RDR-1500B
MAINTENANCE MANUAL
VOLUME 2

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(g) Set RADAR mode selector switch on control unit to WX. Measure pulse width and amplitude on oscilloscope. Pulse width for WX mode should be 4 to 5 us, and amplitude should be 10 ±2 volts.

H. AFC Tests and Alignment

(1) Local Oscillator Control Voltage Adjustment

(a) Connect DVM (13) to TP7009 on the AFC module. DVM should indicate from 4.5 to 5.5 volts dc.

☛ **NOTE**: This test should be made only after the transmitter has been in operation for at least 15 minutes.

(b) If measured voltage is out of tolerance, adjust FREQ ADJ screw on the local oscillator (LO) assembly until DVM (13) indicates 5.0 ±0.2 volts dc.

(2) Lock Test and Adjustment

(a) Connect X10 probe (14) from oscilloscope (11) channel 1 to TP7004 on AFC module.

(b) Set oscilloscope (11) for 1 volt per division, for ground reference at bottom graticule on screen, and for time base suitable for pulse presentation.

(c) Note peak amplitude of lock pulse on oscilloscope (11). It should be from 4.25 to 4.75 volts peak, with respect to ground reference (2 Vdc plus 2.25 to 2.75V pulse).

(d) If the lock pulse amplitude is out of tolerance, adjust R7029 on AFC module for a pulse amplitude of 4.5 volts peak with respect to ground reference.

(3) Mode Change Lock Test

(a) Using X10 probe (14), connect oscilloscope channel 1 to TP7009 on AFC module.

(b) Set ground reference at bottom graticule on oscilloscope (11) screen. At control unit, adjust range switches for 10 nm as viewed on indicator. Local oscillator (LO) control voltage should be approximately 5 volts peak with respect to ground reference, as viewed on the oscilloscope.

(c) At control unit, set RADAR mode selector switch to WXA, BCN, and SRCH (SRCH L, SRCH M, and SRCH S) while observing waveform on oscilloscope. The AFC should lock at approximately 5 volts at TP7009 on the first downward sweep at each mode setting.

(4) Discriminator Alignment

(a) Set control unit RADAR mode selector switch to TEST. Repeat paragraph 3.G.(2) to ensure that magnetron frequency is correct. Record the frequency to the nearest one-hundredth (.XX) MHz for later reference.

(b) Disconnect the frequency counter (12) from R-T unit output and remove the 40 dB stick attenuator (22) from the RF input of the frequency counter.

(c) Connect frequency counter (12) to the UNCAL OUTPUT connector at the rear of the X-band generator (3). This will give a more accurate frequency indication of the X-band generator output. Adjust frequency of X-band generator until frequency counter indicates the same frequency, within ±20 kHz, of that recorded in step (a) or step (h).

(d) Connect a cable from the RF output of the X-band generator (3) to the adapter (7) via the 10 dB stick attenuator (6). Set RADAR mode selector switch to WX and select the 160 NM range.

(e) Adjust X-band generator (3) attenuator to obtain a peaked signal of approximately 2 volts on oscilloscope (11). Adjust X-band generator delay and width controls for a signal approximately 40 NM wide on the indicator, delayed 160 NM from the origin.

(f) Adjust L7017 on AFC module for a peak video response on oscilloscope (11).

> ☛ **NOTE**: L7017 has been filled with wax at the factory so that the core of the inductor will not move under vibration. Before adjusting this inductor, the case of the inductor must be heated up with either the tip of a solder iron, or a heat gun until the wax melts. Failure to melt the wax will result in damage to the inductor.

(g) Disconnect X-band generator (3) from stick attenuator (6). Again, measure the magnetron frequency, using frequency counter and 40 dB attenuator (22).

(h) Compare the frequency measured in step (g) with that measured in step (a). If the frequency difference is greater than 50 kHz, repeat steps (b) through (g), using the frequency measured in step (g) as the X-band generator adjustment frequency in step (c).

(5) AFC Intra-circuit Alignments

☛ **NOTE**: These alignments are performed after repair of AFC module or if the requirements of a test or an adjustment in paragraphs 3.H.(1) through 3.H.(4) were not met.

