

**O P E R A T I N G   I N F O R M A T I O N**

**TRACKING GENERATOR  
COUNTER**

**8443A**

**TRACKING GENERATOR**

**8443B**

DUPLICATE OF SECTIONS 1 THRU 3  
OF YOUR OPERATING AND SERVICE MANUAL  
KEEP WITH INSTRUMENT

MAY 1972

HEWLETT  PACKARD

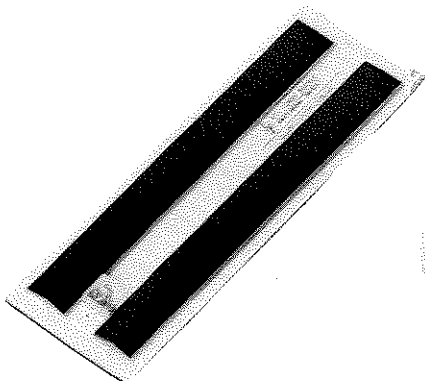


**8443A TRACKING GENERATOR/COUNTER**



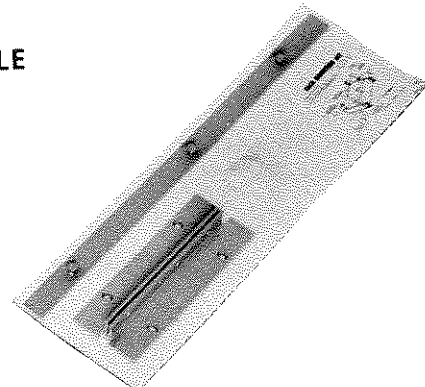
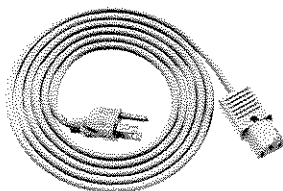
**8443B TRACKING GENERATOR**

**JOINING KIT**



**RACK MOUNTING KIT**

**POWER CABLE**



*Figure 1-1. Models 8443A Tracking Generator/ Counter, 8443B Tracking Generator, and Accessories.*

## SECTION I GENERAL INFORMATION

### 1-1. INTRODUCTION

1-2. This manual contains all information required to install, operate, test adjust and service the Hewlett-Packard Model 8443A Tracking Generator/Counter and the Model 8443B Tracking Generator. This section covers instrument identification, description, options, accessories, specifications and other basic information.

1-3. Figure 1-1 shows the 8443A and 8443B with the supplied accessories.

1-4. The various sections in this manual provide information as follows:

- a. SECTION II, INSTALLATION, provides information relative to incoming inspection, power requirements, mounting, packing and shipping, etc.
- b. SECTION III, OPERATION, provides information relative to operating the instrument.
- c. SECTION IV, PERFORMANCE TESTS, provides information required to ascertain that the instrument is performing in accordance with published specifications.
- d. SECTION V, ADJUSTMENTS, provides information required to properly adjust and align the instrument after repairs are made.
- e. SECTION VI, PARTS LISTS, provides ordering information for all replaceable parts and assemblies.
- f. SECTION VII, MANUAL CHANGES, provides manual back-dating information.
- g. SECTION VIII, SERVICE, includes all information required to service the instrument.

### 1-5. INSTRUMENTS COVERED BY MANUAL

1-6. Hewlett-Packard instruments carry a ten digit serial number (see Figure 1-2) on the back panel. When the prefix on the serial number plate of your instrument is the same as one of the prefix numbers on the inside title page of this manual, the manual applies directly to the instrument. When the instrument serial number prefix is not listed on the inside title page of initial issue, manual change

sheets and manual up-dating information are provided. Later editions or revisions to the manual will contain the required change information in Section VII.

### 1-7. DESCRIPTION

1-8. The Model 8443A/B was designed to be used in conjunction with the Hewlett-Packard 8553/8552 Spectrum Analyzer. The Tracking Generator provides a CW signal which tracks the frequency tuning of the spectrum analyzer or restores the Spectrum Analyzer input signal.

1-9. As implied by the instrument name, the Model 8443A also includes a counter section. The counter section may be used to count the output frequency of the tracking generator or the frequency of signals generated by external sources (up to better than 120 MHz). A rear panel connector provides BCD data output from the counter section for use in external equipment such as a recorder.

1-10. The time base for the Model 8443A counter section is a stable oven-contained, crystal-controlled 1 MHz oscillator. Provisions are made to use an external 1 MHz source for the time base if a frequency standard is available. An output from the internal 1 MHz source is also available for use in external equipment if desired.

1-11. The Model 8443A Counter Section may be operated in one of three modes. They are:

