Performance Verification Procedure

For

Symmetricom Phase Noise Test Set

Models	**5115A**	**Section 1**
	5120A	**Section 2**
	5120A-01	**Section 3**
	5125A	**Section 4**

Symmetricom

4775 Walnut Street
Suite 1B
Boulder, CO USA
www.Symmetricom.com

TSC 5115A, TSC 5120A, TSC 5120A-01, 5125A Phase Noise Test Set
Performance Verification Procedure

ATP00174 Rev D

Revision History:

Revision	Description	Date	Approved
A	Initial	3/30/06	GAR
B	Add SW	6/20/06	GAR
C	Add 5120A-01 and Change to Symmetricom	2/07/08	GAR
D	Add 5125A Broke each product into a separate test	02/03/10	THT

Introduction
This procedure is used to verify electrical performance of the Symmetricom Phase Noise Test Sets (PNTS). It is applicable to models 5115A, 5120A, 5120A-01 and 5125A. This procedure may be used to perform periodic equipment calibration.

Note: This procedure may be used with software versions 241, 254 or above.

Contact Symmetricom to obtain the current software.

Please consult the DOC05120A or DOC05125A Operations and Maintenance Manual if you are not familiar with this equipment.

Applicable Documents
The following documents are referenced by this procedure. The Operations and Maintenance Manual and Flash Replacement Procedure are available at the Symmetricom website http://www.symmetricom.com/support/ttm-manuals.aspx

DOC05120A	Operations and Maintenance Manual (applicable to 5115A, 5120A and 5120A-01)
DOC05125A	Operations and Maintenance Manual (applicable to 5125A)
DOC00018	Flash Replacement Procedure

Test Equipment Calibration
All test equipment used during this testing shall be in calibration at the time that these tests are performed.

Service Equipment Required

This procedure requires the following equipment

- Phillips #2 head screwdriver
- 5/16" torque wrench set to 8 inch-pounds
- USB Mouse
- Two way reactive power divider — Mini-Circuits model ZFSC-2-1 or equivalent
- Special Cables — One pair of double shielded 50 Ohm Coax cables SMA(M) – BNC(M) 4" to 8" long matched in length to +/- .125"
- TNC – BNC Adapters — Supplied with Instrument
- Signal Source
  - Output Type — Sine wave
  - Frequency Range — 1 to 30 MHz (400 MHz for 5125A) CW Adjustable
  - Phase modulate — 0.01 Rad
  - Phase locked to NIST traceable source
  - Level — 17 dBm
  - Impedance — 50 Ohms
- Attenuator — 1dB steps from 0 dB to 10 dB Accuracy +/- .25 dB or better
- Frequency Counter — 1 Hz resolution at 64 MHz With NIST traceable reference
- Spectrum Analyzer *
  - Frequency Range — 1 – 400 MHz
  - Maximum Power — Able to work with +20 dBm or higher signal
  - Measurement accuracy — +/- 0.5 dB or better
- Reference Signal
  - NIST Traceable — 10.000000 MHz +/- 0.1 Hz
  - Amplitude — 13.0 dBm +/- 0.1 dB
- Support Computer — Used for Ethernet Interface test
- Printer — USB (black and white, either PCL5 or PS)

* Note: the spectrum analyzer is used to verify the quality of the phase modulated spurious signal. A calibrated phase modulated source may be used without verifying that the AM content is low.

Test Overview
The procedure is written as a series of six tests. The procedure intends for these tests to be performed in order.

- Test 1 – Ethernet Interface
- Test 2 – Verify displayed Frequency, level and operation of internal attenuators and switches
- Test 3 – Internal Reference Oscillator tuning range
- Test 4 – Spur Detection
- Test 5 – Verifying noise floor spectrum performance
- Test 6 – Frequency counter

A Test Report Data Sheet has been provided in each section for recording all test data. That Test Report with attachments should be retained as part of any calibration procedure.

Notes and Warnings

Note: This procedure may be used with software versions 241 and 254 or above.

Contact Symmetricom for current software.

Note: Ensure torque of all SMA connections using an 8 inch-pound torque wrench.

Note: The operator must have read and understood the Phase Noise Test Set's Operations Manual prior to performing this performance verification procedure.

Warning: Observe ESD precautions while the Instrument's cover is removed.

Warning: Do not disconnect any cables or remove any screws that are not specifically identified by this procedure.

User Action in Case of Warning Messages
The Instrument may potentially display a variety of alarms during its operation. The majority of these alarms are benign. Simply press the "DISMISS" button and proceed. An example of this is when the input level or frequency is changed while the Instrument is collecting. If an alarm message is displayed when the START button is pressed, record the alarm, press DISMISS (if appropriate) and repeat the operation. Contact Symmetricom if the warning message is displayed again and the operator is not able to determine what caused the problem.

Other messages are not benign and indicate that the Instrument is not operational. An example of this is FATAL ERROR after power cycle. Contact Symmetricom in the event of this warning.

Note: It is possible for a "bad" source to cause the Instrument to display error messages. Measure a different source with the Instrument before assuming that the Instrument is not operating correctly.

Environmental Control
The quality of the measurements made by the instrument is highly influenced by environmental conditions. The Instrument and all test equipment used during this testing shall be shielded from air drafts. Also, the Instrument and all test equipment used during this testing shall be isolated from all sources of shock and vibration. Double shielded RF cables shall be used to prevent signals from equipment not associated with this testing from interfering with the performance measurements.

5115A – Section 1

Test 1 - Verification of Ethernet Interfaces and Software Revision

- Connect the Instrument to a support computer through a CAT5 crossover cable.
  The Instrument's Ethernet connector is located on the rear panel.
- Connect AC Power (110 VAC – 240 VAC) to the Instrument's AC connector.
  The Instrument's AC Power connector is located on the rear panel.
- Apply Power to the Instrument by pressing the AC Power Switch. That switch is located in the Instruments upper right corner.
- Verify that the Instrument's Power Indicator LED (located next to the AC Power Switch) is illuminated GREEN. Record the condition in the test report.
- Allow the Instrument to Boot.
  A graph is displayed when the Boot process is completed.
- Press the front panel buttons to navigate to the NETWORK SETTINGS Page.
  {press Settings and Options}
  {press Settings}
  {press Network}
- Determine the IP address of the support computer. (If the computer is Windows XP, open a dos window and enter the command **ipconfig <cr>**. Verify that the support computer and Instrument IP addresses' are on the same network. If necessary, change the Instrument's IP address so that the support computer can communicate with it.)
  During this test section use mouse to move cursor and press buttons.
  Set Instrument to Static Address
  Set desired IP address and Network Mask
  Click on Apply

  Note: Consult your IT professional if you have problems with setting the IP address.

- Record the Instrument's IP address on the Test Report.

- Open a telnet client on the support computer and then open a TCP/IP session to Instrument port 1299. (This step verifies that the instrument's Ethernet functions are operating normally.

- Enter the command ***show version<cr>*** to display the instruments software revision

- Enter the Instrument's software revision in the test report.

  If software revision is 241 and the user does not want to upgrade to the latest software, refer to Appendix - A before proceeding.

  If software revision is neither 241 nor above 254, contact Symmetricom to obtain the latest software.

Use the Instrument's soft keys to navigate to the Print options page, set printer to local and pcl5.
{press printing}
{press local}
{press pcl5}
{press apply}

Use the Instrument's soft keys to navigate to to the phase noise graph
{press return}
{press return}
{press phase noise plot}

Test 2 - Verification of displayed Frequency, level and operation of internal attenuators and switches

Note: tests verify the proper operation of the Instrument's internal attenuators and switches. They also verify that the frequency displayed by the Instrument is NIST traceable to +/- 0.1 MHz and the amplitude displayed by the unit is NIST traceable to +/- 1 dB.

Test 2A - Verification of internal Attenuator and Switch performance

- Allow the Instrument to warm up for at least 5 minutes.
- Refer to Figure 1 for a pictorial representation of the set-up described in the following steps.
- Connect the signal source to the step attenuator input port.
- Set attenuator to 0 dB.
- Connect the output from the step attenuator to the two way power divider input.
- Connect matched length coax cables to the output of the power divider.
- **Use calibrated equipment to set output at the end of the cables that will be connected to the Instrument to 10 MHz +/- 0.1 Hz, 14 dBm +/- 0.5 dB.**
  Note: The above step required the source to be set to 17 dBm plus cable and power divider losses.

- Connect the two cables from the divider to the Instrument's Input and Reference Connectors.

WARNING – During the following test it is not sufficient to simply set the attenuator and record the indicated values while the Instrument is not collecting. Doing so does not test the attenuators.
NOTE: Changing the attenuator setting while collecting results in a warning message. Dismiss the message and continue.

Procedure to verify internal Attenuator operation and displayed Frequency and Amplitude

- Set attenuator to specified value (0,1,2,4,6,8,10 dB)
- Press STOP
- Wait at least 2 seconds
- Press START
  Note: - it is not necessary to wait until the instrument indicates collecting.
  The measurement is acceptable while the Instrument is Initializing
- Verify that the Instrument indicates that it is either Initializing or Collecting.
- Press STOP
- Record Amplitude and Frequency values displayed on the Instrument's screen for the Input and Reference ports in the Test Report before proceeding.

Note: The Input level in the following table refers to the level that should be displayed on the instrument's front panel. The source should not be set to this level.

Note: Out of Spec readings during this test are frequently caused by the attenuator.

Attenuator setting	Input Frequency MHz	Input Level dBm	Reference Frequency MHz	Reference Level dBm
0 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	10.0 MHz +/- 0.1	14 +/- 1 dB
1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB
2 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	10.0 MHz +/- 0.1	12 +/- 1 dB
4 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	10.0 MHz +/- 0.1	10 +/- 1 dB
6 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	10.0 MHz +/- 0.1	8 +/- 1 dB
8 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	10.0 MHz +/- 0.1	6 +/- 1 dB
10 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	10.0 MHz +/- 0.1	4 +/- 1 dB

Test 2B - Verification of frequency measurement capability

Note: During this test ignore the displayed amplitude levels since the levels are not calibrated.

- Set attenuator to 0 dB
- Set source frequency to 1.0 MHz +/- 5 kHz at level = 17 dBm +/- 1 dB.
- Verify that the PNTS Input and Reference Frequency displayed are 1.0 +/- 0.1 MHz
  Record this data in the test report.
- Set source frequency to 30.0 MHz +/- 5 kHz at level = 17 dBm +/- 1 dB
- Verify that the PNTS Input and Reference Frequency displayed are 30.0 +/- 0.1 MHz
- Record this data in the test report.

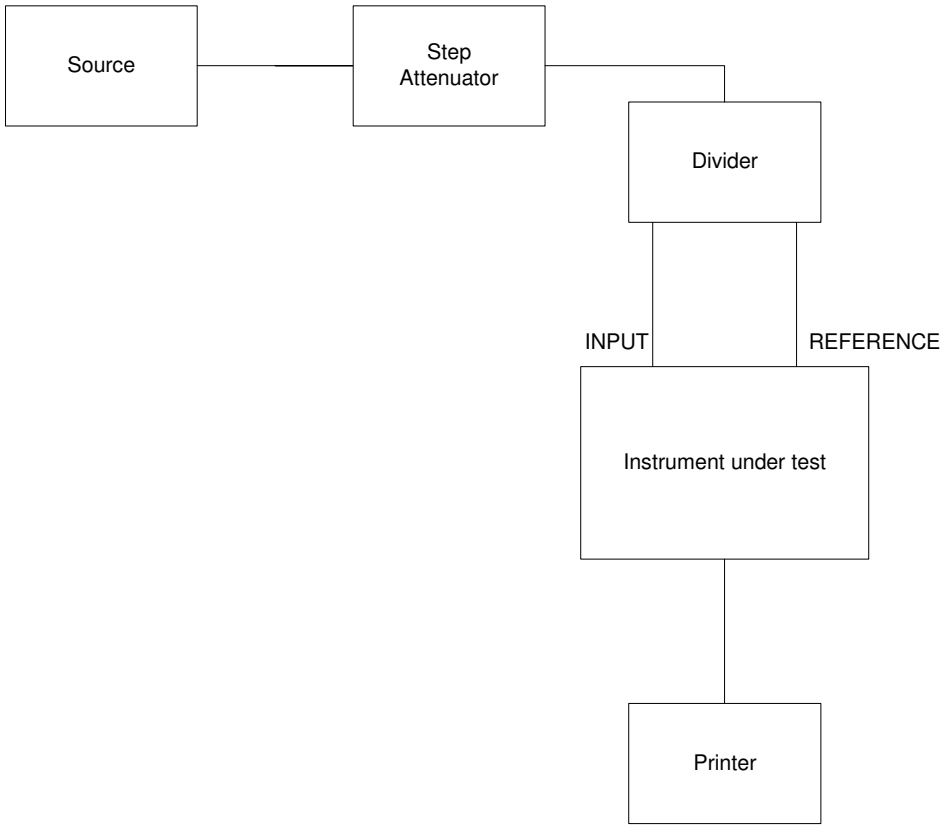

Figure 1: Tests 2, 3 and 5 Configuration

Test 3 Verification of Instrument Reference Oscillator Tuning Range

CAUTION – This procedure is for use with Software Version 254 or later. See Appendix - A if Software Version 241 is installed.