WARNING

TURN OFF POWER TO SYSTEM AND DISCONNECT CONNECTOR P1210

FROM REGULATOR MODULE TO DISABLE TRANSMITTER AND PREVENT POSSIBLE HIGH-VOLTAGE SHOCK HAZARD. TURN ON SYSTEM POWER.

(a) AFC Oscillator Alignment

1 Set oscilloscope (11) to channel 1, vertical sensitivity to 0.01 volts per division, time base to 0.05 microseconds, and to automatic trigger. At control unit, set RADAR mode selector switch to STBY.

2 Using X10 probe, connect oscilloscope (11) channel 1 to TP7002 on AFC module. Adjust L7006 (located within the shielded section) on AFC module for a maximum peak-to-peak amplitude of waveform, as observed on oscilloscope. The amplitude should be approximately 180 mV p-p.

☛ **NOTE**: L7006 is adjusted through access hole in shielded compartment on AFC module.

☛ **NOTE**: L7006 has been filled with wax at the factory so that the core of the inductor will not move under vibration. Before adjusting this inductor, the case of the inductor must be heated up with either the tip of a solder iron, or a heat gun until the wax melts. Failure to melt the wax will result in damage to the inductor

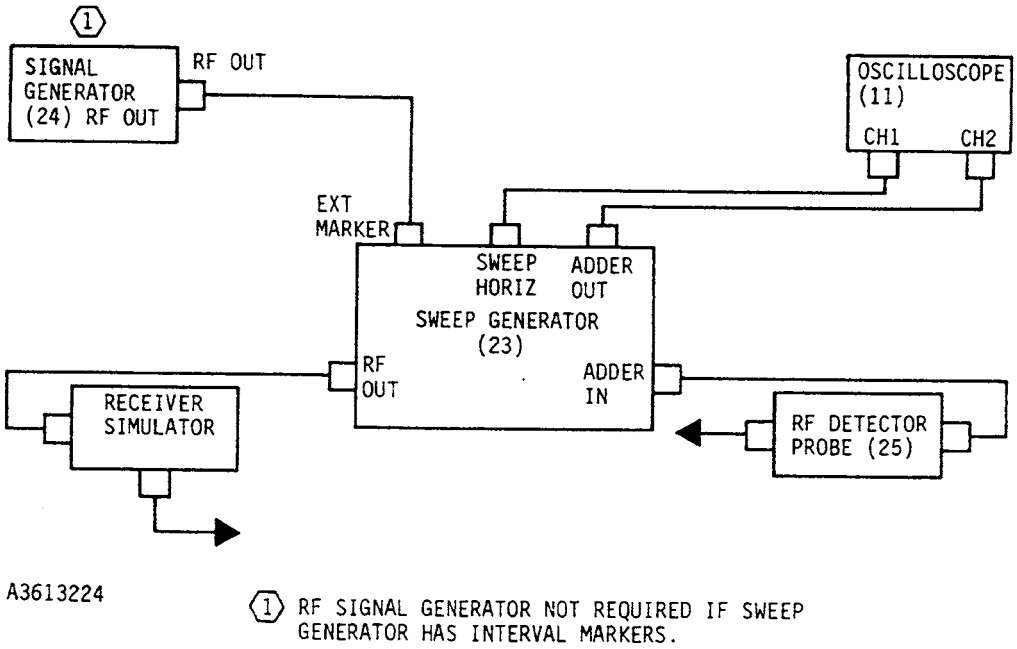
3 At control unit, set RADAR mode selector switch to OFF. Disconnect oscilloscope from TP7002.

(b) AFC Module Test Setup

1 Connect test setup as shown in figure 4-8.

2 Set oscilloscope (11) controls as follows:

CONTROL	SETTING
Horizontal Display	X-Y
CH1 and CH2 Input Select	DC
CH1 Volts/Div	1V
CH2 Volts/Div	0.5V



AFC Module Test Setup
Figure 4-8

3 Set signal generator (24) controls as follows:

☛ **NOTE**: Signal generator (24) not required if sweep generator (23) has internal markers.

