

Technical Service Bulletin 030617

Calibration of DCX System Power Meters

Procedure 030617: Calibration of DCX System Power Meters.	
Applicability	All DCX transmitters. (Does not include DCX Paragon).
Prerequisites	Correct IOT beam voltage (030611). Correct IOT tuning (030529). Individual HPA power meters correctly calibrated (030616). Transmitter operating at or near full power.
Equipment Required	Average Power Meter.
Comments	Two different system metering assemblies exist: UMD and TPCU. Procedure for TPCU is adaptation of procedure contained in 46744200-320 and DCX Millennium Exciter Manual. Additional procedure exists (030616) for calibration of DCX HPA power meters.

NOTE: Calorimetric calibration is not covered in this procedure. The user should consult their system manual or proof of performance documentation for more information on calorimetric calibration. This procedure assumes that the calibration of the system precision directional coupler is trustworthy.

1. Perform zeroing and calibration of average power meter per manufacturer's instructions. Average power meter calibration typically consists of following steps:
 - a. Disconnect sensor head from directional coupler.
 - b. Deactivate "offset" function.
 - c. Electronically "zero" meter.
 - d. Connect sensor head to output of power meter internal test source.
 - e. Activate internal test source on power meter.
 - f. Electronically "cal" meter.
 - g. Meter should agree with nominal rating of internal source printed on meter (typically 0dBm or 1mW).
 - h. Enter frequency-dependent "cal factor" printed on sensor head.
 - i. Activate "offset" function.
 - j. Program offset value to exactly match magnitude of dB coupling value printed on system precision directional coupler, but with a positive value (e.g. - 40.05dB coupler = +40.05dB offset on power meter).

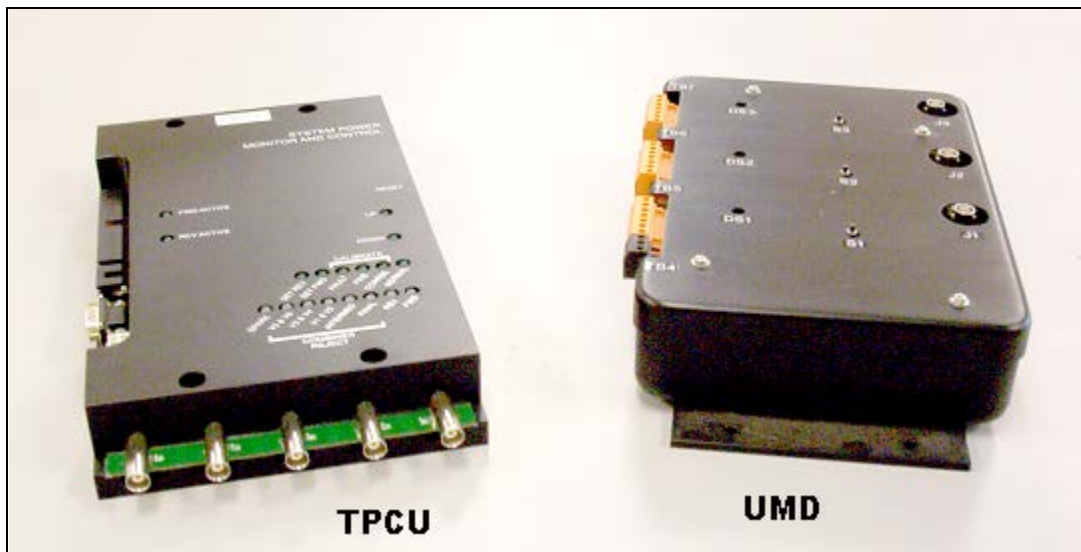
NOTE: Consult average power meter instruction manual for more specific instructions.

