CHAPTER 5
MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE

5-1 INTRODUCTION.

This chapter contains both preventive and corrective operational level maintenance instructions. The information includes cleaning and lubrication, inspection, performance verification, troubleshooting, and subassembly removal and replacement.

5-2 CLEANING AND LUBRICATION.

Clean the external surfaces, front panel and the air inlet filter pads on the front panel every 2 weeks using a vacuum cleaner or small soft brush to remove any dirt or dust. The filter pads can be reused by rinsing with water, see section 5-6 for removal procedures. Do not use any cleaning agents. There are no lubrication requirements.

5-3 INSPECTION.

If the unit is faulty or suspected to be faulty perform a visual inspection as follows:

5-3.1 *External Inspection.*

1. Check front panel for physical damage.
2. Check external case for physical damage.
3. Check rear panel for physical damage.
4. Check rear panel connectors for corrosion and loose connectors.
5. Check rear panel cables for frayed or broken wires.

5-3.2 *Internal Inspection.*

WARNING

With the rear panel power switch set OFF and the power cord plugged into the power source, high voltage shock danger is present internally at the rear panel POWER receptacle/RFI filter, AC Line Filter board, and the rear panel circuit breaker.

CAUTION

When working on the receiver with covers removed and power applied, do not allow tools or metal objects to come in contact with receiver components. Equipment damage may occur.

CAUTION

Unit contains parts and assemblies sensitive to damage by electrostatic discharge (ESD). Use ESD precautionary procedures when touching removing or inserting parts.

1. Turn the unit off, and remove the power cord from the power source.
2. Using a no. 2 Phillips screwdriver, push down and turn all captive fasteners on the cover 1/4 turn counter-clockwise, and remove the cover.
3. Check for loose modules and circuit boards.
4. Check for loose connectors, corrosion, or burn marks.
5. Check for frayed or broken wires and cable ribbons.

5-4 PERFORMANCE VERIFICATION.

Because of the extensive built-in test equipment (BITE), the basic performance can be verified to a high degree of confidence with minimal external equipment. The following sections describe in detail the procedures to run the ATC-100 self verification tests.

5-4.1 *External Connections.*

1. Connect the power input to a suitable power source. Leave the power switched off at this time.

2. Connect a 50-ohm dummy load capable of dissipating 25 watts continuously and 100 watts peak to the Antenna jack.

3. Connect a serial COM1 or COM2 port of a DOS-based computer or a Windows™-based computer running a DOS window to the Maintenance port. In most instances a “Null Modem” cable or adapter is required. In many instances a gender adapter is required. Set the transceiver’s rear panel DIP switches for the desired communications parameters as described in Chapter 3.

4. Power on the transceiver.

5. On the computer, run the Cubic-furnished program, RCOMM, and verify the settings. RCOMM remembers the settings the last time it was run. If running it for the first time, be sure to select the Serial interface: COM port 1 or 2 (Alt-I, 1 or 2). Then examine the serial line parameters at the bottom of the screen or window. If using the recommended Factory Default settings on the transceiver, the RCOMM settings should include
   a. Baud Rate = 38,400
   b. Data Bits = 8, no Parity
   c. Address = 0
   d. F/C (flow control) = OFF
   e. Terminator = <CR>
   f. Preamble = 1STX, 3ADR.

   If any parameters need to be changed, access the Configuration/Serial menu (Alt-C, S) and the parameter to be changed.

6. Verify communications with the transceiver by typing ID? and Return. You should see an ASCII message identifying the unit as an ATC-100 with a control software version and date. If so, proceed to transceiver performance verification.

5-4.2 *Transceiver Performance Verification.*

1. Use the **PO?** query to obtain the results of the Power On Self Test. All zeros indicates no failures. Refer to Table 3-3 for the meaning of the individual result bits. If desired, use the **PO** command to repeat the tests.

2. Use the **BI?** query to obtain the results of the last BITE test sequence. All zeros indicates no failure. Refer to Table 3-3 for the test frequencies of the individual tests. If desired, use the **BI** command to repeat the test sequence. The BITE sequence conducts a receiver functional test at one frequency in each preselector band.