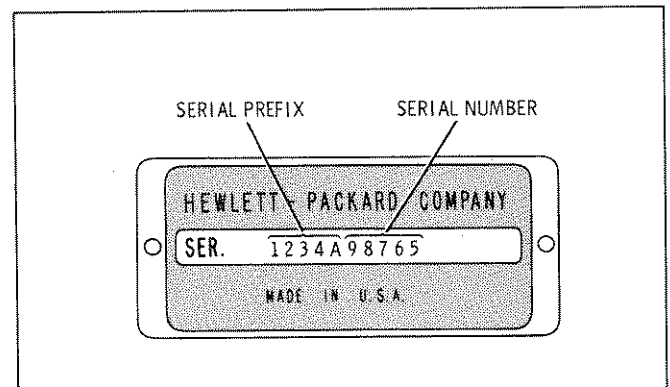


Figure 1-2. Instrument Identification

Table 1-1. Model 8443A/B Specification

SPECIFICATIONS	
NOTE	Function:
<p>Numbered specifications coincide with numbered performance tests in Section IV.</p> <p><b>TRACKING GENERATOR</b></p> <ol style="list-style-type: none"> <li><b>Frequency Range:</b> 100 kHz to 110 MHz. (Output frequency tracks the 8553/8552 Spectrum Analyzer tuning.)</li> <li><b>Amplitude Range:</b> &lt;-120 dBm to +10 dBm in 10 and 1 dB steps with a continuous 1.2 dB vernier.</li> <li><b>Amplitude Accuracy (flatness):</b> ±0.5 dB. Output attenuators 10 dB steps ±0.2 dB, 1 dB steps ±0.1 dB. Absolute: 0 dBm at 30 MHz ±0.3 dB.</li> <li><b>Output Impedance:</b> 50 ohms, AC coupled, reflection coefficient ≤0.09 (1.2 SWR); output &lt;0 dBm.</li> </ol> <p><b>*COUNTER</b>  <b>Modes:</b>  <b>Marker:</b> Counter reads frequency at marker position on the Spectrum Analyzer Display.  <b>Scan Hold:</b> Scan starts at left edge of display and stops at marker. Counter measures frequency continually.  <b>External:</b> Counter measures frequency of signal at counter input.</p> <ol style="list-style-type: none"> <li><b>Measurement Range:</b> 100 kHz to 110 MHz. Display; 7 digits with 1 digit overrange.</li> <li><b>Resolution (gate time):</b> 1 kHz (1 mS), 100 Hz (10 mS) and 10 Hz (100 mS).</li> <li><b>Accuracy:</b> ±1 count ± time base accuracy.</li> <li><b>Time Base Aging Rate:</b> &lt;3 x 10<sup>-9</sup> per day. (0.3 Hz/day) after warmup.</li> <li><b>Time Base Temperature Drift:</b> &lt;3 x 10<sup>-8</sup> (3 Hz) variation, 0 to 55 °C.</li> </ol>	<p><b>Restore Signal:</b> Counter reads frequency of an unknown signal to counter accuracy when marker is placed anywhere on signal response. Typically 15 dB signal-to-noise ratio required for restored operation.</p> <p><b>Track Analyzer:</b> RF OUTPUT tracks spectrum analyzer tuning for swept frequency at marker on spectrum analyzer CRT.</p> <p><b>External Inputs:</b></p> <ol style="list-style-type: none"> <li><b>Counter:</b> 10 kHz to 120 MHz, 50 ohms, -10 dBm minimum, +25 dBm maximum.</li> <li><b>Time Base:</b> 1 MHz, 40 ohms, 1 Vrms minimum.</li> </ol> <p><b>Auxiliary Outputs:</b></p> <ol style="list-style-type: none"> <li><b>Time Base:</b> 1 MHz, 1 V rms nominal.</li> <li><b>Digital Frequency Output:</b> 8,4,2,1, code: positive logic.</li> </ol> <p><b>GENERAL:</b>  <b>Temperature Range:</b> Operation 0 to 55 °C, storage, -40 to +75 °C.  <b>Power:</b> 115 V or 230 V, 48-440 Hz, 75 watts. (When the instrument is in standby power consumption is 30 watts.)  <b>RFI:</b> Meets or exceeds MIL-I-6181D.</p> <p><b>DIMENSIONS:</b> 18-3/4 L x 16-3/4 W x 3-7/8 H.  <b>WEIGHT:</b> 24 lbs, 5 oz. (11,02 kg)</p> <p>* 8443A only</p>

a. **EXTERNAL.** For use in measuring frequency of external signals not related to the Model 8443A or the Spectrum Analyzer.

b. **MARKER.** In this mode the scan ramp of the Spectrum Analyzer is stopped momentarily at a point determined by the Model 8443A **MARKER POSITION** control. At the point where the scan is stopped a bright marker appears on the analyzer display CRT. Simultaneously, the **RF OUTPUT** frequency from the Tracking Generator is counted by the Model 8443A Counter. If the **FUNCTION** switch is set to **TRACK ANALYZER**, the counter frequency indicates marker frequency, independent of Spectrum Analyzer input signal frequency. If the **FUNCTION** switch is set to **RESTORE SIGNAL**, the counter indicates the Spectrum Analyzer input signal frequency (as long as the marker is placed on the signal response).

c. **SCAN HOLD.** In this mode operational sequence is similar to the **MARKER** mode except that when the scan is stopped it will not restart until the operator changes the mode of operation. The counter will count continually in the **SCAN HOLD** mode. The marker position may be controlled manually by the **MARKER POSITION** control to measure the frequency at any point on the CRT.

1-12. A three-position **RESOLUTION** control on the Model 8443A provides counter readouts (in MHz) to accuracies of 10 Hz, 100 Hz and 1 kHz.

1-13. The output of the Model 8443A/B is level ( $\pm 0.5$  dB) from 100 kHz to 110 MHz. The output level may be adjusted, by means of three front panel controls, to any level between +10 dBm and -123.2 dBm.

1-14. Complete specifications for the Model 8443A/B are provided in Table 1-1.

