Errata

Title & Document Type: 3577A Network Analyzer Service Manual

Manual Part Number: 03577-90012

Revision Date: June 1987

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

Support for Your Product

Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website:

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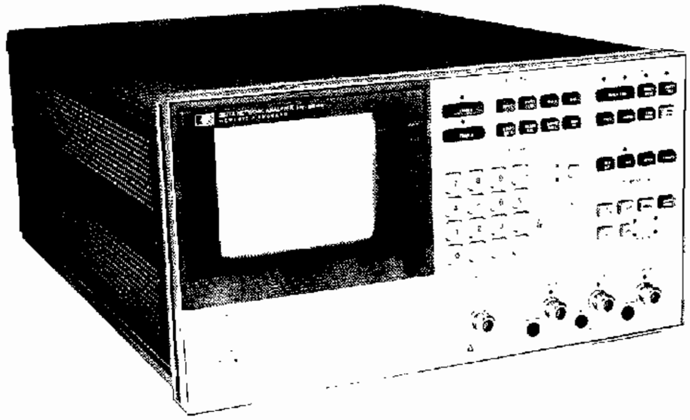
Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

SERVICE MANUAL

NETWORK ANALYZER
3577A



HEWLETT PACKARD

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SERVICE MANUAL

MODEL 3577A NETWORK ANALYZER

Serial Number: 2702A12977

IMPORTANT NOTICE

This manual applies to instruments with the above serial number and greater. As changes are made in the instrument to improve performance and reliability, the appropriate pages will be revised to include this information.

WARNING

To prevent potential fire or shock hazard, do not expose instrument to rain or moisture.

Manual Part No. 03577-90012
Microfiche Part No. 03577-90212

8600 Soper Hill Road, Everett, Washington 98205-1298 U.S.A.

Printed: June 1987

HEWLETT PACKARD

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements. This is a Safety Class 1 instrument.

GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.

SAFETY SYMBOLS

General Definitions of Safety Symbols Used On Equipment or In Manuals.

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).

OR

Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.

Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.

OR

Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.

Alternating current (power line).

Direct current (power line).

Alternating or direct current (power line).

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death to personnel.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like, which,if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

NOTE:

The NOTE sign denotes important information. It calls attention to procedure, practice, condition or the like, which is essential to highlight.

SECTION I
GENERAL INFORMATION

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List of Tables

List of Figures

SECTION I
GENERAL INFORMATION

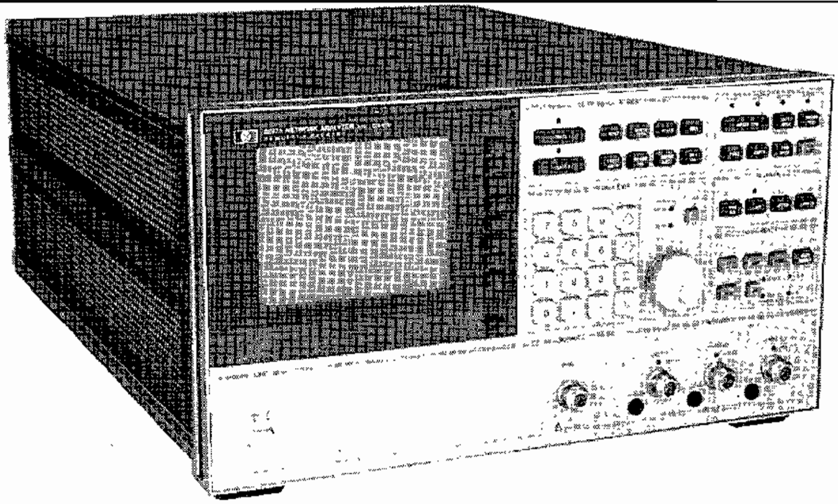
1-1 INTRODUCTION

This service manual contains all the information required by service personnel to test, adjust, and service the HP 3577A Network Analyzer.

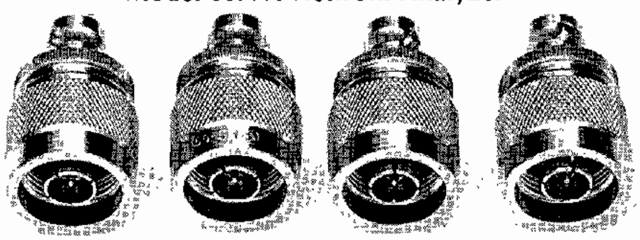
Listed in the title page of this manual is a microfiche part number. This number can be used to order 4 by 6 inch microfilm transparencies of the manual. Each microfiche contains up to 96 photoduplicates of the manual pages. The microfiche package also includes the latest manual change supplements.

The manual is divided into eight sections. Each section and topic is listed below.