Warning – Proper ESD Precautions must be followed during this test

This test verifies that the Instrument's Main Reference Oscillator frequency and tuning range is acceptable.

- Use the test configuration shown in Figure 1 during this test.
- Power the Instrument OFF.

Note: Figure 2 depicts a TSC 5115A.

- Remove the Instrument's cover ,and configure the Instrument as shown in Figure 2 using the following instructions:

Note: Refer to the TSC 5120A Flash Replacement Procedure for additional information regarding removing the Instrument's cover.

- Disconnect the end of the coaxial cable that is connected to the Main Reference Oscillator Module.
- Connect the SMA "Tee" to the Main Reference Oscillator Module.
- Connect the Cable disconnected above to one of the SMA "Tee" ports.

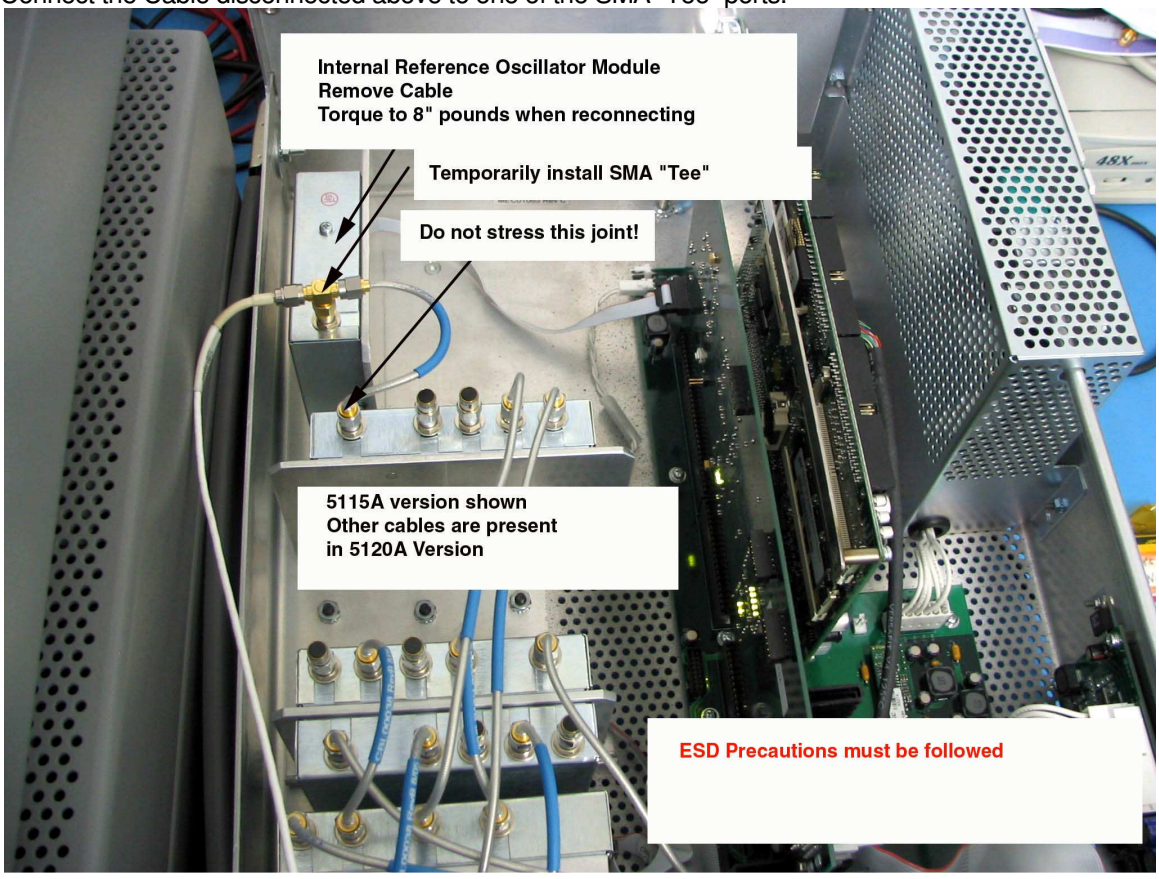

Figure 2 – Main Reference Oscillator Tuning Range Test Configuration

- Connect a coax cable between the other SMA "Tee" port and the frequency counter.

- Connect a NIST traceable reference to the frequency counter Reference input.
- Power frequency counter ON.
- Set frequency counter to the following settings
  - dc coupled, 50 Ohms, set trigger point auto.
- Power the Instrument ON.
- Set the frequency source to 10.000040 MHz +/- 1 Hz at 17 dBm +/- 1dB.
- Set the step attenuator to 1 dB.
- Verify that the Instrument's front panel shows that the Input and Reference Frequency are 10.0 +/- 0.1MHz and Input and Reference Levels are 13 dBm +/- 1 dB

The following commands allow the Instrument's internal oscillator's tuning range to be determined. Before START has been pressed, the internal oscillator is set to its lowest frequency. After START has been pressed and the Instrument starts Collecting, the Instrument sets the Internal Oscillator to its highest frequency.

- Verify that the frequency counter is displaying a frequency that is approximately 64 MHz.
  Record the frequency displayed by the frequency counter in the Test Report.

  - Press START
  - Wait until the Instrument indicates that it is Collecting
  - Record the frequency displayed by the frequency counter in the Test Report.
  - Power the Instrument OFF.
  - Remove the "Tee", reconnect the cable and torque the SMA connection.
  - Replace the Instrument's cover.

  Note: No other internal adjustments will be made during this procedure.

Test 4 - Verification of Ability to Measure Spurious Signals

Note: this test uses the configuration shown in Figure 3.

Note: this test uses a different source for the input port than for the reference port.

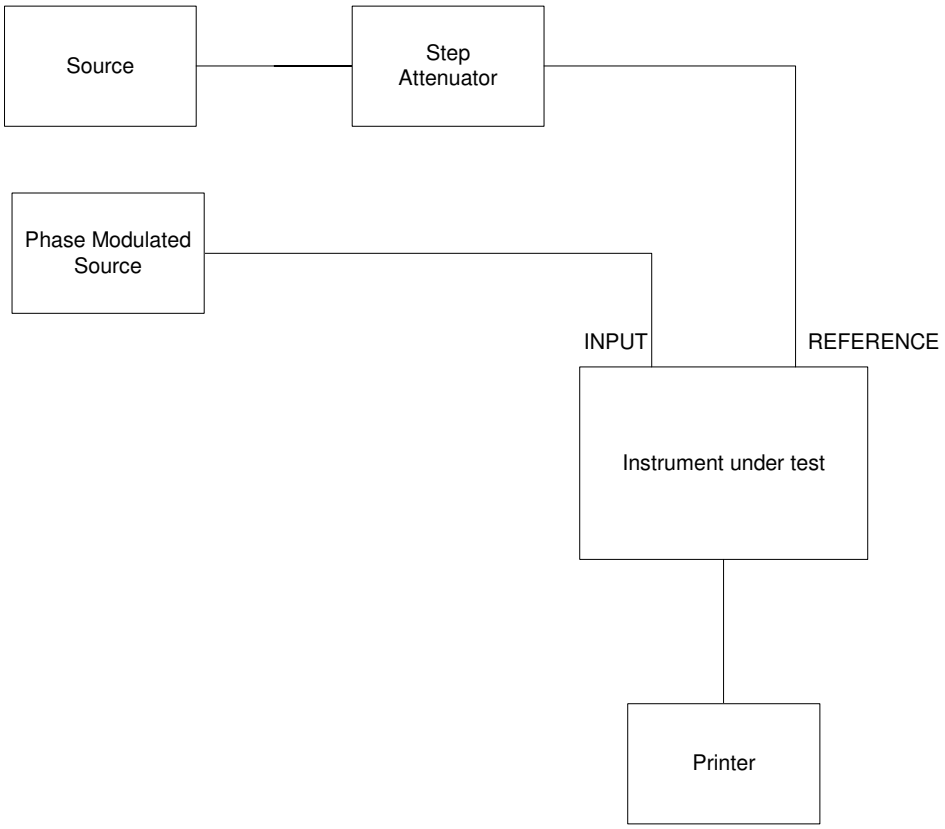

Figure 3 Test configuration Spur Detection

- Set the source used for the Reference input to:

RF Frequency	10.0 MHz +/- 1 Hz
Spur Level	< -65 dBc, 1 kHz to 100 kHz (set to no modulation)
Signal Level	+ 13 dBm +/- 1 dB

- Set the phase modulated source used for the Input Signal to provide a spur that is 46 dB below the peak.

RF Frequency	10.0 MHz +/- 1 Hz
Level	13 dBm +/1 dB
Spur Level	0.01 radian phase modulation
Spur frequency	12 kHz +/- 10 Hz

  Note: if a calibrated phase modulated source is not available and a phase modulator is used, use a spectrum analyzer to verify that both 12 kHz sidebands are -46 dBc +/- 0.25 dB

- Apply power to the Instrument. Allow it to boot and then warm up for at least 5 minutes
- Connect the phase modulated signal to the Instrument's Input Port.
- Connect the reference signal to the Instrument's Reference Port.
- Press START on the Instrument's front panel.
- Allow the Instrument to collect data for approximately 1 minute.
- Press STOP.
- Press PRINT and then attach the Phase Noise Plot with Spur to the Test Report.
- Press Config Phase Noise.
- Press View Spur Table.
- Use the arrows to scroll through the spur table to the spur at 12 kHz.
- Record spur level at 12 kHz in the Test Report.
- Use the instruments buttons to navigate to the Phase Noise Display.
  - {return}
  - {return]

Test 5 - Verification of Phase Noise Performance

Note: Instruments with Software Version 241 must be in Enhanced Spur Detection Mode..

Note: Cover must be installed on 5115A during this test.

Caution – bumping or moving cables or the Instrument or the source will invalidate the following tests.
If the cables are bumped, STOP the test and START again.

Note: Make sure that the unit and test equipment are not in an air draft and that all equipment is isolated from sources of shock and vibration.

NOTE: The length of time that the Instrument has been collecting data is displayed in the upper left corner of the Instrument's display.

Note: Use the test configuration shown in Figure 1 during this test.

Test 5A 1 MHz Performance

- Press STOP on the Instrument's front panel.
- Set the Source frequency to 1.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.
- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 1.0 MHz at 13.0 dBm +/- 1 dB.
- Connect the signals to the Instrument's Input and Reference connectors.
- Press START on the Instrument's front panel.
- Allow the Instrument to collect data until the data collection period is in the range 5 to 10 minutes.
- Press STOP on the Instrument's front panel.
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the PNTS Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

Note: Use the markers function to measure the phase noise levels during the following tests. Refer to the user manual for additional information about this function.

1 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-131
10	-140
100	-142
1000	-142
10000	-142
70000	-142

With phase noise plot displayed, press PRINT – attach data to test report.

Test 5B 10 MHz Performance

- Set the Source frequency to 10.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 10.0 MHz at 13.0 dBm +/- 1 dB.
- Connect the signals to the Instrument's Input and Reference connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range 10 to 20 minutes.
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the PNTS Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

10 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-133
10	-143
100	-147
1000	-147
10000	-147
70000	-147

With phase noise plot displayed, press PRINT – attach data to test report

Test 5C Verification of Allan Deviation Noise Floor Performance at 10 MHz

This test uses the data just collected during the Phase Noise 10 MHz Test Segment.

Note: the spurs generated by the source synthesizer can potentially cause the Allan Deviation Noise Floor test to appear to fail. If this test fails, repeat the test using a clean source such as a Rubidium Oscillator (eg., TSC 4410A). The phase noise data does not need to be collected if the Allan Deviation test is being repeated. Contact Symmetricom for additional support if the test does not pass.

- Press the soft keys to navigate to the Allan Deviation Table for NEQBW = ½ Hz.
- Record the Allan Deviation at 1s for NEQBW = ½ Hz in the Test Report.
- Press the soft keys to navigate to the phase noise plot.