CONTROL	SETTING
Frequency	87.00 MHz
Modulation Mode	CW
RF Output	0 dBm

4 Set sweep generator (23) controls as follows:

CONTROL	SETTING
Attenuator	110 dB
Center Freq	87 MHz
Marker Width	Midway
Marker Size	Minimum Usable
Sweep Mode	1-50
Sweep Width	1/3

5 Disconnect coaxial connector P2031 from RF input jack J7031 on AFC module. Then connect receiver simulator (figure 4-1) output connector to J7031.

(c) RF Alignment

1 At control unit, set RADAR mode selector switch to STBY. Connect RF detector probe (25) to TP7001 on the AFC module.
2 At sweep generator (23), set attenuator to 3 dBm. Use the 87-MHz marker and adjust sweep width and center frequency control for a suitable waveform display.
3 Tune L7003 for maximum frequency response at 87 MHz, as observed on oscilloscope.

☛ **NOTE**: L7003 has been filled with wax at the factory so that the core of the inductor will not move under vibration. Before adjusting this inductor, the case of the inductor must be heated up with either the tip of a solder iron, or a heat gun until the wax melts. Failure to melt the wax will result in damage to the inductor

☛ **NOTE**: Sometimes the maximum frequency response may not be precisely on the 87-MHz marker.

4 Position waveform peak on oscilloscope (11) so top of peak touches center horizontal graticule line.

5 Reduce sweep generator (23) attenuation by 2 dB. The 87-MHz marker should appear above the horizontal graticule line on the oscilloscope screen.

(d) AFC Mixer Alignment

1 Connect jumper lead between TP7010 and TP7005 on AFC module. Set the sweep generator (23) attenuation to 30 dB.

2 Referring to figure 4-8, connect RF detector probe (25) to case (collector) of Q7004 on AFC module.

3 Adjust L7011 on AFC module to obtain a peaked band-pass response at the 87-MHz marker, as observed on the oscilloscope.

☛ **NOTE**: L7011 has been filled with wax at the factory so that the core of the inductor will not move under vibration. Before adjusting this inductor, the case of the inductor must be heated up with either the tip of a solder iron, or a heat gun until the wax melts. Failure to melt the wax will result in damage to the inductor.

4 Reduce sweep generator attenuation to 20 dB and note waveform amplitude. Reduce attenuation further to 10 dB. Output amplitude should not increase. Set sweep generator attenuator to 20 dB.

5 Disconnect RF detector probe. Do not remove jumper lead between TP7005 and TP7010.

(e) AFC Discriminator and Lock Detector Alignment

1 Connect jumper lead from TP7010 to CR7003 anode on the AFC module.

2 Referring to figure 4-8, connect X10 probe (15) from TP7006 to channel 2 of oscilloscope (11).

3 Set oscilloscope (11) channel 2 sensitivity to 1V/Div.

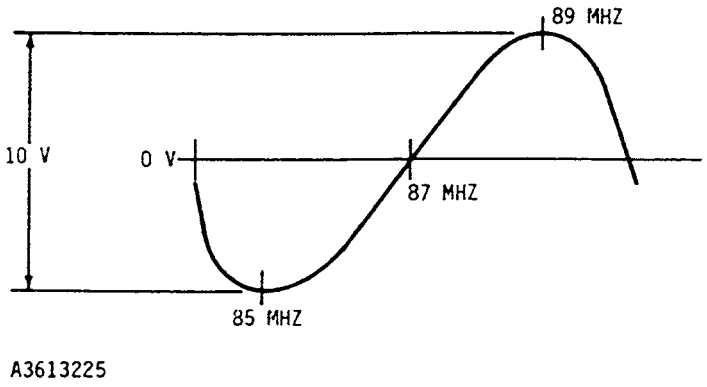
4 Adjust L7017 until zero crossover point of discriminator curve is aligned with 87-MHz marker, as seen on oscilloscope (11). Peak amplitude of the positive and negative peaks of discriminator curve should be at least +4 and -4 volts respectively. See figure 4-9. Reconnect channel 2 of oscilloscope to ADDER IN input of sweep generator (see figure 4-8).

☛ **NOTE**: L7017 has been filled with wax at the factory so that the core of the inductor will not move under vibration. Before adjusting this inductor, the case of the inductor must be heated up with either the tip of a solder iron, or a heat gun until the wax melts. Failure to melt the wax will result in damage to the inductor.

