HEWLETT PACKARD

OPERATING AND SERVICE MANUAL

SPECTRUM ANALYZER RF SECTION 8555A

SERIAL NUMBERS

This manual applies directly to serial numbers prefixed 1436A.

With modifications described in Section VII this manual also applies to serial numbers prefixed 987, 1043A, 1114A, 1116A, 1138A, 1143A, 1203A, 1219A, 1232A, 1311A, 1325A, and 1326A, 1343A, 1416A, and 1429A.

For additional important information about serial numbers see "Instruments Covered by Manual" in Section I.

MANUAL PART NUMBER 08555-90027
MICROFICHE PART NUMBER 08555-90028

Printed: AUGUST 1974

WARNINGS

SAFETY

If this instrument is to be energized via an auto-transformer for voltage reduction, make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THIS INSTRUMENT, the protective earth terminals of this instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding).

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuse holders must be avoided.

Whenever it is likely that the protection offered by fuses has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

GROUNDING

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal is likely to make this instrument dangerous. Intentional interruption is prohibited.

HIGH VOLTAGE

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Adjustments and Service described herein is performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

CAUTIONS

GROUNDING

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that all devices connected to this instrument are connected to the protective (earth) ground.

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.)

LINE VOLTAGE SELECTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the instrument is set to the voltage of the power source.

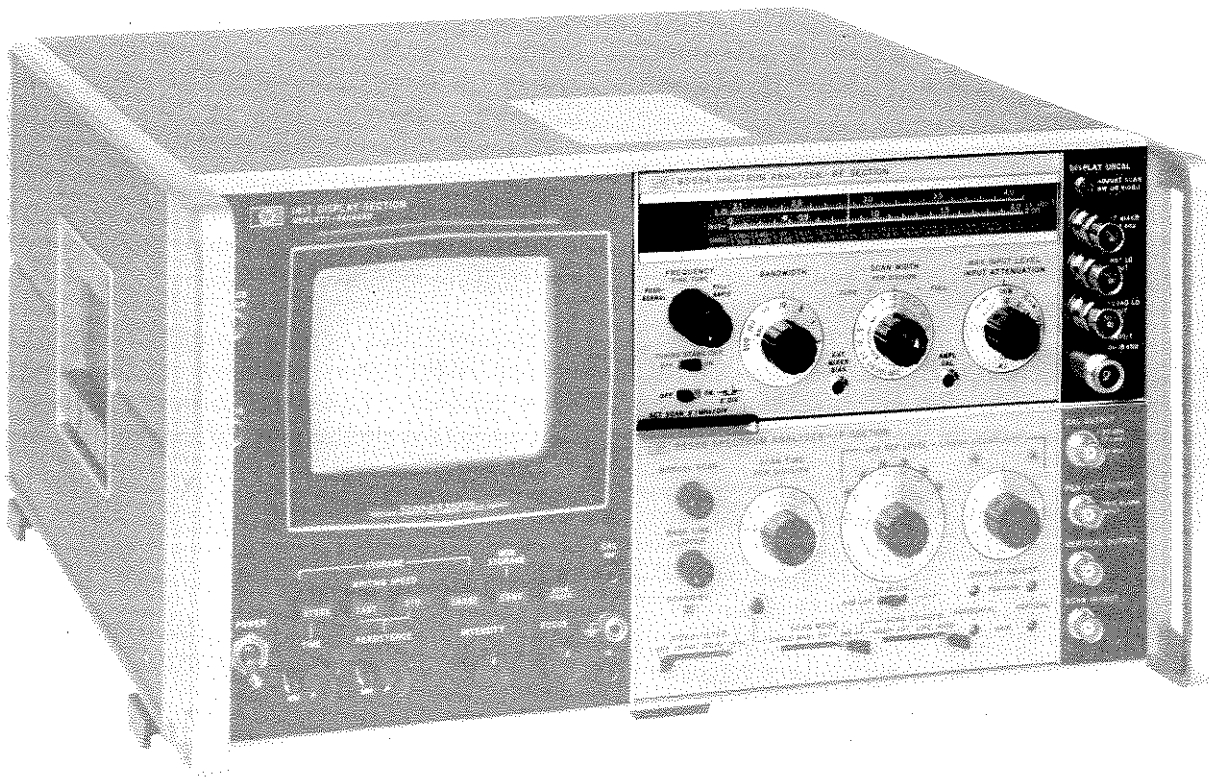


Figure 1-1. Model 8555A Spectrum Analyzer RF Section with 8552B IF Section and 141T Display Section

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 8555A Spectrum Analyzer RF Section. This section covers instrument identification, description, options, accessories, specifications and other basic information.

1-3. Figure 1-1 shows the Hewlett-Packard Model 8555A Spectrum Analyzer RF Section with the Model 8552B Spectrum Analyzer IF Section and the Model 141T Display Section.

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

SECTION II, INSTALLATION, provides information relative to incoming inspection, power requirements, mounting, packing and shipping, etc.

SECTION III, OPERATION, provides information relative to operating the instrument.

SECTION IV, PERFORMANCE TESTS, provides information required to ascertain that the instrument is performing in accordance with published specifications.

SECTION V, ADJUSTMENTS, provides information required to properly adjust and align the instrument after repairs are made.

SECTION VI, REPLACEABLE PARTS, provides ordering information for all replaceable parts and assemblies.

SECTION VII, MANUAL CHANGES, normally will contain no relevant information in the original issue of a manual. This section is reserved to provide back-dated and up-dated information in manual revisions or reprints.

SECTION VIII, SERVICE, includes all information required to service the instrument.

1-5. On the title page of this manual, below the manual part number, is a "Microfiche" part number. This number may be used to order 4 x 6-inch microfilm transparencies of the manual. Each microfiche contains up to 60 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement as well as all pertinent Service Notes.

1-6. WARNINGS AND CAUTIONS

1-7. WARNING. Ensure that the Spectrum Analyzer and any device connected to it are both properly grounded to the same power line ground. An interrupted path from earth ground to an instrument chassis safety ground (an open third-wire ground lead in a cord; for example, see Figure 1-2 below) can develop a potential (V) equal to one half of the power line voltage. This may cause a shock hazard as well as damage to the instrument.

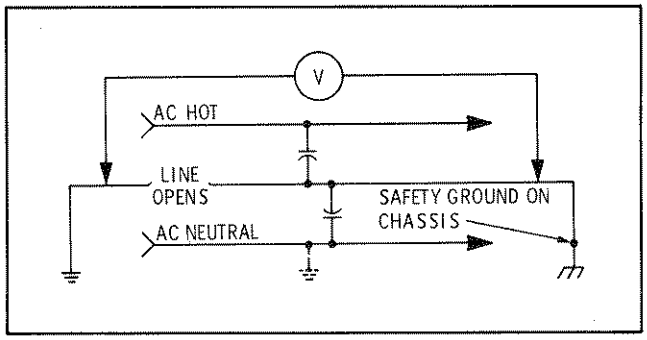


Figure 1-2. Circuit if Equipment Ground Lead Opens

1-8. CAUTION. The input circuits of the Model 8555A are susceptible to burnout if fed an excessively high signal level. To avoid costly repairs and unnecessary down time the following precautions must be taken:

1. Use maximum attenuation when applying signals of unknown amplitude.
2. Ensure that the Spectrum Analyzer Display Section and any signal source to be coupled to the Spectrum Analyzer are both connected to the same power-line ground before connecting an RF cable to the 8555A RF Input. It has been established by HP that floating either instrument from ground may cause damage to the Spectrum Analyzer input mixer assembly.
3. The input attenuation setting should not be changed while dc is applied to the RF Input.
4. Do not connect impulse generators to the Model 8555A RF Input unless they are connected through a Model 8445A Preselector.

5. Observe the following maximum input levels:

Maximum Input Levels	Power		Volts		
	dBm	Watts	Dc	Rms	Peak
Input .01-18 GHz Connector	+33[1]	2[1]	±20[2]	10	14.4
Incident on Input Mixer	+10	10 mW	±20[2]	0.707	1.0

[1]The Input Attenuation Control must be in the 30 dB or greater position when applying +33 dBm or input Mixer will be damaged. The power levels listed apply for peak or average power.

[2]Do not exceed ±20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second.

1-9. INSTRUMENTS COVERED BY MANUAL

1-10. This instrument has a two-part serial number (see Figure 1-3). The first four digits and the letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument.

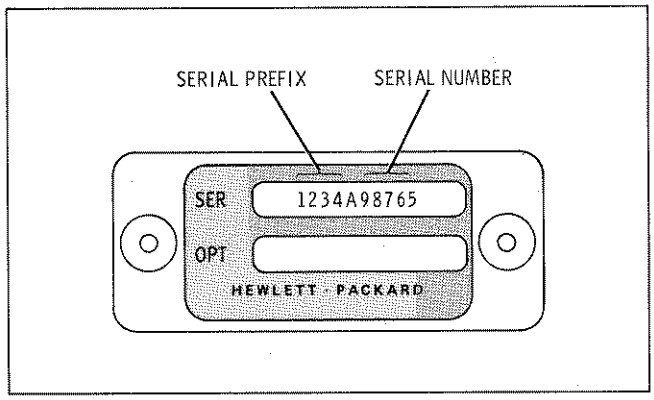


Figure 1-3. Instrument Identification

The contents of this manual apply directly to instruments having the same serial number prefix(es) as listed under SERIAL NUMBERS on the title page.

1-11. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. This unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a yellow Manual Changes supplement that contains "change information" that documents the differences.

1-12. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to this manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-13. For information concerning a serial number prefix not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-14. DESCRIPTION

1-15. The HP Model 8555A Spectrum Analyzer RF Section is shown in Figure 1-1 with the Model 8552B Spectrum Analyzer IF Section and the Model 141T Display Section. Table 1-1, Specifications, and Table 1-2, Supplemental Performance Characteristics, are for the 8555A RF Section *when used with an 8552A/B IF Section and a 140-series Display Section.*

1-16. The 8555A plug-in is the microwave RF Section for use with the 8552-series IF section and the 140-series display section. Together they comprise a receiver that electronically scans an input signal and provides a visual display in the frequency domain. Input signal amplitude is plotted on the CRT as a function of frequency. The amplitude (Y-axis) of the CRT is calibrated in absolute units of power (dBm) or voltage (μV/mV) (50-ohm system): accordingly, absolute and relative measurements of both amplitude and frequency can be made.

1-17. The analyzer RF and IF sections form a highly sensitive super-heterodyne receiver with spectrum-scanning capabilities over the frequency range of 10 MHz to 40 GHz in 14 frequency bands. The analyzer presents a calibrated CRT display up to 2 GHz wide. Absolute calibration accuracy is maintained from 10 MHz to 18.0 GHz in 10 bands, using internal mixing. The frequency range from 12.4 GHz to 40 GHz is covered in 4 bands through the use of external mixers.

1-18. Instrument controls are arranged so that the operator can identify, type, and measure signal parameters with a minimum of switching. For wide-spectrum analysis, the operator can choose a preset scan width covering the full range of each frequency band. For a more detailed study, the spectrum width can be progressively narrowed to

as little as 2 kHz/div, or the scanning capabilities can be eliminated altogether to use the instrument as a fixed-tuned receiver. A 300 kHz IF bandwidth is automatically selected for full-scan operation; for variable-scan and fixed frequency operation, bandwidths as narrow as 100 Hz can be selected. A single switch will automatically enable the first LO tuning stabilization circuit when scan widths of 100 kHz per division, or less, are selected. A signal identifier circuit, controlled by an on/off switch, allows the operator to quickly determine the harmonic mixing mode and select the appropriate frequency band. The signal identifier can be enabled for scan widths of 1 MHz per division or less.

1-19. OPTIONS

1-20. Option 001. Replaces type N with type APC-7 connector.

1-21. Option 002 for the Model 8555A is a limiter which can be installed between the RF Section's INPUT port and the input attenuator to protect input circuitry from being overdriven. See Appendix A for details regarding Option 002.

1-22. ACCESSORIES SUPPLIED

1-23. The RF Section is shipped with three coaxial type terminations and one multi-section termination. The coaxial terminations are installed on the EXT MIXER port, the FIRST LO OUTPUT port and the SECOND LO OUTPUT port. (See Figure 3-1, items 17, 18, and 19.) The multi-section termination is shipped taped to the top of the RF Section. Install the multi-section termination on the Display Section rear panel. (See item 3, Figure 3-3.) The coaxial terminations are HP part number 11593A and the multi-section termination is HP part number 08553-60122.

1-24. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-25. The 8555A Spectrum Analyzer RF Section must be mated with an 8552-series Spectrum Analyzer IF Section and one of the 140-series Display Sections or 140-series Oscilloscope Mainframes before the units can perform their function as a spectrum analyzer. The 140S/140T/143S Display Sections are equipped with a fixed-persistence/non-storage CRT, whereas the 141S and 141T Display Sections are equipped with a variable-persistence storage CRT. Overlays, to provide LOG and LINEAR graticule scales, are available for use with the standard 140A and 141A Oscilloscope Mainframe.

1-26. Operating accessories for use with the 8555/8552/140 Spectrum Analyzer are listed in Table 1-3. Operating accessories include a waveguide mixer, adapters, filters and a frequency comb generator. An external waveguide mixer and appropriate adapters are required over the frequency range of 18 to 40 GHz.

1-27. WARRANTY

1-28. The 8555A Spectrum Analyzer RF Section is warranted and certified as indicated on the inner front cover of this manual. For further information contact the nearest Hewlett-Packard Sales and Service Office; addresses are provided at the back of this manual.