Test 5D 30 MHz Performance

- Set the Source frequency to 30.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 30.0 MHz at 13.0 dBm +/- 1 dB
- Connect the signals to the Instrument's Input and Reference connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range 5 to 10 minutes.
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

30 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-127
10	-137
100	-145
1000	-146
10000	-146
70000	-147

With phase noise plot displayed, press PRINT – attach data to test report

Test 6 – Frequency Counter

The PNTS frequency counter function measures the ratio between the frequency on the Input and Reference Ports. This test verifies that the ratio is within spec for identical signals on the two ports. The frequency ratio is based on a computation made from the same data that was used to determine the Phase Noise Spectrum Noise Floor. Successful completion of that set of tests is sufficient to provide NIST traceability of the frequency counter function.

The following test is used to demonstrate that the frequency counter is operational.

Note: This test uses the same test configuration as Test 1.

- Press STOP
- Set the source frequency to 10 MHz +/- 1 Hz at a level of 17 dBm.
  Set the attenuator to 1 dB.
- Press Config Freq Counter on the PNTS
- Press Auto Reference Freq
- Press Return
- Press START
- Allow Instrument to collect data for at least 2 minutes
- Press STOP
- Verify that the display shows :

Test data for software version 254 or above

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	Measured Frequency MHz
1	9.999 999 999 999 5 to 10.000 000 000 000 5	Within specified range	
10	9.999 999 999 999 95 to 10.000 000 000 000 05	Within specified range	

Test data for software version 241

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	Measured Frequency MHz
1	9.999 999 999 5 to 10.000 000 000 5	Within specified range	
10	9.999 999 999 5 to 10.000 000 000 5	Within specified range	

- Enter measured frequencies in test report section for either software version 254 or 241.

TSC 5115A Phase Noise Test Set

Performance Verification Test Report Data

Date _____

Model Type TSC 5115A

Serial Number _____

Test 1 – Ethernet Interface
Power Indicator illuminated GREEN [P/F] _____
Instrument's IP Address _____
Established communication with port 1299 [P/F] _____
Instrument's Software Version _____

Test 2 – Displayed Frequency and Level and Internal Attenuators
Test 2A

Attenuator setting	Input Frequency MHz	Input Level dBm	Reference Frequency MHz	Reference Level dBm	Pass/Fail
0 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	
1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	
2 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	
4 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	
6 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	
8 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	
10 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	
14 dB	10.0 MHz +/- 0.1	0 +/- 1 dB	10.0 MHz +/- 0.1	0 +/- 1 dB	

Test 2B

Verify that Input and Reference Frequency are 1.0 +/ 0.1 MHz	[P/F]
Verify that Input and Reference Frequency are 30.0 +/ 0.1 MHz	[P/F]

Test 3 – Internal Reference Oscillator tuning range

Parameter	Frequency MHz	Requirement	Pass/Fail
Low Frequency		< 63.999 750 MHz	
High Frequency		> 64.000 250 MHz	
Delta Frequency		High – Low Frequency > 700 Hz	

Test 4 – Spur Detection

Parameter	Frequency MHz	Requirement	Pass/Fail
Spur Level		-46 dBc +/- 0.5 dB	
Spur Frequency (Hz)		12000 Hz +/- 100 Hz	
Spectrum Printout Attached		Shows 12 kHz spur	

Test 5 – Verifying PNTS Phase Noise Spectrum Noise Floor Performance

Parts A,B and D – Data from TSC 5115A

	5115A Noise Floor Performance (dBc/Hz)					
	Part 5A		Part 5B		Part 5D	
Offset Frequency, Hz	1 MHz Measured Performance (dBc/Hz)	1 MHz Requirement (dBc/Hz)	10 MHz Measured Performance (dBc/Hz)	10 MHz Requirement (dBc/Hz)	30 MHz Measured Performance (dBc/Hz)	30 MHz Requirement (dBc/Hz)
1		-131		-133		-127
10		-140		-143		-137
100		-142		-147		-145
1000		-142		-147		-146
10000		-142		-147		-146
70000		-142		-147		-147
Mark [P/F]if column passes						

Test 5C Allan Deviation at 10 MHz

Model	Pass/Fail Requirement (1s NEQBW = 0.5 Hz)	[P/F]
TSC 5115A	< 1e-14	

Spectrum Printout at 1 MHz [attached] _____
Spectrum Printout at 10 MHz [attached] _____
Spectrum Printout at 30 MHz [attached] _____

Test 6 – Frequency Counter
Test data for software version 254 or above

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	
1	9.999 999 999 999 5 to 10.000 000 000 000 5	Within specified range	[P/F] _____
10	9.999 999 999 999 95 to 10.000 000 000 000 05	Within specified range	[P/F] _____

Test data for software version 241

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	
1	9.999 999 999 5 to 10.000 000 000 5	Within specified range	[P/F] _____
10	9.999 999 999 5 to 10.000 000 000 5	Within specified range	[P/F] _____

5120A – Section 2

Test 1 – Verification of Ethernet Interfaces and Software Revision

- Connect the Instrument to a support computer through a CAT5 crossover cable.
  The Instrument's Ethernet connector is located on the rear panel.
- Connect AC Power (110 VAC – 240 VAC) to the Instrument's AC connector.
  The Instrument's AC Power connector is located on the rear panel.
- Apply Power to the Instrument by pressing the AC Power Switch. That switch is located in the Instruments upper right corner.
- Verify that the Instrument's Power Indicator LED (located next to the AC Power Switch) is illuminated GREEN. Record the condition in the test report.
- Allow the Instrument to Boot.
  A graph is displayed when the Boot process is completed.
- Press the front panel buttons to navigate to the NETWORK SETTINGS Page.
  {press Settings and Options}
  {press Settings}
  {press Network}
- Determine the IP address of the support computer. (If the computer is Windows XP, open a dos window and enter the command **ipconfig <cr>**. Verify that the support computer and Instrument IP addresses' are on the same network. If necessary, change the Instrument's IP address so that the support computer can communicate with it.)
  During this test section use mouse to move cursor and press buttons.
  Set Instrument to Static Address
  Set desired IP address and Network Mask
  Click on Apply

  Note: Consult your IT professional if you have problems with setting the IP address.

- Record the Instrument's IP address on the Test Report.

- Open a telnet client on the support computer and then open a TCP/IP session to Instrument port 1299. (This step verifies that the instrument's Ethernet functions are operating normally.

- Enter the command ***show version<cr>*** to display the instruments software revision

- Enter the Instrument's software revision in the test report.

  If software revision is 241 and the user does not want to upgrade to the latest software, refer to Appendix - A before proceeding.

If software revision is neither 241 nor above 254, contact Symmetricom to obtain the latest software.

Use the Instrument's soft keys to navigate to the Print options page, set printer to local and pcl5.
{press printing}
{press local}
{press pcl5}
{press apply}

Use the Instrument's soft keys to navigate to the phase noise graph
{press return}
{press return}
{press phase noise plot}

Test 2 – Verification of displayed Frequency, level and operation of internal attenuators and switches

Note: tests 2A and 2B verify the proper operation of the Instrument's internal attenuators and switches. They also verify that the frequency displayed by the Instrument is NIST traceable to +/- 0.1 MHz and the amplitude displayed by the unit is NIST traceable to +/- 1 dB.

Test 2A – Verification of internal Attenuator and Switch performance

- Allow the Instrument to warm up for at least 5 minutes.
- Refer to Figure 1 for a pictorial representation of the set-up described in the following steps.
- Connect the signal source to the step attenuator input port.
- Set attenuator to 0 dB.
- Connect the output from the step attenuator to the two way power divider input.
- Connect matched length coax cables to the output of the power divider.
- **Use calibrated equipment to set output at the end of the cables that will be connected to the Instrument to 10 MHz +/- 0.1 Hz, 14 dBm +/- 0.5 dB.**
  Note: The above step required the source to be set to 17 dBm plus cable and power divider losses.

- Connect the two cables from the divider to the Instrument's Input and Reference Connectors.

WARNING – During the following test it is not sufficient to simply set the attenuator and record the indicated values while the Instrument is not collecting. Doing so does not test the attenuators.
NOTE: Changing the attenuator setting while collecting results in a warning message. Dismiss the message and continue.

Procedure to verify internal Attenuator operation and displayed Frequency and Amplitude

- Set attenuator to specified value (0,1,2,4,6,8,10 dB)
- Press STOP
- Wait at least 2 seconds
- Press START
  Note: - it is not necessary to wait until the instrument indicates collecting.
  The measurement is acceptable while the Instrument is Initializing
- Verify that the Instrument indicates that it is either Initializing or Collecting.
- Press STOP
- Record Amplitude and Frequency values displayed on the Instrument's screen for the Input and Reference ports in the Test Report before proceeding.

Note: The Input level in the following table refers to the level that should be displayed on the instrument's front panel. The source should not be set to this level.

Note: Out of Spec readings during this test are frequently caused by the attenuator.

Attenuator setting	Input Frequency MHz	Input Level dBm	Reference Frequency MHz	Reference Level dBm
0 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	10.0 MHz +/- 0.1	14 +/- 1 dB
1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB
2 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	10.0 MHz +/- 0.1	12 +/- 1 dB
4 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	10.0 MHz +/- 0.1	10 +/- 1 dB
6 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	10.0 MHz +/- 0.1	8 +/- 1 dB
8 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	10.0 MHz +/- 0.1	6 +/- 1 dB
10 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	10.0 MHz +/- 0.1	4 +/- 1 dB

Test 2B - Verification of frequency measurement capability

Note: During this test ignore the displayed amplitude levels since the levels are not calibrated.

- Set attenuator to 0 dB
- Set source frequency to 1.0 MHz +/- 5 kHz at level = 17 dBm +/- 1 dB.
- Verify that the PNTS Input and Reference Frequency displayed are 1.0 +/- 0.1 MHz
  Record this data in the test report.
- Set source frequency to 30.0 MHz +/- 5 kHz at level = 17 dBm +/- 1 dB
- Verify that the PNTS Input and Reference Frequency displayed are 30.0 +/- 0.1 MHz
- Record this data in the test report.

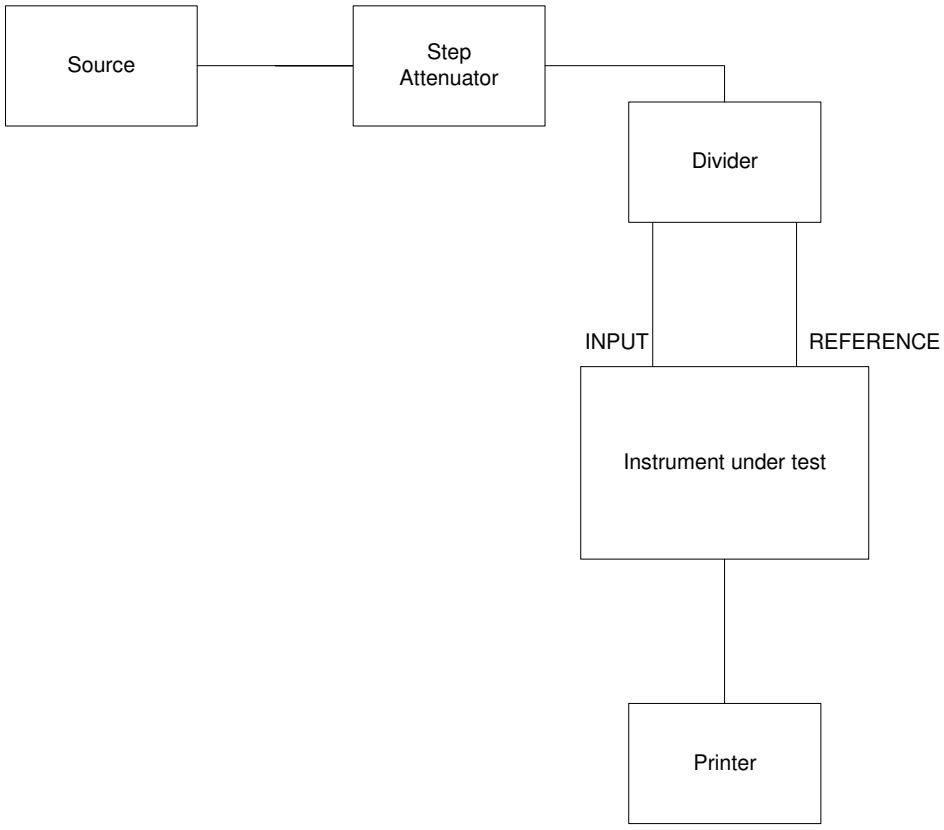

Figure 1: Tests 2, 3 and 5 Configuration

Test 3 - Verification of Instrument Reference Oscillator Tuning Range

CAUTION – This procedure is for use with Software Version 254 or later. See Appendix - A if Software Version 241 is installed.