5 Increase signal generator (24) frequency until marker is positioned on positive peak of discriminator curve. Marker frequency should be at least 89 MHz. See figure 4-9.

6 Decrease signal generator (24) frequency until marker is positioned on negative peak of discriminator curve. Marker frequency should be no greater than 85 MHz.

3.H. (5) (e) (6)



Discriminator S-Curve Waveform
Figure 4-9

☛ **NOTE**: Steps 7 through 11 make up the locking-window alignment procedure.

7 Connect X10 probe (14) from ADDER IN input on sweep generator (23) to TP7004 on AFC module. Readjust signal generator (24) frequency to 87.00 MHz.

8 Adjust L7014 on the AFC module for a peaked response at the 87-MHz marker frequency, as observed on oscilloscope.

☛ **NOTE**: L7014 has been filled with wax at the factory so that the core of the inductor will not move under vibration. Before adjusting this inductor, the case of the inductor must be heated up with either the tip of a solder iron, or a heat gun until the wax melts. Failure to melt the wax will result in damage to the inductor

9 Connect oscilloscope (11) channel 2 via X10 probe (14) to TP7004. Adjust R7029 on AFC module for a response amplitude of 2.5 ±0.1 volts peak with respect to oscilloscope (11) ground reference.

10 Set sweep generator for maximum attenuation. Connect DVM (13) probe to TP7004. DVM (13) should indicate +2.0 ±0.2 Vdc. Reset sweep generator attenuation to 30 dB.

11 Connect oscilloscope (11) channel 2 to TP7007 on AFC module. Set channel 2 sensitivity to 5V/Div.

3.H.(5)(e)11

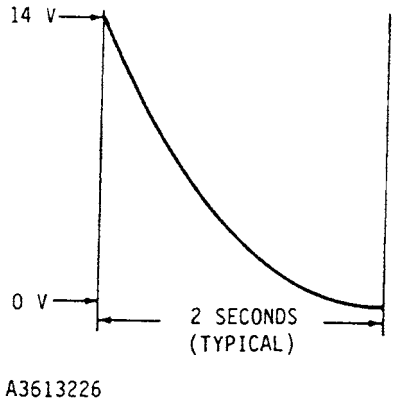
12 Disconnect jumper lead between TP7010 and CR7003 anode. The signal on oscilloscope screen should switch between approximately +12 volts and -12 volts.

13 Disconnect cable from the sweep generator (23) RF output. Observe that signal ceases switching on the oscilloscope and remains at +12 volts. Leave sweep generator (23) RF output disconnected.

(f) AFC Sweep Test

1 Connect oscilloscope (11) channel 2 via X10 probe (15) to TP7009. Set channel 2 sensitivity to 2V/Div.

2 Remove jumper lead between TP7005 and TP7010. Sweep waveform seen on oscilloscope (11) should be similar to one shown in figure 4-10.



Sweep Waveform
Figure 4-10

3 Set control unit RADAR mode selector switch to OFF. Disconnect receiver simulator from J7031 and reconnect P2031 to J7031. Reconnect modulator assembly.

3.H.(5)(f)3

(g) Ring Time Test

1 Connect echo box (35) to the directional coupler (5) output.

2 Set control RADAR mode selector switch to WX and set system test panel (1) STC switch to off.

3 Connect a coax cable from echo box (35) SCOPE BNC connector to one channel of the oscilloscope (11). The other oscilloscope channel should be connected to the system test panel SCOPE jack.

4 Tune echo box (35) frequency control until the detected signal, from the echo box, displayed on oscilloscope is maximum amplitude at approximately 9375 MHz.

5 Adjust coil L7017 on AFC module for maximum width and amplitude of the video test pulse on oscilloscope (11).

> ☛ **NOTE**: L7017 has been filled with wax at the factory so that the core of the inductor will not move under vibration. Before adjusting this inductor, the case of the inductor must be heated up with either the tip of a solder iron, or a heat gun until the wax melts. Failure to melt the wax will result in damage to the inductor

6 Repeat steps 4 and 5 until no further change is observed.

7 Disconnect echo box (35).

I. Comparator Threshold Adjustment

(1) Connect DVM (13) probe to TP3018 on the processor module. Set DVM for 1 Vdc measurement.

