ALIGNMENT PROCEURE

FOR THE

KXP2290 DIVERSITY MODE S TRANSPONDER

066-01198-0101

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REVISION HISTORY

Revision	PRN/CO	Description	Date
-	768843	Initial Release	See Cover Page

Reference Documents:

The following documents apply to the KXP2290 Diversity Mode S Transponder.

1. Minimum Performance Specification (MPS), KXP2290 004-02279-4000.

2. Product Structure Diagram, KXP2290 000-02000-0000.

3. KXP2290 Software Design Document, 721-00894-XXXX.

4. RTCA DO-181C Minimum Operational Performance Standards for the Air Traffic Control Radar Beacon System/Mode Select Airborne Equipment.

5. System Requirements Document, KXP2290 701-00731-XXXX.

Measurement Reference and Required Equipment List:

Measurement Reference:
Throughout this document, unless otherwise noted, receiver and transmitter power levels are measured at the antenna end of a nominal 2dB loss coaxial cable.

1. KXP2290 Manual Test Panel: KPN 071-00224-0020

2. IFR ATC-1400A, (S-1403DL with **MLD**) or-1403DL without **MLD**) DME/Transponder test set.

3. Oscilloscope: Tektronix TDS 320, 350, 380, 3054B, 520, 540C or equivalent.

4. Digital multi meter, 3 ½ digits: Fluke 8010A or equivalent.

5. Power Supply, 0 to 30 Volts, 5 Amps or equivalent.

6. PC pentium_90, or better (Windows 95/98/ME/2000/ XP is not acceptable).

7. KXP2290 Diagnostic Utility CD-ROM: KPN 222-30128-XXXX.

8. Coaxial Directional Coupler with a 30dB port.

9. 10dB Pad attenuator.

10. 20dB Pad attenuator.

11. 50 Ohm Load, BNC.

