Using N8975A in Manual Mode

Using the noise figure analyzer (NFA models N8972A N8973A N8974A and N8975A) in manual mode is not well documented. The process to make manual measurements is shown below.

Most noise figure measurements do not require manual measurement mode. Some specialized applications which may benefit from manual measurement mode are metrology related (hot/cold noise sources), antenna related (G/T and radio astronomy), and service oriented (troubleshooting). It is best to avoid using manual measurement mode if possible, and users must understand that support for such use is limited due to the specialized mature of these applications.

The following steps show how to perform a calibration in manual measurement mode, including analysis of results. There are other methods available, but this is one example.

1. Preset the NFA
2. Set desired start and stop frequencies. These points will be used for measurements as we will limit the measurements to 2 points. You will see why soon. Start frequency=1GHz, stop frequency=2GHz
Note—below 3GHz is RF band, above 3GHz is uW band. This is important when setting attenuators.
3. Choose a noise source for the measurement frequency and select from the ENR menu if needed.
4. Attach the noise source to the analyzer's Input connector directly.
5. Select SWEEP, MANUAL MEAS, MANUAL STATE ON
6. Note the window display shows the first point, 1GHz, and a dB value. This dB value is raw dB not relative to anything. The calibration process will be used to change this situation to dB kTB
7. Select FORMAT, FORMAT TABLE.
8. Select FREQUENY POINTS, More 1 of 2, POINTS, 2 ENTER. You should now see both points, 1 and 2 GHz.
9. SWEEP, MANUAL MEAS, (be sure calibration is off, and noise source is off)
10. ACCEPT, NOISE SOURCE ON, ACCEPT. At this point, the 1GHz NoiseFig dB value represents the raw dB (uncorrected system noise figure at 1GHz)
11. MORE 1 OF 2, POINT 2 ENTER, MORE 2 OF 2
12. ACCEPT, NOISE SOURCE OFF, ACCEPT. At this point, the 2GHz Noise Figure dB value represents the raw dB (uncorrected system noise figure at 2GHz)
13. CALIBRATION ON. Note the NoiseFig dB values show "- - "
14. Note also the window shows 2.000GHz Power in raw dB. This is dB referenced to nothing in particular at this stage of the game. Also note UNCORR shows in lower right of screen.
15. Leave the noise source connected to the analyzer input for now.
16. ACCEPT, NOISE SOURCE ON, ACCEPT. Note the 2Ghz NoiseFig dB represents the analyzer's CORRECTED noise figure value at 2GHz.
17. MORE 1 OF 2, POINT, 1 ENTER, MORE 2 OF 2
18. ACCEPT, NOISE SOURCE OFF, ACCEPT. Note the 1Ghz NoiseFig dB represents the analyzer's CORRECTED noise figure at 1GHz
19. Turn CALIBRATION OFF. Note the NoiseFig dB and GAIN dB values are near zero. Note also, CORR appears in lower right. By turning CALIBRATION OFF, you exit and complete the calibration process, you are not turning calibration off, or correction off by this step.
20. RESULT, PHOT shows dB reading (ENR of noise source) with noise source ON
21. RESULT, PCOLD shows dB reading (kTB) of noise source) with noise source off

22. PHOT should show the noise source excess noise. You can substitute any source of noise (unknown or known) to measure its excess noise in dB (relative to kTB). So long as the noise source you used during the calibration process was at the same temperature as the unknown noise source, the excess noise measured is now measured against a calibrated reference.

23. There is a lot more going on here. We have not changed the attenuators during this process, and left them in AUTO mode. It is possible to calibrate over the default range or any attenuator range by FIRST setting this range as follows… before you calibrate!

CORR, INPUT CAL, and set the minimum and maximum attenuator values for the calibration. This is done separately for the RF frequency range (below 3GHz) and uW frequency range (above 3GHz).

Experimentation is the key to deeper understanding of this application. It is entirely undocumented and due to the specialized nature of such measurements will require considerable engineering effort to understand the inner workings of the NFA. We recommend applications assistance from our RF and Microwave applications engineers if you need assistance with this engineering effort.

Measurement uncertainty is always a factor. Our noise figure uncertainty calculator can provide insight into uncertainty and how to improve it… http://www.agilent.com/find/nfc Keep in mind one of the major sources of uncertainty is system noise figure. You can improve this considerably by adding a system low noise amplifier whose noise figure is below 1dB and whose gain is around 20dB. The typical system noise figure with such a system LNA is 6dB to 12dB. Improvements are most noticeable for low-gain device under test (such as when you leave the noise source connected after calibration and expect to see 0dB gain and NF, but it varies a bit). Be sure to calibrate and measure through the system LNA if you use it.

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