Section	Topic	Includes
I	General Information	-Specifications -Test Equipment -Options
II	Fault Isolation	-Power-On Self Tests -Confidence Tests -Isolation to Board Level.
III	Performance Tests	-Verifies Specs in Table 1-1.
IV	Adjustments	-Adjusts to Specs in Table 1-1.
V	Replaceable Parts	-List of all parts in HP 3577A.
VI	Backdating	-Changes which adapts the manual to older units.
VII	Circuit Descriptions	-Explains Theory of Operation.
VIII	Service	-Individual circuit board troubleshooting data.



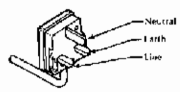
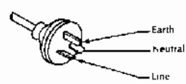
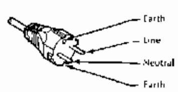
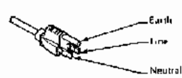
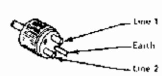
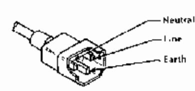
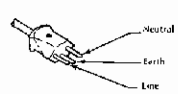
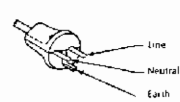
Model 3577A Network Analyzer



4(ea) N male to BNC female adapters
HP 1250-0780

WARNING

The power cable plug must be inserted into a socket outlet provided with a protective earth terminal. Defeating the protection of the grounded instrument cabinet can subject the operator to lethal voltages.

 PLUG*: BS 1363A 220V - 5A CABLE*: HP 5041-5807 OPERATION	 PLUG*: NZSS 198/AS C112 220V - 6A CABLE*: 5041-5808 OPERATION
 PLUG*: CEE7-V11 220V - 6A CABLE*: 5041-5809 OPERATION	 PLUG*: NEMA 5-15P 125V - 10A** CABLE*: 5041-5819 OPERATION
 PLUG*: NEMA-G-15P 250V - 6A** CABLE*: 5041-5806 OPERATION	 PLUG*: CEE22-V1 250V - 10A CABLE*: 5041-5838 30" 5041-5836 60" OPERATION
 PLUG*: SEV 1011.1959-24507 TYPE 12 220V - 6A CABLE*: 5041-5812 OPERATION	 PLUG*: DHCR 107 220V - 6A CABLE*: 5041-5814 OPERATION

*The number shown for the plug is the industry identifier for the plug only
The number shown for the cable is an HP part number for a complete cable including the plug

**UL listed for use in the United States of America

Figure 1-1. 3577A Network Analyzer with accessories supplied.

1-2 MANUAL/INSTRUMENT IDENTIFICATION

The instrument identification serial number is located on the rear panel of the instrument. Hewlett-Packard uses a two-section serial number consisting of a four digit prefix and a five digit suffix separated by a letter designating the country in which the instrument was manufactured (A = U.S.A; G = West Germany; J = Japan; U = United Kingdom.). The prefix is the same for all identical instruments and changes only when a major instrument change is made. The suffix, however, is assigned sequentially and is unique to each instrument.

This manual applies to instruments with serial numbers indicated on the title page. If changes have been made since this manual was printed, a yellow "Manual Change" supplement will define the changes and explain how to adapt the manual to the newer instruments. In addition, backdating information contained in Section VI adapts the manual for instruments with serial numbers lower than those listed on the title page.

1-3 ACCESSORIES SUPPLIED

The following accessories are supplied with the HP 3577A Network Analyzer.

Line Power Cord . . . . see Figure 1-1
Type N male to BNC female Adapters (4 each) . . . . HP 1250-0780

1-4 DESCRIPTION

The HP 3577A measures network performance in the frequency range of 5 Hz to 200 MHz. Each of the three test input ports, R, A and B, provide 100 dB of dynamic range. A front panel "line stretcher" is available with a readout in meters and centimeters. The line stretcher enables the electrical length of the R channel to be changed to match the electrical length of the test port used. This allows compensation for differences in test cable lengths and to measure the electrical length of networks under test.

Each of the three test inputs can be displayed on one or both traces. The traces are labeled Trace 1 and Trace 2. Trace data for each trace is digitally stored as complex data in a trace memory. This results in the ability to display the same data in any of seven display formats. The HP 3577A display has no etched lines. The graticule is drawn as a part of the display operation. No screen overlays are required for polar or Smith charts.

The trace storage capability allows the HP 3577A to perform complex trace arithmetic and one port correction routines. Other features include adjustable receiver bandwidth, complex trace averaging, and automatic plot routines.

The HP 3577A source output frequencies can be swept from 5 Hz to 200 MHz. The same synthesizer drives both the source and input channel tuners, whereby the source and receiver are always tuned to the same frequency. The source and receiver frequencies are coupled, therefore only linear devices can be characterized. The source output level can be set between +15 dBm and −49 dBm. The source amplitude level can also be swept.