### 1-15. COMPATIBILITY

#### 1-16. Spectrum Analyzer RF Section

1-17. **8553L.** The HP Model 8553L that does not have the TG-1 modification installed requires a modification to provide compatibility with the Model 8443B and the Model 8443A. Modification kit part number is 08553-6065; after modification, the unit is designated 8553L-TG-2.

#### NOTE

The TG labels should be on the rear panel next to the serial number.

1-18. The HP Model 8553L that has the TG-1 modification installed requires an additional modification to provide compatibility with the Model 8443A with serial numbers prefix 1217A and above. The modification kit part number is 08553-60142; after modification, the unit is designated 8553L-TG-2.

1-19. **8553B.** The HP Model 8553B with serial number prefix 1215A and above is fully compatible with the Model 8443A/B. The Model 8553B with serial number prefix 1144A and below requires a modification to provide compatibility with the Model 8443A with serial number prefix 1217A and above. The modification kit part number is 08553-60142; after modification, the unit is designated 8553B-TG-2.

1-20. **Spectrum Analyzer IF Section**

1-21. **8552A.** The HP Model 8552A with serial number prefix 1213A and above is fully compatible with the Model 8443A/B. The Model 8552A with serial number prefix 945- and below that does not have the TG-1 modification installed requires a modification to provide compatibility with the Model 8443B and the Model 8443A. The modification kit part number is 08552-6060; after modification, the unit is designated 8552A-TG-2.

1-22. The HP Model 8552A with serial number prefix 1144A and below that has the TG-1 modification installed requires an additional modification to provide compatibility with the Model 8443A with serial number prefix 1217A and above. The modification kit part number is 08552-60159; after modification, the unit is designated 8552A-TG-2.

1-23. **8552B.** The HP Model 8552B with serial number prefix 1210A and above is fully compatible with the Model 8443A/B. The Model 8552B with serial number prefix 1209A and below requires a modification to provide compatibility with the Model 8443A with serial number prefix 1217A and above. The modification kit part number is 08552-60159; after modification, the unit is designated 8552B-TG-2.

#### 1-24. Spectrum Analyzer Display Section

1-25. Display section models 140A, 140S, 141A and 141S all require HP modification kit number 00140-69504 to provide compatibility with the Model 8443A/B.

1-26. Display section models 140T and 141T are compatible with the Model 8443A/B.

#### 1-27. ACCESSORIES SUPPLIED

1-28. The following accessories are provided with the Model 8443A/B:

- a. An interconnecting cable for use between the Spectrum Analyzer and the 8443A/B (HP 08443-60009). (See Figure 3-2.)
- b. A power cable (HP 8120-1348).
- c. A rack mounting kit (HP 5060-8739).
- d. A joining bracket kit (HP 5060-8543).

**1-29. ACCESSORIES NOT SUPPLIED**

1-30. A Service Kit, HP part number 08443-60011 is recommended for maintenance purposes. An HP 562A-16C Interface Cable can be used to connect

the 8443A/B BCD output to an HP 5050 Digital Recorder.

**1-31. WARRANTY**

1-32. Certification and Warranty information for the Model 8443A/B appears on the inside front cover of this manual.

## SECTION II INSTALLATION

### 2-1. INITIAL INSPECTION

#### 2-2. Mechanical Check

2-3. Check the shipping carton for evidence of damage immediately after receipt. If there is any visible damage to the carton, request the carrier's agent to be present when the instrument is unpacked. Inspect the Model 8443A/B for physical damage such as bent or broken parts and dents or scratches. If damage is found refer to paragraph 2-6 for recommended claim procedures. If the Model 8443A/B appears undamaged, perform the electrical check (see paragraph 2-4). The packaging material should be retained for possible future use.

#### 2-4. Electrical Check

2-5. The electrical performance check consists of following the procedures listed in paragraphs 4-10 to 4-22. These procedures allow the operator to determine that the instrument is, or is not, operating within the specifications listed in Table 1-1. The initial performance and accuracy of the instrument are certified as stated on the inside front cover of this manual. If the Model 8443A/B does not operate as specified, refer to paragraph 2-6 for the recommended claim procedure.

### 2-6. CLAIMS FOR DAMAGE

2-7. If physical damage is found when the instrument is unpacked notify the carrier and the nearest Hewlett-Packard Sales/Service Office immediately. The Sales/Service Office will arrange for repair or replacement without waiting for a claim to be settled with the carrier.

2-8. The warranty statement for the Model 8443A/B is on the inside front cover of this manual. Contact the nearest Sales/Service Office for information about warranty claims.

### 2-9. PREPARATION FOR USE

#### CAUTION

Before applying power check the rear panel slide switch for proper position (115 or 230 volts).

### 2-10. Power Requirements

2-11. The model 8443A/B may be operated on 115 or 230 volts ac  $\pm 10\%$  at 48 to 440 cycles, single phase. Power required is 75 watts. The 115/230 volt slide switch on the rear of the instrument must be in the correct position to avoid damage to the instrument. When shipped, the instrument is set for 115 volt ac operation.

### 2-12. Power Cable

2-13. To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a detachable three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cable three-prong connector is the ground connection. When using a three-prong to two-prong adapter the ground lead on the adapter should be grounded to retain the safety feature.