1-29. RECOMMENDED TEST EQUIPMENT

1-30. Tables 1-4 and 1-5 list the test equipment and test equipment accessories required to check, adjust, and repair the 8555A Spectrum Analyzer RF Section.

Table 1-1. 8555A/8552A/8552B Specifications

FREQUENCY SPECIFICATIONS

FREQUENCY RANGE

Tuning Range

With internal mixer: 0.01 - 18.00 GHz.

With external mixer: 12.4 - 40 GHz.

Selectable continuous coarse (by means of push-pull knob) and fine tuning determine display center frequency.

Harmonic Mixing Mode

Signal Identification: Signal identifier separates unknown input signal in center of CRT into two images 2 divisions apart with image on left slightly less in amplitude when the calibrated frequency scale is advanced to the appropriate band.

Scan Width

Full Scan: Inverted marker positioned by tuning control identifies the frequency that becomes the center frequency for scan width per division and zero scan modes. The width of the scan depends on mixing mode. Scan width = n x 2000 MHz, where n is the mixing mode; e.g., for n = 2, scan width is 4 GHz.

Per Division: 16 calibrated scan widths from 2 kHz/div to 200 MHz/div in a 2, 5, 10 sequence.

Manual Scan: (Available with 8552B only.) Scan determined by front panel control; continuously variable across CRT in either direction.

Zero Scan: Analyzer becomes fixed tuned receiver with frequency set by frequency and fine tune controls and selectable bandwidths by bandwidth control. Amplitude variations are displayed versus time on CRT.

FREQUENCY ACCURACY

Dial Accuracy: n x (±15 MHz) where n is the mixing mode.

Scan Accuracy: Frequency error between two points on the display is less than 10% of the indicated separation.

Stability:

Total Analyzer Residual FM (Fundamental Mixing)

Stabilized	Unstabilized
<100 Hz	<10 kHz
peak-to-peak	peak-to-peak

First LO residual FM typically 30 Hz.

Noise Sidebands: For fundamental mixing. More than 70 dB below CW signal, 50 kHz or more away from signal, with 1 kHz IF bandwidth and 100 Hz video filter.

RESOLUTION

Bandwidth Ranges: IF bandwidths of 0.10 to 300 kHz provided in a 1, 3 sequence.

Bandwidth Accuracy: Individual IF bandwidth 3 dB points calibrated to ±20%. (10 kHz bandwidth ±5%).

Bandwidth Selectivity:

IF Bandwidth	60 dB/3 dB Bandwidth Ratio 8552A	8552B
10 kHz - 300 kHz	20:1	20:1
1 kHz - 3 kHz	20:1	11:1
0.1 kHz - 0.3 kHz	25:1	11:1

AMPLITUDE SPECIFICATIONS

ABSOLUTE CALIBRATION RANGE

Measurement Range

CAUTION

See "Input Specifications" for maximum levels to INPUT .01 - 18 GHz connector and to input mixer.

Log Reference Level: From -130 dBm to +10 dBm, in 10 dB steps. Log reference level vernier, 0 to -12 dB continuously.

Linear Sensitivity: From 0.1 μV/div to 100 mV/div in a 1,2 sequence. Linear sensitivity vernier 1 to 0.25 attenuation ratio continuously.

Sensitivity

Average Noise Level: Specified for 1 kHz bandwidth. Using lower bandwidths will improve average noise level; e.g., use of 100 Hz bandwidth will improve noise level in the 1.5 to 3.55 GHz frequency range from -117 dBm to -127 dBm max.

With INTERNAL Coaxial Mixer

Frequency Range (GHz)	Mixing Mode (n)	IF Freq. (MHz)	Average Noise Level (dBm max.)
0.01 - 2.05	1-	2050	-115
1.50 - 3.55	1-	550	-117
2.07 - 6.15	2-	2050	-108
2.60 - 4.65	1+	550	-117
4.11 - 6.15	1+	2050	-115
4.13 - 10.25	3-	2050	-103
6.17 - 10.25	2+	2050	-105
6.19 - 14.35	4-	2050	- 95
8.23 - 14.35	3+	2050	-100
10.29 - 18.00	4+	2050	- 90

With 11517A EXTERNAL Waveguide Mixer and Appropriate Waveguide Tapers

Frequency Range	Average Noise Level (Typ.)
12.4 - 18.0 GHz	-90 dBm
18.0 - 26.5 GHz	-85 dBm
26.5 - 40.0 GHz	-75 dBm

Table 1-1. 8555A/8552A/8552B Specifications (Continued)

Residual Responses: Referred to signal level at input mixer on fundamental mixing: <-90 dBm.

Display Range

Log: 70 dB, 10 dB/div with 8552B 2 dB/div log expand on a 16 dB display.

Linear: From 0.1 mV to 100 mV/div in a 1, 2 sequence on an 8-division display.

Display Uncalibrated Light: Panel light warns operator of uncalibrated amplitude display if the IF or video bandwidth selected is too narrow for combination of scan width and scan time selected.

Input Attenuator Range: 0 - 50 dB in 10 dB steps.

ABSOLUTE CALIBRATION ACCURACY

The overall absolute calibration accuracy of the spectrum analyzer in a particular application is a function of the measurement technique. The following elements also affect absolute calibration accuracy:

Frequency Response: With 10 dB input attenuator setting.

Frequency Range (GHz)	Mixing Mode (n)	IF Freq. (MHz)	Frequency Response (dB max.)
0.01 - 2.05	1-	2050	±1.0
1.50 - 3.55	1-	550	±1.0
2.07 - 6.15	2-	2050	±1.25
2.60 - 4.65	1+	550	±1.0
4.11 - 6.15	1+	2050	±1.0
4.13 - 10.25	3-	2050	±1.5
6.17 - 10.25	2+	2050	±1.5
6.19 - 14.35	4-	2050	±2.0
8.23 - 14.35	3+	2050	±2.0
10.29 - 18.00	4+	2050	±2.0

IF gain variation with different bandwidth settings: (at 20°C).

Log: ±0.5 dB.

Linear: ± 5.8%.

Amplitude Display: Log ±0.25 dB/dB but not more than ±1.5 dB over the full 70 dB display range.

Linear: ±2.8% of full 8-division deflection.

Input RF Attenuator: Frequency response typically ±0.6 dB from 10 MHz to 18 GHz.

Log Reference Level: Accurate to ±0.2 dB (±2.3% Linear Sensitivity).

Log Reference Level Vernier: Accurate to ±0.1 dB (1.2%) in 0, -6, and -12 dB positions; otherwise, ±0.25 dB (±2.8%).

Calibrator Output: Amplitude -30 dBm, ±0.3 dB. Frequency 30 MHz, ±0.3 MHz (8552A), ±3 kHz (8552B).

INPUT SPECIFICATIONS

Input Impedance: 50Ω nominal (0.01 - 18 GHz).

Reflection Coefficient: <0.130 (1.30 SWR) for input RF attenuator settings ≥10 dB.

Maximum Input Level:

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01 - 18 GHz Connector	+33	2	±20	10	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

[1] The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels listed apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

RF Input Connector: Type N female.

External Mixer Input Connector: BNC female; LO power transfer to external mixer through connector as well as 2.05 GHz IF signal return to spectrum analyzer. LO power typically 0 dBm.

SCAN TIME SPECIFICATIONS

Scan Time: 16 internal scan rates from 0.1 ms/div to 10 sec/div in a 1, 2, 5 sequence.

Scan Time Accuracy: 0.1 ms/div to 20 ms/div, ±10%, 50 ms/div to 10 sec/div, ±20%.

GENERAL SPECIFICATIONS

Power Requirements: 115 or 230 volts ± 10%, 50 - 60 Hz, normally less than 225 watts (varies with plug-in units used).

Dimensions: Model 140T or 141T Display Section, 9-1/16 in. H (incl. feet) x 16-3/4 in. W x 18-3/8 in. D (229 x 425 x 467 mm). Model 143S Display Section, 21 in. H (incl. feet) x 16-3/4 in. W x 18-3/8 in. D (533 x 425 x 467 mm).

Weight:

Model 8555A RF Section: Net 14 lb 15 oz (6,8 kg).

Model 8552A IF Section: Net 9 lb (4,1 kg).

Model 8552B IF Section: Net 9 lb (4,1 kg).

Model 140T Display Section: Net 37 lb (16,8 kg).

Model 141T Display Section: Net 40 lb (18 kg).

Model 143S Display Section: Net 62 lb (28,1 kg).

Table 1-2. Supplemental Performance Characteristics

SUPPLEMENTAL PERFORMANCE CHARACTERISTICS

AMPLITUDE CHARACTERISTICS

For typical sensitivity and frequency response versus input frequency, see Figure 1-4.

Spurious Responses Due to Second Harmonic Distortion: With -40 dBm incident on input mixer.

Frequency Range	2nd Harmonic Distortion
0.1 - 6.2 GHz	<-63 dB
6.2 - 10.3 GHz	<-69 dB
10.3 - 14.4 GHz	<-54 dB
14.4 - 18.5 GHz	<-51 dB

Spurious Responses Due to Third Order Intermodulation Distortion: <-70 dB with -30 dBm incident on input mixer and signal separation >1 MHz.

Video Filter: Post-detection filter used to average displayed noise. With 8552A nominal bandwidths: 10 kHz and 100 Hz. With 8552B nominal bandwidths: 10 kHz, 100 Hz, and 10 Hz.

Gain Compression: For internal mixer gain compression <1 dB for -10 dBm peak or average signal level to input mixer. 11517A external mixer (12.4 - 40 GHz) gain compression, <1 dB for -15 dBm peak or average signal level to input mixer.

FREQUENCY CHARACTERISTICS

RESOLUTION

See Figure 1-5 for curves of typical 8555A/8552A and 8555A/8552A spectrum analyzer resolution for different bandwidths.

FREQUENCY DRIFT

Long Term Drift: (At fixed center frequency, after 2-hour warm-up).

Stabilized: ±3.0 kHz/10 min.

Unstabilized: ±25 kHz/10 min.

Stabilization Range: First LO can be automatically stabilized to internal crystal reference for scan widths of 100 kHz/div or less.

OUTPUT CHARACTERISTICS

First LO Output: +10 dBm; 50 ohms; 2.05 - 4.10 GHz.

Second LO Output: +10 dBm; 50 ohms; 1500 MHz.

Third LO Output: +5 dBm; 50 ohms (rear panel); 500 MHz.

Pen Lift Output: 0 to 14 volts (0 volts during scan cycle). Output available in Int and single scan modes and Auto, Line, and Video scan trigger.

Vertical Output: 100 mV per major division on CRT display; output impedance <100 ohms.

SCAN CHARACTERISTICS

Scan Mode:

Int: Analyzer repetitively scanned by internally generated ramp; synchronization selected by scan trigger.

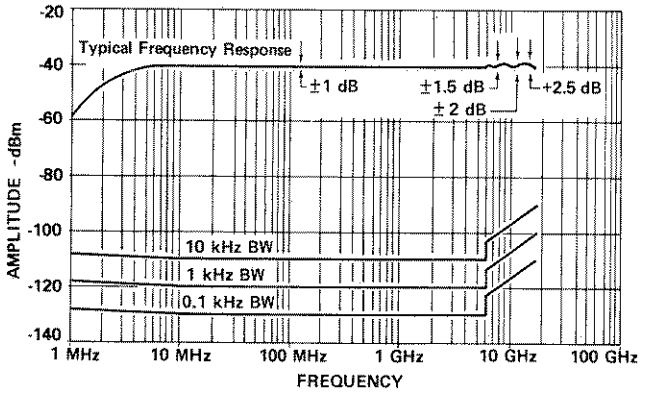


Figure 1-4. Typical Spectrum Analyzer Sensitivity and Frequency Response

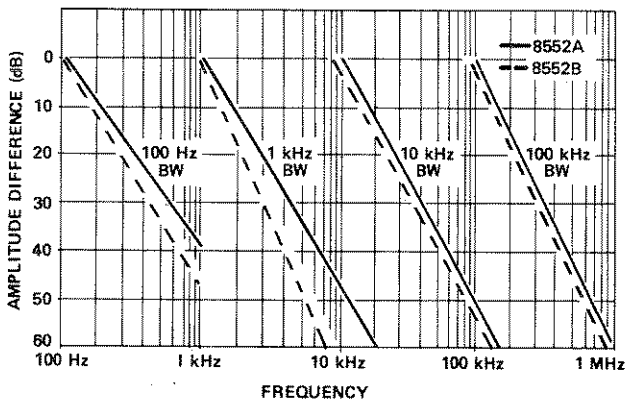


Figure 1-5. Typical Spectrum Analyzer Resolution (Fundamental Mixing)

Table 1-2. Supplemental Performance Characteristics (cont'd)

SUPPLEMENTAL PERFORMANCE CHARACTERISTICS (Continued)

Single: Single scan with reset actuated by front panel pushbutton.

Ext: Scan determined by 0 to +8 volt external signal; scan input impedance >10 kΩ.

Blanking: -1.5V external blanking signal required.

Manual: Scan determined by front panel control; continuously variable across CRT in either direction (8552B only).

Scan Trigger: For Internal Scan Mode, select between:

Auto: Scan free runs.

Line: Scan synchronized with power line frequency.

Ext: Scan synchronized with >2 volt (20 volt max.) trigger signal (polarity selected by internally located switch in IF Section).

Video: Scan internally synchronized to envelope of RF input signal (signal amplitude of 1.5 major divisions peak-to-peak required on display section CRT).