Warning – Proper ESD Precautions must be followed during this test

This test verifies that the Instrument's Main Reference Oscillator frequency and tuning range is acceptable.

- Use the test configuration shown in Figure 1 during this test.
- Power the Instrument OFF.

Note: Figure 2 depicts a TSC 5115A. The TSC 5120A includes two additional modules and several cables. Those changes do not change this test configuration.

- Remove the Instrument's cover ,and configure the Instrument as shown in Figure 2 using the following instructions:

Note: Refer to the TSC 5120A Flash Replacement Procedure for additional information regarding removing the Instrument's cover.

- Disconnect the end of the coaxial cable that is connected to the Main Reference Oscillator Module.
- Connect the SMA "Tee" to the Main Reference Oscillator Module.
- Connect the Cable disconnected above to one of the SMA "Tee" ports.

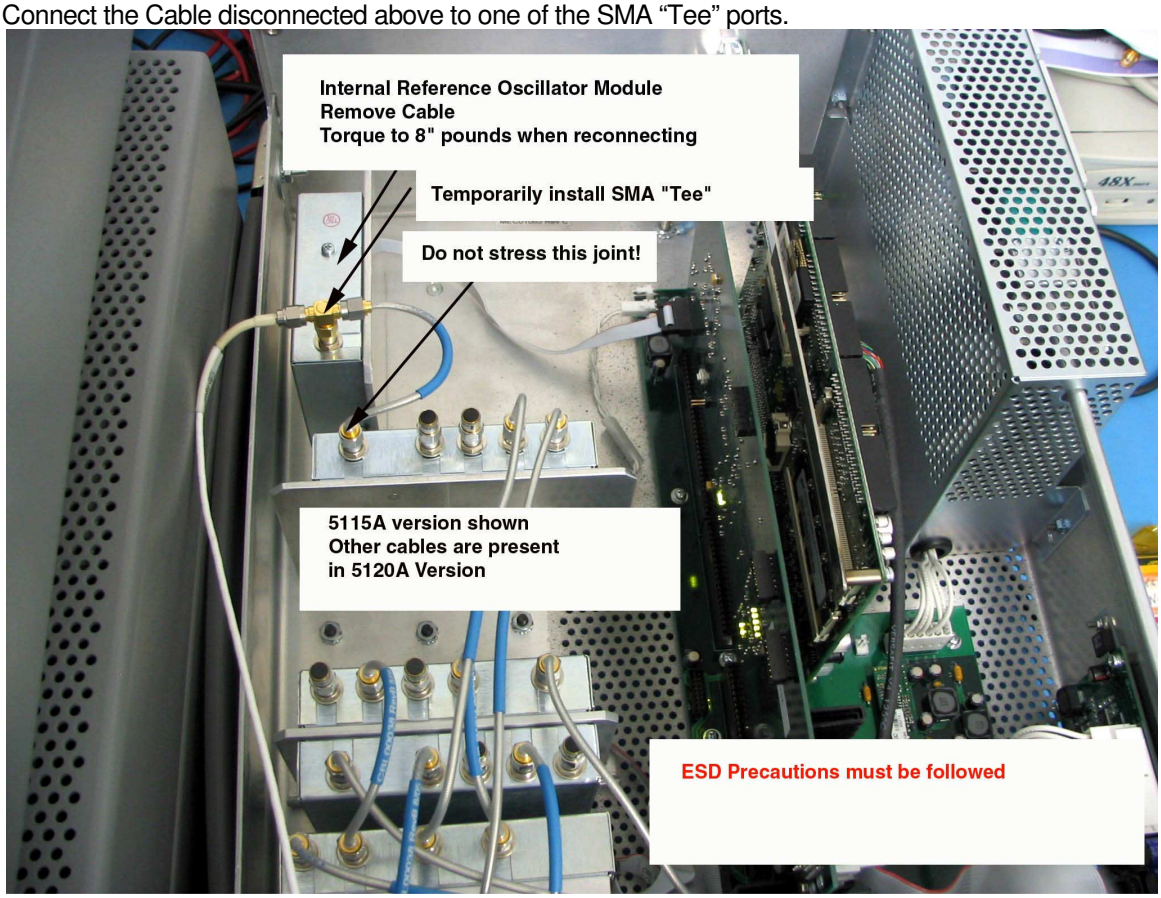

Figure 2 – Main Reference Oscillator Tuning Range Test Configuration

- Connect a coax cable between the other SMA “Tee” port and the frequency counter.
- Connect a NIST traceable reference to the frequency counter Reference input.
- Power frequency counter ON.
- Set frequency counter to the following settings
  - dc coupled, 50 Ohms, set trigger point auto.
- Power the Instrument ON.
- Set the frequency source to 10.000040 MHz +/- 1 Hz at 17 dBm +/- 1dB.
- Set the step attenuator to 1 dB.
- Verify that the Instrument’s front panel shows that the Input and Reference Frequency are 10.0 +/- 0.1MHz and Input and Reference Levels are 13 dBm +/- 1 dB

The following commands allow the Instrument’s internal oscillator’s tuning range to be determined. Before START has been pressed, the internal oscillator is set to its lowest frequency. After START has been pressed and the Instrument starts Collecting, the Instrument sets the Internal Oscillator to its highest frequency.

- Verify that the frequency counter is displaying a frequency that is approximately 64 MHz.
  Record the frequency displayed by the frequency counter in the Test Report.

  - Press START
  - Wait until the Instrument indicates that it is Collecting
  - Record the frequency displayed by the frequency counter in the Test Report.
  - Power the Instrument OFF.
  - Remove the “Tee”, reconnect the cable and torque the SMA connection.
  - Replace the Instrument’s cover.

  Note: No other internal adjustments will be made during this procedure.

Test 4 - Verification of Ability to Measure Spurious Signals

Note: this test uses the configuration shown in Figure 3.

Note: this test uses a different source for the input port than for the reference port.

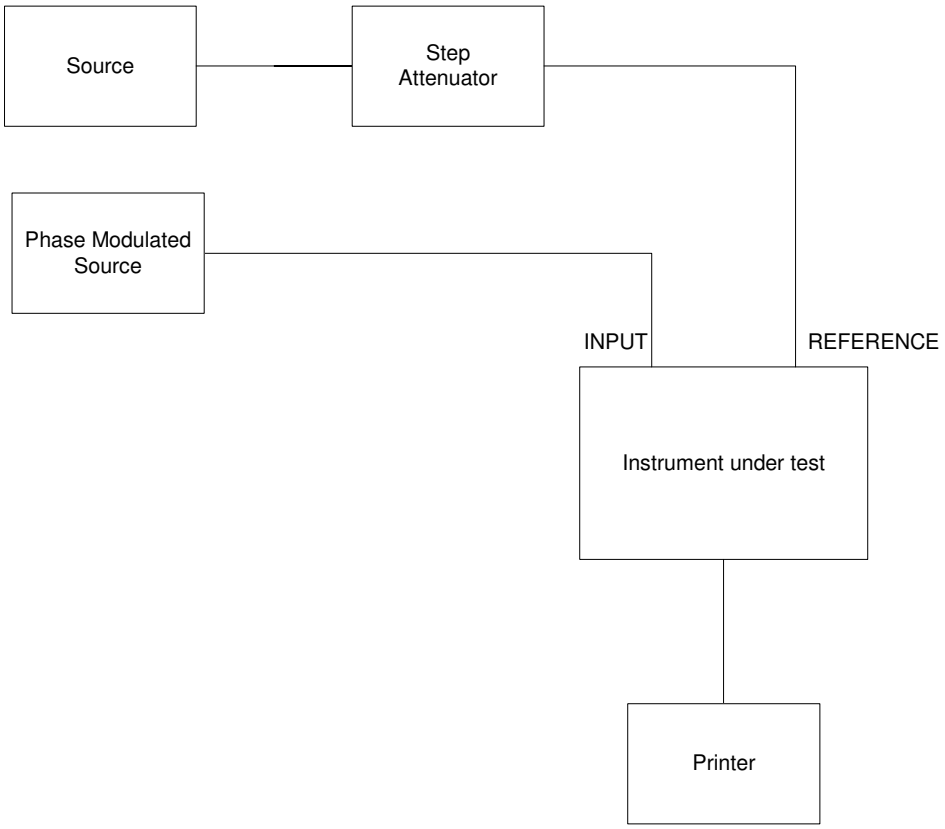

Figure 3 Test configuration Spur Detection

- Set the source used for the Reference input to:

RF Frequency	10.0 MHz +/- 1 Hz
Spur Level	< -65 dBc, 1 kHz to 100 kHz (set to no modulation)
Signal Level	+ 13 dBm +/- 1 dB

- Set the phase modulated source used for the Input Signal to provide a spur that is 46 dB below the peak.

RF Frequency	10.0 MHz +/- 1 Hz
Level	13 dBm +/1 dB
Spur Level	0.01 radian phase modulation
Spur frequency	12 kHz +/- 10 Hz

  Note: if a calibrated phase modulated source is not available and a phase modulator is used, use a spectrum analyzer to verify that both 12 kHz sidebands are -46 dBc +/- 0.25 dB

- Apply power to the Instrument. Allow it to boot and then warm up for at least 5 minutes
- Connect the phase modulated signal to the Instrument's Input Port.
- Connect the reference signal to the Instrument's Reference Port.
- Press START on the Instrument's front panel.
- Allow the Instrument to collect data for approximately 1 minute.
- Press STOP.
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Press Config Phase Noise.
- Press View Spur Table.
- Use the arrows to scroll through the spur table to the spur at 12 kHz.
- Record spur level at 12 kHz in the Test Report.
- Use the instruments buttons to navigate to the Phase Noise Display.
  - {return}
  - {return]

Test 5 - Verification of TSC 5120A Phase Noise Spectrum Performance

Note: Instruments with Software Version 241 must be in Enhanced Spur Detection Mode.

Note: Cover must be installed on 5120A during this test.

Caution – bumping or moving cables or the Instrument or the source will invalidate the following tests. If the cables are bumped, STOP the test and re-START.

NOTE: The length of time that the Instrument has been collecting data is displayed in the upper left corner of the Instrument's display

- Use the test configuration shown in Figure 1 during this test.
- Verify that source phase modulation is OFF.

Test 5A 1 MHz Phase Noise Floor Performance

- Set the Source frequency to 1.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 1.0 MHz at 13.0 dBm +/- 1 dB.
- Connect the signals to the Instrument's Input and Reference connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range 30 to 40 minutes.
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the phase noise plot is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

Note: Use the markers function to measure the phase noise levels during the following tests. Refer to the user manual for additional information about this function.

1 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-131
10	-140
100	-148
1000	-156
10000	-160
70000	-163

Test 5B 10 MHz Phase Noise Floor Performance

- Set the Source frequency to 10.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 10.0 MHz at 13.0 dBm +/- .5 dB.
- Connect the signals to the Instrument's Input and Reference Connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range **90 to 120 minutes.**
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

10 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-145
10	-155
100	-165
1000	-170
10000	-175
70000	-175

Test 5C Verification of Allan Deviation Noise Floor Performance at 10 MHz

This test uses the data just collected during the Phase Noise 10 MHz Test Segment.

Note: the spurs generated by the source synthesizer can potentially cause the Allan Deviation Noise Floor test to fail. If this test fails, repeat the test using a clean source such as a Rubidium or Caeseum Oscillator (eg., TSC 4410A). The phase noise data does not need to be collected if the Allan Deviation test is being repeated. Contact Symmetricom for additional support if the test does not pass.

- Press the soft keys to navigate to the Allan Deviation Table for NEQBW =0.5 Hz.
- Record the Allan Deviation at 1s for NEQBW = 0.5 Hz in the Test Report.
- Press the soft keys to navigate to the phase noise plot.

Test 5D 30 MHz Phase Noise Floor Performance

- Set the Source frequency to 30.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 30.0 MHz at 13.0 dBm +/- .5 dB
- Connect the signals to the Instrument's Input and Reference connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range 30 to 40 minutes.
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.

- Verify that the median of the Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

30 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-127
10	-138
100	-151
1000	-162
10000	-165
70000	-165

Test 6 – Frequency Counter

The PNTS frequency counter function measures the ratio between the frequency on the Input and Reference Ports. This test verifies that the ratio is within spec for identical signals on the two ports. The frequency ratio is based on a computation made from the same data that was used to determine the Phase Noise Spectrum Noise Floor. Successful completion of that set of tests is sufficient to provide NIST traceability of the frequency counter function.