### 2-14. Operating Environment

2-15. The Model 8443B does not require forced air cooling when operating at temperatures from 0 to 55°C (32 to 131°F). Normal air circulation will maintain a reasonable temperature within the instrument. The 8443A is equipped with a fan which is capable of keeping the instrument ambient temperature within reasonable limits when the instrument is operated at temperatures between 0° to 55°C (32° to 131°F).

### 2-16. Bench Operation

2-17. The Model 8443A/B cabinet has plastic feet and a foldaway tilt stand for convenience in bench operation. The tilt stand permits inclining the instrument for ease in viewing the frequency read-out. The plastic feet are shaped to provide clearance for air circulation and to make modular cabinet width instruments self-aligning when stacked. The instrument may also be rack mounted. A joining bracket kit is provided to assure a common ground between the Model 8443A/B and the Spectrum Analyzer.

**2-18. STORAGE AND SHIPMENT**

**2-19. Original Packaging**

2-20. The same containers and materials used in factory packaging can be obtained through the Hewlett-Packard Sales/Service Offices listed at the rear of this manual.

2-21. If the Model 8443A/B is being returned to Hewlett-Packard for servicing attach a tag indicating the type of service required, return address, model number and full serial number. Also mark the container FRAGILE to assure careful handling.

2-22. In any correspondence refer to the instrument by model number and full serial number.

**2-23. Other Packaging Materials**

2-24. The following general instructions should be used for repackaging with commercially available materials.

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard Service Office or center, attach a tag indicating the type of service required, return address, model number and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 350 pound test material is adequate.

c. Use enough shock-absorbing material (three to four inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.



## SECTION III OPERATION

### 3-1. INTRODUCTION

3-2. This section provides operating instructions for the HP Model 8443A Tracking Generator/Counter and the Model 8443B Tracking Generator.

3-3. Operating instructions for the HP Model 8553/8552 Spectrum Analyzer, which must be interconnected with the Model 8443A/B, are not included in this manual except as required in initial setup and operation. The operator should be thoroughly familiar with operation of the Spectrum Analyzer or have the appropriate manual on hand.

### 3-4. PANEL FEATURES

3-5. Front and rear panel controls, indicators and connectors are identified and described in Figures 3-1 and 3-2. For the 8443B, disregard references to the Counter controls; the Tracking Generator controls are the same in both instruments.

### 3-6. OPERATING INSTRUCTIONS

3-7. In view of the simplicity of operation of the Model 8443A/B, the Operator's Checks provide adequate information to assure proper operation of the instrument. However, the operator should experiment with the instrument in order to become more familiar with its operation. It should be noted that the output of any device (within the frequency and amplitude range of the analyzer) may be connected to the RF Section RF INPUT and the frequency at any point of the response counted by the Model 8443A. The input to the device under test may be provided by an external signal generator, or by the output of the Tracking Generator itself.

### 3-8. OPERATOR'S CHECKS

3-9. Use the operator's checks in Figure 3-3 to verify proper operation of the instrument's main functions.

### 3-10. SPECIAL FEATURES

3-11. The output of the internal 1 MHz time base reference oscillator is available for use in external equipment at J4 on the rear of the 8443A.

3-12. An external time base reference signal may be applied to J3 on the rear panel of the Model 8443A. When an external reference signal is used,

the switch located on the top of the A4 Time Base Assembly must be placed in the EXT position.

### 3-13. OPERATOR'S MAINTENANCE

3-14. Operator's maintenance on the Model 8443A/B is limited to fuse replacement and adjustment of the controls indicated in the checkout procedure.

#### NOTE

If maintaining an 8443B, disregard references to the Counter section.

3-15. Adjustment of A7R11 on the marker control board should be made only if the condition described in step j of Figure 3-3 exists. To properly adjust A7R11 first turn the MARKER POSITION control fully clockwise. Adjust the CTR ADJ control so that the marker appears approximately one minor division from the far right CRT graticule line. Turn the MARKER POSITION control fully counterclockwise. The marker should be two minor division or less from the far left graticule line. Now pull the MARKER POSITION control away from the panel and adjust A7R11 to center the marker on the center CRT graticule line.

3-16. Fuse replacement information is provided in Table 3-1.

*Table 3-1. Fuse Information*

Designation	Purpose	Rating
F1	Line Fuse	2 amperes
A15F1	+175 Volt Supply	0.25 ampere
A15F2	+24 Volt Supply	1 ampere
A15F3	+5.8 Volt Supply	2 amperes
A15F4	+20 Volt Supply	1 ampere
A15F5	-12 Volt Supply	1 ampere

### 3-17. TRACKING GENERATOR OPERATION

3-18. The Tracking Generator section of the 8443A and the 8443B is a leveled signal source whose output frequency precisely tracks the Spectrum Analyzer tuning frequency. This output can be used as a source to measure the frequency response of passive and active devices operating within its frequency range.