12. Spectrum Analyzer: HP 8951E or Equivalent

Test Set Up
For
KXP2290 Transmitter Alignment

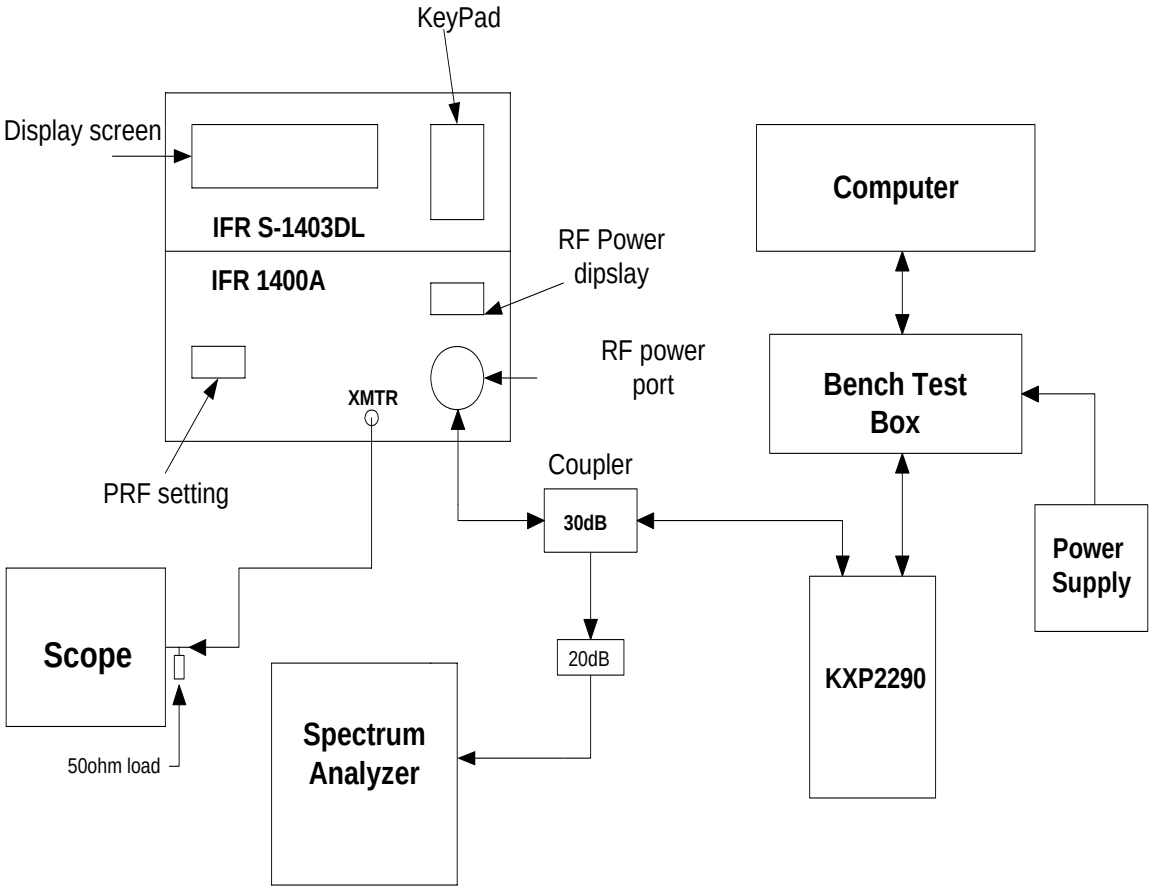

Figure 1

Notes:

1. The IFR TX detector (XMTR Output) is connected to a channel of the scope with a 50 ohm load.
2. The RF power to spectrum analyzer should have a 20dB pad to spectrum analyzer input port.

Preliminary UUT Set UP:

The Following Steps Must Be Preformed Before Power Is Applied To UUT.

Transmitter Final Board: (200-10256-0030)

b. Adjust R1 fully counter clockwise (CCW)
c. Adjust C44, C45 and C27 to mid range.

Transmitter Driver Board: (200-10252-0030)

a. Adjust R3 fully counter clockwise (CCW)

Test Equipment Set Up: See Figure 1

Computer Set Up:

1. Install Diagnostic Software
   (KPN 222-30128-XXXX)
   Drag Kxp_Diag.exe file onto desktop. Double-click icon to activate program.

Test Panel Set Up:

1. Connect a RS232 cable from COMM Port of the computer to the RS232 DIAG input on the Test Panel (KPN 071-00224-0020).

2. Connect Bench Test Cable (KPN 200-10336-0050 or 200-10336-0120) from the Test Panel to the KXP2290 (UUT).

3. Set Test Panel switches in the following positions:
   a. Air/Gnd = “OFF”
   b. Standby = “OUT”
   c. UUT Strap = “XPDR #1”
   d. Aircraft Power = “OFF”

4. Connect a +28 volt power supply to Test Panel, be sure the polarity is correct.

Test Equipment Set Up:

IFR ATC-1400A, S-1403DL Set UP:

1. S-1403DL set up:
    a. Set IFR to OCTAL Mode:
        1. Set menu to “C76”.
        2. Move cursor to “:HEX”
        3. Press “ON/CAL” key & toggle to OCTAL.

    b. Set up for ATCRBS:
        1. Set menu to “C10 f01”:ATC (ATCRBS)

    c. Set up for Long Mode S:
        1. Set menu to “C10 f02”:SEQ (Mode S).
        2. Press the S menu key on the keypad.
        3. Select: S000: D; UF05, PC=0, RR=20, DI=0, SD=100000, ADDR=52525252 on the screen.

2. S-1400A set up:
    a. Set the PRF to 100
    b. Set XPDR Mode switch to “A”
    c. Set SLS/ECHO to “-9dBm”
    d. Set SLS/ECHO switch to “OFF”
    e. Set the RF signal level to -50dBm

Scope:

1. Select channel 2 for observing the IFR detected Video Output (XMTR).
2. Select normal trigger on channel 2. Set the trigger position to 10%.
3. Select the Measurement mode and set for Pulse Width, Rise time, and Fall time measurements.

Spectrum Analyzer:

1. Set the center frequency to 1090MHz.
2. Set the Bandwidth to 3 MHz.
3. Set the Span to 1 GHz (normal operation).
4. Set the Sweep to 10 seconds

NOTE:

Prior to Alignment, perform a visual inspection of all the test equipment.
Verify all connections are made per the Alignment Setup diagrams.
Verify all cables and fixtures are in good repair and free of any defects.

UUT Initial Set Up:

Use the Diagnostic Utility program to initialize the UUT to be Aligned.