The following test is used to demonstrate that the frequency counter is operational.

Note: This test uses the same test configuration as Test 1.

- Press STOP
- Set the source frequency to 10 MHz +/- 1 Hz at a level of 17 dBm.
  Set the attenuator to 1 dB.
- Press Config Freq Counter on the PNTS
- Press Auto Reference Freq
- Press Return
- Press START
- Allow Instrument to collect data for at least 2 minutes
- Press STOP
- Verify that the display shows :

Test data for software version 254 or above

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	Measured Frequency MHz
1	9.999 999 999 999 5 to 10.000 000 000 000 5	Within specified range	
10	9.999 999 999 999 95 to 10.000 000 000 000 05	Within specified range	

Test data for software version 241

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	Measured Frequency MHz
1	9.999 999 999 5 to 10.000 000 000 5	Within specified range	
10	9.999 999 999 5 to 10.000 000 000 5	Within specified range	

- Enter measured frequencies in test report section for either software version 254 or 241.

TSC 5120A Phase Noise Test Set

Performance Verification Test Report Data

Date _____

Model Type TSC 5120A

Serial Number _____

Test 1 – Ethernet Interface
Power Indicator illuminated GREEN [P/F] _____
Instrument's IP Address _____
Established communication with port 1299 [P/F] _____
Instrument's Software Version _____

Test 2 – Displayed Frequency and Level and Internal Attenuators
Test 2A

Attenuator setting	Input Frequency MHz	Input Level dBm	Reference Frequency MHz	Reference Level dBm	Pass/Fail
0 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	
1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	
2 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	
4 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	
6 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	
8 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	
10 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	
14 dB	10.0 MHz +/- 0.1	0 +/- 1 dB	10.0 MHz +/- 0.1	0 +/- 1 dB	

Test 2B

Verify that Input and Reference Frequency are 1.0 +/ 0.1 MHz	[P/F]
Verify that Input and Reference Frequency are 30.0 +/ 0.1 MHz	[P/F]

Test 3 – Internal Reference Oscillator tuning range

Parameter	Frequency MHz	Requirement	Pass/Fail
Low Frequency		< 63.999 750 MHz	
High Frequency		> 64.000 250 MHz	
Delta Frequency		High – Low Frequency > 700 Hz	

Test 4 – Spur Detection

Parameter	Frequency MHz	Requirement	Pass/Fail
Spur Level		-46 dBc +/- 0.5 dB	
Spur Frequency (Hz)		12000 Hz +/- 100 Hz	
Spectrum Printout Attached		Shows 12 kHz spur	

Test 5 – Verifying PNTS Phase Noise Spectrum Noise Floor Performance

Test 5B parts 1-3 – Data from TSC 5120A

	5120A Noise Floor Performance (dBc/Hz)					
Offset Frequency, Hz	1 MHz Measured Performance (dBc/Hz)	1 MHz Requirement (dBc/Hz)	10 MHz Measured Performance (dBc/Hz)	10 MHz Requirement (dBc/Hz)	30 MHz Measured Performance (dBc/Hz)	30 MHz Requirement (dBc/Hz)
1		-131		-145		-127
10		-140		-155		-138
100		-148		-165		-151
1000		-156		-170		-162
10000		-160		-175		-165
70000		-163		-175		-165
Mark [P/F]if column passes						

Test 5A/B -2B, 5D-1B Allan Deviation at 10 MHz

Model	Pass/Fail Requirement (1s NEQBW = 0.5 Hz)	[P/F]
TSC 5120A	< 3e-15	

Test 5-1 Data at 1 MHz analyzed [P/F] _____
Test 5-2 Data at 10 MHz analyzed [P/F] _____
Test 5-3 Data at 30 MHz analyzed [P/F] _____

Test 5A/B part 2 Allan Deviation analyzed [P/F] _____

Spectrum Printout at 1 MHz attached [P/F] _____
Spectrum Printout at 10 MHz attached [P/F] _____
Spectrum Printout at 30 MHz attached [P/F] _____

Test 6 – Frequency Counter

Test data for software version 254 or above

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	
1	9.999 999 999 999 5 to 10.000 000 000 000 5	Within specified range	[P/F] _____
10	9.999 999 999 999 95 to 10.000 000 000 000 05	Within specified range	[P/F] _____

Test data for software version 241

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	
1	9.999 999 999 5 to 10.000 000 000 5	Within specified range	[P/F] _____
10	9.999 999 999 5 to 10.000 000 000 5	Within specified range	[P/F] _____

5120A-01 – Section 3

Test 1 – Verification of Ethernet Interfaces and Software Revision

- Connect the Instrument to a support computer through a CAT5 crossover cable.
  The Instrument's Ethernet connector is located on the rear panel.
- Connect AC Power (110 VAC – 240 VAC) to the Instrument's AC connector.
  The Instrument's AC Power connector is located on the rear panel.
- Apply Power to the Instrument by pressing the AC Power Switch. That switch is located in the Instruments upper right corner.
- Verify that the Instrument's Power Indicator LED (located next to the AC Power Switch) is illuminated GREEN. Record the condition in the test report.
- Allow the Instrument to Boot.
  A graph is displayed when the Boot process is completed.
- Press the front panel buttons to navigate to the NETWORK SETTINGS Page.
  {press Settings and Options}
  {press Settings}
  {press Network}
- Determine the IP address of the support computer. (If the computer is Windows XP, open a dos window and enter the command **ipconfig <cr>**. Verify that the support computer and Instrument IP addresses' are on the same network. If necessary, change the Instrument's IP address so that the support computer can communicate with it.)
  During this test section use mouse to move cursor and press buttons.
  Set Instrument to Static Address
  Set desired IP address and Network Mask
  Click on Apply

  Note: Consult your IT professional if you have problems with setting the IP address.

- Record the Instrument's IP address on the Test Report.

- Open a telnet client on the support computer and then open a TCP/IP session to Instrument port 1299. (This step verifies that the instrument's Ethernet functions are operating normally.

- Enter the command ***show version<cr>*** to display the instruments software revision

- Enter the Instrument's software revision in the test report.

  If software revision is 241 and the user does not want to upgrade to the latest software, refer to Appendix - A before proceeding.

  If software revision is neither 241 nor above 254, contact Symmetricom to obtain the latest software.

Use the Instrument's soft keys to navigate to the Print options page, set printer to local and pcl5.
{press printing}
{press local}
{press pcl5}
{press apply}

Use the Instrument's soft keys to navigate to to the phase noise graph
{press return}
{press return}
{press phase noise plot}

Test 2 – Verification of displayed Frequency, level and operation of internal attenuators and switches

Note: tests 2A and 2B verify the proper operation of the Instrument's internal attenuators and switches. They also verify that the frequency displayed by the Instrument is NIST traceable to +/- 0.1 MHz and the amplitude displayed by the unit is NIST traceable to +/- 1 dB.

Test 2A – Verification of internal Attenuator and Switch performance

- Allow the Instrument to warm up for at least 5 minutes.
- Refer to Figure 1 for a pictorial representation of the set-up described in the following steps.
- Connect the signal source to the step attenuator input port.
- Set attenuator to 0 dB.
- Connect the output from the step attenuator to the two way power divider input.
- Connect matched length coax cables to the output of the power divider.
- **Use calibrated equipment to set output at the end of the cables that will be connected to the Instrument to 10 MHz +/- 0.1 Hz, 14 dBm +/- 0.5 dB.**
  Note: The above step required the source to be set to 17 dBm plus cable and power divider losses.

- Connect the two cables from the divider to the Instrument's Input and Reference Connectors.

WARNING – During the following test it is not sufficient to simply set the attenuator and record the indicated values while the Instrument is not collecting. Doing so does not test the attenuators.
NOTE: Changing the attenuator setting while collecting results in a warning message. Dismiss the message and continue.

Procedure to verify internal Attenuator operation and displayed Frequency and Amplitude

- Set attenuator to specified value (0,1,2,4,6,8,10 dB)
- Press STOP
- Wait at least 2 seconds
- Press START
  Note: - it is not necessary to wait until the instrument indicates collecting.
  The measurement is acceptable while the Instrument is Initializing
- Verify that the Instrument indicates that it is either Initializing or Collecting.
- Press STOP
- Record Amplitude and Frequency values displayed on the Instrument's screen for the Input and Reference ports in the Test Report before proceeding.

Note: The Input level in the following table refers to the level that should be displayed on the instrument's front panel. The source should not be set to this level.

Note: Out of Spec readings during this test are frequently caused by the attenuator.

Attenuator setting	Input Frequency MHz	Input Level dBm	Reference Frequency MHz	Reference Level dBm
0 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	10.0 MHz +/- 0.1	14 +/- 1 dB
1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB
2 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	10.0 MHz +/- 0.1	12 +/- 1 dB
4 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	10.0 MHz +/- 0.1	10 +/- 1 dB
6 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	10.0 MHz +/- 0.1	8 +/- 1 dB
8 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	10.0 MHz +/- 0.1	6 +/- 1 dB
10 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	10.0 MHz +/- 0.1	4 +/- 1 dB

Test 2B - Verification of frequency measurement capability

Note: During this test ignore the displayed amplitude levels since the levels are not calibrated.

- Set attenuator to 0 dB
- Set source frequency to 1.0 MHz +/- 5 kHz at level = 17 dBm +/- 1 dB.
- Verify that the PNTS Input and Reference Frequency displayed are 1.0 +/- 0.1 MHz
  Record this data in the test report.
- Set source frequency to 30.0 MHz +/- 5 kHz at level = 17 dBm +/- 1 dB
- Verify that the PNTS Input and Reference Frequency displayed are 30.0 +/- 0.1 MHz
- Record this data in the test report.

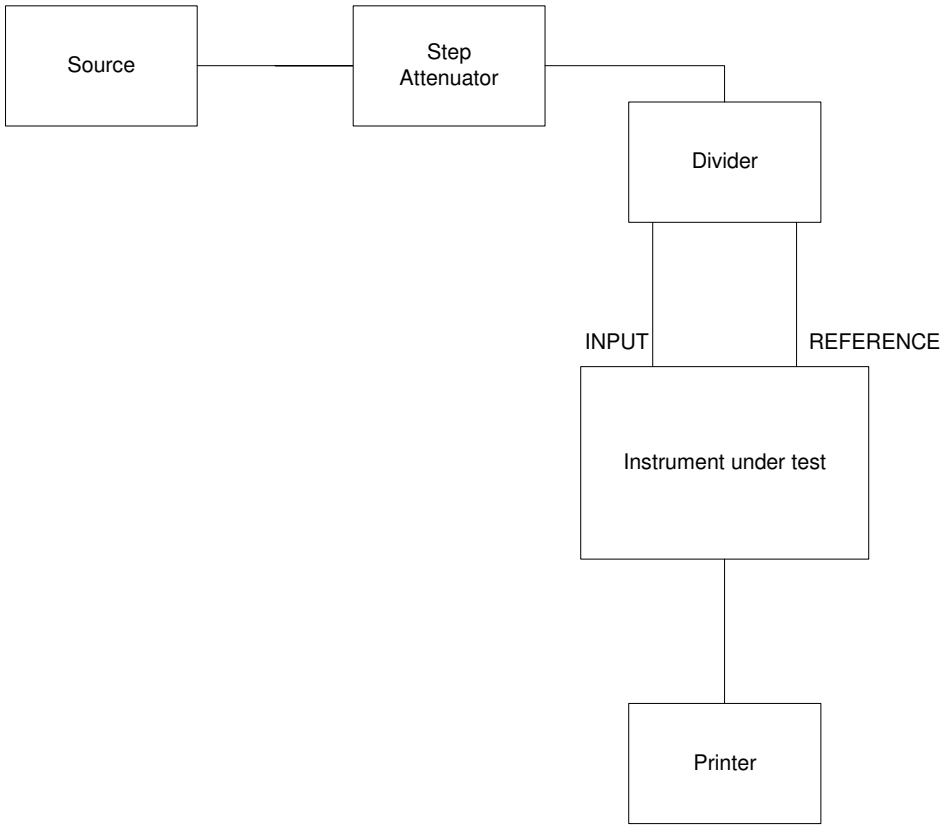

Figure 1: Tests 2, 3 and 5 Configuration

Test 3 - Verification of Instrument Reference Oscillator Tuning Range

CAUTION – This procedure is for use with Software Version 254 or later. See Appendix - A if Software Version 241 is installed.