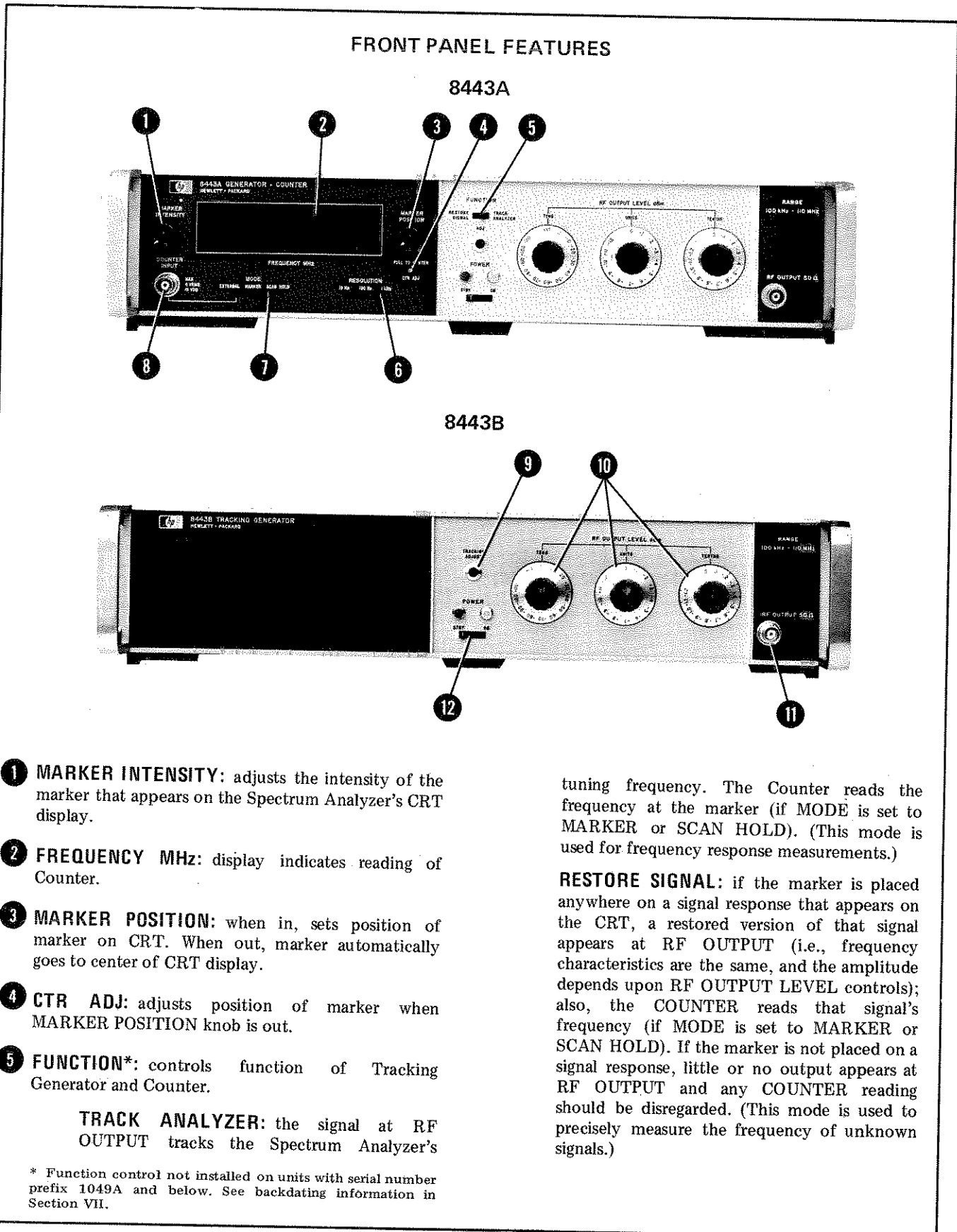


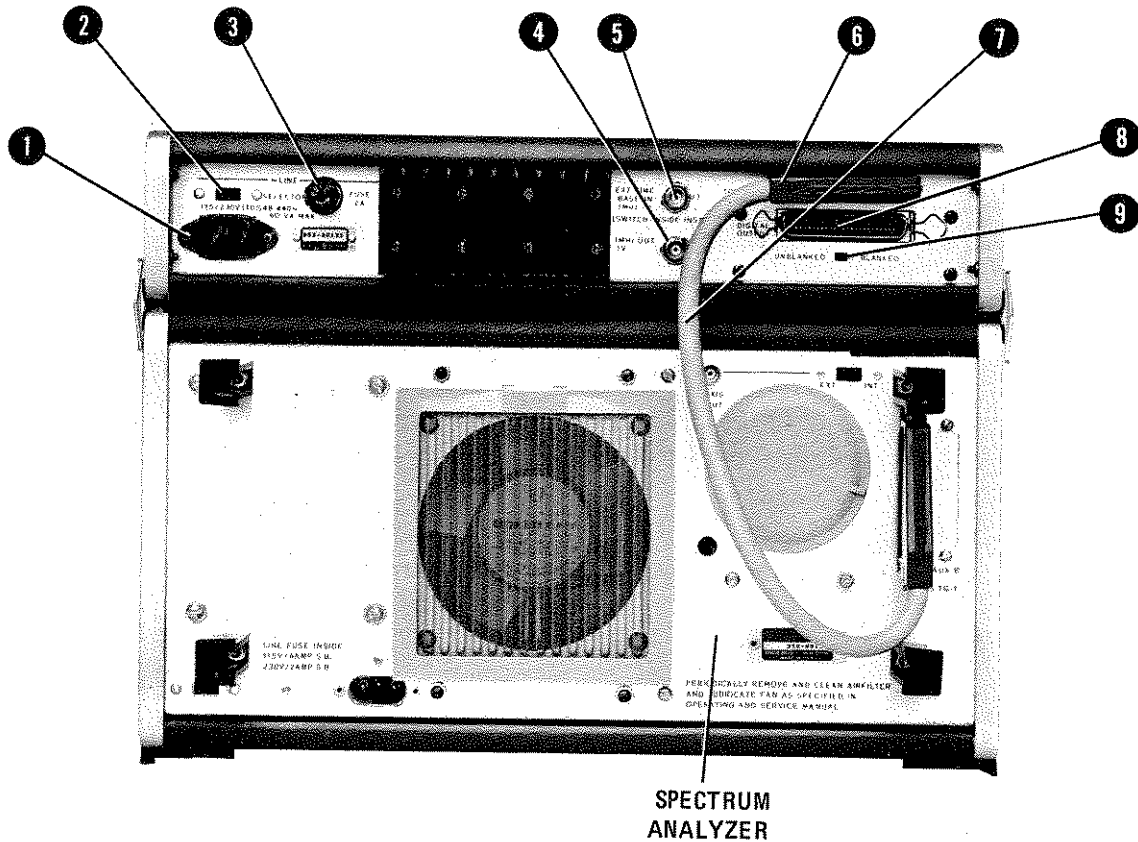
Figure 3-1. Front Panel Controls, Indicators, and Connectors (1 of 2)

