SECTION 4.
SYSTEM CHECKOUT AND TROUBLESHOOTING

4.1 INTRODUCTION

This section provides a procedure for system checkout and troubleshooting to help isolate system failures. Table 4-1 lists the necessary test equipment or its equivalent.

Table 4-1. Test Equipment for Checkout and Troubleshooting

Equipment	Part No. or Value
*RF Signal Generator	Motorola R-1201A
*RF Power Meter	Motorola S-1339A
*SINAD Meter	Motorola R-1013A
*Modulation Meter	Boonton 82AD
RF Power Source	1 watt to 100 watts

*An R2001 is suitable for use in place of these separate equipments.

4.2 SAFE HANDLING OF CMOS INTEGRATED-CIRCUIT DEVICES

Many of the integrated-circuit devices used in communications equipment are CMOS (complementary metal-oxide semiconductor) ICs. Because of their high open-circuit impedance, CMOS ICs are vulnerable to damage from static charges. Take care in handling, shipping, and servicing these ICs and the assemblies in which they are used.

Even though protection devices are provided in CMOS IC inputs, the protection is effective only against overvoltage in the range of hundreds of volts, such as that encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. *However, CMOS circuits can be damaged by improper handling of the modules even in a system.*

To avoid damaging circuits, observe the following handling, shipping, and servicing precautions.

1. Before and while servicing a circuit module, particularly after moving within the service area, momentarily touch *both* hands to a bare metal, earth-grounded surface. This will discharge any static charge which may have accumulated on you.

NOTE

Wearing a "Conductive Wrist Strap" (Motorola No. RSX-4015A) will minimize static buildup during servicing.

WARNING

When wearing a "Conductive Wrist Strap," be careful near high-voltage sources. The "good ground" provided by the wrist strap also increases the danger of lethal shock from accidentally touching high-voltage sources.

2. Whenever possible, avoid touching any electrically conductive parts of the circuit module with your hands.
3. Circuit modules should not be inserted or removed with power applied to the unit.
4. When servicing a circuit module, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static buildup.
5. All electrically powered test equipment should be grounded. **Apply** the **ground lead** from the test equipment to the circuit module **before** connecting the **test probe.** Similarly, **disconnect the test probe before** removing the **ground lead.**
6. If you remove a circuit module from the system, lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through 100k of resistance.

WARNING

If the aluminum foil is connected directly to ground, be careful of possible electrical shock: don't touch both the foil and other electrical circuits at the same time.

7. When soldering, be sure the soldering iron is grounded.
8. Before connecting jumpers, replacing circuit components, or touching CMOS pins (to replace an integrated-circuit device), be sure to discharge any static buildup as described in precaution 1. Since voltage differences can exist across your body, use only one hand if you must touch pins on the CMOS device and associated board wiring.
9. When replacing a CMOS integrated-circuit device, leave the device in its metal rail container or conductive foam until you insert it into the printed circuit module.
10. Connect all low-impedance test equipment (such as pulse generators, etc.) to CMOS device inputs after you apply power to the CMOS circuitry. Similarly, disconnect such low-impedance equipment before you turn off the power.
11. Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a similar material (such as aluminum foil). NEVER USE NON-CONDUCTIVE MATERIAL for packaging these modules.

4.3 CHECKOUT AND TROUBLESHOOTING PROCEDURES

Table 4-2 lists steps to follow for both checkout and troubleshooting of the System Analyzer. For best results, follow the "Checkout Procedures" first; if you encounter problems as listed in the "Fault" column, follow the steps listed under "Troubleshooting Procedures" to correct them. Because of the complexity of the system, the table covers only the major failures and provides only a guide to the most probable failed module. The table also assumes that all tests prior to the failure point have been successfully completed, and thus the applicable circuits are okay.

Table 4-3 provides a list of the system test points and their functions. To aid in troubleshooting, test points are identified on block diagrams throughout this manual.