3. Use the **BR?** query to run the Remote BITE test and receive the results. Refer to Table 3-3 for details on the forward power, reflected power, VSWR, modulation percentage, MAR (receiver sensitivity margin).

If the BITE test reveals no failures and the Remote BITE indicates adequate forward power, low VSWR, adequate modulation percentage and MAR values, the unit is fully operational.

Section II. CORRECTIVE MAINTENANCE

5-5 TROUBLESHOOTING.

5-5.1 Troubleshooting Philosophy.
Certain assumptions are made concerning the troubleshooting approach as applied to the receiver as follows:

1. All point-to-point wiring is correct. Therefore, no malfunction is the result of a wiring (or cable connector) fault.

NOTE
Suspected failure of cables or connectors require visual inspection and continuity tests using the appropriate diagram. See FO-3, Interconnect Diagram.

2. Malfunctions are non-interactive. Each symptom of a problem is caused by a single malfunction and no additional failures occurred during the troubleshooting process.
3. Multiple faults can be isolated if they are non-interactive.
4. Preventive maintenance has been performed (Section I).

5-5.2 *Built-In Tests.* The ATC-100 provides three types of testing: power-on self test (POST), built-in test equipment (BITE), and built-in test (BIT). Each is discussed below.

5-5.2.1 *POST.* The POST is performed automatically each time the receiver is powered on. Under firmware control, the POST sequences through a series of tests that checks the Control and DSP section of the Digital module, then activates the BITE check. If a failure is detected, the unit generates an audio tone in morse code describing error. Record the failure data. Depending on the failure, receiver functions may or may not be possible. If a BIT fault is detected after the POST, the unit will also generate an audio tone in morse code describing error. POST results are also reported over the remote control bus.

5-5.2.2 *BITE.* The BITE check is controlled by the firmware and is a sequence that checks the signal path with the BITE Generator. This test exercises the entire receiver signal path. Different frequencies are used to check each preselector filter. The BITE check is automatically performed during the POST, or may be selected manually at any time by the remote control bus. The audio output is disabled during the POST BITE check, but is enabled during the manual BITE check.

(See figure FO-2). During the BITE check, the Control section in the Digital module activates the BITE circuits through the shift register in the Preselector section of the RF Analog module.

5-5.2.3 *BIT.* During normal receiver operation, fault detectors are operating in the background. Table 5-1 lists the fault detectors, their locations and the fault signal sent to the Control section in the Digital module. If a fault is detected, the Control section stores the information in memory, causes the fault indication to be shown on the display, and sends the fault information over the remote control bus. The operator can view the current or cumulative faults (since power up) using the UTILITY FAULTS soft key menu.

Table 5-1 Fault Detectors.

Detector	Module Location	Fault Signal
LO FLT	RF Analog	1st or 2nd LO out of lock
DSPC FLT	RF Analog	DSP Clock out of lock
TX SYNTH FLD	Transmit Synthesizer	TX Synthesizer out of lock
SELF TEST ADC	Digital Board	Power Supply Monitor
AUDIO DET	RF Analog	Detects audio output

5-5.3 *Troubleshooting Procedure*. Equipment troubleshooting should be performed in the following order:

1. Initial checks.
2. Fault identification
3. Front panel display interpretation.
4. Signal tracing (If required).
5. Subassembly replacement.

5-5.3.1 *Initial Checks.* If a problem is suspected conduct the following::

1. Check that the power switch is on and the Power and No Fault LED's on the front panel are lighted. If the Power and No Fault LED's are off, and the power switch is set to on, ensure that input power is correct.
2. Check for air flow into the unit from the front panel. The fan on the rear panel draws air through the filter on the front panel.
3. If an external reference frequency is used, try disconnecting it, and recheck the transceiver. Check for correct external reference frequency.

