NACT TUTORIAL 3
FREQUENCY RESPONSE CALIBRATION

Applies to: <u>NAT and NACT MODES</u>

Prerequisites: <u>Tutorials 0, 1, and 2</u>

This tutorial takes you through the process of generating and capturing calibration data to account for variations in of the DDS output level at different frequencies. The calibration data can be saved in EEPROM and reloaded every time the NAT is powered up. This calibration sequence also normalizes the power readings such that they reflect the absolute power readings one would observe if the DDS were outputting a constant RF power level of one milliwatt. Some basic Signal Generator mode operations are also described.
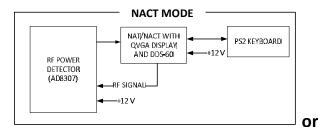
The requirements for this tutorial are:

- NAT running firmware Version 3.0 or later.

- Logarithmic RF Power Meter such as the RF Power meter designed by W7ZOI and W7PUA used by the PHSNA.
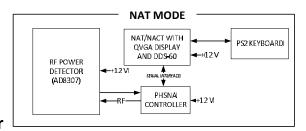
- PS2 Keyboard

To operate in NAT mode you will also need the following:

- PHSNA Arduino UNO/NANO based controller.

You will also need all interconnecting cables and power sources.

For this tutorial, the RF signal is connected direct to the RF Power Meter input, there is no DUT requirement. For NACT mode it is assumed you have completed the steps in tutorials 1 (RF POWER METER SETUP and 2 (RF POWER METER SLOPE AND INTERCEPT). For NAT mode it is assumed that the equivalent PHSNA procedures have been completed.

1. Connect the DDS-60 output direct to the RF Power Meter input, no DUT.

2. Power on all components.

3. Create a PLX data form as follows:

   a. Press Scroll Lock to enter Command mode.

   b. Press F1 to display the data entry form

   c. Set up the F1 PLX form to cover a frequency range of 1 MHz to 31 MHz with 50 KHz
      frequency increments and op modes specified for NAC (Network Analyzer Controller, if
      appropriate) and Signal generator modes.
      Enter the following on the form:

      page one:

      TITLE – SETUP
      FILE NAME – leave blank
      FREQ LO – 1000
      FREQ HI – 31000
      FREQ ST – 50000
      leave the rest of page one blank and press Page Down to display page two

      page two:

      AUTO DELAY(ms) – 0
      XTAL PREFIX – leave blank
      OP MODES – S
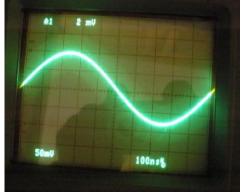   also specify NAC op mode ('C') if appropriate.

4. Press Enter to save the form to EEPROM.

5. Press F1 to activate the form.
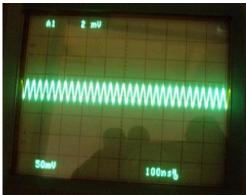   You should now see the sig gen screen and the DDS output should be 1 MHz.

6. Press Space and you should see the current dBm reading displayed, no change in frequency.

7. Pressing End on the keyboard will change the frequency to 31 MHz (note the change in signal amplitude).

8. The up and down arrows will increment and decrement the frequency by the FREQ ST amount (initially 50000 Hz). The left and right arrows will change FREQ ST by a factor of ten up and down and move the yellow markers on the frequency display to indicate the location of the most-significant digit of FREQ ST.

9. Press Escape to exit sig gen mode, Scroll Lock to enter Command mode, and F1 to bring up the SETUP PLX form. Press Page Down to go to page two. Delete the Signal generator op mode. Press Enter to save the change.

10. Press F1 to activate the form. If NAC op mode is specified, you should see the same thing as in step 4 above. Otherwise you will see the PLX directives in the display text area.

11. In NAC op mode you will need to press space to start a scan; otherwise, the scan will start automatically. The frequency will sweep from FREQ LO to FREQ HI recording the dBm for each step and then plot the result. (The scan is so fast I cannot get a picture of the display during the scan). The plot shows the frequency response of the DDS. This is the calibration curve for your test setup.

12. Press Escape twice to go to Terminal mode and press Ctrl-C to capture the calibration data in the calibration data buffer and save it to EEPROM. The calibrated calibration curve will then be plotted with the calibration applied (A straight line at 0.00 dBm).

13. Press Escape twice to go to Terminal mode and press Alt-C to clear the calibration data in the calibration data buffer and the EEPROM. You should see the same plot as in step 10.

14. Press Escape twice to go to Terminal mode and press Ctrl-C to capture the calibration data in the calibration data buffer and save it to EEPROM. You should see the same plot as in step 11.

15. Press Escape twice to go to Terminal mode and end the tutorial.

Your NAT is now calibrated for general use such as testing and evaluating filters and attenuators. For use with specialized test fixtures such as crystal test fixtures and Return Loss Bridges, the NAT will need to be recalibrated to account for test fixture insertion loss and any non-linearity inherent in the test fixture.