

Technical Service Bulletin 100129

Calibration of HPA Power Sensors: DCX Paragon (w/LDMOS based drivers installed in HPA)

The calibration of the HPA power meter sensors is perhaps the most important of all the meter calibrations. Errors in power meter calibrations can lead to potentially damaging or possibly illegal operating conditions. The HPA **forward power** meter calibration should be checked if an abnormal level of beam current vs. output power is observed or difficulty obtaining adequate adjacent channel mask performance is experienced. These problems may be the result of operating at an incorrect power level. The HPA **reverse power** meter calibration should be checked if high reverse power readings are observed or output cavity arcing is experienced. The HPA **drive power** meters should be checked if the IOT is exhibiting low gain or does not appear to tune correctly at its input.

Procedure 100129: Calibration of HPA Power Sensors: DCX Paragon	
Applicability	DCX Paragon transmitters (w/LDMOS based drivers installed in HPA).
Prerequisites	Calibrated HPA meter movements (031209). Transmitter operating at or near full power.
Equipment Required	Average power meter connected to precision directional coupler. Type N calibrated Directional Coupler
Comments	Calorimetric calibration is not covered in this procedure. User should consult their system manual or proof of performance documentation for more information on calorimetric calibration. Calorimetry can be used as the reference measurement for output power if desired, however a calibrated coupler and calibrated average power meter is necessary to perform driver meter calibration.

1. Perform zeroing and calibration of average power meter per manufacturer's instructions. Average power meter calibration typically consists of the 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.

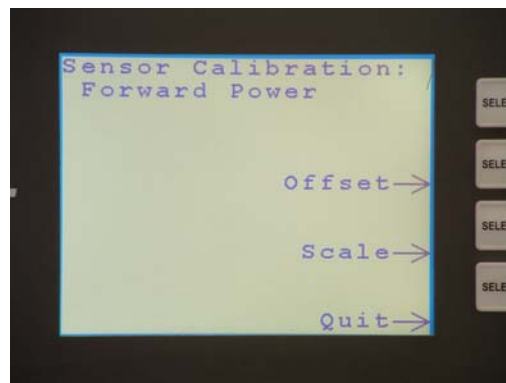
- j. Program offset value to exactly match magnitude of dB coupling value printed on system precision directional coupler, but with a positive value (e.g. -40.05dB coupler = $+40.05\text{dB}$ offset on power meter).

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

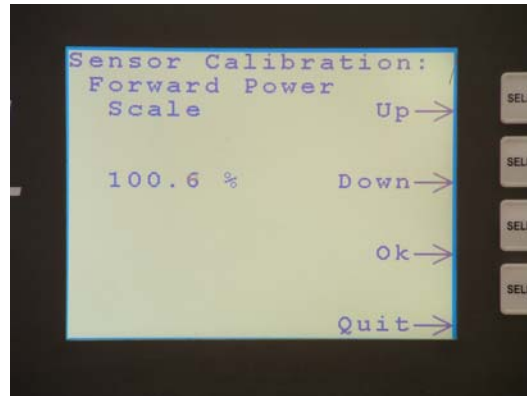
2. Connect average power meter to system precision direction coupler. Precision directional coupler will have coupling value listed to one or two decimal places (e.g. -50.76 dB).
3. Select RF pattern or program RF switches via system control panel such that output of HPA whose meters are to be calibrated is directed to system test load and all other HPAs are extinguished.
4. Select **Output Power** on upper set of meters on front panel display to enable forward and reverse power readings.
5. Place amplifier cabinet in **BEAM** mode to deactivate RF drive.
6. Navigate to forward power sensor calibration screen using following button sequence on LCD control screen: **Information Access > System Operations > HPA Maintenance > Password=4444> HPA Maintenance> Sensor Calibration >Password = 5555> Sensor Calibration> RF Power > Forward > Offset**. Default technician password is 4444.
7. Use **Up** and **Down** menu options to adjust forward power (left) meter reading to exactly zero. Press **Ok** to save setting and return to previous menu.

NOTE: Do not go "past" zero as shown on the analog meter. Continuing to press the down button will not physically drive the reading below zero, but the zero calibration factor will continue to decrease, thereby creating the potential for metering inaccuracy.

8. Repeat procedure for reverse power (right) meter.
9. Return amplifier cabinet to **RF** mode and adjust RF output power to desired 100% level as read on average power meter.
10. Navigate to forward power sensor calibration screen using following button sequence on LCD control screen: **Information Access > System Operations > HPA Maintenance > Password=4444> HPA Maintenance> Sensor Calibration >Password = 5555> Sensor Calibration> RF Power > Forward >**



11. Press **Scale** menu option. Screen should now resemble photo below. Also the forward power meter has now been automatically adjusted to read 100%.