5-5.3.2 *Fault Identification.* Should the transceiver identify a fault, the "No Fault" LED on the front panel of the transceiver will extinguish.. Since the transceiver is designed to be operated remotely verification of the "No Fault" LED may not be a viable option. If a malfunction is suspected Several Radio Command Messages are available to help localize and determine the cause of the problem. These command messages are:

:? Request Interface Status Messages.
A? Request AGC status (on or off).
BI? Request BITE status.
BR? Request results of Remote BITE test.
C? Request a report of Radio Status Messages.
DACn Initiate DAC test.
DAC? Request condition of the DAC.
FA? Request a report of all accumulated faults.
FC? Request a report of all current faults.
FS? Request a fault summary report.
G? Request manual gain status setting.
IS? Request the audio input source.
PO? Request results of the most recent POST.
PS? Request status of the power supply voltages.
PWR? Request the transmitter power output.
R? Request receiver operating parameter status.
SS? Request signal strength in Mode 0.
SSH? Same as SS? except return value is in units of ½ dB.
SA? Request the audio output level in dBm.
SN? Request the carrier-to- noise measurement.
T? Request the Transmit/receive status.
TN? Request the frequency of the tone generator.
TO? Request the current transmitter offset frequency.
TT? Request the mode 0 transmit timer value.
VF? Request the vector feedback status.
VPC? Request the vector feedback values for the current frequency.
VFONE Runs the vector feedback calibration routine on the current frequency.
VPS? Displays the current power supply voltages.

A more detailed description of these commands is provided in chapter 3.

NOTE

When using the FA? or FC? Radio Commands the operator can determine the fault from table 3-3. To determine the meaning and the maintenance action to take in response to these fault messages, refer to table 5-2.

5-5.3.3 *Signal Tracing.* If the failed subassembly cannot be isolated using the initial check or fault identification interpretation, isolate the failed subassembly using conventional signal tracing techniques. Refer to chapter 4 for signal flow descriptions.

Signals are checked at various locations in the equipment using an RF signal generator and oscilloscope (see figures FO-3 and FO-4). Refer to SECTION 5-4 to pass a signal through the transceiver for signal tracing. Tables 2-1 through 2-5 lists signals at the rear panel connectors.

Table 5-2 Fault Messages.

Message	Meaning	Action To Take
Software error interrupt has occurred	Divide by zero or other software error has occurred. Normally innocuous and very rare.	If condition recurs, report to CCI factory engineers. Use **R?** query to identify all operation conditions at time of error.
1st or 2nd LO PLL out of lock	Phase Lock Loop (PLL) malfunctioning.	1. Recycle power. 2. If problem persists or recurs, replace RF Analog board.
DSP clock synthesizer PLL out of lock	Phase Lock Loop (PLL) malfunctioning.	1. Recycle power. 2. If problem persists or recurs, replace RF Analog board.
Transmit synthesizer PLL out of lock	Phase Lock Loop (PLL) malfunctioning.	1. Recycle power. 2. If problem persists or recurs, replace RF Analog board.
DSP processor not responding to requests	Digital Signal Processor or DSP Clock malfunctioning.	1. Recycle Power. 2. If problem persists or recurs, check 49.152 MHz DSP clock: a. If bad, replace RF Analog board. b. If good, replace Digital board.
EEPROM does not accept programming	EEPROM faulty.	Replace Digital board.
One of the serial ports has timed out while transmitting	Hardware handshake has presented timely transmission of a message from the transceiver.	1. Check handshake lines. 2. Check host software. 3. Try different baud rate.
Serial port overrun error	Character receive to fast for transceiver to process.	Verify that host respects RTS handshake.
Serial port parity error	Character received with incorrect parity.	1. Check line parameter settings. 2. Choose host line settings. 3. Choose no-parity mode of transmission.
Serial port framing error	Character received without required stop bit.	1. Check transceiver line parameter settings. 2. Check host line parameter settings for match.

5-6 SUBASSEMBLY REMOVAL AND REPLACEMENT.

