Transmitter Peak Power Out Measurement and Power Monitor Calibration

5.5.6 Transmitter Peak Power Out Measurement and Power Monitor Calibration

5.5.6 TRANSMITTER PEAK POWER OUT MEASUREMENT AND POWER MONITOR CALIBRATION TR9.

5.5.6.2 Initial Conditions/Preliminary Setup.

1. Gain control and place the system in standby by performing the procedures in paragraph 3.4.1.2, steps 1 and 2.

5.5.6.3 Procedure.

1. On the Main RDA HCI, click **Adaptation Data Current▸adaptcur.dat**.

2. Click the Transmitter tab and record the values for the following parameters:

TR5_____	TR6_____	TR17_____
TR18_____	TR19_____	TR20_____
TR21_____	TR23_____	TR32_____

NWSTC Note: TR5 & TR6 were updated in step 44 and the rest were added gathered in step 17 of 5.5.10.3

Close Adaptation Data windows.

NWSTC Note: Steps 3 – 9 re-measure and verify that TR 5 is correct

3. Disconnect cable W61/161 from 1AT4 and connect the following:

a. Connect a 30 dB attenuator to 1AT4.

b. Connect the Type-N test cable to the 30 dB attenuator.

c. Connect the other end of the Type-N cable to the 0-11 dB variable attenuator.

d. Connect the output of the variable attenuator to the crystal detector.

e. Connect the other end of the crystal detector to the BNC cable.

f. Connect the BNC cable to the oscilloscope.

g. Terminate the BNC cable using 50 Ω of termination. This may be done by setting the oscilloscope input impedance to 50 Ω in most cases. If this feature is not available on the oscilloscope in use, connect an external 50 Ω terminator using a BNC Tee adapter at oscilloscope input.

4. On the Main RDA HCI, click on **System Test Software** and **Yes** to confirm. Click
Control ► AME/Receiver Control; and select the following:
Test Source: **KLYSTRON OUTPUT**
Pulse Width: **Short Pulse**
PRF: **S1** (record the PRF, e.g., 322)
Click: **Inject Signal**

5. Set the variable attenuator 6 dB. Set oscilloscope to display pulse (see Figure 5-8).

6. Adjust the oscilloscope V/div and vertical position controls to display the peak of the pulse at the center graticule line.

NOTE

Once the pulse has been set to display the peak on the center graticule line, DO NOT adjust the vertical position control or V/Div. In the next step, it is expected to have the top of the pulse leave the oscilloscope's viewing area. The pulse measurement will be at the center graticule line.

7. Remove 6 dB from the variable attenuator and measure the pulse width at the center graticule line using the vertical time cursors. The 6 dB down pulse width (6 dB PW) must be 1.57 ± 0.05 µS; if so, proceed to the next step. If the 6 dB PW is **NOT** within this range, check the RF Drive (paragraph 5.5.8) and RF Bracketing (paragraph 5.5.9), and re-accomplish this procedure from the beginning.

8. Check for the proper pulse shape (see Figure 5-11) and verify no fold over exists (see Figure 5-9). If fold over is present, proceed to the Klystron Transmitter Tuning paragraph 5.5.10.

9. Insert 3 dB back into the variable attenuator and measure the pulse width at the center graticule line using the vertical time cursors. The 3 dB down pulse width (3 dB PW) must equal the value of TR5 (recorded in step 2) for the Transmitter Peak Power to be calculated properly. If the 3 dB PW equals the TR5 value, proceed to the next step. If the 3 dB PW does **NOT** equal the TR5 value, it is likely the transmitted pulse parameters have changed. Proceed to paragraph 5.5.10 for necessary alignments.

10. Set the variable attenuator back to 6 dB.

NWSTC Note: Steps 11 – 14 re-measure and verify that TR 6 is correct

11. In the AME/Receiver Control window, select the following:

Pulse Width: **Long Pulse**
Click: **Inject Signal**

12. Set the oscilloscope horizontal control (time/div) to observe the entire pulse on the display and use the vertical position control to set the peak of the pulse on the center graticule line. Once set, do not adjust the vertical position.