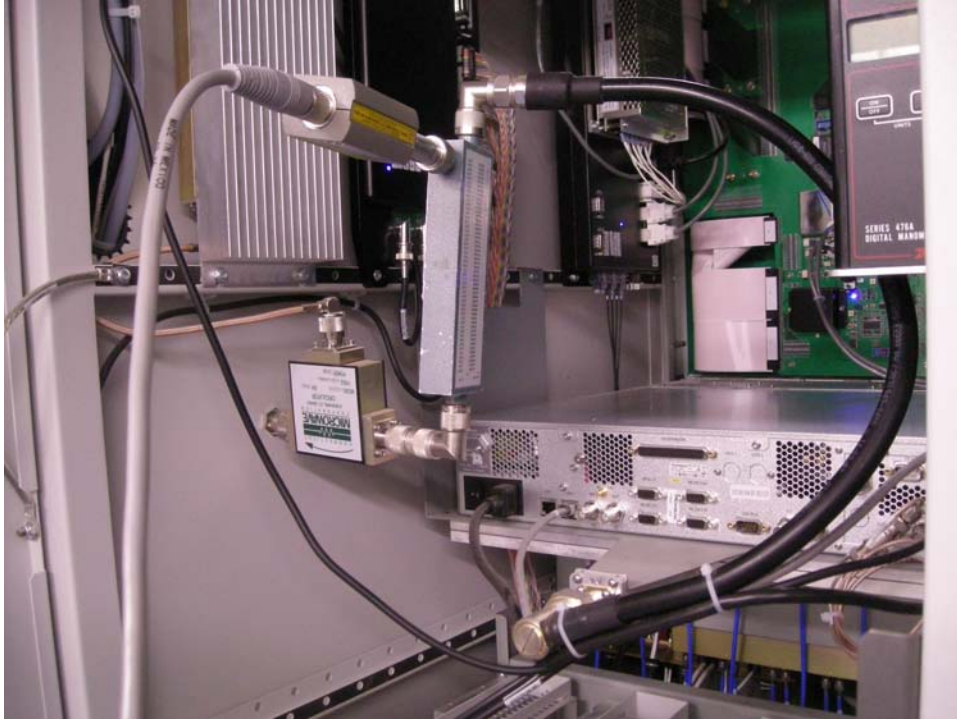


12. Press **OK**. This will automatically set the reverse power meter to 10x the sensitivity of the forward meter thereby automatically calibrating it. There is no need to use the reverse meter calibration menus.
13. To store this calibration value, press **Ok**. To restart procedure, press **Quit**.

NOTE: Forward / Reverse power sensor calibration **MUST** be performed at 100% HPA output power. Otherwise, the calibration routine will automatically re-calibrate the forward power meter to read 100% at the new power level.

Driver meter calibration:

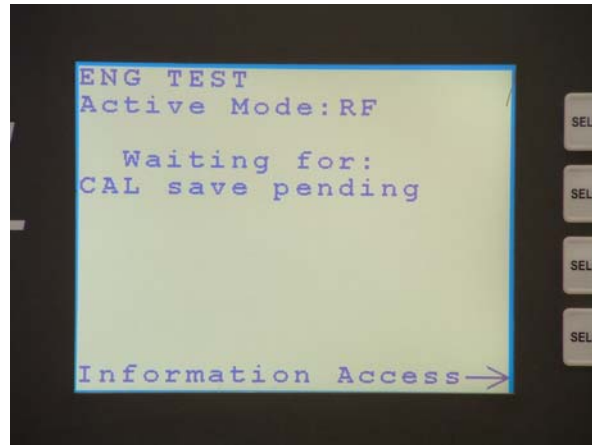
14. Proceed to calibrate RF drive power meter by selecting **Drive Watts** on upper set of meters on front panel display to enable forward and reverse drive power readings.
15. Place amplifier cabinet into **BEAM** mode on HPA control panel to extinguish RF drive.
16. Install a calibrated type N directional coupler in between the output of the driver system and the circulator as shown in the picture below. Connect average power meter to forward coupler terminal on the calibrated type N coupler in-line with RF drive transmission line as shown in the picture below.



17. Use **OFFSET** or similar function on power meter to enter the offset or factor listed printed on coupler on power meter to compensate for directional coupler.
18. While RF drive is still extinguished, navigate to forward drive power sensor calibration screen using following button sequence: **Information Access > System Operations > HPA Maintenance > Sensor Calibration > RF Power > Drive > Forward > Offset.**
19. Use **Up** and **Down** menu options to adjust forward drive meter reading to (exactly) zero. Press **Ok** to save setting and return to previous menu.
20. Activate RF drive by depressing **RF** button on HPA control panel.
21. Press **Scale** button. Forward drive power meter movement on front panel should move to drive value in watts.
22. Use **Up** and **Down** menu options to adjust forward drive meter reading to match reading on power meter. Press **Ok** to save setting and return to previous menu.
23. Place amplifier cabinet into **BEAM** mode on HPA control panel to extinguish RF drive.
24. Remove the calibrated type N coupler and return the drive connection directly to the circulator input.
25. Install a calibrated type N coupler between the reject port of the circulator and the circulator load as shown in the picture below. Connect the power meter to coupler terminal on the calibrated type N coupler in-line with RF transmission line between circulator reject port and IOT input reject load.



26. While RF drive is still extinguished, navigate to reverse drive power sensor calibration screen using following button sequence: **Information Access > System Operations > HPA Maintenance > Sensor Calibration > RF Power > Drive > Reverse > Offset.**
27. Use **Up** and **Down** menu options to adjust reverse drive meter reading to (exactly) zero. Press **Ok** to save setting and return to previous menu.
28. Activate RF drive by depressing **RF** button on HPA control panel.
29. Press **Scale** button. Reverse drive power meter movement on front panel should move to reverse drive value in watts.
30. Use **Up** and **Down** menu options to adjust reverse drive meter reading to match reading on power meter. Press **Ok** to save setting and return to previous menu
31. Once this is all complete you will need to back all the way out of the menu screens to the very first "main" menu. This will now display "CAL save pending" as shown in the photo below.



Changing the HPA mode of operation from RF / BEAM to standby will allow a final save and will remove this message. Once this is done the HPA can be returned to its original operating state.

32. Procedure complete.

At Comark, we are constantly striving to improve the satisfaction of both our new and existing customers. Please do not hesitate to contact Comark Customer Service with any questions you may have concerning the contents of this service bulletin.

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