The following procedures describe removal and replacement procedures for subassemblies at the maintenance operational level:

No internal adjustments (except audio line output) or component level maintenance should be performed at the operational level. These functions should be performed at the factory or an authorized repair depot.

WARNING

Turn off power and remove power cord before replacing subassemblies. Personnel injury or equipment damage may occur.

To remove the top cover, do the following: (Refer to figure FO-4 for locations.

Using a no. 2 Phillips screwdriver, push down and turn all captive fasteners on the cover 1/4 turn counter-clockwise, and remove the cover.

CAUTION

In the following procedures, to prevent damage to screw holes in the chassis, ensure screws are completely retracted before pulling the module or board from the chassis..

CAUTION

Module connectors may be difficult to separate. Pry gently on both sides of the connector to assist module removal.

NOTE

After replacing a module, run VFCAL to insure equipment peak operation. Refer to table 3-3.

5-6.1 *RF Analog Board.*

1. Remove top cover.
2. Disconnect the 4 ribbon cable connectors J2, J3, J5, & J7 and the single column wire connector J1 from the board.
3. Using an Engage/Disengage OSMT Cable Tool, disconnect coax cables from J8, J9, J11, & J12.
4. Disconnect the two coax cable connectors:
   a. Disconnect the antenna coax connector (J4) from the board.
   b. Disconnect J10 coax connector from the board.
5. Using a no. 1 Phillips screwdriver remove the 7 screws from the top of the board.
6. Lift the board out of the chassis and turn over.
7. Using a 5/16 in. wrench, disconnect the 2 coax cable SMA connectors from the TX Synthesizer Module.
8. Using a no. 1 Phillips screwdriver remove 7 screws that attach the metal plate to the RF Analog board.
9. Lift the board from the plate.
10. To replace, reverse removal procedures.

5-6.2 *TX Synthesizer Module.*

1. Remove the top cover.
2. Remove the RF Analog Board:
   a. Using a no. 1 Phillips screwdriver remove the 7 screws from the board.
   b. Lift the board out of the chassis and turn over
   c. Using a 5/16 in. wrench, disconnect the 2 coax cable SMA connectors from the TX Synthesizer Module.
   d. Using a no. 1 Phillips screwdriver remove 7 screws that attach the metal plate to the RF Analog board.
   e. Lift the board from the plate.
3. Using a no. 1 Phillips screwdriver, remove 4 screws from the metal plate that are connected to the TX Synthesizer Module.
4. To replace, reverse removal procedures.

5-6.3 *Digital Board.*

1. Remove the top cover.
2. Remove the RF Analog Board:
   a. Using a no. 1 Phillips screwdriver remove the 7 screws from the board.
   b. Lift the board out of the chassis.

3. Disconnect 4 ribbon cables connectors J1, J2, J5, J6 and the dual column wire connector J9 from the Digital Board.
4. Using an Engage/Disengage OSMT Cable Tool, disconnect the coax cable from J7 & J8.
5. Using a 5 mm socket driver, unscrew the 2 lugs from each of the rear panel's 25 pin female connectors J3 & J4.

CAUTION

When removing board from chassis ensure that the connectors J3 & J4 do not hang up on the rear panel chassis.

6. Using a no. 1 Phillips screwdriver, remove the screws from the underneath portion of the chassis that screws to the Digital Board.
7. To replace, reverse removal procedures.

5-6.4 Power Amplifier Module.

1. Remove the top cover.
2. Disconnect the 3 cables GND (J4), +28 VDC (J1), & J3.
3. Disconnect the ribbon cable J2.
4. Disconnect the coax cable E3 from the RF Analog board.
5. Remove the RF Analog Board:
   a. Using a no. 1 Phillips screwdriver remove the 7 screws from the board.
   b. Lift the board out of the chassis and turn over.
6. On the Power Amplifier Module, locate the coax cable E4.
7. Using a 5/16 in. wrench, disconnect the coax cable, E4, SMA connector from the TX Synthesizer Module.
8. Turn the transceiver on its side. Using a no. 1 Phillips screwdriver, remove the 8 screws from the bottom of the chassis that secure the PA Module.
9. Lift the Module out (heat sink & board).
10. To replace, reverse removal procedures.