## FRONT PANEL FEATURES

- 6 RESOLUTION:** sets frequency resolution of Counter.
- 7 MODE:** controls mode of Counter.
- EXTERNAL:** Counter reads frequency of signal at COUNTER INPUT jack (up to 110 MHz).
- MARKER:** Counter reads frequency at marker.
- SCAN HOLD:** analyzer stops scanning; tuning frequency follows marker, controlled by MARKER POSITION. Counter reads frequency at marker.
- 8 COUNTER INPUT:** external input to frequency counter. Signal level should be  $>-10$  dBm and  $<+15$  dBm. BNC 50 ohm jack.
- 9 TRACKING ADJUST:** centers tracking signal in IF pass-band of Spectrum Analyzer (when FUNCTION is set to TRACK ANALYZER).
- 10 RF OUTPUT LEVEL dBm:** controls set the signal level at the RF OUTPUT jack.
- TENS:** 10 dB steps from +10 to -110 dB.
- UNITS:** 1 dB steps from 0 to -12 dB.
- TENTHS:** 0 to -1.2 dB vernier, calibrated at tenth-dB points.
- 11 RF OUTPUT 50  $\Omega$ :** output for tracking signal. BNC 50 ohm jack.
- 12 POWER:** when in ON position, it applies power to the circuitry (white lamp lights). When in STBY, it removes power from the circuitry (blue lamp lights), however, power is still applied to Counter reference oscillator heater (8443A only).

Figure 3-1. Front Panel Controls, Indicators, and Connectors (2 of 2)