DISPLAY CHARACTERISTICS

Variable Persistence/Storage (Model 141T):

Plug-ins: Accepts Model 8550-series Spectrum Analyzer plug-ins and Model 1400-series time domain plug-ins.

Cathode-ray Tube:

Type: Post-accelerator storage tube, 9000 volt accelerating potential; aluminized P31 phosphor; etched safety glass faceplate reduces glare.

Functions Used with Time Domain Plug-ins Only: Intensity modulation, calibrator, beam finder.

Special Order: Chassis slides and adapter kit: Fixed slides, order HP Part Number 1490-0714; pivot slides, order HP Part Number 1490-0718; slide adapter kit for mounting slides on scope, order HP Part Number 1490-0721.

Persistence:

Normal: Natural persistence of P31 phosphor (approximately 0.1 second).

Variable:

Normal Writing Rate Mode: Continuously variable from less than 0.2 second to more than one minute (typically to two or three minutes).

Maximum Writing Rate Mode: Typically from 0.2 second to 15 seconds.

Erase: Manual; erasure takes approximately 350 ms; CRT ready to record immediately after erasure.

Storage Time: Normal writing rate; more than 2 hours at reduced brightness (typically 4 hours). More than one minute at maximum brightness. Fast writing speed; more than 15 minutes (typically 30 minutes) at reduced brightness or more than 15 seconds at maximum brightness.

Functions Used with Time Domain Plug-ins Only: Intensity modulation, calibrator, beam finder.

Normal Persistence (Model 140T):

Plug-ins: Same as 141T.

Cathode-ray Tube:

Type: Post-accelerator, 7300 volt potential medium-short persistence P7 phosphor; tinted and etched safety glass faceplate reduces glare. (Normal persistence of P7 phosphor approximately 0.3 sec).

Graticule: 8 x 10 division (approximately 7,6 x 9,5 cm) parallax-free internal graticule; five subdivisions per major division on horizontal and vertical axes.

Functions Used with Time Domain Plug-ins Only: Same as 141T.

Normal Persistence Large Screen Display (Model 143S):

Plug-ins: Same as 141T.

Cathode-ray Tube:

Type: Post-accelerator, 20 kV accelerating potential, aluminized P7 phosphor. (Persistence approximately 0.3 sec.)

Graticule: 8 x 10 divisions (approximately 8 x 10 inch) parallax-free internal graticule, five subdivisions per major division on horizontal and vertical axes.

Functions Used with Time Domain Plug-ins Only: Same as 141T.

GENERAL CHARACTERISTICS

CRT BASELINE CLIPPER: Front panel control adjusts blanking of CRT trace baseline to allow more detailed analysis of low-repetition-rate signals and improved photographic records to be made.

Temperature Range: Operating, 0° to +40°C; storage, -40° to +75°C.

Table 1-3. Operating Accessories

Model Number	Name	Description
11517A	Waveguide Mixer	Mixes inputs from 12.4 to 40 GHz with frequencies from first LO HP 10503A Coaxial Cable terminated with BNC male connectors supplied with Mixer
11518A	Adapter	For mating 11517A Waveguide Mixer to P-band (12.4 to 18.0 GHz) system
11519A	Adapter	For mating 11517A Waveguide Mixer to K-band (18.0 to 26.5 GHz) system
11520A	Adapter	For mating 11517A Waveguide Mixer to R-band (26.5 to 40 GHz) system
8406A	Frequency Comb Generator	For calibrating scan-width function; generates precision markers with 1-, 10-, and 100-MHz spacing
8403A	Bandpass Filter	Pass band: 1 - 2 GHz
8431A	Bandpass Filter	Pass band: 2 - 4 GHz
8432A	Bandpass Filter	Pass band: 4 - 6 GHz
8433A	Bandpass Filter	Pass band: 6 - 8 GHz
8434A	Bandpass Filter	Pass band: 8 - 10 GHz
8435A	Bandpass Filter	Pass band: 4 - 8 GHz
8436A	Bandpass Filter	Pass band: 8 - 12.4 GHz
8444A	Tracking Generator	Functions as a frequency response measurement system when used with the Spectrum Analyzer. The system can be used as a sweeper or signal generator 10 MHz to 1.3 GHz.
8445B	Automatic Preselector	Functions to reduce or eliminate signal intermodulation, and multiple and spurious responses. Preselector is a low-pass filter over the 0 to 1.8 GHz range and a voltage tuned filter over the 1.8 to 18 GHz range.
8447D	Preamp	100 kHz - 1.3 GHz low noise preamp; improves sensitivity or average noise level or RF Section approximately 18 dB
360 series	Low-pass Filter	360A cuts off at 700 MHz, 360B cuts off at 1200 MHz
362A series	Low-pass Filter	Acts like bandpass when used with waveguide; available for X, P, K, R bands; eliminates signals outside normal waveguide band

Table 1-4. Test Equipment Required

Item	Minimum Specifications	Suggested Model	Use*
Frequency Comb Generator	Frequency markers spaced 1, 10, 100 MHz apart; usable to 4 GHz Frequency Accuracy: ±0.01% Output Amplitude: > - 40 dBm	HP 8406A Comb Generator	P, A
HF Signal Generator	Frequency Range: 1—50 MHz Output Amplitude: > -20 dBm Output Amplitude Accuracy: ±1% Frequency Accuracy: ±1% Output Impedance: 50 ohms	HP 606A/B HF Signal Generator	P
VHF Signal Generator	Frequency Range: 40—455 MHz Frequency Accuracy: ±1% Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 608E/F VHF Signal Generator	A, T
UHF Signal Generator	Frequency Range: 450—1230 MHz Frequency Accuracy: ±1% Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 612A UHF Signal Generator	T
Signal Generator	Frequency Range: 1.0—2.1 GHz Frequency Accuracy: ±1% Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 8614A/B Signal Generator	A, T
Signal Generator	Frequency Range: 2.0—4.0 GHz Frequency Accuracy: ±1% Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 8616A/B Signal Generator	A
Sweep Oscillator	Frequency Range: 0.1—18 GHz Output Amplitude: > -20 dBm Output Impedance: 50 ohms	HP 8690B Sweep Oscillator with 8693A/B RF Unit 8694A/B RF Unit 8695A/B RF Unit 8699B RF Unit	P
Audio Oscillator	Frequency Range: 10 Hz—10 kHz Output Amplitude: 2 Vrms Frequency Accuracy: 2% Output Impedance: 600 ohms	HP 200CD Audio Oscillator	P
Test Oscillator	Frequency Range: 10 kHz—1.3 MHz Frequency Accuracy: ±3% Output Amplitude: 3 Vrms Output Impedance: 50 ohms	HP 652A Test Oscillator	A
Frequency Counter	Frequency Range: 100 kHz—18.5 GHz Accuracy: ±0.001% Sensitivity: 100 mV rms Readout Digits: 7 digits	HP 5245L Frequency Counter w/ HP 5257A Transfer Oscillator	A, T

*Use: P = PERFORMANCE; A = ADJUSTMENT; T = TROUBLESHOOTING

Table 1-4. Test Equipment Required (cont'd)

Item	Minimum Specifications	Suggested Model	*Use
Tunable RF Voltmeter	Bandwidth: 1 kHz Frequency Range: 1—1000 MHz Sensitivity: 10 mV—1 Vrms Input Impedance: ⩾ 0.1 megohms	HP 8405A Vector Voltmeter	T
Digital Voltmeter	Voltage Accuracy: ±0.2% Range Selection: manual or automatic Voltage Range: 1—1000 Vdc full scale Input Impedance: 10 megohms Polarity: Automatic indication	HP 3440A Digital Voltmeter w/ HP 3443A Plug-in	A, T
Oscilloscope	Frequency Range: Dc to 50 MHz Time Base: 1 us/div to 10 ms/div Time Base Accuracy: ±3% Dual Channel, Alternate Operation Ac or dc Coupling External Sweep Mode Voltage Accuracy: ±3% Sensitivity: 0.005 V/div	HP 180A with HP 1801A Vertical Amplifier and HP 1821A Horizontal Amplifier HP 10004 10:1 Divider Probes (2)	A, T
Power Meter	Frequency Range: 0.01—18.0 GHz Accuracy: ±1% Power Range: -20 to +10 dBm	HP 432A Power Meter with HP 8478B Thermistor Mount	A, T
Power Supply Dual DC	Output Voltage: Variable, 0—30 Vdc Output Current: 0—300 mA Meter Accuracy: 3%	HP 6205B Power Supply	T
DC Volt-Ohm-Ammeter	Voltmeter Voltage Range: 1 mV—300V Accuracy: ±1% Input Resistance: 10 megohms Ammeter Current Range: 1 μA—1A Accuracy: ±2% Ohmmeter Resistance range: 1 ohm—100 megohm Accuracy: ±5% reading at center scale	HP 412A Volt-Ohm-Ammeter	A, T

Table 1-5. Test Accessories

Item	Required Features	Suggested Model
Service Kit	Contents: 140/141 Display Section to Spectrum Analyzer Plug-in Extender Cable Assembly (HP 11592-60015) IF to RF Unit Interconnection Extender Cable Assembly (HP 11592-60016) Selectro Female to BNC Male Test Cable, 36 inches long (HP 11592-60001) Selectro Male to Selectro Female Test Cable, 8 inches long yellow (HP 11592-60003)	HP 08555-60077

Table 1-5. Test Accessories (cont'd)

Item	Required Features	Model
Service Kit	Selectro Female to Selectro Female Cable, 8" long, red (HP 11592-60002) Extender Board Assy, 15 pins, 30 conductors, for plug-in circuit boards (HP 11592-60011) Extender Board Assy, 10 pins, 20 conductors, for plug-in circuit boards (HP 5060-0256) Extender Board Assy, 12 pins, 24 conductors, for plug-in circuit boards (HP 5060-0257) Extender Board Assy, 24 pins, 48 conductors, for plug-in circuit boards (HP 5060-0258) Cable Assy, R & P Female to BNC Male (HP 11592-60013) Cable Assy, SMA Male to BNC Male (HP 08555-60076) Wrench, box-end slotted 3/16-inch (HP 08555-20097) Selectro Jack-to-Jack Adapter (HP 1250-0827) Wrench, open-end, 15/64-inch (HP 8710-0946) OSM Plug-to-Plug Adapter (HP 1250-1158)	HP Service Kit 08555-60077

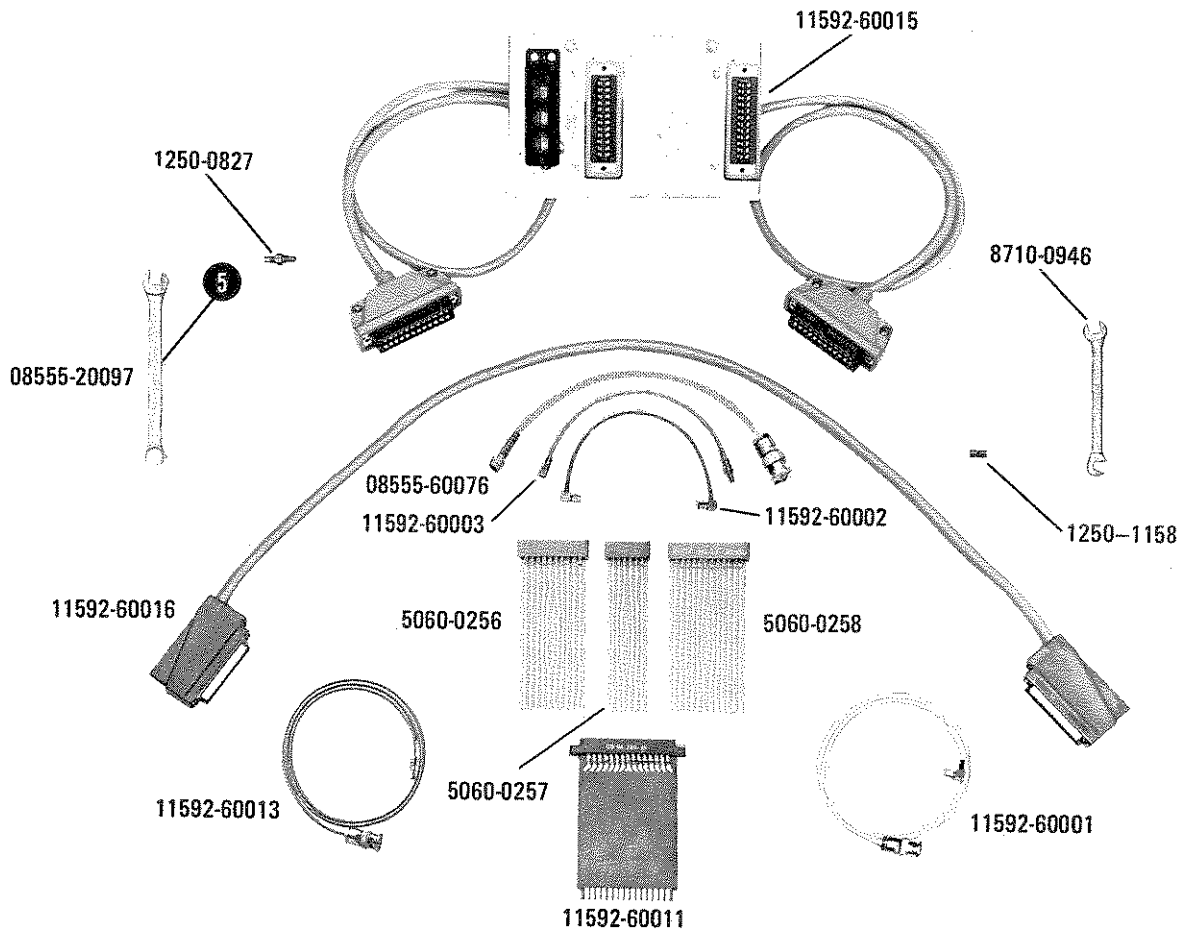


Figure 1-6. HP 08555-60077 Service Kit Required for Adjustment & Service Procedures

