

# Setting Up Ultra-Fast Noise Parameters Using the Agilent PNA-X

## Introduction

*This application note provides step-by-step instructions for setting up a test bench for ultra-fast noise parameters measurement using a Maury MT98x Series automated tuner, Maury ATS software version 5.1 with the MT993B01 Ultra-Fast Noise Parameter Option, and the Agilent PNA-X network analyzer.*

*The Ultra-Fast Noise Parameter Measurement Option is over 2 orders of magnitude faster and produces smoother and more accurate results than other methods. With 73 frequencies, the total time for the in-situ system cal, noise receiver cal, and DUT measurement takes about 8 minutes, not including connection or s-parameter calibration time. Typically, the noise receiver cal takes about 2 minutes and the DUT measurement takes under 2 minutes.*

## Step 1. Software Installation

- 1.1 Required Software Versions:
  - 1.1.1 PNA-X firmware revision A.08.50.01 or later
  - 1.1.2 ATS Software version 5.1.00 Build 5 or later, with the MT993B01 option.
- 1.2 Install the Maury ATS software into the PNA-X and install the hardware key into a USB port at the back of the PNA-X.
- 1.3 Boot up the PNA-X, and press the Windows Flag key to get the start menu for starting the Maury Software. Alternately, select File->Minimize Application to minimize the PNA app so the desktop can be seen.
  - Note: Press the Alt-Tab keys together to switch back and forth between the NVNA app and the ATS software.
- 1.4 Use "VnaPnaxCom.exe", "NfmPnaxCom.exe", and "SwPnaxCom.exe" drivers for the network analyzer, noise figure analyzer and RF switches.
- 1.5 Setting up NI-488.2 compatibility:
  - 1.5.1 Required to run ATS GPIB drivers.
  - 1.5.2 Run the Agilent connection expert from the computer start menu->Agilent IO Libraries Suite. Select "Tools->Agilent 488...":
    - a) Check Enable Agilent GPIB cards for 488 programs.
  - 1.5.3 Right-click on "GPIB0" to get the popup menu:
    - a) From the popup menu, select "Change Properties".
    - b) Click the "Agilent 488 Properties..." button, and note the GPIB board number. This is the address of the GPIB board to use in the ATS software (NVNA default is 10).

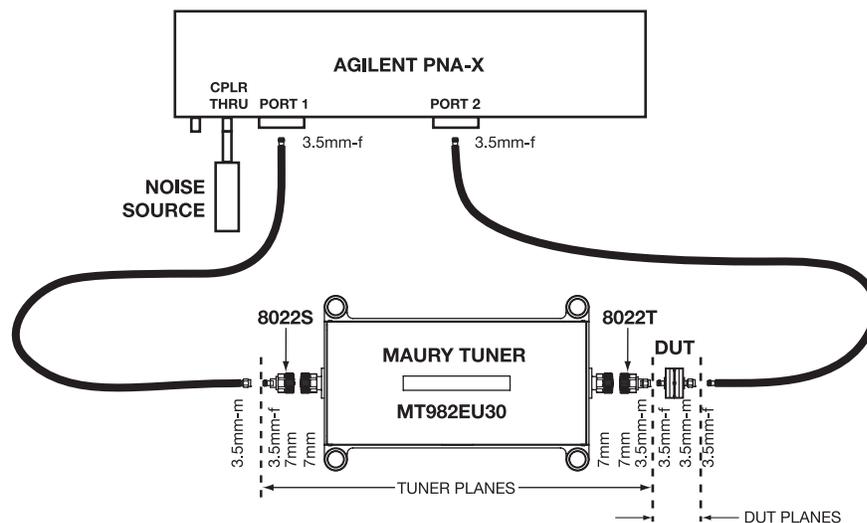


Figure 1. PNA-X connections for Noise Parameter Demo. The DUT is 3.5mm-f to 3.5mm-m; noise source connects to the CPLR THRU port; source tuner input connects to PNA-X Port 1; DUT output connects to PNA-X Port 2.



- 1.5.4 In the ATS software, select "Setup Instruments" from the main block diagram menu, and click the "GPIB Board" button. Enable the GPIB and set the address of the GPIB board.

## Step 2. Setting Up The System

- 2.1 Remove the middle coax link on the left of the PNA-X front panel and connect the noise source to the CPLR THRU connector.
  - 2.2 If available, use a short extension to move the noise source plane away from the PNA-X front panel. This is not required, but makes connection of the noise source easier.
  - 2.3 Set up the system as shown in Figure 1. The DUT will be 3.5mm-female to 3.5mm-male. Set up the tuner with the Power/USB ports facing away (toward the PNA-X). Use adapters as required to connect the tuner and create the correct connections for the DUT planes.
  - 2.4 Set the PNA-X IF BW to 1 KHz or lower. 1 KHz is the value used for the timing tests.
  - 2.5 The thru is zero length, connecting the 3.5mm m-f connectors together.
- ☛ Note: The first time that a USB tuner is plugged into a particular USB port, it will want to install the driver. DO NOT let it do so automatically. You must browse for it.
- 2.6 Start the ATS software, and select "PnaxNoise.cfg" as a starting point. Click on the tuner icon and set up the tuner. If a USB tuner is already connected, click "Scan" and then click on the tuner to automatically get the model number and serial number.

## Step 3. System Calibration

- 3.1 Select "Calibrate->In-Situ System Cal" to start the SNP wizard. Set the frequencies to go from 0.8 to 8 GHz, step 0.1 GHz, producing 73 frequencies. Click "Write New VNA Frequencies" if they are not already set.
- 3.2 You will be prompted to do a 2-port cal at the DUT planes (DUT is 3.5mm female to 3.5mm

male). Alt-Tab to the PNA-X software and do the cal. When the cal is finished, select "File->SaveAs" and enter the filename "Cset01", "Cset02", etc. Alt-Tab back to the Maury software, and use the number in the filename as the calset number in the Maury dialog.

- 3.3 You will be prompted to do a 1-port S22 cal at the noise source plane (DUT is 3.5mm male of the noise source). Alt-Tab to the PNA-X software, and do the cal. When the cal is finished, select "File->SaveAs" and enter the file name "Cset01", "Cset02", etc. Alt-Tab back to the Maury software and use the number in the filename as the calset number in the Maury dialog.
- 3.4 In the Tuner Setup dialog, select the "Fixed Posn" method.
- 3.5 In the Fixed Position Range Setup dialog, select "Auto" for both the carriage and probe list. Enter 7 carriage points and 3 probe points. Harmonics to include is "None". This will completely calibrate the tuner and the system, and create the necessary files.
- 3.6 When the system cal is complete, save the config file, so the new filenames will be remembered.

## Step 4. Noise Receiver Cal

- 4.1 Leave the thru in place and select "Calibrate->New Cal Fixed Posn".

## Step 5. DUT Noise Parameter Measurements

- 5.1 Connect the DUT to the DUT planes, and connect the bias.
- 5.2 Select "Measure->Swept Noise Fixed Posn".
- 5.3 For best results, set the Auto disable option to the ATS method, 2 points max, and Fmin weight = 0.5. This will automatically filter outliers out of the data at the end of the measurement, and is the default in PnaxNoise.cfg.