The HP 3577A features menu-driven operation, using eight "softkeys." The menus are accessed by pressing the labeled hardkeys, and the appropriate softkeys select the desired parameters for the hardkey function. Marker and sweep parameters are presented on the 3577A display.

1-5 OPTIONS

There are no options for the HP 3577A which alter the electrical specifications. All options are standard exterior hardware options. The available options are:

		-hp- Part Number
Option 907:	Front Handle Kit	5061-9691
Option 908:	Rack Mounting Kit	5061-9679
Option 909:	Front Handle and Rack Mount Kit	5061-9685
Option 910:	Additional Operating Manual	03577-90000
	Additional Service Manual	03577-90012

If your instrument has a serial number prefix of 2333A or lower, see the Manual Backdating section for correct kit part numbers.

1-6 SPECIFICATIONS

The 3577A specifications are listed in Table 1-1, Specifications. The specifications describe the instrument's warranted performance. Specifications apply after a warm up period of one hour except as noted otherwise. Supplemental characteristics are intended to provide information useful in applying the instrument by giving typical, but non-warranted, performance specifications. Supplemental characteristics are denoted as "typical", "nominal", or "approximately."

1-7 SAFETY CONSIDERATIONS

The HP 3577A is a Safety Class 1 instrument (provided with a protective earth terminal). The instrument and manuals should be reviewed for safety markings and instructions before operation.

1-8 GROUNDING

The following connections on the HP-IB connector are tied to Protective Earth Ground: pins 12 and 18 through 24 of the edge connector, and the HP-IB cable shield. The instrument frame, chassis, covers, and all exposed metal surfaces are connected to the protective earth terminal. The output and receiver N-connector outer conductors are at earth ground. The maximum safe float voltage for these terminals is 25 Volts peak.

WARNING

DO NOT interrupt the protective earth ground or "float" the HP 3577A. This action could expose the operator to potentially hazardous voltages!

1-9 RECOMMENDED TEST EQUIPMENT

The equipment required to maintain the HP 3577A is listed in Table 1-2, Recommended Test Equipment. Other equipment may be substituted for the recommended model if it meets or exceeds the listed critical specifications. When substitutions are made, the user may have to modify the performance and adjustment procedures to accomodate the different operating characteristics.

1-10 OPERATOR MAINTENANCE

Operator maintenance is limited to replacing the line fuse, and cleaning the fan filter. There are no operator controls inside the HP 3577A.

WARNING

To avoid serious injury, be sure that the ac line power cord is disconnected before removing or installing the ac line fuse.

Only service trained personnel should perform any instrument repair.

WARNING

Under no circumstances should an operator remove any covers, screws, shields, or in any other way enter the HP 3577A. There are no operator controls inside the HP 3577A Network Analyzer.

Refer to the Safety Symbol chart in the preface section for all applicable instrument and manual safety symbols.

Table 1-1. Specifications

SOURCE CHARACTERISTICS

Frequency Characteristics

Frequency Range: 5 Hz to 200 MHz.
Frequency Resolution: 0.001 Hz.
Stability: $\pm 5 \times 10^{-8}$/day, 0 to 55°C.

Output Characteristics

Level Range: +15 dBm to −49 dBm (1.26 Vrms to 793 μVrms; 2 dBV to −62 dBV) into a 50 Ω load.
Resolution: 0.1 dB.
Entry Units: dBm, dBV, V.
Accuracy: ±1 dB at +15 dBm and 100 kHz. Below +15 dBm, add the greater of ±0.02 dB/dB or 0.2 dB.
Flatness: 1.5 dBp-p from 5 Hz to 200 MHz.
Impedance: 50Ω; >20 dB return loss at all levels.
RF Output Connector: 50 Ω Type N female
Spectral Purity:
Phase Noise (in 1 Hz Bandwidth):
< −70 dBc at offset frequencies from carrier of 100 Hz to 20 kHz.
Harmonics: < −30 dBc.
Non-Harmonic Spurious Signals:
< −50 dBc or −70 dBm whichever is greater.
Reverse Power Protection: Output is automatically opened at a signal level of approximately +22 dBm (50Ω), or ±4 Vdc, or greater applied to the source output. Source output is reconnected with the Clear Trip function.

Sweep Characteristics

Linear Frequency:
Range: 5 Hz to 200 MHz.
Entry: Start/stop or center/span frequencies
Span: 0 Hz or 0.01 Hz to 200 MHz, phase continuous.
Sweep Time: 100 ms/span to 6553 s/span
Direction: Increasing or decreasing frequency

Log Frequency (segmented linear approximation):
Range: 5 Hz to 200 MHz.
Entry: Start/stop frequencies.
Span: 0.01 Hz to 200 MHz, phase continuous.
Log Accuracy: 2%.
Sweep Time: 200 ms/span to 6553 s/span.
Sweep Direction: Increasing frequency.