Table 1-5. Test Accessories (cont'd)

Item	Required Features	Suggested Model	Use*
10 dB Fixed Attenuator	Frequency Range: Dc—12.4 GHz Flatness: ±0.2 dB	HP 8491A, Option 10	A
12 dB Variable Attenuator	Frequency Range: Dc—1 GHz Flatness: ±0.3 dB	HP 355C	A
VHF Attenuator	Frequency Range: Dc—1 GHz 0—60 dB in 10 dB steps	HP 355D	A
50-ohm Termination	Frequency Range: Dc—18 GHz VSWR: 1:1 Power Rating: 0.5 Watts Connector: Type N Male	HP 909A Coaxial Termination, Option 012	P, A
Dual Directional Coupler	Frequency Range: 100 MHz—2 GHz Directivity: 32 dB	HP 778D Dual Directional Coupler	P, A
Directional Coupler (2)	Frequency Range: 1.7—12.4 GHz Directivity: 26 dB	HP 779D Directional Coupler	P
Coaxial Short	Type N Male Shorting Plug	HP 11512A	P
Low Pass Filter	Cut-off Frequency: 2.2 GHz Insertion Loss: ⩽ 1 dB below 0.9 times cut-off frequency Rejection: ⩾ 50 dB at 1.25 times cut-off freq.	HP 360C Low Pass Filter	P
BNC Tee	Two BNC Female Connectors, one Male BNC Connector	UG-274A/U HP 1250-0781	T
Adapter	SMA Jack to BNC Plug	HP 1250-0831	A
Adapter	BNC Jack to BNC Jack	UG-914A/U HP 1250-0080	A
Adapter	BNC Male to Type N Female	UG-349A/U HP 1250-0077	A, T
Adapter (2)	BNC Female to Type N Male	UG-201A/U HP 1250-0067	P,A.T
Crystal Detector	Frequency Range: 0.01—12.4 GHz Frequency Response: ±0.5 dB	HP 423A	P
Logic Level Indicator	Compatibility: DTL or TTL Power Requirements: 5 volts ±10% across any two pins	HP 10528A Logic Clip	T
Voltage Probe	Dual Banana Plug-to-Probe Tip and Clip (Ground) Lead	HP 10025A Straight-through Voltage Probe	A, T
Cable Assy (2)	Male BNC Connectors, 48 inches long	HP 10503A	P,A,T
Cable Assy	BNC Male to Dual Banana Plug, 45 inches long	HP 11001A	P

*USE: A = ADJUSTMENT; P = PERFORMANCE; T = TROUBLESHOOTING

Table 1-5. Test Accessories (cont'd)

Item	Required Features	Suggested Model	Use*
Cable Assembly	Dual Banana Plug to Clip Lead and Probe, 60 inches long	HP 11003A	A
Cable Assembly	Male Type N Connectors, 72 inches long	HP 11500A	A
Tuning Tool, Blade	Nonmetallic Shaft, 6 inches long	General Cement 5003 (HP 8730-0013)	A, T
Tuning Tool, Slot	Nonmetallic, 6-inch shaft	Gowanda PC9668	A, T
Wrench	Open-end, 15/64-inch	HP 8710-0946	A, T
Wrench	Open-end, 5/16-inch	HP 8720-0030	A, T
Wrench	No. 6, Allen Driver	HP 5020-0289	A, T
Wrench	No. 10, Allen Driver	HP 5020-0291	A, T
Wrench	Nut Driver, 5/16-inch	HP 8720-0003	A, T
Screwdrivers	Phillips No. 1 Phillips No. 2 Pozidriv No. 1 (Small) Stanley No. 5531 Pozidriv No. 2 (Medium) Stanley No. 5332	 HP 8710-0899 HP 8710-0900	A, T A, T A, T A, T
Tuning Tool, Slot	Nonmetallic, 2.5-inch shaft	HP 8710-0095	A, T
Cover Assy	Modified display section cover (see Paragraph 3-40)	Modified HP 5060-0740	A, T
Soldering Iron	47-1/2 watt	Ungar No. 776 with No. 4037 Heating Unit	A, T
Dummy Load	Resistance: 83 ohms, 5% Wattage: 20 watts (100 ohm HP 0819-0019 and 500 ohm HP 0819-0035 in parallel)	 HP 0819-0019 HP 0819-0035	T
Voltage Divider	Resistance: 22.97K 1% 1/4W 21.5K (HP 0757-0199) in series with 1.47K (HP 0757-1094)	 HP 0757-0199 HP 0757-1094	A
Variable Resistor	Resistance: 2.5K ohms variable	HP 2100-2729	A
Tuning tool kit, slug	Modified 5/16-inch nut driver (HP 08555-20122) with modified number 10 Allen driver (HP 08555-20121)	HP 08555-20122 HP 08555-20121	A

*USE: A = ADJUSTMENT; P = PERFORMANCE; T = TROUBLESHOOTING

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 be present when the instrument is unpacked. Inspect the instrument 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 instrument appears to be 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 check consists of following the performance test procedures listed in Section IV. These procedures allow the operator to determine that the instrument is, or is not, operating within the specificaions 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 instrument 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 instrument 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 on the Display Section for proper position (115 or 230 volts).

2-10. Shipping Configuration

2-11. Because of individual customer requirements, shipping configurations are flexible. Preparation for use is based on the premise that the RF and IF Sections are installed in a Display Section to make the Spectrum Analyzer physically and functionally complete for use. Since the RF and IF Sections are usually received separately, the plug-ins must be mechanically fitted together, electrically connected, and inserted in a display section or oscilloscope mainframe of the 140-series. For mechanical and electrical connections, refer to Figure 2-1 and paragraph 2-20.

2-12. Power Requirements

2-13. The Spectrum Analyzer can be operated from a 50- to 60-hertz input line that supplies either a 115-volt or 230-volt (±10% in each case) power. Consumed power varies with the plug-ins used but is normally less than 225 watts. Line power enters the Display Section or Mainframe, where it is converted to dc voltages, and then is distributed to the RF and IF Sections via internal connectors.

2-14. The 115/230 power selector switch at the rear of Display Section must be set to agree with the available line voltage. If the line voltage is 115 volts, the slide switch must be positioned so that 115 is clearly visible. The instrument is internally fused for 115-volt operation, when shipped. If 230-volt source is to be used, refer to fuse replacement procedures in the display section manual.

2-15. Power Cable

2-16. To protect operating personnel, the National Electrical Manufacturers Association (NEMA) and the International Electrotechnical Commission (IEC) recommends that the instrument panel and cabinet be grounded. The Spectrum Analyzer is equipped with a three-conductor power cable; the third conductor is the ground conductor and when the cable is plugged into an appropriate receptacle, the instrument is grounded. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green lead on the adapter to ground.

2-17. Operating Environment

2-18. The Spectrum Analyzer uses a forced-air cooling system to maintain required operating temperatures within the instrument. The air intake and filter are located on the rear of the Display Sec-

tion; air is exhausted through the side panel perforations. When operating the instrument, choose a location which provides at least three inches of clearance around the rear and both sides. Refer to the Display Section manual for maintenance instructions for the cooling system.

2-19. Interconnections

2-20. The RF and IF Sections are normally shipped separately, the plug-ins must be mechanically fitted together, electrically connected, and then inserted in the Display Section or mainframe. To make these connections, refer to Figure 2-1 and proceed as follows:

a. Set the IF Section on a level bench. Locate slot near right rear corner of RF Section; also, locate metal tab on IF Section that engages with this slot.

b. Grasp the 8555A RF Section near middle of chassis and raise until it is a few inches above the IF Section.

c. Tilt RF Section until front of assembly is about 2 inches higher than the rear.

d. Engage assemblies in such a way that metal tab on the rear of the IF Section slips through the slot on RF Section.

e. With the preceding mechanical interface completed, gently lower RF Section until electrical plug and receptacle meet.

f. Position RF Section as required to mate the plug and receptacle. When plug and receptacle are properly aligned, only a small downward pressure is required to obtain a snug fit.

g. Position the latch on each side of the RF Section to lock the RF and IF Sections together.

h. Remove the 50-ohm lead assembly AT4 (shipped taped to top of the RF Section) and install at the AUXILIARY "A" connector on the rear panel of the Display Section. On Display Sections not equipped with an AUXILIARY "A" connector, install 50-ohm load assembly AT4 at AUXILIARY "A" connector on rear of RF Section.

i. Pick up the RF/IF Sections and center in opening of Display Section. Push forward until assembly fits snugly into Display Section mainframe.

j. Push in front latch to securely fasten assembly in place.

2-21. To separate the RF/IF Sections from Display Section and to separate the RF Section from the IF Section, proceed as follows:

a. Push front panel latch in direction of arrow until it releases.

b. Firmly grasp the middle of latch flange and pull RF/IF Sections straight out.

c. Unlock the latch on each side of the RF section and exert an upward pulling force on front edge of RF Section.

d. When the two sections separate at the front, raise RF Section two or three inches and slide metal tab at rear of IF Section out of the slot with which it is engaged.

2-22. Three HP 11593A 50-ohm Terminations are supplied with each HP 8555A. They should be connected to the unused EXT MIXER, FIRST LO OUTPUT, and SECOND LO OUTPUT connectors on the front panel.

2-23. STORAGE AND SHIPMENT

2-24. Original Packaging

2-25. 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.

2-26. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating service required, return address, instrument model number and full serial number. Mark the container FRAGILE to assure careful handling.

2-27. In any correspondence refer to the instrument by model number and full serial number.

2-28. Other Packaging Materials

2-29. The following general instructions should be followed when 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.

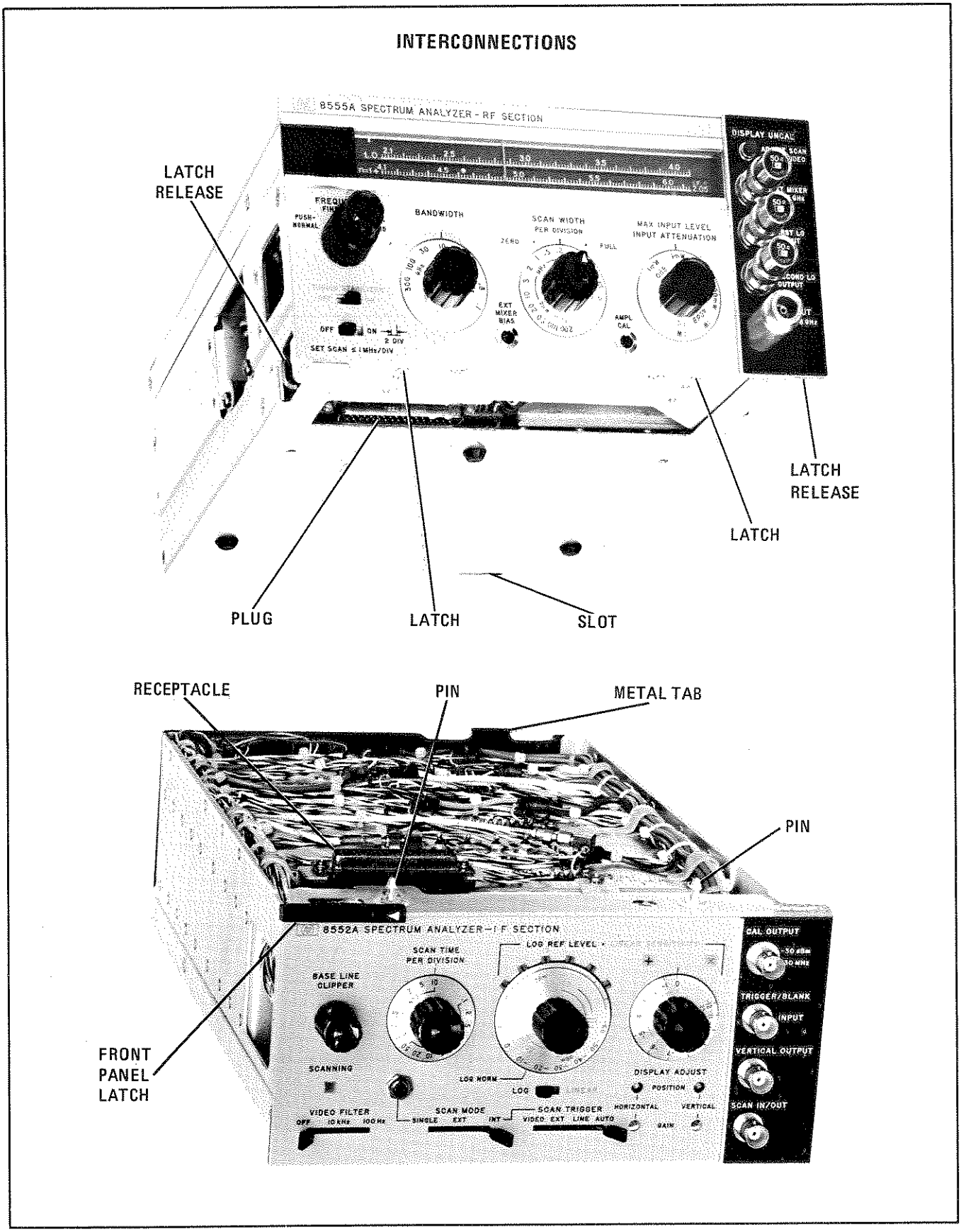


Figure 2-1. RF Section and IF Section Interconnections

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 complete operation instructions for the HP 8555A/8552A/140-series Spectrum Analyzer. Front panel controls, connectors and indicators, for the 8555A RF Section, are identified and described in Figure 3-1. Controls and indicators, for a typical Display Section and IF Section, are identified and described in Figure 3-2. Refer to the appropriate IF Section and Display Section manuals for identification and description of controls, indicators, and connectors not contained in this manual. Operational adjustments are detailed in Figure 3-3 and general operating instructions are provided in Figures 3-4 through 3-6.