(2) Set RADAR mode selector switch to WX. Adjust R3062 on the processor module until DVM indicates +0.52 Vdc.

(3) Connect DVM (13) to U3007, pin 5. DVM should indicate +0.79 ±0.04 Vdc.

(4) Connect DVM (13) to U3007, pin 12. Adjust R3063 for +1.20 Vdc reading on DVM.

J. Sensitivity Time Control (STC) Adjustment

(1) Adjust control unit STC control fully CCW. Test panel (1) STC switch should be off and WX RADAR mode should be selected.

(2) Connect DVM (13) to TP3507 on STC module. Adjust R3509 for 10.00 ±0.01 Vdc indication on DVM.

(3) Connect DVM (13) to U3515, pin 6, on STC module. Set RADAR mode selector switch to SRCH and press PULSE pushbutton for SRCH L mode. Adjust R3521 for a 0- to 10-millivolt indication on DVM.

(4) Set test panel (1) STC switch to ON. Connect oscilloscope (11) via x10 probe (14) to TP3508 on STC module. Set RADAR mode selector switch on control unit to TEST. Adjust oscilloscope time base to view the waveform, which should resemble figure 4-11.

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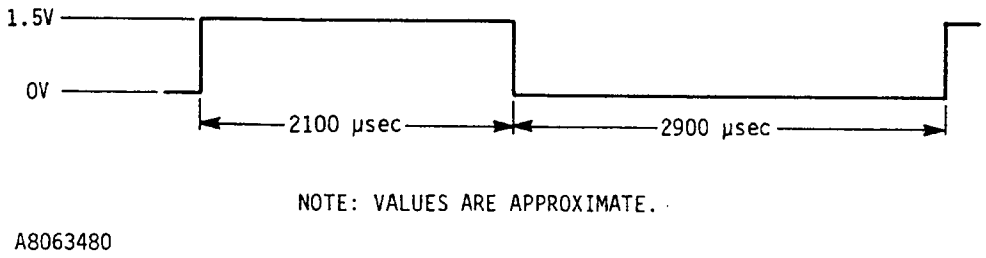
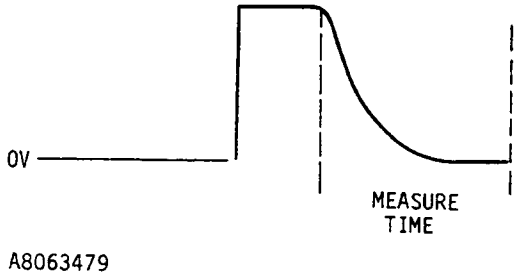


STC Waveform, TEST Mode
Figure 4-11

(5) At control unit select all other RADAR modes (WX, BCN, SRCH S, SRCH M, and SRCH L) and verify that waveform displayed is similar to figure 4-12 and that STC time for each mode complies with table 4-5.



STC Waveform, Transmit Modes
Figure 4-12

MODE	TIME (uSEC)*	NAUTICAL MILES
WX	680 ±50	55
BCN	680 ±50	55
SRCH S	120 ±10	10
SRCH M	240 ±10	20
SRCH L	550 ±50	45

*STC time is measured from beginning of ramp to the point where the ramp reaches zero volts.

STC Time
Table 4-5

(k) On oscilloscope (11), adjust channel 1 vertical position to set trace 5 divisions up from bottom of graticule. Adjust signal generator (24) frequency to 87.000 MHz. Set up sweep generator (23) for a center frequency of 87.00 MHz with the 87-MHz marker on. Adjust the sweep generator marker controls for the best display. Adjust oscilloscope (11) channel 2 vertical position to place the peak of the response curve at the center horizontal graticule line.

(1) Set the sweep generator (23) attenuators to 70 dB. Increase signal generator (24) frequency so that marker is positioned at the high frequency side where the response curve crosses the center horizontal graticule. The frequency should be 92.0 to 95.7 MHz.

(m) Reduce signal generator (24) frequency to the low frequency side until waveform again is at crossover point of response curve and center horizontal graticule. The frequency should be 80.0 to 82.7 MHz.