Warning – Proper ESD Precautions must be followed during this test

This test verifies that the Instrument's Main Reference Oscillator frequency and tuning range is acceptable.

- Use the test configuration shown in Figure 1 during this test.
- Power the Instrument OFF.

Note: Figure 2 depicts a TSC 5115A. The TSC 5120A includes two additional modules and several cables. Those changes do not change this test configuration.

- Remove the Instrument's cover ,and configure the Instrument as shown in Figure 2 using the following instructions:

Note: Refer to the TSC 5120A Flash Replacement Procedure for additional information regarding removing the Instrument's cover.

- Disconnect the end of the coaxial cable that is connected to the Main Reference Oscillator Module.
- Connect the SMA "Tee" to the Main Reference Oscillator Module.
- Connect the Cable disconnected above to one of the SMA "Tee" ports.

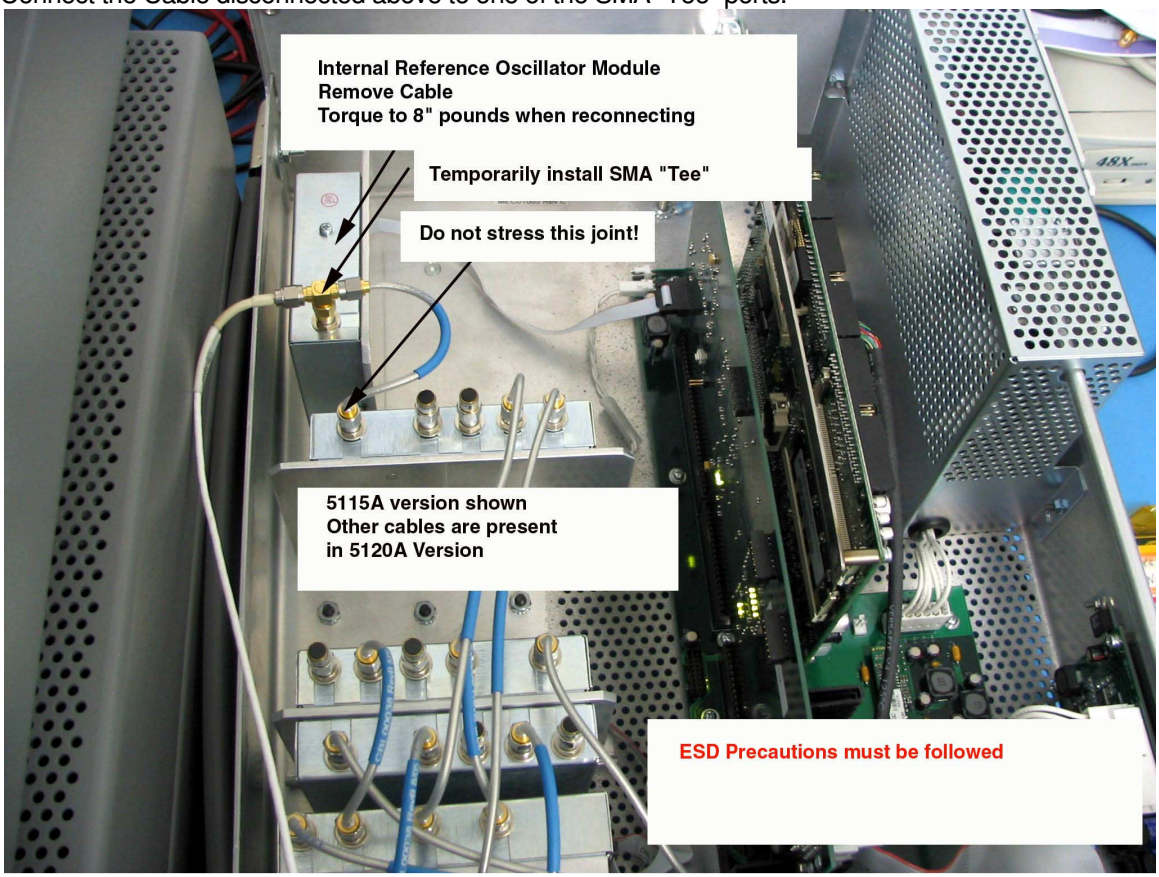

Figure 2 – Main Reference Oscillator Tuning Range Test Configuration

- Connect a coax cable between the other SMA “Tee” port and the frequency counter.
- Connect a NIST traceable reference to the frequency counter Reference input.
- Power frequency counter ON.
- Set frequency counter to the following settings
  - dc coupled, 50 Ohms, set trigger point auto.
- Power the Instrument ON.
- Set the frequency source to 10.000040 MHz +/- 1 Hz at 17 dBm +/- 1dB.
- Set the step attenuator to 1 dB.
- Verify that the Instrument’s front panel shows that the Input and Reference Frequency are 10.0 +/- 0.1MHz and Input and Reference Levels are 13 dBm +/- 1 dB

The following commands allow the Instrument’s internal oscillator’s tuning range to be determined. Before START has been pressed, the internal oscillator is set to its lowest frequency. After START has been pressed and the Instrument starts Collecting, the Instrument sets the Internal Oscillator to its highest frequency.

- Verify that the frequency counter is displaying a frequency that is approximately 64 MHz.
  Record the frequency displayed by the frequency counter in the Test Report.

  - Press START
  - Wait until the Instrument indicates that it is Collecting
  - Record the frequency displayed by the frequency counter in the Test Report.
  - Power the Instrument OFF.
  - Remove the “Tee”, reconnect the cable and torque the SMA connection.
  - Replace the Instrument’s cover.

  Note: No other internal adjustments will be made during this procedure.

Test 4 - Verification of Ability to Measure Spurious Signals

Note: this test uses the configuration shown in Figure 3.

Note: this test uses a different source for the input port than for the reference port.

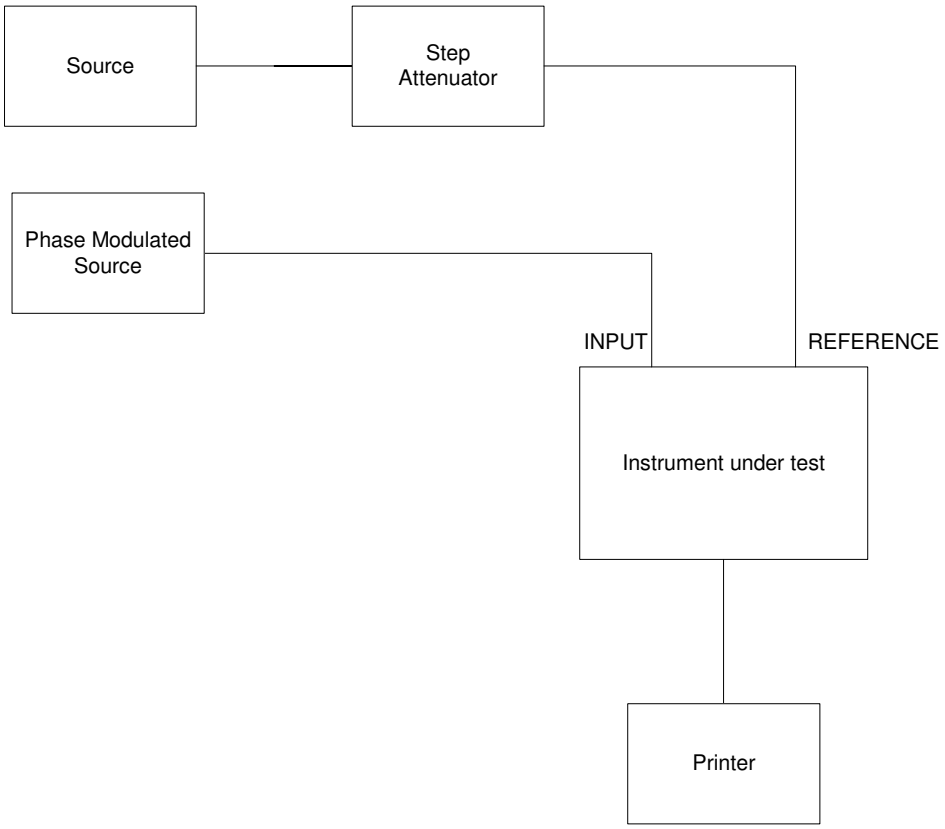

Figure 3 Test configuration Spur Detection

- Set the source used for the Reference input to:

RF Frequency	10.0 MHz +/- 1 Hz
Spur Level	< -65 dBc, 1 kHz to 100 kHz (set to no modulation)
Signal Level	+ 13 dbm +/- 1 dB

- Set the phase modulated source used for the Input Signal to provide a spur that is 46 dB below the peak.

RF Frequency	10.0 MHz +/- 1 Hz
Level	13 dBm +/1 dB
Spur Level	0.01 radian phase modulation
Spur frequency	12 kHz +/- 10 Hz

  Note: if a calibrated phase modulated source is not available and a phase modulator is used, use a spectrum analyzer to verify that both 12 kHz sidebands are -46 dBc +/- 0.25 dB

- Apply power to the Instrument. Allow it to boot and then warm up for at least 5 minutes
- Connect the phase modulated signal to the Instrument's Input Port.
- Connect the reference signal to the Instrument's Reference Port.
- Press START on the Instrument's front panel.
- Allow the Instrument to collect data for approximately 1 minute.
- Press STOP.
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Press Config Phase Noise.
- Press View Spur Table.
- Use the arrows to scroll through the spur table to the spur at 12 kHz.
- Record spur level at 12 kHz in the Test Report.
- Use the instruments buttons to navigate to the Phase Noise Display.
  - {return}
  - {return]

Test 5 - Verification of Phase Noise Performance

Note: Instruments with Software Version 241 must be in Enhanced Spur Detection Mode. This mode was set during test 3 (appendix-B).

Note: Cover must be installed on 5120A-01 during this test.

Caution – bumping or moving cables or the Instrument or the source will invalidate the following tests. If the cables are bumped, STOP the test and re-START.

NOTE: The length of time that the Instrument has been collecting data is displayed in the upper left corner of the Instrument's display

- Use the test configuration shown in Figure 1 during this test.
- Verify that source phase modulation is OFF.

Test 5A 1 MHz Phase Noise Floor Performance

- Set the Source frequency to 1.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 1.0 MHz at 13.0 dBm +/- 1 dB.
- Connect the signals to the Instrument's Input and Reference connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range 30 to 40 minutes.
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the phase noise plot is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

Note: Use the markers function to measure the phase noise levels during the following tests. Refer to the user manual for additional information about this function.

1 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-131
10	-140
100	-148
1000	-156
10000	-160
70000	-163

Test 5B 10 MHz Phase Noise Floor Performance

- Set the Source frequency to 10.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 10.0 MHz at 13.0 dBm +/- .5 dB.
- Connect the signals to the Instrument's Input and Reference Connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range **90 to 120 minutes.**
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

10 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-145
10	-155
100	-165
1000	-170
10000	-175
70000	-175

Test 5C 30 MHz Phase Noise Floor Performance

- Set the Source frequency to 30.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 30.0 MHz at 13.0 dBm +/- .5 dB
- Connect the signals to the Instrument's Input and Reference connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range 30 to 40 minutes.
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

30 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-127
10	-138
100	-151
1000	-162
10000	-165
70000	-165

Test 5D - 5 MHz Phase Noise Floor Performance Using Internal Reference

- Note: the Source Phase Noise must be better than the specs being measured.

- Set the Source frequency to 5.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signal that will be connected to Instrument is: 5.0 MHz at 13.0 dBm +/- .5 dB.
- Connect the signal to the Instrument's Input Connector.
- Verify that nothing is connected to the Instrument's Reference Connector.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range
  90 to 120 minutes.
- Press STOP
- Verify that the median of the Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

5120A-01 5 MHz Phase Noise Floor Requirement

Offset Frequency, Hz	5 MHz Requirement (dBc/Hz)
1	-126
10000	-168

Test 5E - 10 MHz Phase Noise Floor Performance Using Internal Reference

- Note: the Source Phase Noise must be better than the specs being measured.
- Set the Source frequency to 10.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signal that will be connected to Instrument is: 10.0 MHz at 13.0 dBm +/- .5 dB.
- Connect the signal to the Instrument's Input Connector.
- Verify that nothing is connected to the Instrument's Reference Connector.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range
  90 to 120 minutes.
- Press STOP
- Verify that the median of the Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

Test 5F - Verification of Allan Deviation Noise Floor Performance at 10 MHz

This test uses the data just collected during the Phase Noise 10 MHz Test Segment (Test 5E).