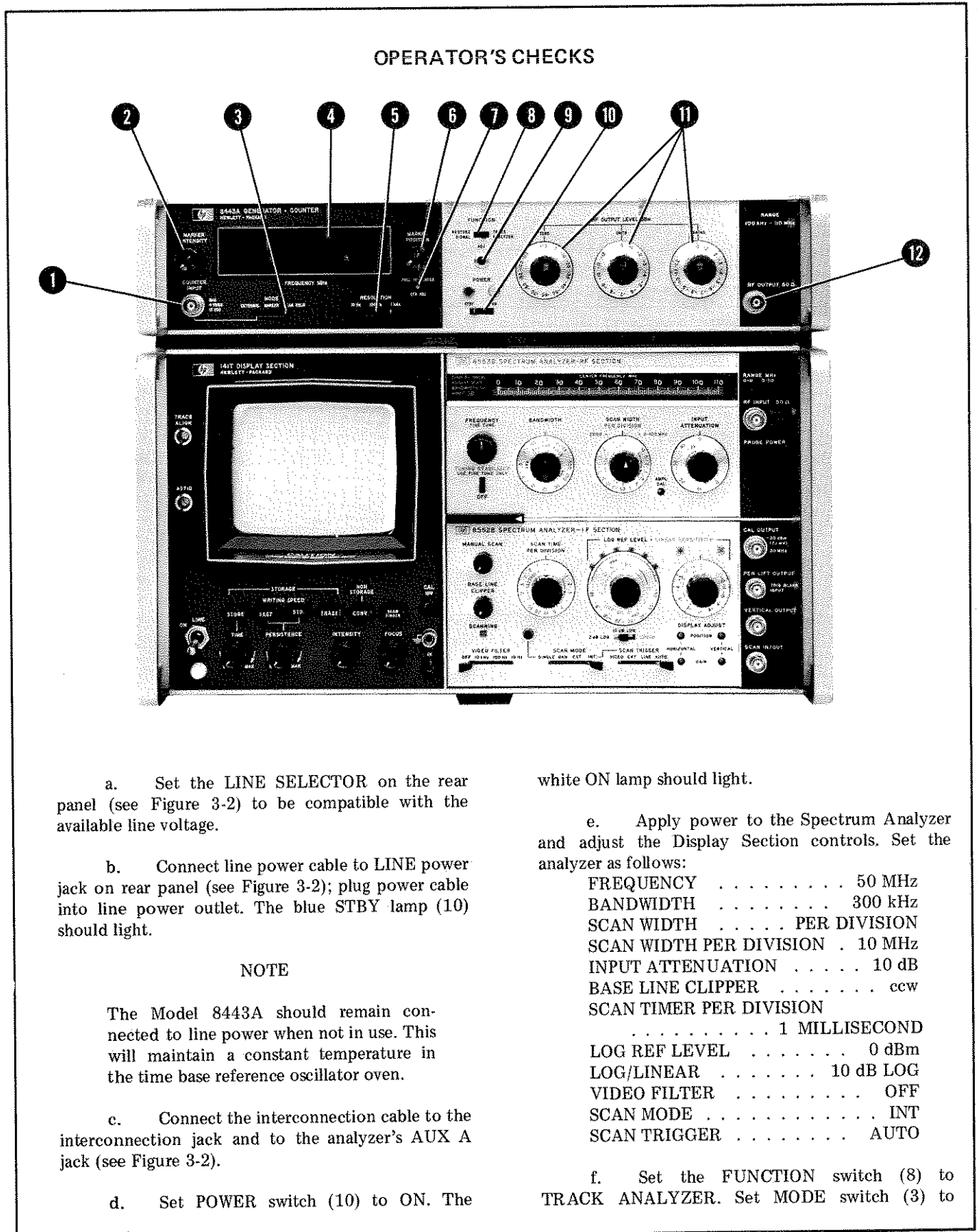
REAR PANEL FEATURES



- 1 **LINE Power Jack:** connection for line power cable.
- 2 **LINE SELECTOR:** used to select 115 or 230 Vac operation.
- 3 **LINE FUSE:** houses line power fuse (fuse value is the same for both voltages).
- 4 **1 MHz OUT:** output for internal time base signal, 1 Vrms (8443A).
- 5 **EXT TIME BASE IN:** input for external time base signal, 1 MHz, >1 Vrms (8443A).
- 6 **Interconnection Jack:** connects to Spectrum

- 7 **Interconnection Cable:** connects to Tracking Generator/Counter interconnection jack and to Display Section AUX A jack.
- 8 **DIGITAL OUTPUT:** BCD output of Counter indication (8443A).
- 9 **UNBLANKED/BLANKED:** in UNBLANKED position, all seven digits are always lit. In BLANKED position, insignificant zeros to the left of the decimal point are blanked (8443A).

Figure 3-2. Rear Panel Controls and Connectors



- a. Set the LINE SELECTOR on the rear panel (see Figure 3-2) to be compatible with the available line voltage.
- b. Connect line power cable to LINE power jack on rear panel (see Figure 3-2); plug power cable into line power outlet. The blue STBY lamp (10) should light.

**NOTE**

The Model 8443A should remain connected to line power when not in use. This will maintain a constant temperature in the time base reference oscillator oven.

- c. Connect the interconnection cable to the interconnection jack and to the analyzer's AUX A jack (see Figure 3-2).
- d. Set POWER switch (10) to ON. The

white ON lamp should light.

- e. Apply power to the Spectrum Analyzer and adjust the Display Section controls. Set the analyzer as follows:

- FREQUENCY . . . . . 50 MHz
- BANDWIDTH . . . . . 300 kHz
- SCAN WIDTH . . . . . PER DIVISION
- SCAN WIDTH PER DIVISION . . . 10 MHz
- INPUT ATTENUATION . . . . . 10 dB
- BASE LINE CLIPPER . . . . . ccw
- SCAN TIMER PER DIVISION . . . . . 1 MILLISECOND
- LOG REF LEVEL . . . . . 0 dBm
- LOG/LINEAR . . . . . 10 dB LOG
- VIDEO FILTER . . . . . OFF
- SCAN MODE . . . . . INT
- SCAN TRIGGER . . . . . AUTO

- f. Set the FUNCTION switch (8) to TRACK ANALYZER. Set MODE switch (3) to

Figure 3-3. Operator's Checks (1 of 2)

## OPERATOR'S CHECKS

MARKER, the RESOLUTION switch (5) to 100 Hz, and RF OUTPUT LEVEL controls (11) to 0 dBm.

## NOTE

If checking an 8443B, disregard references to the Counter controls.

g. Connect RF OUTPUT (12) to the analyzer RF INPUT with a BNC to BNC cable assembly. The trace on the analyzer's CRT display should rise from the baseline to the top graticule line.

h. Set RF OUTPUT LEVEL (11) to -30 dBm. Set the Spectrum Analyzer SCAN WIDTH to ZERO, BANDWIDTH to the narrowest bandwidth, LOG/LINEAR to LINEAR and LINEAR SENSITIVITY to 1 mV/Div. Adjust TRACKING ADJUST (9) for maximum vertical deflection on the CRT. (This assures that the Tracking Generator is accurately tracking the Spectrum Analyzer's tuning frequency.) Re-set the analyzer as set in step e.

i. Change the RF OUTPUT LEVEL controls (11); the trace on the CRT should change as indicated by the controls. (At low output levels it will be necessary to change the analyzer LOG REF LEVEL control to keep the signal above the baseline.)