2. Connect average power meter to system precision direction coupler. Precision directional coupler will have coupling value listed to one or two decimal places (e.g. - 50.76 dB).
3. Read transmitter average power output directly from power meter.
4. Select RF pattern such that combined output of all HPAs is directed to system test load.
5. Adjust phasing trombones and RF attenuators in exciter cabinet until power in system test load is maximized and power in all reject loads is zero. Add RF attenuators and/or N-barrels to various HPA feed cables in system phasing drawing to center adjustment range of controls, as necessary. Consult system RF flow diagram for more information on specific controls.

NOTE: Once system balance and phasing is correct, average power meter on system test load should automatically display a reading at or close to the desired average power.

6. Make fine adjustments, as necessary, to transmitter power level until desired reading is obtained on average power meter.

NOTE: Comark DCX transmitters employ two different system metering assemblies. The original DCX series is equipped the Universal Meter Driver (UMD), while the DCX Millennium series features the Total Power Control Unit (TPCU). A photograph of the two assemblies is shown below. This bulletin contains two separate calibration procedures for these two meter assemblies.



7. Continue with either UMD or TPCU calibration procedure.

Calibration Procedure for Universal Meter Driver (UMD)

1. Remove cover from universal meter driver in rear section of transmitter system cabinet.
2. Adjust potentiometers R30 (coarse) and R15 (fine) of universal meter driver until reading of 100% is obtained on system forward power meter.
3. Remove forward power sample cable from connector J1 of universal meter driver and connect to reverse power connector J2.
4. Adjust potentiometers R61 (coarse) and R46 (fine) of universal meter driver until reading of 10% is obtained on system reverse power meter.
5. Return sample cables to original positions.
6. To adjust VSWR alarm threshold, press test button S2 of universal meter driver.
7. Adjust test signal level with potentiometer R40 of universal meter driver until reading of 2% is obtained on system reverse power meter.
8. Rotate trip level potentiometer R50 of universal meter driver clockwise until green LED DS2 first lights. Do not rotate potentiometer R50 any further once this threshold is reached.

NOTE: multi-tube systems may have one or more reject loads. The reject load(s) will occupy the third channel on the UMD and possibly additional channels on a second UMD.

9. To calibrate a given reject power meter, select RF pattern such that entire output of a single HPA is directed to reject load in question.
10. Adjust coarse and fine potentiometers of appropriate universal meter driver channel until reading on reject power meter matches single HPAs portion of total system power level. (i.e. 50% for single HPA in two tube system, 33% for single HPA in three tube system. 25% for single HPA in four tube system).
11. Repeat procedure for multiple reject power meters.
12. Replace cover on universal meter driver.
13. Procedure complete.

Calibration Procedure for Total Power Control Unit (TCPU)*Meter Zeroing*

1. Press 'RF OFF' on system controller and observe meter readings on exciter meter panel. If meters do not read absolute zero, disconnect P11 from system power monitor and control assembly (TCPU) and mechanically zero meters. Reconnect P11.
2. If meters still do not read zero, disconnect RF cables connected to J1 through J8 and connect 50-ohm terminations in place of cables. If meters still do not read zero, press MODE SELECT button on TPCU several times until SET REVERSE mode LED is

illuminated. Press and hold CHANNEL SELECT button, then press mode select button. Release both buttons. With a pen or non-metallic tool, press and release recessed reset button on side of TPCU. Meters should now read zero. Reconnect RF cables to J1 through J8.

3. Press 'RF ON' on system controller to return to full power.

Forward Power Calibration

4. Read transmitter forward power level directly from average power meter.
5. If forward power meter is more than 5% off, press MODE SELECT button until CALIBRATE COARSE mode LED is illuminated. Use CHANNEL SELECT button to select forward power channel. Press UP or DOWN pushbutton, accordingly, until forward power meter is as close as possible to 100%.
6. Press MODE SELECT button until CALIBRATE FINE mode LED is illuminated. Use CHANNEL SELECT button to select forward power channel (if not already selected). Press UP or DOWN pushbutton, accordingly, until forward power meter reads 100%.