Table 4-2. System Checkout and Troubleshooting Procedures

Checkout Procedure	Fault	Troubleshooting Procedure
POWER ON		
1. Check that the ac-input select switch is at 120V. With the front panel's POWER switch at DC Off, connect the unit under test (UUT) to a 120-Vac line source. Verify that the AC and Oven Ready LEDs are on.	No AC indication.	1. Check the ac line cord and line fuse. 2. If system powers up normally when on, replace the AC LED.
2. Set the POWER switch to ON. Verify that after a warmup period, a display is visible on the CRT.	No Oven Ready indication.	1. Check for approximately +15 Vdc at J16 pin 1 of the A16 board. If it is not present, check the fuse on the A3 board. If the fuse is okay, replace the Battery Charger board (A3). 2. Check J16 pin 5 of A16 for +9 Vdc and J16 pin 6 for approximately +7.5 Vdc. If J16 pin 5 is okay and J16 pin 6 is 0 Vdc, replace the LED. If the +9 Vdc is not present on J16 pin 5, replace A16.
	System won't turn on.	1. Check for approximately +15 Vdc at TP3 of the Control board (A4). If it is not present, replace the Battery Charger board (A3). 2. Check for +5 Vdc at TP5 and +11.3 Vdc at TP6 of the Control board (A4). Check for +5.1 Vdc at U2 pin 16 of A4. If one of these voltages is not present, replace the Control board (A4).

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
POWER ON (Cont)		
		3. Check for shorts to ground at TP1, TP2, TP3, TP4, TP5, TP6, and TP7 of the Output board (A5). If there is a short, remove A5 and recheck for shorts to ground on the A5 alone at all test points. If there is still a short, replace A5. If there is no short, locate the short in the system.
	System turns on, but there is no display on the CRT for any mode.	1. Remove the bottom cover of the System Analyzer. Check for approximately −4.3 Vdc at edge-connector pins 27 and 28 and for −4.69 Vdc at edge-connector pins 3 and 4 of the High-Voltage Power Supply (A1). If voltages are not present, replace A1. 2. Check for the presence of a 20-kHz square wave signal at U4 pins 11 and 14 of the Control board (A4). If signals are not present, replace A4. 3. Check for approximately +110 Vdc at TP1 and −110 Vdc at TP7 of the Output board (A5). If voltages are not present, replace A5. 4. In Gen/Mon Mtr display, check for the presence of a 110-Vp-p ramp signal at TP2, TP3, TP4, and TP5 of the Scope Amplifier board (A2). If signals are not present, replace A2. 5. If troubleshooting steps 1-4 check out okay, replace the CRT.
KEYBOARD		
1. Verify that each key has the proper effect by observing the Gen/Mon Mtr display and entering a frequency of 123.4567 MHz and a PL frequency of 890. Check for proper cursor-key operation. 2. Verify that the up and down DISPLAY, FUNCTION, and MODULATION keys work properly and their associated LEDs light up.	Only one key is inoperative. More than one key is inoperative or has the wrong effect.	Replace the defective key switch. Replace the Processor board.
NONVOLATILE MEMORY		
Select some random combination of DISPLAY, FUNCTION, and MODULATION modes. Simultaneously depress both cursor keys and, after a five-second delay, turn the system power OFF. Turn the system power back ON and verify that the same DISPLAY, FUNCTION, and MODULATION modes are present.	Any part of the nonvolatile memory fails to remember.	WARNING Lithium Battery Do not multilate or disassemble the battery cell. The lithium metal is a very active material that burns in the presence of water or high humidity. Do not put the battery in fire, attempt to charge it, heat it above 100°C, or solder directly to the cell. Do not overdischarge

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
NONVOLATILE MEMORY (Cont)		
		the cell to a reverse voltage greater than 3 volts: the battery may burst and burn or release hazardous materials. 1. Troubleshooting Instructions: A. Turn the system POWER switch OFF and disconnect the unit from the primary power source. B. Remove the Processor board from the system and place it on a nonconductive surface. C. With a voltmeter, measure the dc voltage across the lithium battery in the lower left corner of the board. D. If the battery voltage is less than 2.4V, the cell is discharged and should be replaced. If the battery is okay, replace the entire Processor board (A14). E. If you need a new battery, obtain a new cell (P/N 60-80396A0) from Motorola. Replace the battery using the procedure in Part 2. *CAUTION* *Do not substitute another type of lithium battery. The specified battery was chosen with safety as a major consideration. Other lithium battery types may present a hazard when used in this system.* 2. Replacement Instructions: A. Turn the system POWER switch OFF and disconnect the unit from the primary power source. B. Remove the Processor board from the system and place it on a nonconductive surface. C. Cut the battery end of each of the two wires that connect the battery to the circuit board. D. Remove the battery from the hold-down clip.