1. Double-click on the Icon of the previously installed Diagnostic Utility program.
2. Set +28 volt Power Supply to “ON” position.
3. Set Test Panel Aircraft Power switch to “ON” position.
4. Be sure the correct revision of Boot, Application and Firmware are loaded. The Diagnostic Utility program will display this information.
5. Set MODE S ADDRESS to “52525252” (Octal) or “AAAAAA” (Hex)
6. Set 4096 CODE to “7777”
7. Set MAX AIR SPEED to “75-150”
8. Set OPERATIONAL MODE to “Altitude”
9. Set AIRBORN/GROUND to “Airborne”
10. Set DIVERSITY to “Enable”
11. CYCLE AIRCRAFT POWER
12. Set SQUITTER to “Disable”

TX Driver and TX Final Alignment Procedures:

1. Set the IFR to ATCRBS.

2. Verify that R1 on the TX Final board and R3 on the TX Driver board are set fully CCW. Apply unit power.

3. On the TX Driver board, measure the voltage at L4 (scope or voltmeter). Set this voltage to 4.5V by adjusting R3 CW. Note that the total unit current draw at this time should be no more than 190ma.

4. On the TX Final board, attach scope probe to the junction of L11 and R16. Adjust R1 CW while observing a positive pulse on the scope. Set this pulse height to 3.8 V (maximum is 4 V).

5. Adjust the scope to observe the 1st TX pulse. While observing this 1st pulse, on the TX Final board, start by adjusting C27 first, then C44 and then C26 (in this order) for maximum TX pulse power as observed on the scope and IFR Power Monitor. Also, observe this pulse and adjust the three tuning caps slightly for the best Pulse Top flatness and Rise and Fall time linearity.

6. Check the pulse Width measurement. It should be approximately 430nsec at this time. If not, on the TX Driver board, adjust R4 (first) and then R30 to set the preliminary pulse width to 430ns. The pulse Rise time should be greater than 50ns and less than 100ns. The pulse Fall time should be greater than 50ns and less than 170ns. Make minor readjustments to C27, C44, and C26 on the TX Final board as necessary to bring the pulse Rise and Fall times within specifications. Check the power output on the IFR display. It should be greater than 125W minimum.

7. Set the scope delay to approximately 20.5usec and adjust as necessary to observe the last pulse of the TX pulse train. Check the TX Pulse Width. It should be approximately 430nsec. If not, make a slight adjustment to R4 then R30 on the driver board. Verify the pulse Rise and Fall times are within the specifications listed above. If not, make minor adjustments to the TX board tuning caps as necessary.

8. Set the IFR to Long Mode S.

9. Set up the scope to observe the first TX Pulse.

10. Check the pulse width measurement. It should be a minimum of 520 +/- 10nsec. If necessary, on the TX Driver board, adjust R4 then R30 to set this pulse width to 520nsec. The pulse Rise time should be greater than 50ns and less than 100ns. The pulse Fall time should be greater than 50ns and less than 170ns. Again, if necessary, make minor readjustments to C27, C44, and C26 on the TX Final board to bring the pulse Rise and Fall times within specifications. Check the power output on the IFR display. It should be greater than 125W minimum.

11. Set the scope delay to approximately 119.5usec and adjust as necessary to observe the last pulse of the TX pulse train. Check the pulse Width. It should be 520nsec +/- 10nsec. Make minor adjustments to R4 then R30 if necessary. Verify that the pulse Rise and Fall times are within the specifications listed above. If not, make minor adjustments to the TX board tuning caps as necessary.

12. Check the TX Pulse Spectrum on the spectrum analyzer. With a Span of 1GHz, verify there are no spurs on either side of the 1090Mhz TX pulse.

13. Measure the close-in TX Pulse Spectrum with the analyzer Span set to 50MHz and the RES BW set to 300Khz. The spectrum observed should meet the TX Pulse Spectrum requirements shown below on both the lower and upper side frequencies down from the 1090Mhz peak:

MHz difference from 1090mHz	dB down from 1090Mhz peak
>1.3 to <7 Mhz	3dB or more
>7 to <23 Mhz	20dB or more
Increase span to 200Mhz. Set RES BW to 3Mhz.	
>23 to <78 Mhz	40dB or more
Increase span to 500Mhz.	
>78Mhz	60dB or more

14. Make slight adjustments if necessary to C26, C27, and C44 on the TX Final board to bring the side lobes within specifications.

15. Set the IFR back to ATCRBS.

16. Set the Spectrum analyzer Span to 1Ghz and the RES BW back to 3Mhz.

17. Repeat all TX Pulse Spectrum tests as listed above on both sides of the 1090Mhz peak. Verify the spectrum measurements are within specifications. Make minor TX tuning adjustments only if necessary. Note: When testing spectrums >78Mhz in ATCRBS reduce the RES BW to 1Mhz.