Note: the spurs generated by the source synthesizer can potentially cause the Allan Deviation Floor test to fail. If this test fails, repeat the test using a clean source such as a Rubidium or Cesium Oscillator (g., TSC 4410A). The phase noise data does not need to be collected if the Allan Deviation test is being repeated. Contact Symmetricom for additional support if the test does not pass.

- Press the soft keys to navigate to the Allan Deviation Table for NEQBW = 0.5 Hz by adjusting the value of τ_0.
- Confirm the values displayed in the table are less than the values shown in the following table, and record the Allan Deviation in the Test Report.

Allen Deviation requirements for 5120A-01

Allen Deviation	Averaging time
3E-12	200 seconds

Test 6 – Frequency Counter

The PNTS frequency counter function measures the ratio between the frequency on the Input and Reference Ports. This test verifies that the ratio is within spec for identical signals on the two ports. The frequency ratio is based on a computation made from the same data that was used to determine the Phase Noise Spectrum Noise Floor. Successful completion of that set of tests is sufficient to provide NIST traceability of the frequency counter function.

The following test is used to demonstrate that the frequency counter is operational.

Note: This test uses the same test configuration as Test 1.

- Press STOP
- Set the source frequency to 10 MHz +/- 1 Hz at a level of 17 dBm.
  Set the attenuator to 1 dB.
- Press Config Freq Counter on the PNTS
- Press Auto Reference Freq
- Press Return
- Press START
- Allow Instrument to collect data for at least 2 minutes
- Press STOP
- Verify that the display shows :

Test data for software version 254 or above

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	Measured Frequency MHz
1	9.999 999 999 999 5 to 10.000 000 000 000 5	Within specified range	
10	9.999 999 999 999 95 to 10.000 000 000 000 05	Within specified range	

Test data for software version 241

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	Measured Frequency MHz
1	9.999 999 999 5 to 10.000 000 000 5	Within specified range	
10	9.999 999 999 5 to 10.000 000 000 5	Within specified range	

- Enter measured frequencies in test report.

TSC 5120A-01 Phase Noise Test Set

Performance Verification Test Report Data

Date _____

Model Type TSC 5120A-01

Serial Number _____

Test 1 – Ethernet Interface
Power Indicator illuminated GREEN [P/F] _____
Instrument's IP Address _____
Established communication with port 1299 [P/F] _____
Instrument's Software Version _____

Test 2 – Displayed Frequency and Level and Internal Attenuators
Test 2A

Attenuator setting	Input Frequency MHz	Input Level dBm	Reference Frequency MHz	Reference Level dBm	Pass/Fail
0 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	
1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	
2 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	
4 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	
6 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	
8 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	
10 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	
14 dB	10.0 MHz +/- 0.1	0 +/- 1 dB	10.0 MHz +/- 0.1	0 +/- 1 dB	

Test 2B

Verify that Input and Reference Frequency are 1.0 +/ 0.1 MHz	[P/F]
Verify that Input and Reference Frequency are 30.0 +/ 0.1 MHz	[P/F]

Test 3 – Internal Reference Oscillator tuning range

Parameter	Frequency MHz	Requirement	Pass/Fail
Low Frequency		< 63.999 750 MHz	
High Frequency		> 64.000 250 MHz	
Delta Frequency		High – Low Frequency > 700 Hz	

Test 4 – Spur Detection

Parameter	Frequency MHz	Requirement	Pass/Fail
Spur Level		-46 dBc +/- 0.5 dB	
Spur Frequency (Hz)		12000 Hz +/- 100 Hz	
Spectrum Printout Attached		Shows 12 kHz spur	

Test 5 – Verifying PNTS Phase Noise Spectrum Noise Floor Performance

Test 5A -5C – Data from 5120A-01 with external reference

	5120A-01 Noise Floor Performance (dBc/Hz)					
	Test 5A		Test 5B		Test 5C	
Offset Frequency, Hz	1 MHz Measured Performance (dBc/Hz)	1 MHz Requirement (dBc/Hz)	10 MHz Measured Performance (dBc/Hz)	10 MHz Requirement (dBc/Hz)	30 MHz Measured Performance (dBc/Hz)	30 MHz Requirement (dBc/Hz)
1		-131		-145		-127
10		-140		-155		-138
100		-148		-165		-151
1000		-156		-170		-162
10000		-160		-175		-165
70000		-163		-175		-165
Mark [P/F]if column passes						

Tests 5D and 5E – Phase Noise Performance using Internal Reference Oscillator

Offset Frequency, Hz	5 MHz Measured Performance (dBc/Hz)	5 MHz Requirement (dBc/Hz)	10 MHz Measured Performance (dBc/Hz)	10 MHz Requirement (dBc/Hz)
1		-126		-120
10000		-168		-170
Mark [P/F]if column passes				

Test 5F - Allan Deviation at 10 MHz

Averaging time	Allen Deviation NEQBW = 0.5 Hz	[P/F]
200 seconds	3E-12	

Spectrum Printout at 1 MHz [Attached] _____
Spectrum Printout at 10 MHz [Attached] _____
Spectrum Printout at 30 MHz [Attached] _____

Test 6 – Frequency Counter

Test data for software version 254 or above

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	
1	9.999 999 999 999 5 to 10.000 000 000 000 5	Within specified range	[P/F] _____
10	9.999 999 999 999 95 to 10.000 000 000 000 05	Within specified range	[P/F] _____

Test data for software version 241

Sample time(s)	Frequency (MHz)	Pass/Fail Criteria	
1	9.999 999 999 5 to 10.000 000 000 5	Within specified range	[P/F] _____
10	9.999 999 999 5 to 10.000 000 000 5	Within specified range	[P/F] _____

5125A – Section 4

Test 1 – Verification of Ethernet Interfaces and Software Revision

- Connect the Instrument to a support computer through a CAT5 crossover cable.
  The Instrument's Ethernet connector is located on the rear panel.
- Connect AC Power (110 VAC – 240 VAC) to the Instrument's AC connector.
  The Instrument's AC Power connector is located on the rear panel.
- Apply Power to the Instrument by pressing the AC Power Switch. That switch is located in the Instruments upper right corner.
- Verify that the Instrument's Power Indicator LED (located next to the AC Power Switch) is illuminated GREEN. Record the condition in the test report.
- Allow the Instrument to Boot.
  A graph is displayed when the Boot process is completed.
- Press the front panel buttons to navigate to the NETWORK SETTINGS Page.
  {press Settings and Options}
  {press Settings}
  {press Network}
- Determine the IP address of the support computer. (If the computer is Windows XP, open a dos window and enter the command **ipconfig <cr>**. Verify that the support computer and Instrument IP addresses' are on the same network. If necessary, change the Instrument's IP address so that the support computer can communicate with it.)
  During this test section use mouse to move cursor and press buttons.
  Set Instrument to Static Address
  Set desired IP address and Network Mask
  Click on Apply

  Note: Consult your IT professional if you have problems with setting the IP address.

- Record the Instrument's IP address on the Test Report.

- Open a telnet client on the support computer and then open a TCP/IP session to Instrument port 1299. (This step verifies that the instrument's Ethernet functions are operating normally.

- Enter the command ***show version<cr>*** to display the instruments software revision

- Enter the Instrument's software revision in the test report.

  If software revision is 241 and the user does not want to upgrade to the latest software, refer to Appendix - A before proceeding.

  If software revision is neither 241 nor above 254, contact Symmetricom to obtain the latest software.

Use the Instrument's soft keys to navigate to the Print options page, set printer to local and pcl5.
{press printing}
{press local}
{press pcl5}
{press apply}

Use the Instrument's soft keys to navigate to the phase noise graph

{press return}
{press return}
{press phase noise plot}

Test 2 – Verification of displayed Frequency, level and operation of internal attenuators and switches

Note: tests 2A and 2B verify the proper operation of the Instrument's internal attenuators and switches. They also verify that the frequency displayed by the Instrument is NIST traceable to +/- 0.1 MHz and the amplitude displayed by the unit is NIST traceable to +/- 1 dB.

Test 2A – Verification of internal Attenuator and Switch performance

- Allow the Instrument to warm up for at least 5 minutes.
- Refer to Figure 1 for a pictorial representation of the set-up described in the following steps.
- Connect the signal source to the step attenuator input port.
- Set attenuator to 0 dB.
- Connect the output from the step attenuator to the two way power divider input.
- Connect matched length coax cables to the output of the power divider.
- **Use calibrated equipment to set output at the end of the cables that will be connected to the Instrument to 10 MHz +/- 0.1 Hz, 14 dBm +/- 0.5 dB.**
  Note: The above step required the source to be set to 17 dBm plus cable and power divider losses.

- Connect the two cables from the divider to the Instrument's Input and Reference Connectors.

WARNING – During the following test it is not sufficient to simply set the attenuator and record the indicated values while the Instrument is not collecting. Doing so does not test the attenuators.
NOTE: Changing the attenuator setting while collecting results in a warning message. Dismiss the message and continue.

Procedure to verify internal Attenuator operation and displayed Frequency and Amplitude

- Set attenuator to specified value (0,1,2,4,6,8,10 dB)
- Press STOP
- Wait at least 2 seconds
- Press START
  Note: - it is not necessary to wait until the instrument indicates collecting.
  The measurement is acceptable while the Instrument is Initializing
- Verify that the Instrument indicates that it is either Initializing or Collecting.
- Press STOP
- Record Amplitude and Frequency values displayed on the Instrument's screen for the Input and Reference ports in the Test Report before proceeding.

Note: The Input level in the following table refers to the level that should be displayed on the instrument's front panel. The source should not be set to this level.

Note: Out of Spec readings during this test are frequently caused by the attenuator.

Attenuator setting	Input Frequency MHz	Input Level dBm	Reference Frequency MHz	Reference Level dBm
0 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	10.0 MHz +/- 0.1	14 +/- 1 dB
1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB
2 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	10.0 MHz +/- 0.1	12 +/- 1 dB
4 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	10.0 MHz +/- 0.1	10 +/- 1 dB
6 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	10.0 MHz +/- 0.1	8 +/- 1 dB
8 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	10.0 MHz +/- 0.1	6 +/- 1 dB
10 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	10.0 MHz +/- 0.1	4 +/- 1 dB

Test 2B

Verification of frequency measurement capability

Note: During this test ignore the displayed amplitude levels since the levels are not calibrated.

- Set attenuator to 0 dB
- Set source frequency to 1.0 MHz +/- 5 kHz at level = 17 dBm +/- 1 dB.
- Verify that the PNTS Input and Reference Frequency displayed are 1.0 +/- 0.1 MHz
  Record this data in the test report.
- Set source frequency to 30.0 MHz +/- 5 kHz at level = 17 dBm +/- 1 dB
- Verify that the PNTS Input and Reference Frequency displayed are 30.0 +/- 0.1 MHz
- Record this data in the test report.

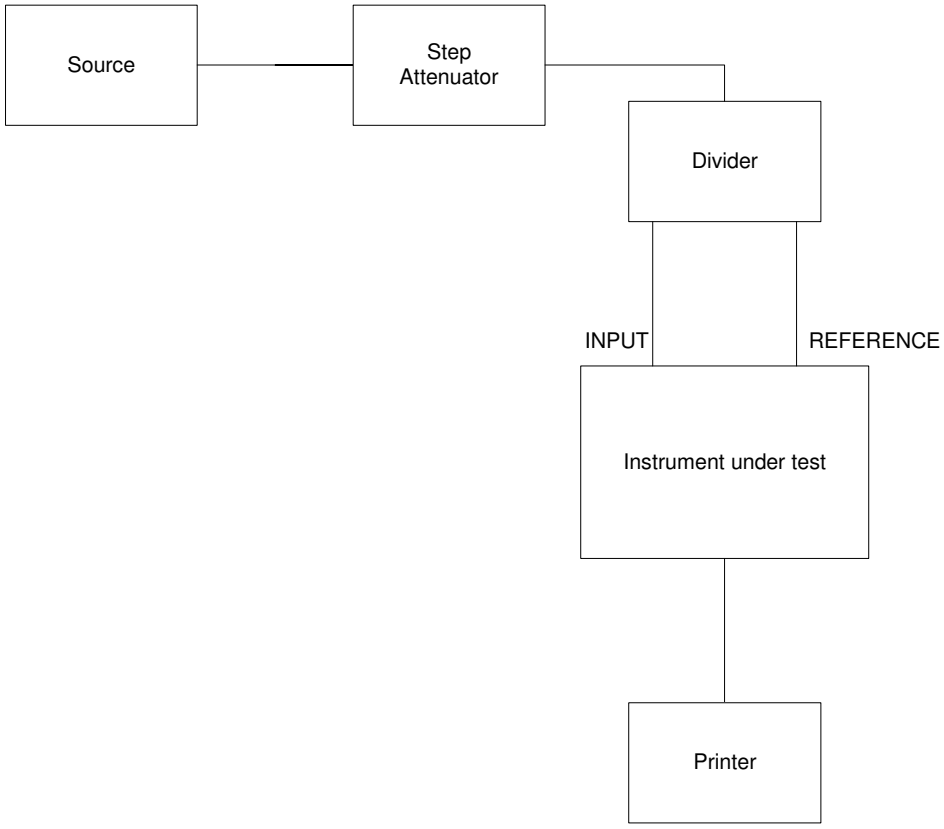

Figure 1: Tests 2, 3 and 5 Configuration

Test 3 - Verification of Ability to Measure Spurious Signals

Note: this test uses the configuration shown in Figure 3.