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
NONVOLATILE MEMORY (Cont)		
		E. Remove the new battery from its shipping container and put the old battery into the shipping container. Dispose of the battery as described in Part 3. F. With a soldering iron of 40 watts or lower, remove the old battery leads from the board. G. Being careful not to short the battery leads to each other or to the battery case, install the battery in the hold-down clip with the negative lead nearest the left edge of the card (with the circuit-board connector edge toward you). H. Solder the leads from the new battery into the printed wiring board at the points from which the old leads were removed. I. Trim the lead ends and put the board back into the system. 3. Disposal Instructions: A. Do not dispose of the lithium battery by putting it in the everyday trash. Lithium batteries are classified as hazardous material and must be disposed of accordingly. B. Consult state and local codes for the appropriate disposal procedure. C. Motorola will dispose of the battery if you send it in the shipping container (by the same method used to send the new battery to you) to the following address: Motorola, Inc. Return Goods Department 1313 East Algonquin Road Schaumburg, Ill 60196
MODULATION CAPABILITY		
1. Set the UUT to Generate FM function and select Gen/Mon Mtr display. On the Gen/Mon Mtr display, enter a DPL code of 111. Select Oscilloscope display and connect the Mod Out port to the vertical input port (Vert In). Set the Code Synthesizer mode to continuous (Cont) PL/DPL. On the scope, verify	No DPL (modulation) signal on the CRT.	1. Check TP1 of the Audio Synthesizer board (A10) for the DPL signal. If it is not present, replace the Audio Synthesizer board. 2. Check for the DPL signal on pin 64 of the Audio Synthesizer board. If it is not present, replace the IEEE Interface board (A13), or check for the presence of the A13 jumper card.

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
MODULATION CAPABILITY (Cont)		
the presence of a DPL waveform whose amplitude is variable with the Code Synthesizer level control. 2. Move the MODULATION switch from CONT to OFF and verify that a short burst of 133 Hz is present before the output stops. 3. Move the MODULATION switch to BURST. Verify that a 133-Hz tone is output as long as the switch is held at BURST. 4. Select continuous (Cont) Tone A mode. Verify a Tone A output on the scope and at the speaker. 5. Select Tone Remote mode. Verify that moving the MODULATION switch from OFF to BURST generates a single Tone-Remote-Access Sequence. 6. Connect a microphone to the Mic port. Turn up the external level control (Ext Level) and verify that speaking into the mike produces a modulation signal on the scope display.	No external modulation on the CRT.	3. Check for the DPL signal at TP6 of the Audio Synthesizer board. If it is not present, replace the Audio Synthesizer board. 4. Check for the DPL signal at TP1 of the Scope Amplifier board (A2). If it is not present, replace the Scope/DVM Control board (A7). 5. If signal switching is okay to the Scope Amplifier board, proceed to the **SCOPE** Troubleshooting Procedure. 1. Check for the modulation signal at TP7 of the Audio Synthesizer board. If it is not present, replace the Audio Synthesizer board. 2. Check for the modulation signal on pin 66 of the Audio Synthesizer board. If it is not present, replace the IEEE Interface board (A13), or check for the presence of the A13 jumper card. 3. Continue troubleshooting at step 3 of "No DPL signal on the CRT."
FREQUENCY COUNTER		
1. Set the UUT to Generate CW function with an output frequency of 30 MHz at 0 dBm, as displayed on the Gen/Mon Mtr display. Connect the Antenna port to the Frequency Counter Input port (Counter In) of the UUT, and pull the RF Port Select knob to the Antenna position. Select Freq Counter display and verify a frequency reading of 30 MHz. 2. Set the UUT to Generate FM function and select Gen/Mon Mtr display. Turn the Code Synthesizer and external modulation sources OFF. Select Narrowband mode on the bandwidth switch (BW), and adjust the 1 KHz Level control for an FM-deviation	Frequency Counter does not work.	1. Check for a 1-kHz signal at TP9 of the Audio Synthesizer board (A10). If it is not present, check for the 10-MHz signal from the Frequency-Standard Interface board (A16) to the RF Synthesizer module (A9). If it is present, replace the RF Synthesizer module. If it is not present, replace the Frequency-Standard Interface board. 2. If the 1-kHz signal is present, check for the signal to be counted at pins 61 and 63 of the Processor Interface board (A11). If it is not present, replace the Front-Panel Interface board (A15). 3. If the signal is okay up to the Processor Interface board, replace the Processor Interface board.