5-6.5a *Power Supply (AC Version).*

1. Remove the top cover.
2. Turn the transceiver on its side. Using a no. 1 Phillips screwdriver, remove the 4 screws from the bottom of the chassis that secure the power supply.
3. Using a no. 2 Philips screwdriver, remove 2 screws from the front and rear of the ATC-100 chassis that secures the power supply partition wall.

NOTE

Step 3 is required to increase clearance for removal of the power supply.

4. Disconnect 12 pin single column connector (CN2).
5. Disconnect 2 pin single column connector used for the +,-5 volt sense line.
6. Lift the power supply up at an angle from the power amplifier side.
7. Using a no. 2 Phillips screwdriver, remove the AC input cables (L, N, & G) from the power supply.
8. To replace, reverse removal procedures.

5-6.5b *Power Supply (DC Version).*

1. Remove the top cover.
2. Disconnect single column connectors J1 & J2.
3. Turn the transceiver on its side. Using a no. 1 Phillips screwdriver, remove the 4 screws from the bottom of the chassis that secure the power supply.
4. Lift the power supply up at an angle from the power amplifier side.
5. To replace, reverse removal procedures.

5-6.6 *AC/DC Line Filter Board.*

1. Remove top.
2. Disconnect wire connections J1 thru J4 from the AC/DC Line Filter Board.
3. Turn the transceiver on it side. Using a no. 1 Phillips screwdriver, remove the 4 screw from the bottom of the chassis that secure the AC Line Filter Board.
5. Lift board from unit.
6. To replace, reverse removal procedures.

5-6.7 *Receptacle/RFI Filter.*

1. Remove top cover.
2. Using no. 1 Phillips screwdriver remove the 2 screw fromthe rear panel that secure the power receptacle to the rear panel.
3. Pull the Receptacle out from inside the transceiver and disconnect the 3 wire connectors from the rear of the receptacle.
4. To replace, reverse removal procedures.

5-6.8 *Power Switch/Circuit Breaker.*

1. Remove top cover.
2. Using a 9/16 in. wrench, remove the nut that secures the power switch to the outside rear panel.
3. Pull switch out through the inside of the chassis.
4. Using a no. 2 Phillips screwdriver, remove the 2 wires from the rear of the power switch.
5. To replace, reverse removal procedures.

5-6.9 *Fan Assembly.*

1. Remove top cover.
2. Disconnect the fan cable from the PA Module J3.
3. Using a no. 1 Phillips screwdriver and 3/16 in. wrench, remove 4 screws and attaching hardware from the fan assembly.
4. Lift fan from chassis.
5. To replace, reverse removal procedures.

5-6.10 *Air Inlet Filter Pads.*

1. Starting at the top of the filter pad cover, gently lift and pry back.
2. Work the sides and bottom and gently pull cover off.

CAUTION

The cover is held on by plastic clips. Excessive pulling may damage the cover.

3. Lift out filter pad.
4. To replace, reverse removal procedures.

5-6.11 *Support Handles*

1. Remove top cover.
2. Using no. 2 Phillips screwdriver, remove 2 screws securing handles to front panel.

NOTE:
To remove the handle near the RF Analog Board an offset screwdriver is required. If an offset screwdriver is not available then perform step 3 & 4.

3. Remove the RF Analog Board.
   a. Using a no. 1 Phillips screwdriver remove the 7 screws from the board.
   b. Lift the board out of the chassis.
4. Using a no. 2 Phillips screwdriver, remove the lower screw.
5. To replace, reverse removal procedures.

5-7 SOFTWARE UPLOADING.

The transceiver's control and DSP software may be replaced using the Maintenance connector J2 on the rear of the unit to gain access to the unit's flash memory. The upload may be done using a DOS-based personal computer with a serial bus null-modem cable and one of the COMM ports on the PC.

To upload software to the transceiver control and DSP processors, refer to section 3-1 of the manual.