(n) Return sweep generator (23) attenuators to 73 dB. Verify that reference point set on oscilloscope (11) in step (k) remains on center horizontal graticule line.

(2) Search-Mid Bandwidth

(a) With control unit RADAR mode selector switch set to SRCH, press PULSE pushbutton to select SRCH M mode.

(b) With sweep generator (23) set to sweep mode, adjust attenuators to 83 dB.

(c) On oscilloscope (11), adjust channel 1 vertical position to set trace 5 divisions up from bottom graticule. Adjust signal generator (24) frequency to 87.000 MHz.

(d) Adjust L2017 through slot in RF cover to center the response at the 87-MHz marker. Readjust sweep width for better resolution.

☛ **NOTE**: L2017 has been filled with wax at the factory so that the core of the inductor will not move under vibration. Before adjusting this inductor, the case of the inductor must be heated up with either the tip of a solder iron, or a heat gun until the wax melts. Failure to melt the wax will result in damage to the inductor

(e) Set sweep generator attenuators for 80 dB. Increase signal generator (24) frequency so that marker is positioned at the high frequency side where the response curve crosses the center horizontal graticule. The frequency should be 88.0 to 88.3 MHz.

(f) Reduce signal generator (24) frequency to the low frequency side until waveform again is at crossover point of response curve and center horizontal graticule. The frequency should be 86.0 to 86.3 MHz.

(g) Return sweep generator (23) attenuators to 83 dB. Verify that reference point set on oscilloscope (11) in step (c) remains on center horizontal graticule line.

(3) Weather, Beacon, and Search-Long Narrow Bandwidth

(a) Set control unit RADAR mode selector switch to WX.

(b) With sweep generator (23) set to sweep mode, adjust attenuators to 73 dB.

(c) On oscilloscope (11), adjust channel 1 vertical position to set trace 5 divisions up from bottom graticule. Adjust signal generator (24) frequency to 87.000 MHz.

(d) While observing the display on oscilloscope (11), adjust C2046 through hole in receiver cover for a response centered at 87 MHz. Use maximum sweep width to enhance the resolution.

(e) Reduce sweep generator (23) attenuator by 3 dB. Increase signal generator (24) frequency so that marker is positioned at the high frequency side where the response curve crosses the center horizontal graticule. Note the frequency.

(f) Reduce signal generator (24) frequency to the low frequency side until waveform again is at crossover point of response curve and center horizontal graticule. Subtract this frequency from that noted in step (e). The difference between the 3-dB low side and the 3-dB high side should be from 575 to 650 kHz.

(4) False Alarm Adjustment Controls

(a) Check that RADAR mode selector switch is set to WX. Remove receiver cover and disconnect jumper lead from TP2001.

(b) Connect DVM (13) to TP2001. Connect X10 probe (14) from oscilloscope (11) channel 2 to TP2003.

(c) Observe oscilloscope display and adjust R2040 (0.5 MHZ FALSE TARGET ADJ) for approximately 1 volt of noise. DVM indication at TP2001 should be a maximum of 2 volts.

8. Modulator Assembly Wiring Diagram

To facilitate repair, the wiring diagram for the RT-1501A modulator assembly (P/N 3606478-0501) is provided as figure 5-1.

9. Replacing Programmed Devices

The PC modules contain several devices which are specially programmed. These devices must be replaced with the correctly programmed component or erroneous operation will result. The manufacturer's part (type) number is for the un-programmed device and cannot be used. Telephonics part number must be used to obtain the correctly programmed device.

When a device is programmed at the factory, a portion of the Telephonics part number is stenciled on the case. When replacing one of these components, be sure that it contains the same identifying part number. The abbreviated identifying numbers are usually formed from the last two digits of the Telephonics basic part number. This is followed by the significant digit or digits in the dash portion of the part number. For example, Telephonics part number 51096-0212 would appear as 96-212 on the device.

10. Scheduled Maintenance

Telephonics recommends that Receiver-Transmitters and Magnetrons be re-energized if held in storage, or are inactive, for greater than 6 months.

See Service Letter SL-T-05-0003 for periodic (Scheduled) maintenance of these products.