3-3. PANEL FEATURES

3-4. Front panel features of the 8555A RF Section are described in Figure 3-1. Front and rear panel views of the HP 8555A/8552A/140T Spectrum Analyzer are shown in Figure 3-3. For a detailed description of the IF Section and Display Section controls and indicators, refer to the operation and service manuals for those instruments. Interconnection wiring between the RF Section and the IF Section and between the RF Section and the Display Section is contained in Section VIII of this manual.

3-5. OPERATOR'S CHECKS

3-6. Upon receipt of the instrument, or when one or more sections of the analyzer are changed, perform the operational adjustment procedures listed in Figure 3-3. This procedure corrects for minor differences between units and ensures that the RF Section, IF Section and Display Section are properly matched.

3-7. OPERATING INSTRUCTIONS

3-8. General operating instructions are contained in Figure 3-4. These instructions will familiarize the operator with basic operating functions of the spectrum analyzer. Additional information covering signal identifying techniques and external mixer operation is contained in Figures 3-5 and 3-6.

3-9. CONTROLS, INDICATORS AND CONNECTORS

3-10. Front panel controls, indicators, and connectors are identified and briefly described in Figures 3-1 and 3-2. Operational Adjustment procedures are given in Figure 3-3. Additional information, to assist the user during instrument operation, is given in the following paragraphs.

3-11. RF Input. The RF Section is normally shipped with a Type N input connector. (Option 001 instruments are shipped with a Type APC-7 input connector.) Refer to Section VI for part numbers associated with connector J1. (See Input Mixer Diode Characteristics below.) The mixer diode, in the First Converter Assembly A12, *will* burn out if overloaded. This diode is *not* separately replaceable; it is part of a thin film microcircuit enclosed in the sealed assembly. To protect the mixer diode it is a good operating practice to always set the INPUT ATTENUATION control to 50 dB before connecting the signal input.

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01-18 GHz Connector	+33	2	±20	20	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

[1] The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels listed apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

CAUTION

Do not connect impulse generators to 8555A input. These mechanical type switching devices can generate pulses in excess of 300 volts. The broadband output from impulse generators can destroy both input attenuator and first converter. See additional information in paragraphs 3-11 through 3-13 of Operating and Service manual prior to instrument operation.

3-12. Input Attenuation. The input attenuator is connected between the RF INPUT (.01—18 GHz) and First Converter. The attenuator should be set to reduce the signal level at the attenuator output to -10 dBm average (signal compression level). The maximum input level, for each position of the attenuator control, for less than 1 dB signal compression, is indicated in red on the attenuator control dial. Unless extra sensitivity is required, at least 10 dB of input attenuation should be used. This provides a 50-ohm termination for currents at the IF and LO frequencies that appear at the mixer's input port. With the input attenuator set to 0 dB, the RF INPUT is a dc block, capable of withstanding ±20 volts. In other attenuator positions the input is a dc return to ground of about 50-ohms and is capable of handling ±400 mA (see CAUTION). When in the 0 dB position the input impedance is greater than 50 ohms. This may cause some mismatch, VSWR, and display amplitude variation as the input frequency changes.

CAUTION

Care must be taken when applying dc voltage to the RF INPUT of the analyzer. Do *not* change INPUT ATTENUATION setting while dc is applied. Apply only dc voltages with rise time less than 10^6 volts per second and current with rise times less than 2×10^4 amperes per second. Do *not* exceed ±20 volts dc or 1.0 volt ac peaks.

3-13. Mixer Overload Characteristics. The input mixer will provide absolute calibration at signal levels up to —10 dBm, incident on the mixer. Smaller signal levels will generally be necessary for distortion measurements to assure that the measurement does not include distortion from the 8555A mixer. (See distortion data in Table 1-2 Supplemental Performance Characteristics.)

3-14. EXT MIXER Connector. Provides an output for the 2.05 to 3.1 GHz first LO signal. A dc bias voltage, adjustable from the front panel, is supplied to the external mixer through this connector. The 2.05 GHz IF signal generated by the external mixer is applied through this same connector. The HP 11517A Waveguide Mixer is recommended as an accessory along with Waveguide Adapters 11518A, 11519A and 11520A for use over the 12.4 to 40 GHz frequency range. Maximum input power for less than 1 dB signal compression is typically .03 mW peak for the 11517A. To protect the external mixer diode, inputs should never exceed 1 milliwatt. Terminate the EXT MIXER input with the 50-ohm load supplied when not in use. When using external mixing, terminate the .01—18 GHz INPUT with the 50-ohm load or set INPUT ATTENUATION to 10 or 20 dB. The input attenuator is not in the external mixing circuit, but does control the LOG REF LEVEL index lamps. Amplitude display accuracy will be approximate with INPUT ATTENUATION set to match external mixer loss.

3-15. FIRST LO OUTPUT. A 2.05 to 4.1 GHz output from the YIG-tuned oscillator at a level of approximately +10 dBm. Available at a test point and for use with accessory equipment. Terminate the FIRST LO OUTPUT with the 50-ohm load supplied when not in use.

3-16. SECOND LO OUTPUT. A 1.5 GHz output from second LO at a power level of approximately +9 dBm. Available as a test point and for use with accessory equipment. Can be used as a test signal with INPUT ATTENUATION set to at least 20 dB. Terminate the SECOND LO OUTPUT with the 50-ohm load supplied when not in use.

3-17. Frequency Scales. Set of 14 scales selected by the Band Switch Lever. Harmonic number (n =) associated with selected scale is shown on left edge of frequency scale. IF frequency (550 MHz or 2.05 GHz being used) is shown on the right edge of the scale.

3-18. LO Scale. Indicates the fundamental frequency of the first LO (YIG). Cursor positioned by the FREQUENCY control indicates the LO fundamental center frequency in the ZERO and PER DIVISION SCAN WIDTH modes.

3-19. BAND Scale. Indictes the frequency range of each of the 14 frequency bands. Green dot on the selected Frequency Scale indicates the frequency BAND.

3-20. FREQUENCY Control. Coarse tunes the analyzer's center frequency in the ZERO and PER DIVISION SCAN WIDTH modes. It is a two-speed control (push-pull action) providing normal or rapid tuning. Do *not* use coarse tuning when analyzer is stabilized (TUNING STABILIZER ON and SCAN WIDTH PER DIVISION set to blue color-coded numbers). When stabilized, coarse tuning will cause signal to jump off CRT screen.

3-21. FINE TUNE. Three turn control fine tunes the analyzer's center frequency in the ZERO and PER DIVISION SCAN WIDTH modes. Use FINE TUNE control to tune analyzer in stabilized mode (see FREQUENCY control above). Provides a 1 MHz tuning range of the 1st LO (YIG) on fundamental mixing.

3-22. DISPLAY UNCAL. Warning indicator associated with BANDWIDTH, SCAN WIDTH, SCAN TIME PER DIVISION and VIDEO FILTER controls. Lamp lights when control settings are

such that the calibration of the instrument is impaired. On some control settings it is acceptable for the DISPLAY UNCAL light to be "on" if the light subsequently goes "off" when either the SCAN TIME PER DIVISION or SCAN WIDTH PER DIVISION control is switched one position counterclockwise. The indicator lamp bulb is replaceable from the front panel. HP Part Number 2140-0259, incandescent lamp, 12 volt, .06 ampere, type T1 bulb. Turn plastic lens cover counterclockwise to remove cover.

3-23. BAND Switch Lever. Selects frequency scale from a set of 14 frequency scales. The band switch lever also controls a shaft encoder on the frequency scale drum that performs several functions:

a. Controls attenuation of the 1st LO (YIG-tuned osc.) tuning ramp to maintain scan width calibration when using harmonic mixing.

b. Optimizes the bias for the input mixer to match the harmonic number (n) of the YIG-tuned oscillator. (n = harmonic number, shown on left of each frequency scale.)

c. Controls the overall gain of the RF Section to maintain absolute calibration when using internal mixing.

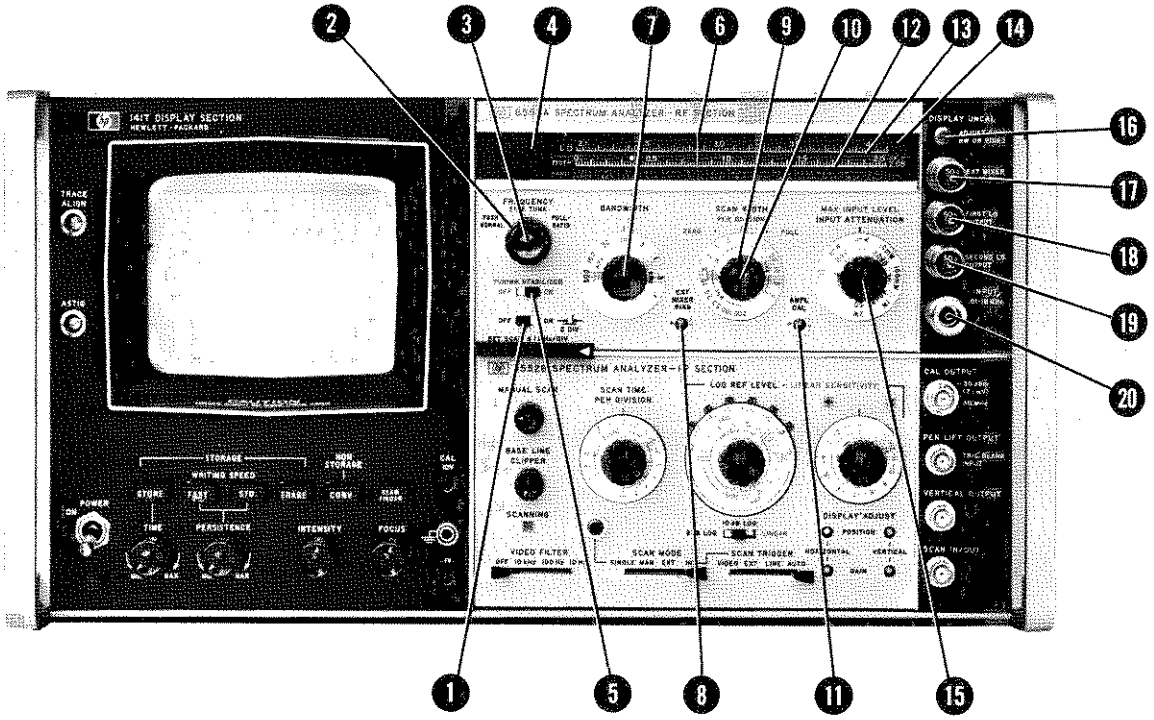
d. Controls switching of the IF signal path. Bypassing and disabling the second converter on the 1+ and 1- (550 MHz IF bands). Bypassing the first converter when using external mixing on the n=6, 10- and 10+ frequency bands.

e. Provides n ± information to signal identification circuit.

f. Provides frequency information to accessory equipment.

3-24. TUNING STABILIZER Switch. ON/OFF control for tuning stabilization circuit. The tuning stabilizer locks the first LO (YIG) to a 1 MHz voltage-controlled crystal oscillator (VCXO) to reduce residual FM of the first LO. The circuitry is enabled when the switch is set to ON and the SCAN WIDTH switch is in the ZERO or blue color-coded PER DIVISION positions.

3-25. SIGNAL IDENTIFIER Switch. ON/OFF control for signal-identification circuit. The signal identifier circuit provides a method of determining which harmonic of the 1st LO is mixing with the input signal to give the display on the CRT. The circuitry is enabled when the switch is ON and SCAN WIDTH PER DIVISION control is set to 1 MHz or below. (See Signal Identification Technique, Figure 3-5).



1. SIGNAL IDENTIFIER Switch: Used in signal-identification technique to identify which harmonic is being mixed with the input signal to obtain the display. See Figure 3-5.

2. FREQUENCY Control: Coarse tunes analyzer center frequency. Push-pull action provides either normal or rapid tuning.

3. FINE TUNE Control: Fine tunes analyzer center frequency. Three turn tuning control used in narrow (stabilized) scan widths.

4. Band Switch Lever: Frequency range selection control. Bi-directional control, rotates Frequency Scales and Frequency Band Shaft Encoder. Shaft Encoder controls digital logic to provide automatic attenuation of 1st LO (YIG-tuned oscillator) tuning ramp to maintain calibration on harmonic mixing. The logic circuitry also controls the input mixer bias and gain of the RF Section to maintain absolute calibration. In addition, the logic circuitry controls relay switching for external mixer operation (10.4 to 40 GHz) and for 2nd converter bypass (1+ and 1-* bands).