Alternate Frequency: Sweep alternates between two separate start/stop frequencies using linear sweep only.

CW: Frequency is fixed. Data is updated with a selectable sample time from 1ms to 16 s.

Log Amplitude (fixed frequency):
Range: +15 dBm to −49 dBm
Entry: Start/stop level in dBm or dBV.
Sweep Time: 1 ms/step to 16 s/step. Total sweep time/span depends upon total number of steps and time/step

Sweep Modes: Continuous, single, manual.

Trigger Modes: Free run, immediate, line, external.

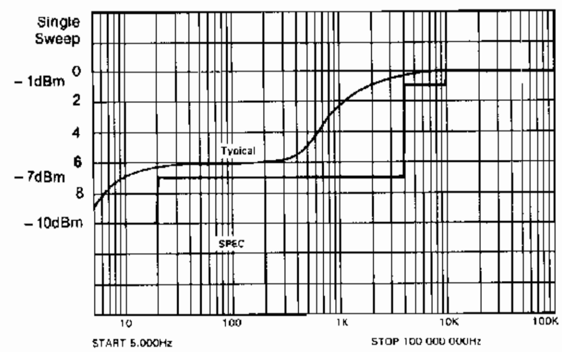
RECEIVER CHARACTERISTICS

Input Characteristics

Frequency Range: 5 Hz to 200 MHz.
Inputs: Three receiver inputs (A, B and R)
Input Impedance: Selectable 50 Ω with >25 dB return loss, or 1 MΩ in parallel with approximately 30 pF.

Full Scale Input Level:

Input Impedance	Input Attenuation	
	0 dB	20 dB
50 Ω	−20 dBm	0 dBm
1 MΩ	−33 dBV (22.4 mV)	−13 dBV (224 mV)



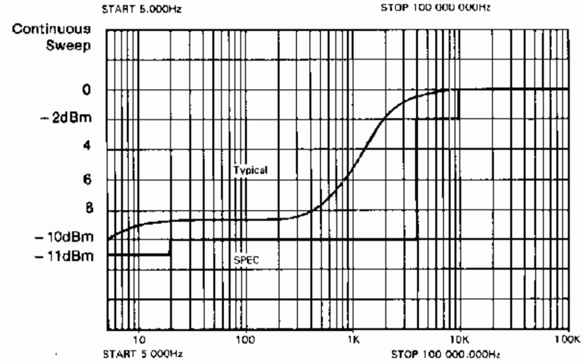


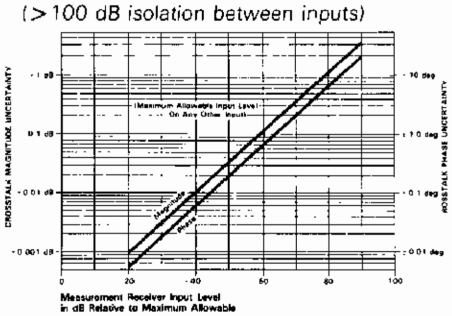
Table 1-1. Specifications (Cont)

Input Damage Level (approximate):
50 Ω: +30 dBm or 25 Vdc.
1 MΩ: +16.9 dBV(7 Vrms) or 25 Vdc
The 50 Ω input impedance automatically switches to 1 MΩ at approximately +20 dBm, and can be reset with the clear trip function.
Input Connectors: 50 Ω Type N female.
Resolution Bandwidth: Selectable 1 kHz, 100 Hz, 10 Hz, or 1 Hz.
Sensitivity(Due to noise and internal crosstalk between source and receiver inputs):

Resolution Bandwidth	Minimum Freq.	Minimum Freq. - 30 kHz, Full Scale Input: 0 dBm −13 dBV (20 dB atten)	Minimum Freq. - 30 kHz, Full Scale Input: −20 dBm −33 dBV (0 dB atten)	30 kHz - 200 MHz (50 Ω) 30 kHz - 20 MHz (1 MΩ), Full Scale Input: 0 dBm −13 dBV (20 dB atten)	30 kHz - 200 MHz (50 Ω) 30 kHz - 20 MHz (1 MΩ), Full Scale Input: 20 dBm −33 dBV (0 dB atten)
1 Hz	100 Hz	−110 dBm	−130 dBm	−110 dBm	−130 dBm
10 Hz	100 Hz	−100 dBm	−120 dBm	−110 dBm	−130 dBm
100 Hz	500 Hz	−90 dBm	−110 dBm	−105 dBm	−125 dBm
1 kHz	5 kHz	−80 dBm	−100 dBm	−95 dBm	−115 dBm

Residual Responses: >100 dB below full scale input, except for crosstalk error limits, L.O. feedthrough, and ac line and fan related spurious signals.