## NOTE

This concludes the checks that apply to the 8443B.

j. Adjust MARKER INTENSITY (2) for the desired marker intensity. The marker is a bright spot on the trace on the CRT. If it is not visible, check that the MARKER POSITION knob (6) is in (push toward the panel) and turn the knob to position the marker on-screen. (If the marker cannot be positioned on-screen, follow the procedures specified in Paragraph 3-15.)

k. Rotate MARKER POSITION (6) to position the marker to various points on the CRT. The Counter should display whatever frequency is represented by the position of the marker.

l. Pull the MARKER POSITION knob (6) away from the panel; the marker should be near the center vertical graticule line on the CRT. Adjust CRT ADJ (7) to position the marker on the line.

m. Tune the analyzer FREQUENCY control through its range. The Counter should again display whatever frequency is represented by the position of the marker.

n. Set the analyzer to a narrow scan width (20 kHz PER DIVISION or less), and set TUNING STABILIZER to on. Set RESOLUTION (5) to 10 Hz and then to 1 kHz. The Counter's readout (4) should have 10 Hz and then 1 kHz resolution.

o. Push the MARKER POSITION knob (6) in, and set MODE (3) to EXTERNAL. Set RF OUTPUT LEVEL (11) to 0 dBm and connect RF OUTPUT (12) to COUNTER INPUT (1). Set analyzer SCAN WIDTH to ZERO. The Counter should display the frequency the analyzer is tuned to; the marker should not be visible.

p. Set MODE (3) to SCAN HOLD. The analyzer's scan should stop at the marker, and the Counter should display the frequency represented by the position of the marker. The marker (the point at which the scan is stopped) can be positioned at any point on the CRT by the MARKER POSITION control (6).

q. Set MODE (3) to MARKER, RESOLUTION (5) to 1 kHz, and tune the analyzer to a frequency below 10 MHz. Set MARKER POSITION (6) ccw and set the rear panel UNBLANKED/BLANKED switch (see Figure 3-2) to UNBLANKED. The digits to the left of any significant digits that are left of the decimal point should display zeros. Set UNBLANKED/BLANKED to blanked; the zeros should blank (i.e., disappear).

r. Set the analyzer as set in step e. Connect analyzer CAL OUTPUT to RF INPUT. Set FUNCTION (8) to RESTORE SIGNAL. Using MARKER POSITION (6) set marker on skirt of 30 MHz signal; the Counter should indicate approximately 30 MHz. Set marker off signal into baseline noise; the Counter should indicate 0 MHz or random frequencies.

Figure 3-3. Operator's Checks (2 of 2)

3-19. The signal output of the 8443A/B has absolute amplitude calibration. It can be set, in one dB steps, from +10 dBm to -122 dBm. There is also a vernier, calibrated in tenth dB steps, that allows continuously adjustable attenuation over a 1.2 dB range.

### 3-20. Measuring Passive Devices

3-21. To quickly measure the frequency response of a passive device, set the Spectrum Analyzer to display the desired frequency range. Set the RF OUTPUT LEVEL control settings so that:

a. The signal level at the analyzer's input mixer does not exceed -10 dBm (Signal level at input mixer = Signal level at RF INPUT - INPUT ATTENUATION).

b. The signal level out of the 8443A/B will not damage or over-drive the device to be measured.

3-22. Set the analyzer LOG REF LEVEL controls to the same settings as RF OUTPUT LEVEL. Connect the device between the 8443A/B RF OUTPUT and the analyzer RF INPUT. The frequency response of the device will be displayed directly on the CRT. Insertion loss can be read directly from the graticule lines.

### 3-23. Measuring Active Devices

3-24. When measuring active devices, some provision should be made for the gain of the device to prevent damage to the Spectrum Analyzer or to the device. This is readily accomplished using the 8443A/B RF OUTPUT LEVEL controls.

3-25. Set the Tracking Generator and the Spectrum Analyzer using the procedure described for measuring passive devices. However, before connecting the active device between the 8443A/B and the analyzer, *decrease* the signal level out of the 8443A/B by an amount greater than the gain of the device. The gain of the device will be the sum

of the decrease and the dB reading from the CRT graticule. (Remember, this is a negative number on the graticule).

3-26. For example, the Spectrum Analyzer is calibrated for a reference at the top graticule line of the CRT. Then the setting of the RF OUTPUT LEVEL TENS control is decreased 40 dB, and the device is connected between the 8443A/B RF OUTPUT and the analyzer RF INPUT. If the response curve is at the -7 dB graticule line, the gain of the device is 33 dB (40 dB - 7 dB).

### 3-27. Important Considerations

3-28. When using the Tracking Generator for swept response measurements, the Spectrum Analyzer BANDWIDTH control and DISPLAY UNCAL light take on a somewhat different significance. The BANDWIDTH setting mainly affects the average noise level of the analyzer and has only a secondary effect on resolution. Narrowing BANDWIDTH improves dynamic range, but requires slower scan rates.

3-29. In most cases the DISPLAY UNCAL light will not apply. The best procedure in swept response measurements is to slow the scan rate (i.e. increase SCAN TIME PER DIVISION) until the display amplitude remains constant. At this point, the scan is at the proper rate to satisfy the requirements of both the Spectrum Analyzer and the device being measured.

3-30. Spurious responses are not displayed on the CRT due to the tracking signal source and receiver. Therefore measurements can be made over a dynamic range limited only by gain compression as an upper limit and system noise as a lower limit.

3-31. Devices, such as filters, which have attenuation greater than 100 dB can be measured. Trace the response on the CRT in two 70 dB segments; photograph each segment to get a composite picture.