13. Remove 6 dB from the variable attenuator and measure the pulse width at the center graticule line using the vertical time cursors. The 6 dB down pulse width (6 dB PW) must be 4.71 ± 0.10 µS; if so, proceed to the next step. If the 6 dB PW is **NOT** within this range, check the RF Drive (paragraph 5.5.8) and RF Bracketing (paragraph 5.5.9), and re-accomplish this procedure from the beginning.

14. Insert 3 dB back into the variable attenuator and measure the pulse width at the center graticule line using the vertical time cursors. The 3 dB down pulse width (3 dB PW) must equal the value of TR6 (recorded in step 2) for the Long Pulse Peak Power to be calculated properly. _____

If the 3 dB PW equals the TR6 value, proceed to the next step. If the 3 dB PW does NOT equal the TR6 value, it is likely the transmitted pulse parameters have changed. Proceed to paragraph 5.5.10

15. In the AME/Receiver Control window, select the following:

Test Source: **NONE**

Click: **Inject Signal**

16. Disconnect the 30 dB attenuator and test cable from 1AT4.

17. Connect the power meter to Attenuator 1AT4 using the HP8481H power sensor.

18. Calculate the target value for 700 kW of peak power by performing the following:

a. Sum the values of TR17, TR18, TR19, TR20, TR21, TR23, and TR32. This is the path loss from the klystron through 1AT4.

PL_KLY_1AT4 = _____ **dBm** (typically -38.30)

b. Using Table 5-4, locate the appropriate duty cycle (DCdB) for the Short Pulse 3 dB PW measured in step 9.

DCdB = _____ (ex. PRF S1 = 322 Hz, 3 dB PW = 1.53 µS, **DCdB = - 33.07**)

c. Sum the values of the two previous steps. _____ (ex. -38.30 + -33.07 = -71.37)

d. Calculate the difference between 88.45 and the result of step 18c _____. This result is the expected power reading for 700 kW of peak power at the klystron (ex. 88.45 - 71.37 = 17.08).

19. In the AME/Receiver Control window, select the following:

Test Source: **KLYSTRON OUTPUT**
Pulse Width: **Short Pulse**
PRF: **S1**
Click: **Inject Signal**

NWSTC Note:
Steps 19 – 24 calculates the current power at the tube in short pulse

20. Let the power meter stabilize and record the power meter reading: _____ dBm.

21. The difference between the recorded power in step 20 and the expected result of 18d is the amount of power (in dBm) over or under 700 kW. Calculate and record the difference _____dBm.

(Under power example: step 18d = 17.08, step 20 = 16.92, the difference = -.16 dBm)

(Over power example: step 18d = 17.08, step 20 = 17.35, the difference = +.27 dBm)

22. Apply the difference recorded in step 21 to 88.45, then divide the result by 10 and record _____. (ex. 88.45 -.16 = 88.29, 88.29 ÷ 10 = 8.829) or (ex. 88.45 + .27 = 88.72, 88.72 ÷ 10 = 8.872)

23. Using the calculator's antilog (10X) function to the result in step 22 will display the measured transmitter peak power in milliwatts. To display in watts, divide by 1000. Divide by 1000 again to display in kW.

Record as XMT_PK_PWR_Short _____kW.
(ex. the antilog (10X) of 8.872 = 744,731,974 in mW, then ÷ 1000 = 744,732 W, again ÷ 1000 = 745 kW)

24. If the result for XMT_PK_PWR_Short in the previous step is outside the specification of 700 kW ± 50 kW, refer to paragraph 5.5.10 for necessary alignments.

25. In the AME/Receiver Control window, select the following:

Test Source: **KLYSTRON OUTPUT**
Pulse Width: **Long Pulse**
Click: **Inject Signal**

26. Let the power meter stabilize and record the power meter reading: _____ dBm.

27. Calculate the target value for 700 kW of peak power by performing the following:

NWSTC Note:
Steps 25 – 31 calculates the current power at the tube in short pulse

27. Calculate the target value for 700 kW of peak power by performing the following:

a. Path loss of the klystron through 1AT4 from step 18a.