Crosstalk Error Limits:
(>100 dB isolation between inputs)



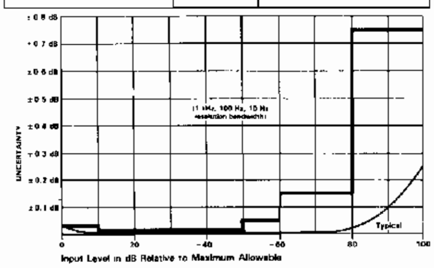
L.O. Feedthrough: < −33 dB below maximum input level.
AC Line and Fan Related Spurious Signals: < −100 dBm below 1 kHz input frequency.

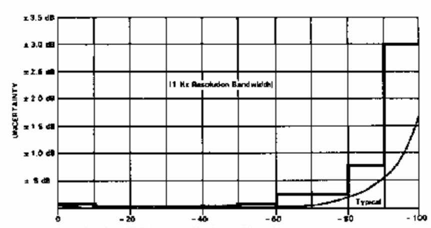
Electrical Length/Reference Plane Extension: Provides equivalent electrical line length, or delay at inputs A, B and R.
Range: -3×10^8 m to $+3\times10^8$ m, or +1 s to −1 s.
Resolution: 5 digits or 0.1 cm (3.3 ps) whichever is greater.
Accuracy: ±0.1 cm or ±0.02% whichever is greater.

Magnitude Characteristics

Range: Full Scale Input to Sensitivity.
Resolution:
Marker: 0.001 dB (log); 5 digits (linear)
Display: 0.01 dB/div to 20 dB/div (log absolute);
0.01 dB/div to 200 dB/div (log ratio),
0.1 nV/div to 10 V/div (linear absolute);
10^{-10}/div to 10^{20}/div (linear ratio).
Display Units: dB, dBm, dBV, V, and linear ratio.
Accuracy (at 100 kHz, 25° C, and Full Scale Input):
Absolute (A,B,R): ±0.2 dB.
Ratio (A/R,B/R,A/B): ±0.15 dB (50 Ω); ±0.2 dB (1 MΩ).
Accuracy and frequency response errors, and effects of different input attenuation can be calibrated out with normalization.
Dynamic Accuracy:

Error: Resolution Bandwidth 1 kHz, 100 Hz, 10 Hz	Error: Resolution Bandwidth 1 Hz	Input Level Relative to Full Scale Input
±.04 dB	±.04 dB	0 dB to −10 dB
±.02 dB	±.02 dB	−10 dB to −50 dB
±.05 dB	±.05 dB	−50 dB to −60 dB
±.15 dB	±.25 dB	−60 dB to −80 dB
±.75 dB	±.75 dB	−80 dB to −90 dB
±.75 dB	±3.00 dB	−90 dB to −100 dB





Frequency Response: Specifications apply when inputs are driven from a 50 Ω source impedance
Absolute (A,B,R):

Frequency	Error: 50 Ω Input	Error: 1 MΩ Input
20 Hz to 20 MHz	.3 dB pp	.5 dB pp
5 Hz to 200 MHz	.6 dB pp	----
5 Hz to 20 MHz	----	1 dB pp

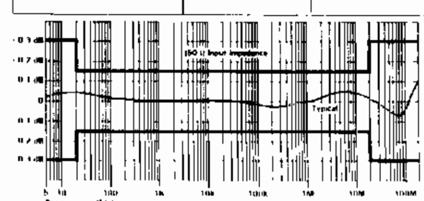
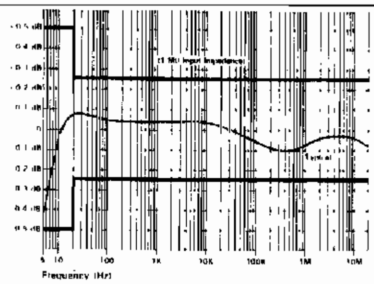
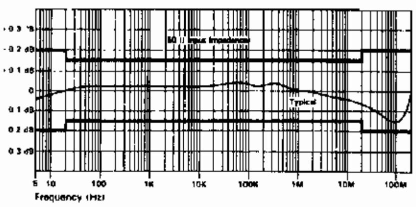


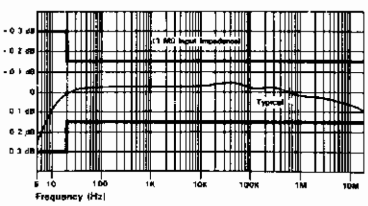
Table 1-1. Specifications (Cont)



Ratio (A/R,B/R,A/B):

Frequency	Error*	
	50 Ω Input	**1 MΩ Input**
20 Hz to 20 MHz	.3 dB pp	.3 dB pp
5 Hz to 200 MHz	.4 dB pp	----
5 Hz to 20 MHz	----	.6 dB pp





*For unequal 50 Ω input attenuation add 0.15 dB pp (20 Hz to 20 MHz), 0.3 dB pp (5 Hz to 200 MHz). For unequal 1 MΩ input attenuation add 0.2 dB pp (20 Hz to 20 MHz), 0.4 dB pp (5 Hz to 20 MHz).