Figure 3-1. Front Panel Controls, Connectors and Indicators

5. TUNING STABILIZER Switch: Used to lock the 1st LO to a harmonic of a voltage-tuned crystal oscillator for scan widths of 100 kHz per division or less.

6. Dial Pointer: Indicates center frequency to which analyzer is tuned by FREQUENCY Control (2) in PER DIVISION and ZERO scan modes. Also indicates LO center frequency in PER DIVISION and ZERO scan modes. Indicates marker frequency in FULL scan mode. Ganged to FREQUENCY Control; FINE TUNE does not move dial pointer.

7. BANDWIDTH Control: Selects 3 dB IF bandwidths to determine analyzer resolution in ZERO and PER DIVISION positions of SCAN WIDTH Mode Switch (10). 300 kHz bandwidth automatically selected in FULL scan mode.

8. EXT MIXER BIAS: Adjusts bias on external waveguide mixer diode; adjusted for optimum mixer sensitivity.

9. SCAN WIDTH PER DIVISION: Indicates frequency scan calibration; scan widths from 2 kHz/div to 200 MHz/div are selectable. Scan is symmetrical about center frequency selected by FREQUENCY (2) and FINE TUNE (3). Enabled by SCAN WIDTH mode switch (10).

10. SCAN WIDTH Mode Switch: Selects ZERO, PER DIVISION (9) or FULL scan modes. In ZERO scan mode, analyzer acts as a fixed tuned receiver at the frequency selected by FREQUENCY (2) and FINE TUNE (3). In FULL scan mode, the analyzer scans the full range of the selected frequency band.

11. AMPL CAL: Used to match RF Section with IF Section. Sets overall gain of analyzer for absolute amplitude calibration.

12. Frequency BANDS: Set of fourteen, indicates frequency ranges of analyzer. Green dot on Frequency Scale also indicates frequency BAND selected.

13. Frequency Scale: Set of fourteen scales, selected by frequency BAND lever.

14. YIG-tuned Oscillator (LO) Fundamental Frequency Scale: Pointer indicates LO center frequency.

15. INPUT ATTENUATION: Attenuates input signal from 0 to 50 dB in 10 dB steps. Maximum input signal for 1 dB signal compression, indicated on outer dial scale.

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01-18 GHz Connector	+33	2	±20	10	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

[1] The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels lsited apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

16. DISPLAY UNCAL: Display uncalibrated warning lights when relationship between scan time, scan width, bandwidth, and video filtering is such that accuracy of vertical calibration is impaired.

17. EXT MIXER Input: External mixer input for analyzer operation over 10.4 to 43 GHz frequency range. BNC female connector; accepts cable from external mixer. Supplies LO signal to external mixer and returns IF Signal from mixer. Terminate in 50 ohm load when not in use. See Figure 3-6, External Mixer Operation.

CAUTION

To prevent damage to external mixer do not apply more than 1 mW to 11517A mixer.

18. FIRST LO OUTPUT: 2 to 4 GHz output from YIG-tuned oscillator. Female BNC connector, terminate in 50-ohm load when not in use.

19. SECOND LO OUTPUT: 1.5 GHz output from second LO. Female BNC connector, terminate in 50-ohm load when not in use.

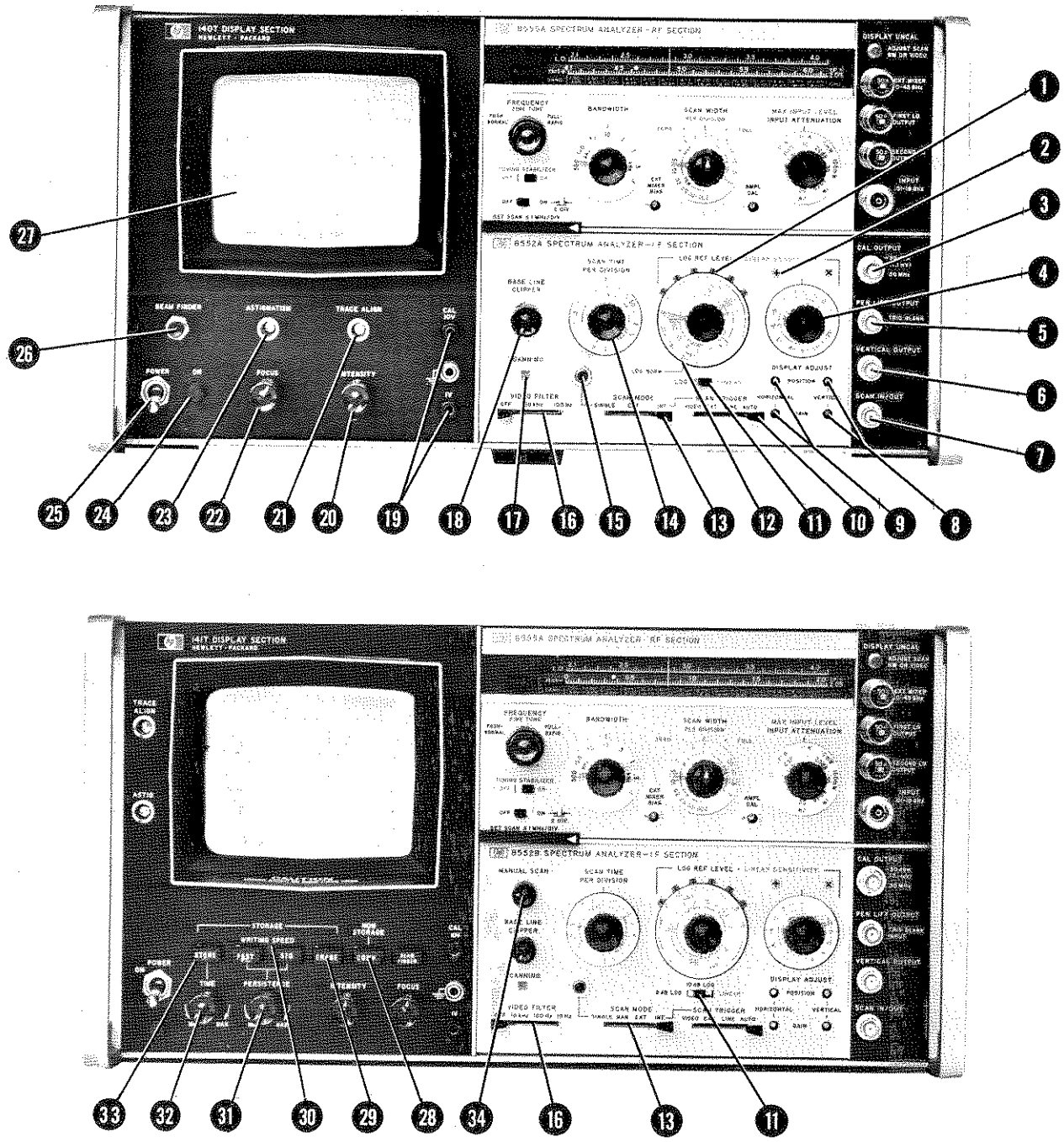
20. RF INPUT: Input for .01 to 18 GHz signals. Female type N connector (Option 001 APC-7 connector).

CAUTION

See 15 above.

*Indicates 550 MHz FIRST IF.

Figure 3-1. Front Panel Controls, Connectors and Indicators (cont'd)



1 With LOG/LINEAR switch (11) set to LOG, lighted index lamp refers matching dB graduation to top LOG REF line of graticule; for example, if -30 dBm is opposite lighted lamp, then top LOG REF line is -30 dBm and so serves as an absolute amplitude reference. With LOG/LINEAR switch set to LINEAR, lighted index lamp indicates the matching voltage graduation to be used as a per-division multiplier for calibrated voltage readings (blue marking).

Figure 3-2. Typical Display and IF Section Controls, Connectors and Indicators

2. Plus "+" lights when logarithmic amplification (11) is selected; times "x" lights when linear amplification (11) is selected. With "+" lighted, LOG REF line is sum (black numerals) of LOG REF LEVEL controls). With "x" lighted, per division absolute voltage amplitude is product of blue numeral LINEAR SENSITIVITY control settings.

3. Provides a 30-MHz signal at -30 dBm for amplitude calibration of spectrum analyzer.

4. Indicates 1 dB increments for logarithmic amplification; indicates multiplication factors up to unity for linear amplification.

5. Provides pen lift operation to HP 7005, 7035, 7004, 7034 and all new TTL compatible HP recorders. Provides input for external blanking signal (-1.5V) for external scan mode operation. Provides input for external positive or negative trigger pulses (2-20V), normally negative, polarity selected by internal switch in IF Section) for external scan trigger operation.

6. Detected video output proportional to vertical deflection on CRT.

7. For receiving an external scan ramp or output coupling for the internally-generated scan ramp. Input or output function determined by INT/EXT positions of SCAN MODE switch.

8. Adjusts vertical position and gain of trace.

9. Adjusts horizontal position and gain of trace.

10. Selects scan trigger mode.

11. Selects 10 dB logarithmic or linear display mode in 8552A plus another 2 dB log position in 8552B.

12. The dB graduation (black numerals), opposite the lighted index lamp, indicate the power level at the LOG REF graticule line on CRT when LOG/LINEAR (11) is set to LOG. With LOG/LINEAR set to LINEAR, the voltage graduations (blue numerals), opposite the lighted index lamp, indicate the per division multiplier for calibrated voltage amplitude.

13. Selects scan ramp mode. Ramp is internally generated for SINGLE/INT positions but it must be externally supplied for EXT position. (Refer to Item 7). Model 8552B has an added manual scan mode position. (Refer to Item 34.)

14. Controls SCAN TIME PER DIVISION.

15. Press to initiate scan with SCAN MODE switch set to SINGLE. Press during scan to stop and reset scan.

16. Selects 100 Hz, 10 kHz or OFF position of lowpass filter for detected video in 8552A plus an added 10 Hz in 8552B.

17. Lights for duration of each scan for single and internal scan modes.

18. Blanks lower part of trace to prevent overexposure of photographs due to high intensity of baseline. Blanking function also prevents blooming with a variable-persistence storage display section.

19. Provides 1- and 10-volt, peak-to-peak, 60 Hz squarewave outputs.

CAUTION

These calibrated outputs should never be used with the spectrum analyzer. (These outputs are for use only with the 1400-series oscilloscope plug-ins.)

20. Adjusts brightness of CRT display.

CAUTION

Excessive brightness for a static or very slow-moving trace may burn the phosphor and permanently damage the CRT. This caution is applicable to both the fixed and variable-persistence/storage CRT; however, the latter is especially vulnerable to operational errors of this type.

21. Makes base line parallel with the horizontal graticule line.

22. Focuses CRT beam.

23. Used with FOCUS control (22) to obtain smallest spot with maximum roundness.

24. Lights when line voltage is applied and instrument is turned on.

25. Switches line voltage to instrument.

26. When used with 1400-series oscilloscope plug-ins, intensifies and returns beam to CRT, regardless of deflection potentials. Produces no effect on analyzer displays.

27. Display CRT with graticule lines.

28. Selects non-storage function.

CAUTION

Use storage function when possible to prevent damage to the CRT.

29. Press to ERASE when in STD or FAST writing speed.

30. Selects writing speed.

31. Varies time the trace is visible.

32. Selects storage time.

33. Press to store signal display. Storage time (relative display brightness) in storage mode is adjusted by (32).

34. Manual scan control positions the electron beam on CRT when using MAN SCAN mode.

Figure 3-2. Typical Display and IF Section Controls, Connectors and Indicators (cont'd)