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
FREQUENCY COUNTER (Cont)		
reading of 5 kHz. Connect the Mod Out port to the Counter In port of the UUT. Select Freq Counter display and verify a nominal frequency reading of 1 kHz.		
DVM		
1. Maintaining the same conditions as with **FREQUENCY COUNTER** Checkout Procedure 2, select DVM display and AC mode on the display. Verify a DVM reading of 0.707 Vrms ±0.04 Vrms 2. Select DC mode and verify a dc reading of near zero volts.	DVM AC mode does not work.	1. Check for the DVM signal at pin 22 of the Front-Panel Interface board (A15). If it is not present, replace the Front-Panel Interface board. 2. Check for short bursts of the DVM AC signal at TP2 of the Scope/DVM Control board (A7). If the signal is not present at TP2, replace the Scope/DVM Control board. 3. If the signal is okay to TP2 of A7, replace the Processor Interface board (A11).
	DVM DC mode does not work.	1. Check for the dc input level attenuated by factors of 10 to less than 1 volt at pin 22 of the Front-Panel Interface board (A15). If it is not present, or if it is greater than 1 volt, replace the Front-Panel Interface board. 2. Check for the same voltage at TP2 of A7. If the signal is not present, replace A7. 3. If the signal is present at TP2, replace the Processor Interface board (A11).
SCOPE		
1. Set the UUT to Scope AC display and connect the scope's vertical input port (Vert In) to the Mod Out port. Enable the internal 1-kHz modulation source. Verify the operation of each position of the vertical-input range switch and the vertical vernier-gain control.	No vertical display.	1. Check for the input signal at TP1 of the Scope Amplifier board (A2). If it is not present, replace the Front-Panel Interface board (A15). 2. If the signal is okay at TP1, replace the Scope Amplifier board (A2).
2. With the same connection as in step 1, verify the operation of each position of the horizontal control and the horizontal timebase vernier. 3. With the horizontal control set to external mode (Ext), connect the external horizontal port (Ext Horiz) to the Mode Out port. Verify that a	No horizontal sweep.	1. Check for a voltage level between −2.0 Vdc and +2.0 Vdc at TP1 of the Scope Amplifier board (A2). If the voltage cannot be brought within range with either the vertical range attenuator or the vertical position control, replace the Front-Panel Interface board (A15). 2. If the voltage at TP1 is okay, replace the Scope Amplifier board (A2).