Reference Level:
Range: −207 dBm to +33 dBm (−220 dBV to +20 dBV) (log absolute), −400 dB to +400 dB (log ratio); 0 V to 10 V (linear absolute); 0 to 10^{20} (linear ratio).
Resolution: 0.001 dB (log); 5 digits (linear).

Stability:
Temperature: Typically < ±0.02 dB/°C.
Time: Typically < ±0.05 dB/hour at 25°C.

Phase Characteristics (A/R,B/R,A/B):

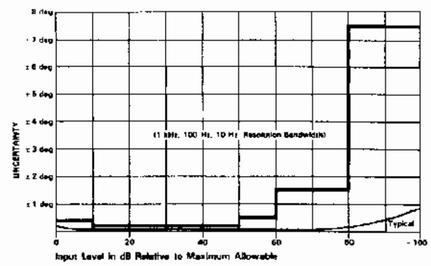
Range: ±180 deg.
Resolution:
Marker: 0.005 deg (0.0001 rad)
Display: 0.01 deg/div to 200 deg/div (0.00018 rad/div to 3.49 rad/div).
Display Units: degrees, radians.

Accuracy (at 100 kHz, 25° C, and Full Scale Input): ±2.0 deg
Accuracy and frequency response errors, and effects of different input attenuation can be calibrated out with normalization.

Dynamic Accuracy:

Error*	Input Level Relative to Full Scale Input
±.4 deg	0 dB to −10 dB
±.2 deg	−10 dB to −50 dB
±.5 deg	−50 dB to −60 dB
±1.5 deg	−60 dB to −80 dB
±7.5 deg	−80 dB to −100 dB

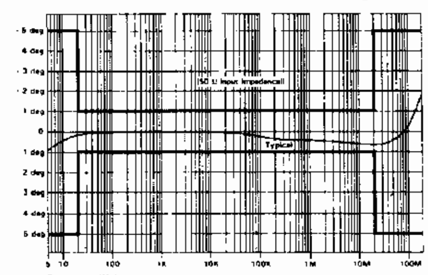
*Specifications do not apply below −60 dB in a 1 Hz Resolution Bandwidth.



Frequency Response: Specifications apply when inputs are driven from a 50 Ω source impedance.

Frequency	Error*	
	50 Ω Input	1 MΩ Input
20 Hz to 20 MHz	2 deg pp	5 deg pp
5 Hz to 200 MHz	10 deg pp	----
5 Hz to 20 MHz	----	10 deg pp

*For unequal input attenuation add 8 deg pp.



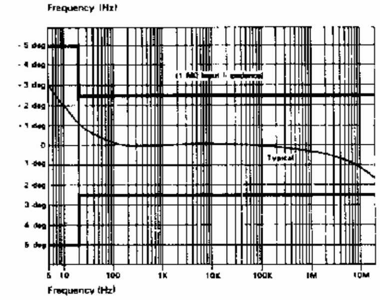


Table 1-1. Specifications (Cont)

Crosstalk: Specified under Input Characteristics.
Reference Level:
Range: -500 deg to $+500$ deg (-8.7 rad to $+8.7$ rad)
Resolution: 0.01 deg.
Stability:
Temperature: Typically $< \pm 0.05$ deg/°C.
Time: Typically $< \pm 0.05$ deg/hour at 25°C.

Polar Characteristics

Range, Resolution, Display Units, Dynamic Accuracy, Frequency Response, Uncertainty, Crosstalk, Reference Level, and Stability specifications are the same as the corresponding magnitude and phase characteristics.
Full Scale Magnitude Range:
Absolute (A,B,R): 0.1 nV to 10 V.
Ratio (A/R,B/R,A/B): 10^{-10} to 10^{20}.

Real/Imaginary Characteristics

Range, Dynamic Accuracy, Frequency Response, Uncertainty, Crosstalk, Stability specifications are the same as the corresponding magnitude and phase characteristics.