18. Repeat the pulse Width measurements on the first and last TX pulse. The pulse Width should now be 450 +/- 100 ns. If not, make minor adjustments to R4 and R30 on the Driver board. Check the pulse Rise and Fall times for the first and last TX pulse. Verify they are within specifications (Ref step 6). Make only miner adjustments as necessary.

Test Set Up
For
KXP2290 Receiver Alignment

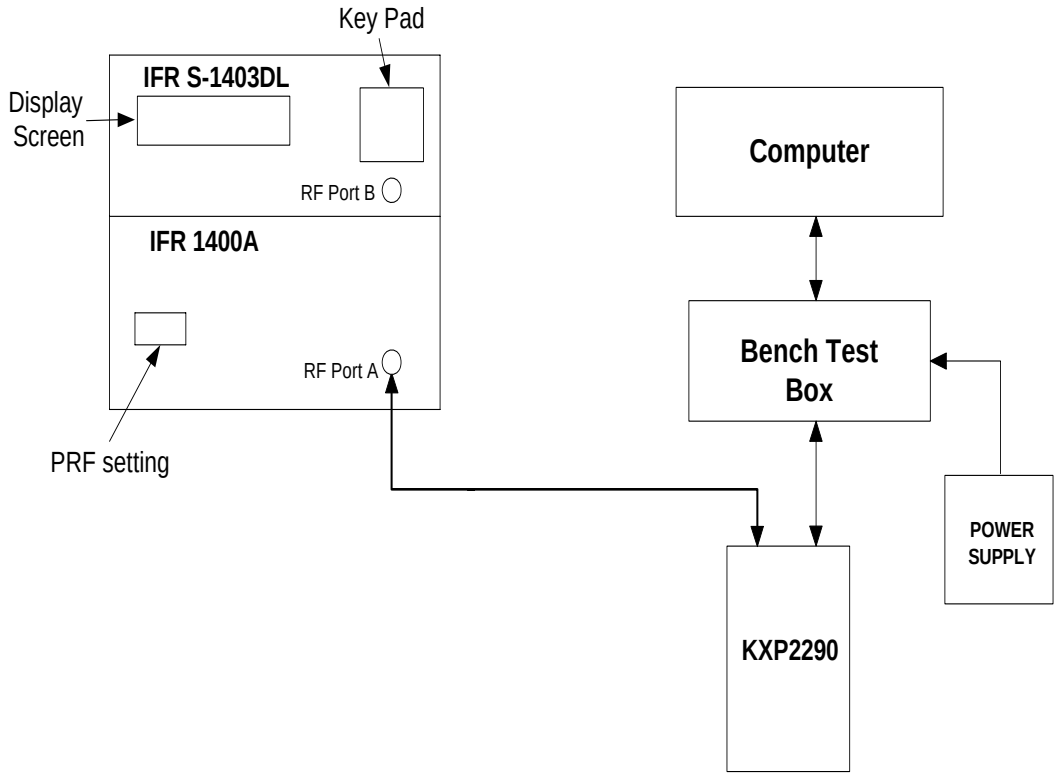

Figure 2

Unit Receiver Sensitivity Alignment:

See Figure 2 For Test Equipment Set UP:

1. Set IFR to ATCRBS, and set the PRF to 450.
2. On the KXP2290 Main Board set R1200 to its center position.
3. Connect a 2dB loss RF cable from IFR antenna port (A) to the KXP2290 Bottom Antenna port (J2). The KXP2290 Top Antenna port (J3) is not connected to IFR at this time.
4. Set IFR RF Level to -75dBm.
5. While observing the IFR for ATCRBS reply, adjust R2212 on the KXP2290 Receiver Board, to obtain a 50% to 70% reply.
6. Set IFR RF Level to -74dBm.
7. Observe the IFR for a 99% to 100% ATCRBS reply.
8. Connect a 2dB loss RF cable from IFR antenna port (A) to the KXP2290 Top Antenna port (J3). The KXP2290 Bottom Antenna port (J2) is not connected to IFR at this time.
9. Set IFR RF level to -75dBm.
10. While observing the IFR for ATCRBS reply, adjust R2211 on the KXP2290 Receiver Board, to obtain a 50% to 70% reply.
11. Set IFR RF level to -74dBm.
12. Observe the IFR for a 99% to 100% ATCRBS reply.