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
SCOPE (Cont)		
horizontal line whole-length is variable with the horizontal vernier.		
4. Connect the Vert In port to the Mod Out port on the UUT. Set the vertical and horizontal controls for a convenient display. Verify a steady sync is obtained in either Normal or Auto mode and that the point of triggering is adjustable with the Trig Level control. Remove the input signal and verify a horizontal sweep with Auto triggering and no horizontal sweep with Normal triggering.	No vertical sync.	1. Check for sync pulses at pin 12 of the Scope/DVM Control board (A7) and for a nominal SYNC PRESENT level of zero volts at pin 76. If either signal is not present, replace the Scope/DVM Control board. 2. If SYNC PULSE and the SYNC PRESENT lines are okay, replace the Scope Amplifier board (A2).
DISTORTION/SINAD METER		
1. Set the UUT for Generate FM function, Narrowband mode and Tone Memory display. On the Tone Table, set Tone A for 2000.0 Hz. 2. Select Gen/Mon Mtr display and continuous (Cont) Tone modulation. Turn the Ext Level and the 1 KHz Level controls OFF. Adjust the Code Synthesizer level control (Code Synth Lvl) for an FM deviation of 1.88 kHz, as read on the CRT display. 3. Without disturbing the Code Synth Lvl control, turn the Code Synthesizer OFF. Turn ON the 1 KHz Level control and adjust for an FM deviation of 7.5 kHz on the CRT display. 4. Connect the Mod Out port to the SINAD In port on the UUT. Verify a SINAD reading greater than 25 dB. 5. Set the Code Synthesizer to continuous mode (Cont) and verify a SINAD reading of 12 dB ± 1 dB.	Distortion/SINAD meter does not work.	1. If the DVM mode checks okay, replace the Scope/DVM Control board. 2. If the DVM mode does not check okay, go to the troubleshooting list for "DVM AC mode does not work."
SCAN MODE		
Set the UUT for Gen/Mon Mtr display. Verify that the RF Scan knob operates properly.		

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
GENERATE MODE		
1. Set the UUT for Generate FM function at 200 MHz and select Gen/Mon Mtr display. Verify an RF-level-output display on the CRT.	No generate output.	1. Remove the RF cable between the RF Synthesizer module (A9) and the RF Input module (A17). Check for a nominal level of 0 dBm at the Synthesizer output. If there is no output, replace the RF Synthesizer module.
2. Connect the RF millivoltmeter with a 50-ohm termination to the Antenna port, and pull the RF Port Select knob on the UUT to the Antenna position. Set the RF step attenuator (Step) to 0 dB and adjust the Variable RF Level control for a displayed output level of +13 dBm. Verify that the RF millivoltmeter reads +13 dBm ±2 dBm.		2. If the Synthesizer output is okay, replace the RF Input module (A17).
	No frequency modulation.	1. Check for the modulation signal at pin 30 of the RF Synthesizer module (A9). If the signal is okay, replace the RF Synthesizer module.
3. Repeat step 2 at the center frequency of 800 MHz.		2. If the modulation signal is not present, proceed to the troubleshooting list under "No DPL (modulation) signal on the CRT."
4. Increase the RF step attenuator setting in 10-dB increments, and verify that the displayed RF level decreases in 10-dB increments.		
5. Set the Code Synthesizer MODULATION switch and the Ext Level control to OFF. Select Narrowband mode and adjust the 1 KHz Level control for a 5-kHz FM-deviation reading on the CRT display. Verify a 1-kHz tone at the speaker output.		
6. Connect the Modulation Meter to the UUT's Antenna Port and pull the RF Port Select knob to the Antenna position. Set the Modulation Meter for a deviation display of 5 kHz ±250 Hz.		
7. Select Wideband mode on the UUT and verify that the CRT displays a deviation of 20 kHz. Also verify that the Modulation Meter shows a peak deviation of 20 kHz ±1 kHz.		
8. Select Modulation display on the UUT and verify a peak-to-peak modulation display of 40 kHz ±2 kHz.		

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
GENERATE MODE (Cont)		
9. Select Generate CW function and verify that there is no modulation on the CRT. 10. Set the UUT for Generate AM function and Gen/Mon Mtr display, and adjust for an RF output level of 0 dBm. Adjust the 1 KHz Level control for a 50% AM reading on the CRT. Verify that the Modulation Meter reads 50% ±10% AM. 11. Select Modulation display and verify a low-distortion 1-kHz sinewave. 12. Set the UUT for Generate SSB/ DSBSC function and verify a low-distortion 1-kHz sinewave on the CRT. 13. Set the UUT for Generate SWP 1-10 MHz function and Scope DC display. Verify a horizontal trace and a center-frequency display on the CRT. 14. Set the UUT for Generate SWP 0.01-1 MHz function and verify the same results as in step 13.		
POWER MONITOR MODE		
Set the UUT to POWER Monitor mode. Set the RF step attenuator at 30 dB, and select Gen/Mon Mtr display. Connect the RF power source to the RF In/Out port. Key the power source and verify a correct power reading on the CRT display. Unkey the power source.	Internal Wattmeter is wrong.	Replace RF Input Module (A17).
MONITOR MODE		
1. Set the UUT to Monitor FM function. Set the Squelch control to OFF and verify the signal-level LED (Sig Lvl) lights up and there is noise at the speaker. Turn the Squelch control fully ON and verify the Sig Lvl LED goes off and there is no noise at the speaker.	No Monitor function.	1. Apply a 10.7-MHz modulation carrier to the RF input. Check for normal receiver operation, but with reduced sensitivity. If the receiver is not working, replace the Receiver board (A8). 2. If the receiver checks okay and the Generate function is okay, replace the RF Input module (A17).