Resolution:
Marker: 5 digits.
Display: 0.1 nV/div to 10 V/div for absolute; 10^{-10} to 10^{20} for ratio.
Display Units: V and linear ratio.
Reference Level:
Range: ± 10 V for absolute; $\pm 10^{20}$ for ratio.
Resolution: 5 digits.

Delay Characteristics (Linear Frequency Sweep; A/R, B/R, A/B; 50 Ω input impedance)

Range: Group delay is a computed parameter, defined by the equation

$$t_g = -\frac{\Delta\phi}{2\pi\Delta f}.$$

Minimum: The minimum delay time is given by the expression

$$\frac{1.4 \times 10^{-5}}{\text{Aperture [Hz]}}.$$

Maximum: The maximum delay is given by the expression

$$\frac{N-1}{2 \times \text{Span [Hz]}},$$

where N = number of points per sweep (51,101,201,401).
Effective Range: 1 ps to 20,000 s.

Resolution:
Marker: Same as minimum delay time or 5 digits, whichever is greater.
Display: 0.01 ns/div to 1000 s/div.
Aperture: Selectable 0.5%, 1%, 2%, 4%, 8%, 16% of frequency span.
Display Units: s.
Accuracy:

$$\frac{.13 \text{ s}}{(\text{freq [Hz]})^2} \pm 2 \text{ ns}$$

or

$$\frac{\text{Dynamic Phase Accuracy}}{360 \times \text{Aperture [Hz]}} \pm 2 \text{ ns}$$

whichever is greater.
The $\frac{.13 \text{ s}}{(\text{freq [Hz]})^2} \pm 2$ ns term can be calibrated out with normalization.
Crosstalk: Determined by the expression

$$\frac{\text{Phase Crosstalk}}{360 \times \text{Aperture [Hz]}}.$$

Reference Level:
Range: $\pm 10^3$ s.
Resolution: 5 digits.
Stability:
Temperature: Determined by the expression

$$\frac{\text{Phase Temperature Stability}}{360 \times \text{Aperture [Hz]}}.$$

Time: Determined by the expression

$$\frac{\text{Phase Time Stability}}{360 \times \text{Aperture [Hz]}}.$$

DISPLAY CHARACTERISTICS

Annotation: Start/stop, center/span or CW frequency, source level, scale/div, reference level, delay aperture, marker data, and soft key functions.
Graticules: Rectangular logarithmic and linear, polar, and Smith. All graticules are electronically generated.
Traces: Two simultaneous traces may be present with a rectangular graticule. One trace with polar or Smith graticules
Markers: Each trace has one main marker and an offset marker. Markers indicate data at corresponding trace coordinates in the same units as used to set the Reference Level. Markers can be used to modify certain display parameters. Marker resolution is the same as horizontal display resolution
Reference Line Position:
Rectangular Graticule: 0% to 100% full scale deflection in 0.05% increments.
Polar/Smith Chart Graticule: ± 500 deg in 0.001 deg increments.
Data Storage: Measured data can be stored in vector format in non-volatile storage registers D1,D2,D3,D4. Stored data can be redisplayed later or operated on with Vector Math.

Table 1-1. Specifications (Cont)

Vector Math: Input Magnitude and Phase Data, Stored Data, and User Defined Constants and Functions can be mathematically combined into expressions which define displayed or stored data. Mathematical operations are: add, subtract, multiply, and divide.

Calibration:

Normalization: Both traces can be normalized to measured data with full accuracy, and resolution. Scale factors can be changed after normalization without affecting calibration.

Normalize(Short): Compensates for frequency response errors Requires a short termination.

One Port Part Cal: Compensates for directivity errors and frequency response errors. Requires open and load terminations.

One Port Full Cal: Compensates for directivity, frequency response and source match errors. Requires open, short, and load terminations.

Noise Averaging:

Type: Exponentially weighted vector averaging on successive sweep data.

Averaging Factor: Selectable 1(off), 4,8,16,32,64,128,256.

The current trace A_n is always displayed and updated at the sweep rate according to the expression

$A_n = S_n/F + (F-1)(A_{n-1})/F$, where S_n = current input signal, F = averaging factor, A_{n-1} = previously averaged trace.

Averaging Factor is fixed at 1 in alternate sweep.

Linear Phase Slope Compensation: Provides linear phase slope offset in deg/span.

Range: −72,000 deg./span to +72,000 deg./span (−1256 rad/span to +1256 rad/span).

Resolution: 5 digits or 0.001 deg whichever is greater.

Accuracy: 0.02%.

Autoscale: Automatically adjusts the reference level and scale/div. of the displayed measurement

Measured No. of Points per Sweep:
Logarithmic frequency, 401;
linear frequency, 51,101,201,401;
CW frequency, 1.