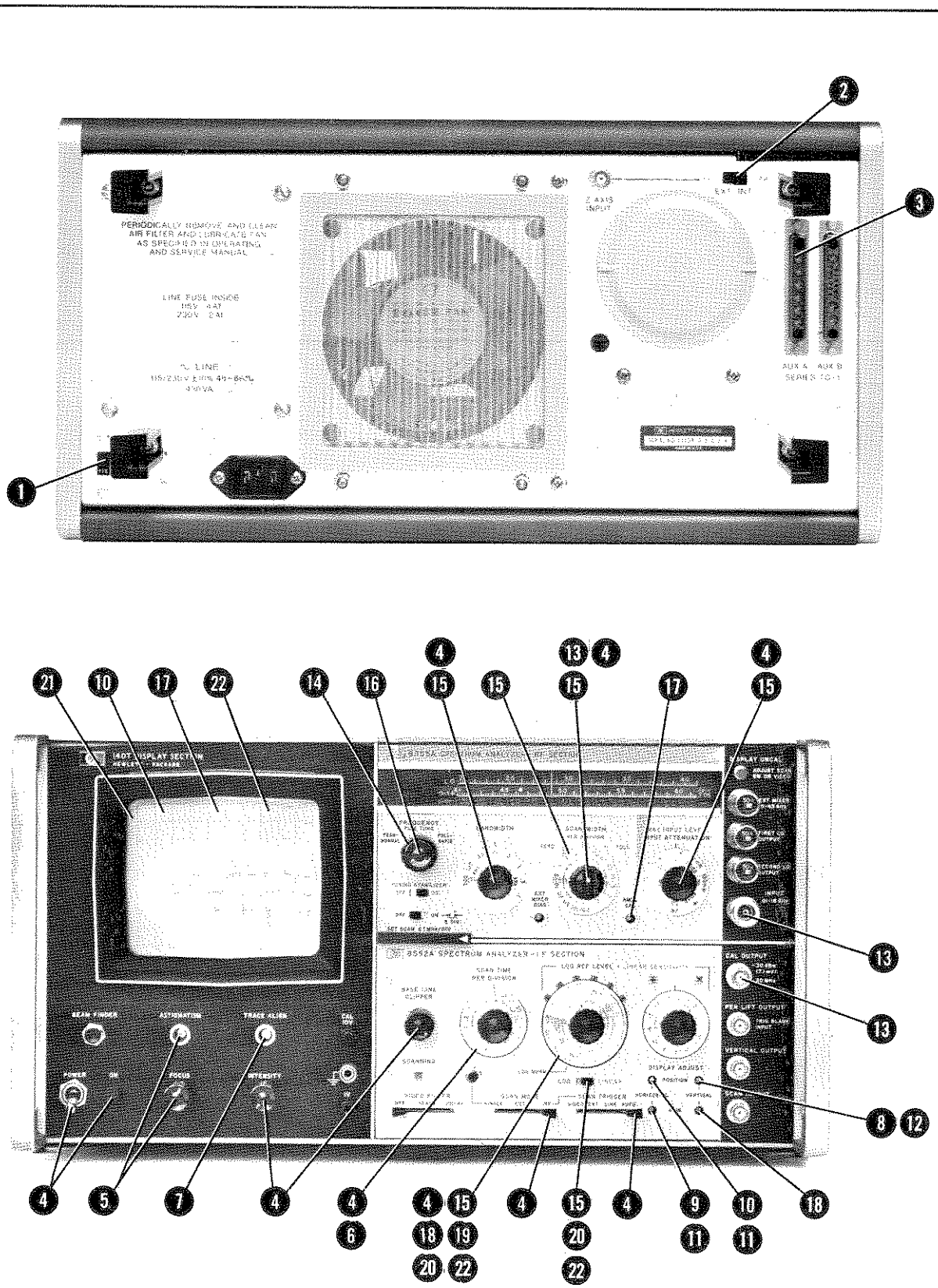


Figure 3-3. Operational Adjustments

INPUT POWER AND INTENSITY MODULATION

1. Set 115/230 switch to correspond with available input voltage. (The instrument is fused for 115-volt, 50/60 Hz operation; if 230-volt power is used, refer to the display section service manual for fuse replacement procedures.)
2. Set INT/EXT switch to INT. (Set to EXT only if CRT is to be externally modulated — normally used with 1400-series time-domain plug-ins.)
3. Connect 50-ohm termination AT4.

FOCUS AND ASTIGMATISM ADJUSTMENTS

4. Set:
   POWER ON (up; observe that ON lamp lights)
   BASE LINE CLIPPER, fully ccw
   SCAN WIDTH (inner/red) to ZERO
   INPUT ATTENUATION to 10 dB
   BANDWIDTH to 0.3 kHz
   SCAN TIME PER DIVISION to 10 SECONDS
   SCAN MODE to INT.
   SCAN TRIGGER to AUTO
   TUNING STABILIZER to ON
   FINE TUNE Control centered
   LOG/LINEAR to LOG
   LOG REF LEVEL Vernier: max CCW
   INTENSITY clockwise until trace is medium bright (approx. 1 o'clock position).
   BAND to 0—2.05 GHz
   VIDEO FILTER to OFF
5. Adjust FOCUS and ASTIGMATISM controls until combined effect produces best resolution (maximum roundness without fuzz) of the dot.

TRACE ALIGNMENT

6. Set SCAN TIME PER DIVISION to 10 MILLISECONDS.
7. If not already aligned, adjust TRACE ALIGN until trace is aligned with horizontal line of graticule.

HORIZONTAL POSITION AND GAIN

8. For convenience in making these adjustments, move trace to upper half of graticule by adjusting the VERTICAL POSITION control.
9. Rotate HORIZONTAL GAIN until trace is of minimum length.
10. Rotate HORIZONTAL POSITION until trace is centered on CENTER FREQUENCY line of graticule.
11. Alternately adjust HORIZONTAL POSITION/GAIN controls until trace begins at first line of graticule and ends at last.
12. Readjust VERTICAL POSITION until trace aligns with bottom line of graticule.

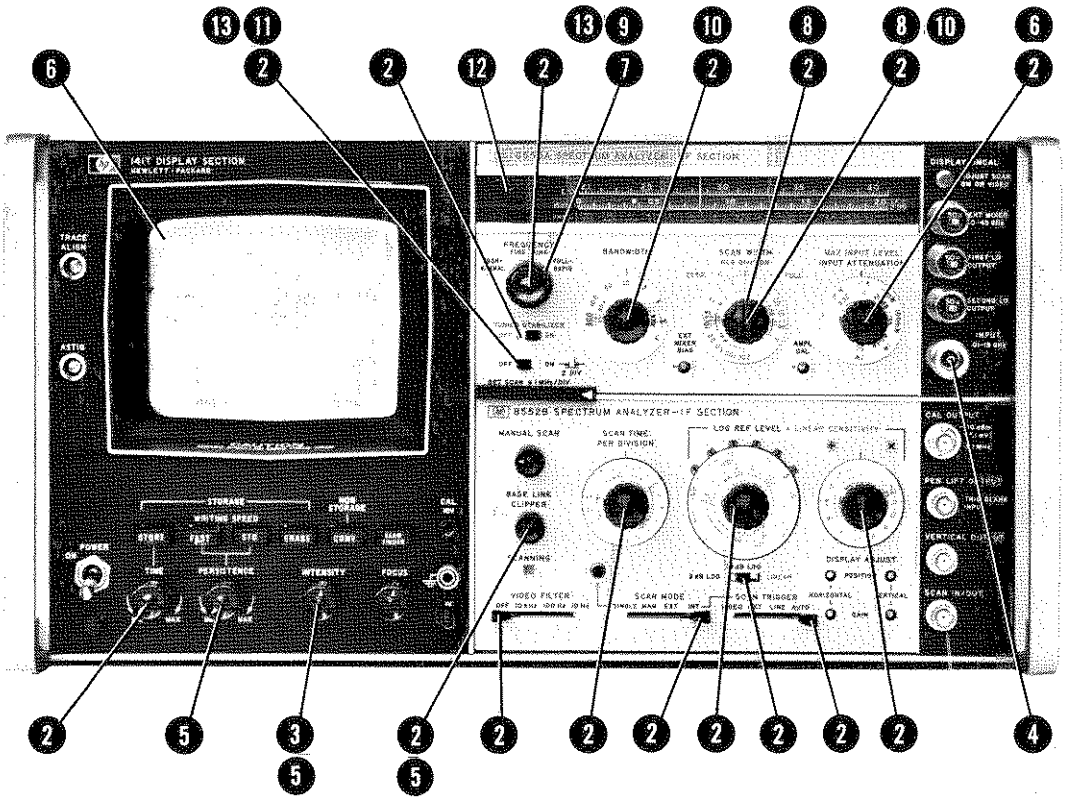
VERTICAL POSITION AND GAIN

13. Connect CAL OUTPUT (30 MHz/ -30 dBm) signal to RF INPUT; select 100 kHz BANDWIDTH, 10 MHz PER DIVISION SCAN WIDTH and set LOG REF LEVEL to +10 dBm.
14. Tune FREQUENCY to align LO feedthru signal on -3 graticule line. The 30 MHz calibration signal should appear at the CENTER FREQUENCY graticule line with a harmonic at the +3 graticule line (60 MHz). The dial marker should indicate approximately 30 MHz.
15. Reduce SCAN WIDTH PER DIVISION to 0.2 MHz. Center signal on display with FREQUENCY control. Reduce SCAN WIDTH PER DIVISION to 2 kHz (keep signal centered on display with FINE TUNE). Set LOG REF LEVEL to -30 dBm.
16. FINE TUNE to center signal on display.
17. Rotate AMPL CAL until trace is centered on top line of graticule at the CENTER FREQUENCY position.
18. Rotate LOG REF LEVEL counterclockwise and note that the signal decreases one division (10 dB) for each calibrated switch position. If trace moves one division per step in lower part of graticule but the amplitude creeps upward near top of graticule, adjust VERTICAL GAIN until each step is equal.

LINEAR AND LOGARITHMIC ADJUSTMENT

19. Rotate LOG REF LEVEL control until signal trace appears on fourth graticule line from bottom.
20. Set LOG/LINEAR switch to LINEAR and rotate LOG REF LEVEL control until 1 mV/DIV is matched with the lighted index lamp.
21. Reading from bottom of graticule (LIN scale), signal amplitude should be 7.1 millivolts. If it is not, adjust AMPL CAL for a signal amplitude of 7.1 millivolts.
22. Set LOG/LINEAR switch to LOG. Rotate LOG REF LEVEL control until -30 dBm graduation matches the lighted index lamp. Signal trace should align with top (LOG REF) line of the graticule.

Figure 3-3. Operational Adjustments (cont'd)



1 Perform Operational Adjustments, Figure 3-3.

2 Set controls as follows:

POWER	ON
BANDWIDTH	300 kHz
SCAN WIDTH	FULL
SCAN WIDTH PER DIVISION	20 MHz
INPUT ATTENUATION	50 dB
FINE TUNE	Centered
TUNING STABILIZER	ON
SIGNAL IDENTIFIER	OFF
BASE LINE CLIPPER	9 o'clock
SCAN TIME PER DIVISION	0.2 SECONDS
LOG REF LEVEL	+10 dBm
LOG REF LEVEL Vernier	max CCW
LOG/LINEAR	10 dB LOG
SCAN MODE	INT
SCAN TRIGGER	AUTO
VIDEO FILTER	10 kHz

Figure 3-4. General Operating Instructions, .01 to 18.0 GHz

3 Adjust INTENSITY for a display trace.

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01 - 18 GHz Connector	+33	2	±20	10	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

[1] The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels listed apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

4 Connect input signal (any frequency between 10 MHz and 18 GHz) to RF INPUT.

5 Adjust PERSISTENCE, INTENSITY and BASE LINE CLIPPER for a display trace without blooming.

6 Observe display for presence of a signal. If a signal is not observed, reduce INPUT ATTENUATION in steps while observing display for a signal.

7 When a signal (or signals) is obtained on the display, tune FREQUENCY control to position inverted marker under signal (under largest signal, if more than one signal is viewed on the display).

8 Set SCAN WIDTH to PER DIVISION, SCAN TIME PER DIVISION to 20 MILLISECONDS and adjust INTENSITY for a convenient display.

9 Center signal on display with FREQUENCY control.

10 Reduce SCAN WIDTH PER DIVISION to 1 MHz and BANDWIDTH to 30 kHz, keeping signal centered on display with FREQUENCY control. Increase SCAN TIME PER DIVISION to 50 MILLISECONDS.

11 Set SIGNAL IDENTIFIER to ON. Note amount and direction signal shifts on alternate scan traces.

12 Rotate Frequency Scales with Band Switch Lever until the signal shifts two divisions to the left on alternate scans and is approximately 5 dB less in amplitude.

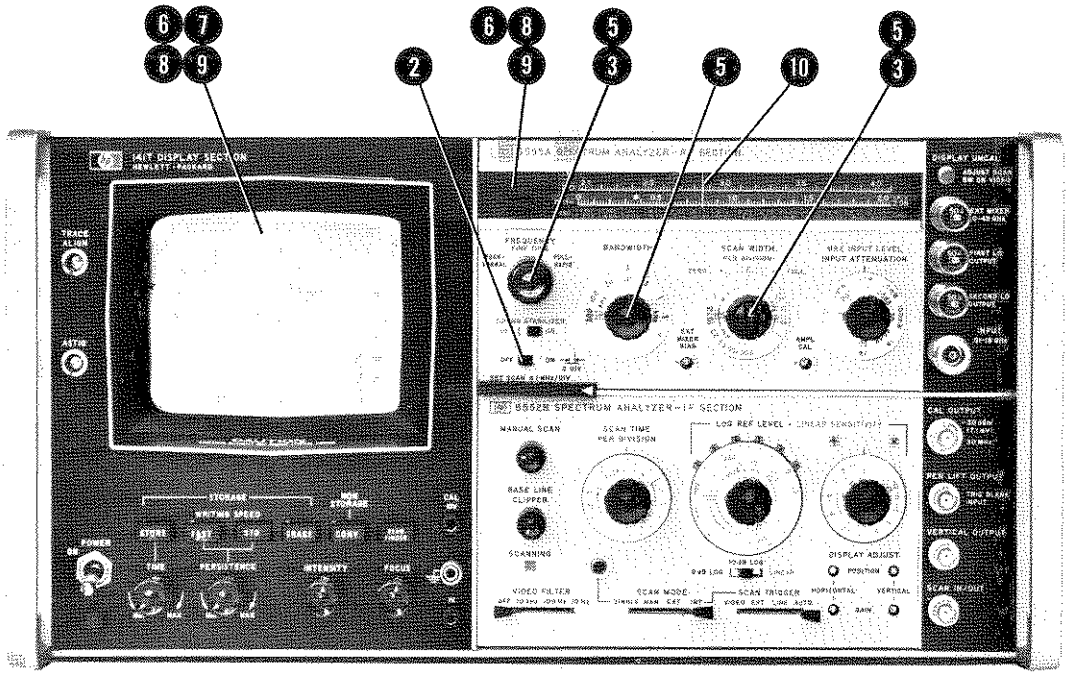
NOTE

When switching from the n=1±, 550 MHz IF Frequency Bands, allow a few seconds for instrument stabilization. Voltage to the 2nd LO (1.5 GHz) is removed when these bands are selected.

13 Set SIGNAL IDENTIFIER switch to OFF. Center signal on CRT with FREQUENCY control. Read frequency of signal indicated by cursor on Frequency Scale.