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
MONITOR MODE (Cont)		
2. Repeat step 1 with the AM function.	No monitor frequency-error display.	Go to the troubleshooting list under "Frequency Counter does not work."
3. Repeat step 1 with the SSB/DSBSC function and enable the BFO. After the test, turn the BFO OFF.	Monitor frequency error is wrong.	1. Check for the IF signal at pin 91 of the Scope/DVM Control board (A7). If it is not present, replace the Receiver board (A8).
4. Select the Narrowband FM Monitor function at 300 MHz, and set the RF step attenuator to 0 dB. Connect the RF Signal Generator to the ~~RF In/Out port~~ Antenna and the SINAD Meter to the Demod Out port. Set the RF Signal Generator for a center frequency of 300 MHz and for 3 kHz FM at a 1-kHz rate. Adjust the RF output level from the Signal Generator for a 10-dB reading on the SINAD Meter. Verify that the Signal Generator's level is less than −103 dBm (1.5 μVrms).		2. If the IF signal is present, replace the Scope/DVM Control board.
5. Using the Modulation Meter, calibrate the RF Signal Generator for 3 kHz FM at a 1-kHz rate. Set the Generator for a nominal output level of −60 dBm and connect it to the Antenna port of the UUT. Select Gen/Mon Mtr display and verify a monitor deviation reading of 3 kHz ± 150 Hz.		
6. Calibrate the RF Signal Generator for 50 kHz FM at a 1-kHz rate. Select Wideband mode on the UUT and verify a reading of 50 kHz ± 2.5 kHz on the CRT's deviation display.		
7. Calibrate the RF Signal Generator for 30% AM at a 1-kHz rate. Set the Generator for a nominal output level of −60 dBm and connect it to the Antenna port of the UUT. Select Monitor AM function and Narrowband mode. Verify a monitor-AM reading of 30% ±5%.		
8. Monitor the percent AM displayed on the CRT while increasing the RF level out of the Signal Generator. Verify that the IF-Overload Warning occurs before the displayed AM exceeds a reading of 30% ± 5%.		

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
MONITOR MODE (Cont)		
9. Select Modulation display on the UUT and verify the presence of the received modulation signal. 10. Select Gen/Mon Mtr display and Wideband mode on the UUT. Vary the center frequency on either the UUT or the Signal Generator, and verify that the frequency-error display properly represents the difference between the UUT's center frequency and the Signal Generator's center frequency. 11. Select IF display on the UUT and verify an IF envelope on the CRT.		
SPECTRUM ANALYZER		
1. Set the UUT for Monitor function at 300 MHz, Spectrum Analyzer display, and 0-dB input attenuation. Connect the Signal Generator to the Antenna port on the UUT. Verify a spectral amplitude of −40 dBm ± 3 dB on the CRT display. Increase the RF step attenuator setting in 10-dB increments, verifying that the spectral amplitude decreases by 10 dB ± 2 dB with each step. 2. Verify the dispersion control (Dispr) works.	No spectrum-analyzer sweep. Spectrum display is wrong.	1. Check pin 67 of the Processor Interface board (A11) for a 100-Hz square wave. If it is not present, replace the Processor Interface board. 2. If there is a 100-Hz signal, replace the Scope/DVM Control board (A7). Replace the Receiver board (A8).
DUPLEX GENERATOR		
1. Select Duplex Gen display and Monitor FM function at a monitor frequency of 100 MHz. Set the offset frequency to 45 MHz. With the Image switch set on Low, verify a displayed Duplex frequency of 55 MHz. Set the Image switch to High, and verify a displayed Duplex frequency of 145 MHz.	No Duplex output.	Replace the RF Input module (A17).

