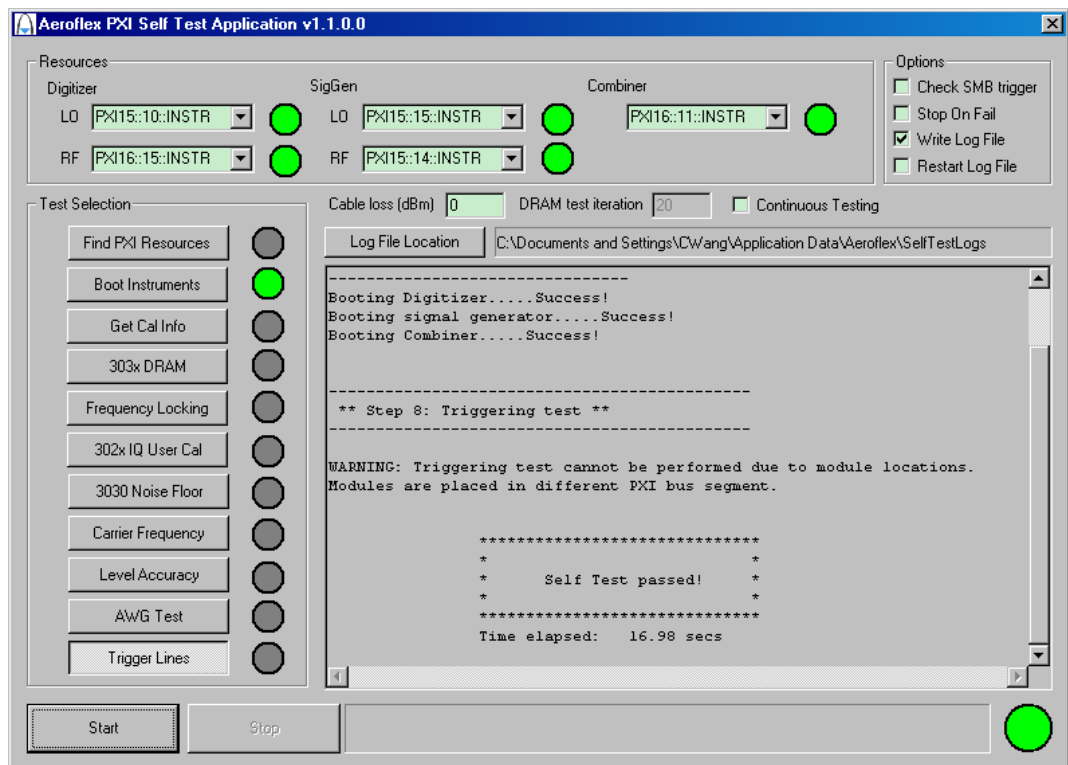


Fig. 23 Trigger test failed due to modules not residing in the same PXI bus segment