PL_KLY_1AT4 = _____ dBm

b. Using Table 5-5, locate the appropriate duty cycle (DCdB) for the Long Pulse 3 dB PW measured in step 14.

DCdB = _____

c. Sum the values of the two previous steps.

d. Calculate the difference between 88.45 and the result of step 27c. This result is the expected power meter reading for 700 kW of peak power at the klystron.

28. The difference between the recorded power in step 26 and the expected result of step 27d is the amount of power (in dBm) over or under 700 kW.

Calculate and record the difference _____ dBm.

29. Apply the difference recorded in step 28 to 88.45, then divide the result by 10 and record _____.

30. Using the calculator's antilog (10X) function to the result in step 29 will display the measured transmitter peak power in milliwatts. To display in watts, divide by 1000. Divide by 1000 again to display in kW.

Record as XMT_PK_PWR_Long_____kW

31. If the result for XMT_PK_PWR_Long in the previous step is outside the specification of 700 kW ± 50 kW, refer to paragraph 5.5.10 for necessary alignments.

32. In the AME/Receiver Control window, select the following:

Test Source: **NONE**
Click: **Inject Signal**

33. Disconnect all test equipment and reconnect cable W61/161 to Attenuator 1AT4.

34. In the AME/Receiver Control window, click the **Close** button.

35. In the System Test Software window, click **Diagnostics ► Transmitter.**

NWSTC Note: Steps 35 – 37 determine what the system reads for transmitter power

36. In the Transmitter Diagnostics window, select the following:

Click: **None**
Subtest: **5 Peak Power Measurement**
Click: **Run**

37. Run the Peak Power Measurement four more times and record to use the average of the five readings for step 38.

Peak Power @ KLY Transmitter LONG PULSE	Peak Power @ KLY Transmitter SHORT PULSE
_____kW	_____kW
_____kW	_____kW
_____kW	_____kW
_____kW	_____kW
_____kW	_____kW
_____avg	_____avg

38. Compare the results of both long and short pulse peak power measurements to the values measured and calculated in step 23 for short pulse and 30 for long pulse. If the values match within 15 kW, this ends the peak power measurement; skip to step 46. If the values are outside the ± 15 kW, continue with step 39.

NOTE

The Power Monitor 4A26 is calibrated by adjusting the power monitor scale factor (TR9 in adaptation data) using STS. It is recommended to complete paragraph 5.5.15 before proceeding to the next steps if problems are suspected with the calibration of the transmitter power monitor measurement path from the klystron through Attenuator 1AT4 (paragraph 5.5.15.2) or from 1AT4 output to Power Monitor 4A26 (paragraph 5.5.15.3). However, if no problems are suspected with the power measurement path, the following steps can be performed as necessary to calibrate the power monitor readings.

39. Close the Peak Power Measurements and Transmitter Diagnostics windows.

40. Click **Calibration▶Transmitter Power**. Ensure the Short Pulse radio button is selected and click **Calibrate Scale**.

41. When prompted to enter the power level measured at 1AT4, input the value from step 20 and click **OK**.

42. The Power Meter Scale Calibration window displays the Peak Power, Power Measured, Old Meter Scale, and New Meter Scale. The Peak Power should now equal the value from step 23 ± 15 kW; if not, complete the remainder of this procedure and re-accomplish steps 35 through 41 again. If the Peak Power is not within ± 15 kW after the second attempt, call the WSR-88D Hotline at 1-800-643-3363.

43. The Power Meter Scale Calibration window displays the New Meter Scale, click **Accept** and **Yes** to the confirmation pop-up window.

44. Another pop-up window will appear stating adaptation data changes have been submitted, click **OK**.

45. Close any remaining STS windows, click **File** and **Exit** to leave the System Test Software program, click **Yes** at the Confirm Exit pop-up and **OK** at the Elapsed Time pop-up window.

46. At the RDA HCI, click **RDA ► Restart RDASC**, and **Yes** at the Confirm Restart RDASC window. Log into the HCI once the restart is complete.

47. Create a backup by performing the Backup Files procedure in NWS EHB 6-513, Section 4.9.

48. Return to remote operations by performing the procedures in paragraph 3.4.1.5, step 4.