Table 4-2. System Checkout and Troubleshooting Procedures (Cont)

Checkout Procedure	Fault	Troubleshooting Procedure
SCAN MODE (Cont)		
2. Set the offset frequency on the screen for 0 to 10 MHz, and verify displayed Duplex frequencies from 100 to 110 MHz. 3. Set the UUT to Generate FM function with Duplex Gen display. With the Code Synthesizer and the external modulation sources OFF, adjust the 1 KHz Level control for an FM-deviation reading of 20 kHz on the CRT. Select Monitor function and set the offset frequency to 0 Hz. Connect the DUPLEX GEN Output port to the Antenna port, and verify an FM-deviation reading of 20 kHz ± 1 kHz on the CRT.		

Table 4-3. Test-Point Identification
(All test points are located near the top edge of the board. Count them from left to right, as you face the component-side of the board.)

Test-Point Number	Signal Name
Scope Amplifier Board (A2)	
1	VERTICAL DRIVE
2	VERTICAL DEFLECTION DRIVE
3	VERTICAL DEFLECTION DRIVE
4	HORIZONTAL DEFLECTION DRIVE
5	HORIZONTAL DEFLECTION DRIVE
6	HORIZONTAL DRIVE
7	CRT Z-AXIS
8	TIME BASE OUTPUT
9	FOCUS TV
10	INTENSITY TV
Low-Voltage Power Supply - Battery Charger Board (A3)	
1	FREQUENCY STANDARD SUPPLY
2	BATTERY CHARGER SUPPLY
Low-Voltage Power Supply - Control Board (A4)	
1	DC CURRENT SENSE
2	AC CURRENT SENSE
3	FREQUENCY STANDARD SUPPLY
4	ERROR VOLTAGE REFERENCE
5	V_L
6	V_S

Table 4-3. Test-Point Identification (Cont)

Test-Point Number	Signal Name
Low-Voltage Power Supply - Output Board (A5)	
1	+110V
2	+33V
3	+12V
4	−5V
5	+5V
6	−12V
7	−110V
Low-Voltage Power Supply - Switcher Board (A6)	
1	AC DRIVE
2	AC DRIVE
3	DC DRIVE
4	DC DRIVE
Scope/DVM Control Board (A7)	
1	VERTICAL CHARACTER SYNC
2	EXT DVM TO A/D
3	+15V
4	POSITIVE PEAK DETECTOR
5	INT DVM TO A/D
6	NEGATIVE PEAK DETECTOR
7	CARRIER + MOD LEVEL
8	CHARACTER GEN RESET
9	GND
10	GND
11	+8V
12	−8V

Table 4-3. Test-Point Identification (Cont)

Test-Point Number	Signal Name
Audio Synthesizer Board (A10)	
1	SYNTH DPL AUDIO
2	DPL CLOCK
3	UNFILTERED DPL
4	SYNTH D/A OUTPUT
5	GROUND
6	COMPOSITE MODULATION AUDIO
7	COMPOSITE EXTERNAL MOD AUDIO
8	SYNTHESIZER CLOCK 104,857.6 HZ
9	1 KHZ MODULATION SOURCE
Processor Interface Board (A11)	
1	A/D INPUT
2	DVM/FREQ COUNTER SELECT
3	FREQUENCY COUNTER INPUT
Processor (A14)	
1	CHARACTER LINE CLOCK
2	CHARACTER ROW CLOCK
3	250 KHZ
4	DOT CLOCK
5	$\overline{\text{RESET}}$
6	$\overline{\text{HALT}}$
7	Q
8	R/W
9	E
Front-Panel Interface Board (A15)	
1	ATTENUATOR BUFFER OUTPUT