Forward Power Fault Calibration

7. Press MODE SELECT button until CALIBRATE FAULT mode LED is illuminated. Use CHANNEL SELECT button to select forward power channel (if not already selected). Forward power meter will rise to fault setting. Press UP or DOWN pushbutton, accordingly, until forward power meter indicates desired fault level. (For forward power, fault is a low-level limit).

Reverse Power Calibration

8. Swap RF cables on forward and reflected ports of power metering directional coupler. Note that 10dB attenuator must remain on forward port.
9. If reverse power meter is less than 9.5%, or more than 10.5%, press MODE SELECT button until CALIBRATE COARSE mode LED is illuminated. Use CHANNEL SELECT button to select reverse power channel. Press UP or DOWN pushbutton, accordingly, until reverse power meter is as close as possible to 10.0%.
10. Press MODE SELECT button until CALIBRATE FINE mode LED is illuminated. Use CHANNEL SELECT button to select reverse power channel (if not already selected). Press UP or DOWN pushbutton, accordingly, until reverse power meter reads 10.0%.
11. Swap RF cables on forward and reflected ports of power metering directional coupler back to normal. Note that 10dB attenuator must remain on forward port.

Reverse Power Fault Calibration

12. Press MODE SELECT button until CALIBRATE FAULT mode LED is illuminated. Use CHANNEL SELECT button to select reverse power channel (if not already selected). Reverse power meter will rise to fault setting. Press UP or DOWN pushbutton, accordingly, until reverse power meter indicates desired fault level. (For reverse power, fault is a high-level limit).

Reject Load Power Calibration

NOTE: multi-tube systems may have one or more reject loads.

13. To calibrate given reject load meter, select RF pattern such that entire output of a single HPA is directed to reject load in question.
14. Reject power meter should read value equivalent to single HPAs portion of total system power level. (i.e. 50% for single HPA in two tube system, 33% for single HPA in three tube system. 25% for single HPA in four tube system). If reject power meter differs from desired value by more than 5%, press MODE SELECT button until CALIBRATE COARSE mode LED is illuminated. Use CHANNEL SELECT button to select proper reject power channel. Press UP or DOWN pushbutton, accordingly, until reject power meter in question is as close as possible to desired value.
15. Press MODE SELECT button until CALIBRATE FINE mode LED is illuminated. Use CHANNEL SELECT button to select proper reject power channel (if not already selected). Press UP or DOWN pushbutton, accordingly, until reject power meter in question reads desired value.
16. Repeat procedure for additional reject power meters.

NOTE: The reject load calibration instructions given here contradict those given in document 46744200-320 or the DCX Millennium Exciter Manual. The instructions given in those documents use the convention 100% reject power = 100% single HPA power, while this procedure uses the convention 100% reject power = 100% total system power. This second convention is preferred by the author because it prevents counter-intuitive readings. Compare for a two-tube system:

V1 bypass + V2 to antenna = 100% reject power + 50% system power according to document 46744200-300 instructions.

V1 bypass + V2 to antenna = 50% reject power + 50% system power according to this procedure.

Reject Load Power Fault Calibration

17. Press MODE SELECT button until CALIBRATE FAULT mode LED is illuminated. Use CHANNEL SELECT button to select proper reject power channel (if not already selected). Selected reject power meter will rise to fault setting. Press UP or DOWN pushbutton, accordingly, until that power meter indicates desired fault level. (For reject load power, fault is a high-level limit).

Adjusting VSWR Fold-Back Level (Reverse AGC level, .01 version only)

18. Press MODE SELECT button until SET REVERSE mode LED is illuminated. Reverse power meter will rise to foldback threshold (AGC) setting. Press UP or DOWN pushbutton, accordingly, until that power meter indicates desired AGC level.
19. Press MODE SELECT button until NORMAL mode LED is illuminated.
20. Procedure complete.

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