14 If additional signals were observed during step 7 above, they may be identified in the same manner. Set SCAN WIDTH to FULL, SCAN WIDTH PER DIVISION to 20 MHz, BANDWIDTH to 30 kHz, and SCAN TIME PER DIVISION to 0.2 SECONDS. Tune FREQUENCY control to position inverted marker under signal of interest. Repeat steps 8 through 13 to identify signal frequency.

Figure 3-4. General Operating Instructions, .01 to 18.0 GHz (cont'd)



NOTE

This procedure is given in two parts. Steps 1 through 10 provides one signal identification technique for use during normal operation. Steps 11 through 27 provides a procedure for operator familiarization.

1. Center unknown signal on the display (use FINE TUNE when analyzer is stabilized).
2. Set SIGNAL IDENTIFIER switch to ON.
3. Reduce SCAN WIDTH PER DIVISION to 1 MHz. Keep signal centered on display with FINE TUNE control.
4. Alternate sweep scans across the display. CRT will displace the unknown signal to the left or right of center.

Figure 3-5. Signal Identification Technique

5. Reduce SCAN WIDTH PER DIVISION and BANDWIDTH to separate other signals on the display. Keep the signal under investigation centered on the display.

6. Note direction and spacing of signal shift on the CRT. When the correct harmonic (n) number and sign (+ or -) is selected by the BAND Switch Lever, the signal will shift two divisions to the left. The shifted signal is reduced in amplitude by approximately 5 dB.

7. If signal shifts to the right two divisions, the harmonic number is correct, however the sign (+ or -) on the left edge of the Frequency Scale is wrong.

8. If the signal shifts less than two divisions on the CRT, press the BAND Switch Lever "up" to increase the harmonic number. Note that the signal shifts in the opposite direction with each change in sign and increases in width with each increasing harmonic number.

9. Change Band Switch Lever until the signal shift is two divisions apart with the reduced signal on the left. FINE TUNE to align the reduced signal on the -2 graticule line with the signal to be identified on the Center Frequency graticule line.

10. Read frequency indicated by the cursor on the Frequency Scale. The signal frequency is related to the first LO harmonic by the equation Fsig = nFLO ± IF.

where Fsig = signal frequency
n = harmonic number
FLO = LO fundamental frequency
IF = frequency of first IF

NOTE

In the following familiarization procedure a known input signal is applied and the harmonic numbers producing the signals on the CRT display are identified. The input mixer is overdriven to produce signals that would not normally be present on the display.

CAUTION

DO NOT EXCEED THE FOLLOWING MAXIMUM INPUT LEVELS:

Maximum Input Levels	POWER[1]		VOLTS[2]		
	dBm	Watts	DC	Rms	Peak
Input 0.01 - 18 GHz Connector	+33	2	±20	20	14.14
Incident on Input Mixer	+10	10mW	±20	0.707	1.0

[1] The INPUT ATTENUATION control must be in the 30 dB or greater position when applying +33 dBm or input mixer will be damaged. The power levels listed apply for peak or average power.

[2] Do not exceed ± 20 volts dc. Apply only dc voltages with rise times less than 10^6 volts per second. Do not change INPUT ATTENUATION levels when dc voltages are applied to RF INPUT Connector.

11. Set analyzer controls as follows:

FREQUENCY ..... Full CCW
FINE TUNE ..... Centered
BAND ..... n=1- 0—2.05 GHz
TUNING STABILIZER ..... ON
SIGNAL IDENTIFIER ..... OFF
BANDWIDTH ..... 100 kHz
SCAN WIDTH ..... FULL
SCAN WIDTH PER DIVISION ..... 20 MHz
INPUT ATTENUATION ..... 50 dB
VIDEO FILTER ..... 10 kHz
SCAN TIME PER DIVISION ..... 0.2 SECONDS
SCAN MODE ..... INT
SCAN TRIGGER ..... AUTO
LOG/LINEAR ..... LOG
LOG REF LEVEL ..... (+30 dBm)*
POWER ..... ON
WRITING SPEED ..... STD
INTENSITY ..... 12 o'clock
PERSISTENCE ..... MAX

*2 steps CCW from +10 dBm

Figure 3-5. Signal Identification Technique (cont'd)

⑫ Adjust INTENSITY for a visible scan trace without blooming. ERASE display as necessary between adjustments. Adjust BASE LINE CLIPPER to blank lower portion of scan trace. Repeat adjustments as necessary during the following steps.

CAUTION

INPUT ATTENUATION should be set to at least 20 dB before proceeding with the following step.

⑬ Remove 50-ohm termination from SECOND LO OUTPUT and connect a cable from SECOND LO OUTPUT to RF INPUT.

⑭ Tune FREQUENCY control to position the marker under the signal between the +2 and +3 graticule lines.

⑮ Note reading on Frequency Scale. Cursor indicates 1.5 GHz.

⑯ Switch SCAN WIDTH to PER DIVISION. Center signal on display with FREQUENCY control. ERASE display to remove stored signals.

⑰ Set PERSISTENCE to MIN, SCAN WIDTH PER DIVISION to 1 MHz and SCAN TIME to 20 MILLISECONDS.

⑱ Center signal on display. Set SIGNAL IDENTIFIER to ON. Note signal shifts to the left and is reduced in amplitude on alternate sweep scans.

⑲ Set SCAN WIDTH PER DIVISION to 20 MHz, SCAN WIDTH to FULL, INPUT ATTENUATION to 40 dB and SCAN TIME PER DIVISION to 0.2 SECONDS.

⑳ Note signal display similar to Figure 3-5a. Decrease INPUT ATTENUATION to 30 dB. Note display similar to Figure 3-5b. Note that some signal levels increased more than 10 dB. The input mixer is being overdriven (see Mixer Diode Characteristics, paragraph 3-13).

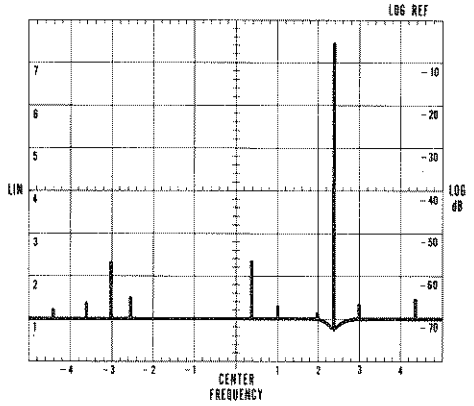


Figure 3-5a.

㉑ Tune FREQUENCY control to place marker under signal at +3 graticule line.

㉒ Set PERSISTENCE to MIN, SCAN WIDTH to PER DIVISION, SCAN WIDTH PER DIVISION to 10 MHz and SCAN TIME PER DIVISION to 50 MILLISECONDS. Center signal on display with FREQUENCY control. Reduce SCAN WIDTH PER DIVISION to 1 MHz. Note amount and direction of signal shift.

㉓ Select n=3- 4.10 to 10.25 GHz Frequency BAND. Note change in direction and amount of shift as BAND Switch Lever is pressed. Read frequency on Frequency Scale (9 GHz).

Figure 3-5. Signal Identification Technique (cont'd)

24 Set SCAN WIDTH to FULL and tune FREQUENCY to place marker under any signal on the display. Disregard DISPLAY UNCAL light at this time. Repeat step 22 for selected signal.

25 Change BAND Switch Lever until the correct display is obtained. Read frequency of signal on Frequency Scale.

26 The signal at the -4.2 graticule line (just above the analyzer's noise level) is the 9 GHz signal from the n=5- harmonic. Signal shifts to the left approximately 1 and 2/3-divisions on n=4- Frequency Band.

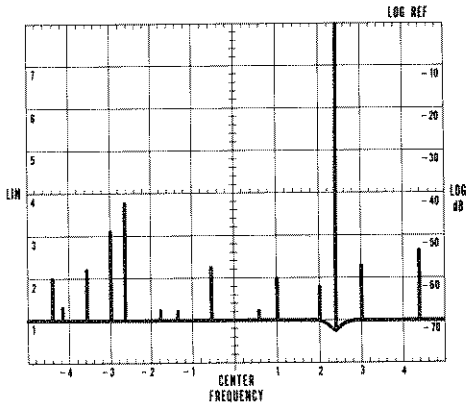


Figure 3-5b

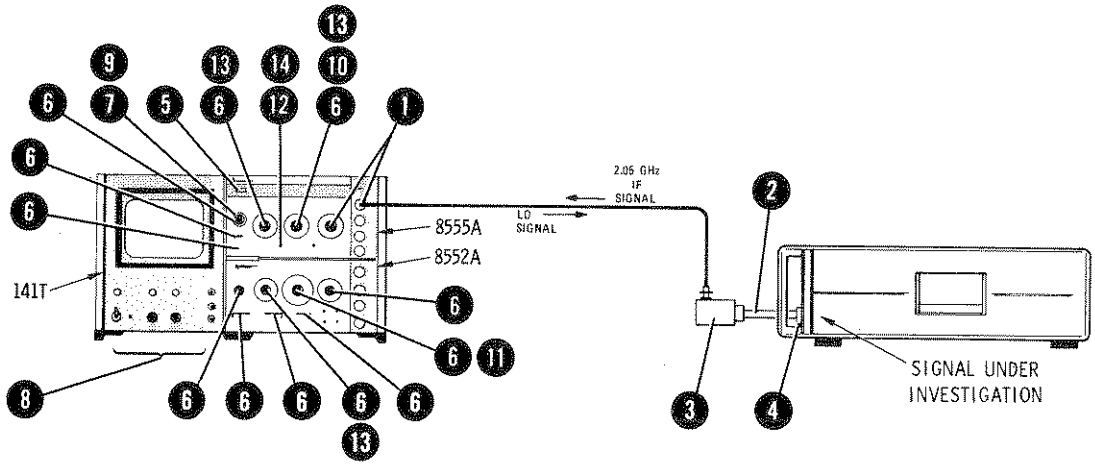
27 Signals shown in Figure 3-5b (mixer overdriven) are as follows:

Graticule Line	Harmonic	Frequency Scale
-4.4	n = 3-	4.5 GHz
-4.2	n = 5-	See step 26
-3.0	n = 1+	4.5 GHz
-2.6	n = 2-	3.0 GHz
-1.8	n = 3-	6.0 GHz
-1.6	n = 2+	7.5 GHz
-1.4	n = 4-	9.0 GHz
+0.6	n = 3-	7.5 GHz
+1.0	n = 2-	4.5 GHz
+2.0	n = 2+	9.0 GHz
+2.4	n = 1-	1.5 GHz
+3.0	n = 3-	9.0 GHz
+4.4	n = 1+	6.0 GHz

28 Use the formula below to determine the harmonic mixing mode for modes not on the Frequency Scales (i.e., 5, 7, 8 and 9).

$$n_{true} = \frac{2\ cm}{actual\ shift} \times (displayed\ n)$$

Figure 3-5. Signal Identification Technique (cont'd)



NOTE

Amplifier is not calibrated when using external mixer.

1. Set INPUT ATTENUATION to 20 dB*. Connect cable supplied with waveguide mixer to EXT MIXER input.

CAUTION

Discharge cable to avoid damage to mixer diode. Touch edge of male BNC connector on cable to edge of female BNC connector on mixer to discharge cable. See 11517A Operating Note.

2. Connect cable to mixer. The LO signal from the RF Section and the mixing products to the RF Section are carried in this cable.

3. Connect appropriate waveguide adapter to the mixer.

4. Connect waveguide adapter to signal source. For linear operation, adjust signal source for output no greater than .03 milliwatt. For minimum intermodulation and spurious signals, keep input signal level at -30 dBm or below.

5. Set Frequency Band Switch to lowest BAND which covers range of signal under investigation. (External mixer bands are as follows: n=6- 10.25 — 22.55 GHz; n=6+ 14.35 — 26.65 GHz; n=10- 18.45 — 38.95 GHz and n=10+ 22.55 — 43.05 GHz.) When other bands are selected the external mixer circuit path is opened by coaxial switches in the RF Section.

6. Set Analyzer controls as follows:

POWER	ON
BAND	See step 5
FINE TUNE	Centered
BANDWIDTH	300 kHz
SCAN WIDTH	FULL
SCAN WIDTH PER DIVISION	10 MHz
TUNING STABILIZER	ON
SIGNAL IDENTIFIER	OFF
BASE LINE CLIPPER	12 o'clock
SCAN TIME PER DIVISION	0.2 SECONDS
LOG REF LEVEL	0 dB
LOG REF LEVEL Vernier	CCW
VIDEO FILTER	OFF
SCAN TRIGGER	AUTO
SCAN MODE	INT

(Input attenuator is not in external mixing circuit, but switch controls position of LOG REF LEVEL index lamps and attenuator provides termination for internal mixer input port to decrease crosstalk.)

7.

8. Adjust Display Section for a convenient display. (WRITING SPEED—STD, PERSISTENCE—MIN, INTENSITY—approximately 12 o'clock.)

9. Adjust FREQUENCY control to position marker under signal of interest.

10. Set SCAN WIDTH to PER DIVISION and adjust FREQUENCY control to center signal on display.

11. Adjust LOG REF LEVEL for a convenient signal-to-noise ratio.

12. Adjust EXT MIXER BIAS for best signal trace.

13. Adjust BANDWIDTH, SCAN WIDTH PER DIVISION and SCAN TIME PER DIVISION to obtain best detail in region of interest.

14. Readjust EXT MIXER BIAS for maximum amplitude.

Figure 3-6. External Mixer (HP 11517A) Operating Instructions