Note: this test uses a different source for the input port than for the reference port.

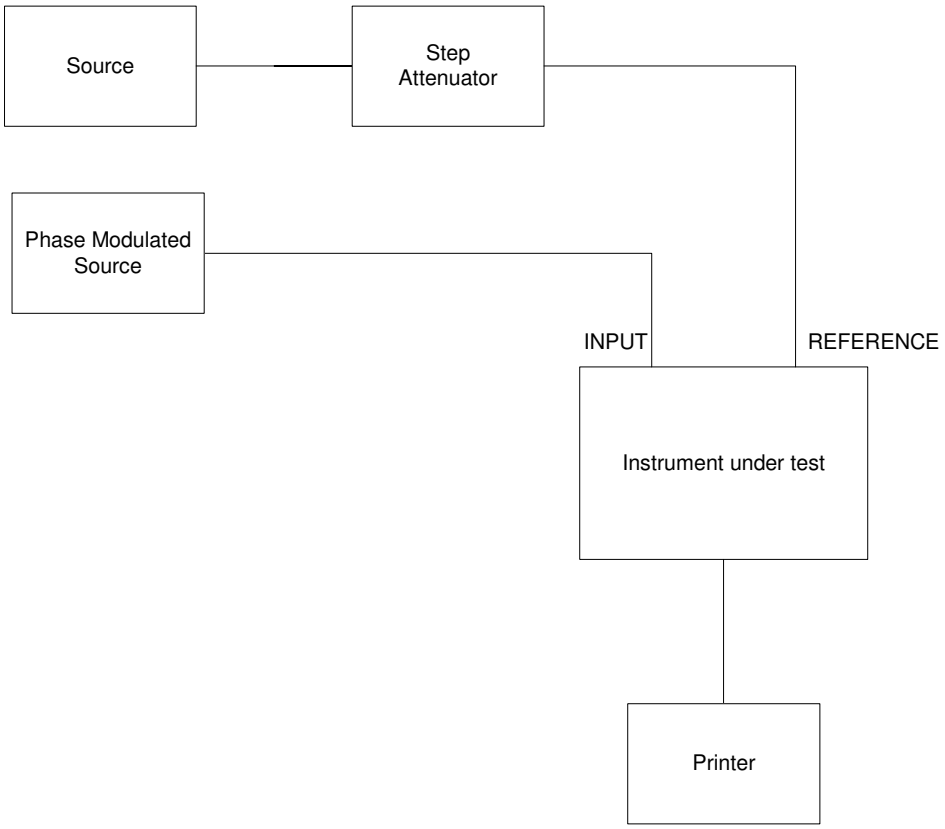

Figure 3 Test configuration Spur Detection

- Set the source used for the Reference input to:

RF Frequency	10.0 MHz +/- 1 Hz
Spur Level	< -65 dBc, 1 kHz to 100 kHz (set to no modulation)
Signal Level	+ 13 dBm +/- 1 dB

- Set the phase modulated source used for the Input Signal to provide a spur that is 46 dB below the peak.

RF Frequency	10.0 MHz +/- 1 Hz
Level	13 dBm +/1 dB
Spur Level	0.01 radian phase modulation
Spur frequency	12 kHz +/- 10 Hz

  Note: if a calibrated phase modulated source is not available and a phase modulator is used, use a spectrum analyzer to verify that both 12 kHz sidebands are -46 dBc +/- 0.25 dB

- Apply power to the Instrument. Allow it to boot and then warm up for at least 5 minutes
- Connect the phase modulated signal to the Instrument's Input Port.
- Connect the reference signal to the Instrument's Reference Port.
- Press START on the Instrument's front panel.
- Allow the Instrument to collect data for approximately 1 minute.
- Press STOP.
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Press Config Phase Noise.
- Press View Spur Table.
- Use the arrows to scroll through the spur table to the spur at 12 kHz.
- Record spur level at 12 kHz in the Test Report.
- Use the instruments buttons to navigate to the Phase Noise Display.
  - {return}
  - {return]

Test 4 - Verification of TSC 5125A Phase Noise Floor Performance

Note: Cover must be installed on 5125A during this test.

Caution – bumping or moving cables or the Instrument or the source will invalidate the following tests. If the cables are bumped, STOP the test and re-START.

NOTE: The length of time that the Instrument has been collecting data is displayed in the upper left corner of the Instrument's display

- Use the test configuration shown in Figure 1 during this test.
- Verify that source phase modulation is OFF.

Test 4A - 10 MHz Phase Noise Floor Performance

- Set the Source frequency to 10.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 10.0 MHz at 13.0 dBm +/- 1 dB.
- Connect the signals to the Instrument's Input and Reference connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range 30 to 40 minutes.
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the phase noise plot is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

Note: Use the markers function to measure the phase noise levels during the following tests. Refer to the user manual for additional information about this function.

10 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-140
10	-150
100	-157
1000	-162
10000	-165
100000	-165

Test 4B - 100 MHz Phase Noise Floor Performance

- Set the Source frequency to 100.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.

- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 100.0 MHz at 13.0 dBm +/- .5 dB.
- Connect the signals to the Instrument's Input and Reference Connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range **90 to 120 minutes.**
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.

- Verify that the median of the Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

100 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-120
10	-130
100	-140
1000	-150
10000	-160
100000	-165

Test 4C - 400 MHz Phase Noise Floor Performance

- Set the Source frequency to 400.0 MHz at a level of 17 dBm.
  Set the attenuator to 1 dB.
- Use calibrated equipment to verify that the signals that will be connected to Instrument are: 400.0 MHz at 13.0 dBm +/- .5 dB
- Connect the signals to the Instrument's Input and Reference connectors.
- Press START on the Instrument's front panel
- Allow the Instrument to collect data until the data collection period is in the range 30 to 40 minutes.
- Press STOP
- Press PRINT and then attach the Phase Noise Plot to the Test Report.
- Verify that the median of the Phase Noise display is less than the value in the following table at each specified offset frequency. If a spur is present at the specified offset frequency, use the level adjacent to the spur. Record the measured values in the test report.

400 MHz Noise Floor Requirement

Offset Frequency	Phase Noise Requirement (dBc/Hz)
1	-110
10	-120
100	-130
1000	-140
10000	-150
100000	-155

Test 6 - RF Filter and Switch Test

The 5125A has 7 RF input filters. This test verifies that the 5125A correctly switches each of these filters into the RF path.

Band Number	Frequency (MHz)	Comment
Band 1	10	Tested during a previous step
Band 2	50	
Band 3	100	Tested during a previous step
Band 4	160	
Band 5	230	
Band 6	300	
Band 7	400	Tested during a previous step

Perform the following test for each of the bands shown in the above table.

- Using figure 1 as the test configuration, connect a +17 dBm +/1 dB Sine wave at the frequency shown in the above table
- Press the 5125A front panel Stop and then Start buttons.

Wait for approximately 45 seconds to verify that the 5125A has started collecting data.

5125A Phase Noise Test Set

Performance Verification Test Report data

Date _____

Model Type TSC 5125A

Serial Number _____

Test 1 – Ethernet Interface

Power Indicator illuminated GREEN [P/F] _____

Instrument's IP Address _____

Established communication with port 1299 [P/F] _____

Instrument's Software Version _____

Test 2 – Displayed Frequency and Level and Internal Attenuators

Test 2A

Attenuator setting	**Input Frequency MHz**	**Input Level dBm**	**Reference Frequency MHz**	**Reference Level dBm**	**Pass/Fail**
0 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	10.0 MHz +/- 0.1	14 +/- 1 dB	
1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	10.0 MHz +/- 0.1	13 +/- 1 dB	
2 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	10.0 MHz +/- 0.1	12 +/- 1 dB	
4 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	10.0 MHz +/- 0.1	10 +/- 1 dB	
6 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	10.0 MHz +/- 0.1	8 +/- 1 dB	
8 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	10.0 MHz +/- 0.1	6 +/- 1 dB	
10 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	10.0 MHz +/- 0.1	4 +/- 1 dB	
14 dB	10.0 MHz +/- 0.1	0 +/- 1 dB	10.0 MHz +/- 0.1	0 +/- 1 dB	

Test 2B

Verify that Input and Reference Frequency are 1.0 +/ 0.1 MHz	[P/F]
Verify that Input and Reference Frequency are 30.0 +/ 0.1 MHz	[P/F]

Test 3 – Spur Detection

Parameter	**Frequency MHz**	**Requirement**	**Pass/Fail**
Spur Level		-46 dBc +/- 0.5 dB	
Spur Frequency (Hz)		12000 Hz +/- 100 Hz	
Spectrum Printout Attached		Shows 12 kHz spur	

Test 4 – Verifying PNTS Phase Noise Spectrum Noise Floor Performance

	5125A Noise Floor Performance (dBc/Hz)					
	Test 4A		Test 4B		Test 4C	
Offset Frequency, Hz	10 MHz Measured Performance (dBc/Hz)	10 MHz Requirement (dBc/Hz)	100 MHz Measured Performance (dBc/Hz)	100 MHz Requirement (dBc/Hz)	400 MHz Measured Performance (dBc/Hz)	400 MHz Requirement (dBc/Hz)
1		-140		-120		-110
10		-150		-130		-120
100		-157		-140		-130
1000		-162		-150		-140
10000		-165		-160		-150
100000		-165		-165		-155
Mark [P/F]if column passes						

Spectrum Printout at 10 MHz [Attached] _____

Spectrum Printout at 100 MHz [Attached] _____

Spectrum Printout at 400 MHz [Attached] _____

Test 7 - RF Filter and Switch Test

5125A was able to collect data at each of the specified frequencies [P/F]_____

Appendix - A

Procedure for use with Revision 241 software

Test 3 for use with Software Revision 241
Verification of Internal Reference Oscillator Tuning Range

Warning – Proper ESD Precautions must be followed during this test
This test verifies that the Instrument's Internal Reference Oscillator frequency and tuning range is acceptable.

- Use the test configuration shown in Figure 1 during this test.
- Power the Instrument OFF.
- Remove the Instrument's cover ,and configure the Instrument as shown in Figure 2 using the following instructions:

Note: Refer to the TSC 5120A Flash Replacement Procedure for additional information regarding removing the Instrument's cover.

  - Disconnect the end of the coaxial cable that is connected to the Internal Reference Oscillator Module.
  - Connect the SMA "Tee" to the Internal Reference Oscillator Module.
  - Connect the Cable disconnected above to one of the SMA "Tee" ports.
  - Connect a coax cable between the other SMA "Tee" port and the frequency counter.

- Connect a NIST traceable reference to the frequency counter.
- Power frequency counter ON.
- Set frequency counter to the following settings
  - dc coupled, 50 Ohms, set trigger point to 0.5 VDC.
- Power the Instrument ON.
- Set the frequency source to 10.0000 MHz +/- 1 Hz.
- Set the step attenuator to 4 dB.
- Verify that the Instrument's front panel shows that the Input and Reference Frequency are 10.0 +/- 0.1MHz and Input and Reference Levels are 13 dBm +/- 1 dB
- Set the Instrument to Enhanced Spur Detection mode by pressing the following buttons.
  {press Config Phase Noise}
  {press Spurs]
  {press Enhanced Spur Detection}

The following commands allow the Instrument's internal oscillator's tuning range to be determined. Pressing START causes the instrument to tune its internal oscillator to three frequencies. The Instrument will dwell at each frequency for about 8 seconds.

- Press START.
- Record the low frequency in the Test Report.
- Ignore the second frequency that is displayed.
- Record the high frequency in the Test Report.

- Power the Instrument OFF.

- Remove the "Tee", reconnect the cable and torque the SMA connection.
- Replace the Instrument's cover.