Measure No. of Steps per Sweep:
Logarithmic Amplitude Sweep, 5,10,20, 50,100,200,400

Display Resolution: Horizontal and vertical.

Rectangular: 1600 points.

Polar: 1200 points.

PROGRAMMING CHARACTERISTICS

Capability: Remote programming is via the Hewlett-Packard Interface Bus (HP-IB)* for all 3577A front panel control functions, except the ac line switch, display intensity, entry knob, HP-IB address and talk-only on/off. The 35677A/B S-Parameter Test Sets are programmable through the 3577A interface only

Interface Functions: SH1,AH1,T5,TEØ,L4, LEØ,SR1,RL1,PP1,DC1,DT1,CØ,E1.

Output Data Transfer Time: 401 data points (single parameter) can be transferred directly to an HP 200 series computer in Basic language as follows:

ASCII Mode: Typically 1500 ms.

Binary Floating Point Mode: Typically 160 ms.

Graphics Capabilities:

Alphanumeric Characters: 12 lines of text with 40 characters per line can be displayed. Character set includes alphanumerics special characters and line vectors.

Vector Display: Trace lines can be drawn on the display between any two points with a resolution of 2048 points along the horizontal and vertical axes.

*HP-IB is Hewlett-Packard's implementation of IEEE Standard 488-1978.

Table 1-1. Specifications (Cont)

GENERAL CHARACTERISTICS

External Reference Frequency Input:
Frequency: 10 MHz/N (N is an integer from 1 to 100).
Level: 0 dBm ± 10 dB, nominal.
Impedance: 50 Ω, nominal.
Connector: BNC female, rear panel.
Reference Frequency Output:
Frequency: 10 MHz.
Level: Typically 0 dBm.
Impedance: 50 Ω, nominal.
Connector: BNC female, rear panel.
External Trigger: Triggers on negative TTL transition or contact closure to ground.
Minimum Pulse Width: Typically 1 μs.
Impedance: 50 Ω, nominal.
Connector: BNC female, rear panel
Plotter Control: Directly compatible with HP-IB graphics plotters that use Hewlett-Packard Graphics Language (HP-GL) with listen only capability. Plotter may be controlled by the 3577A through the HP-IB connector without an external computer Plotted data includes trace 1, trace 2, graticule, are annotation. Additional markers can be plotted, and pen numbers, pen speed, and line type can also be selected.

Display Adjustments: Astigmatism, x-axis position, y-axis position, alignment, focus, and intensity.
Save/Recall: Front panel setups can be stored in non-volatile memory locations 1 through 5. Last state is saved when power is removed.
Operating Conditions:
Temperature: 0°C to +55°C.
Relative Humidity: <95% at 40°C.
Altitude: <4,572 m (15,000 ft).
Non-Operating Conditions:
Temperature: −40°C to +75°C.
Altitude: <15,240 m (50,000 ft).
Accessories Included:
4ea Type N male to BNC female Adapter. (HP Part No. 1250-0780.)
1 ea. Operating Manual. (HP Part No. 03577-90000).
1 ea. Service Manual. (HP Part No. 03577-90012)
Power: 115V +10%, −25% (47 Hz to 440 Hz), or 230 V +10%, −15% (47 Hz to 66 Hz), 450 VA maximum.
Weight: 31 kg (67 lbs) net. 41 kg (90 lbs) shipping.
Dimensions: 222 mm H × 426 mm W × 578 mm D (8.75 in × 16.75 in × 22.75 in). Add 1 1/8 inch to depth to include front panel controls and connectors.

Table 1-2 Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model	Use*
Ratio Transformer	± 0.5 ppm Terminal Linearity worst case ± 0.01 ppm for 10 ppm ratio	ESI DT72A‡	P
Spectrum Analyzer	Frequency Range: 10 Hz - 300 MHz Amplitude Measurement Range: -134 dBm to +30 dBm Dynamic Range: 70 dB	HP 8568B	F,P,A,O
Oscilloscope	Vertical Bandwidth: DC - 100 MHz Vertical Sensitivity: 10 mV/div Horizontal Sweep Rate: 0.01 μs/div Input Coupling: AC, DC, 50 Ω Waveform Math: A-B Trigger: Ext, Int, Chop	HP 1980B Alternative HP 54201A/D	F,P,A
Digital Voltmeter	AC Range: 0 - 700 mVrms, 20 Hz - 250 kHz DC Range: 0 - 1000 V Accuracy: ± 1% at 100 kHz, 1 Vrms	HP 3456A	F,P,A,O
Signal Generator	Frequency Range: 100 kHz - 300 MHz Power Range: -30 dBm to +10 dBm	HP 8660C HP 86602B	P,A
Synthesizer	Amplitude Accuracy: ±0.15 dB at 100 kHz	HP 3335A	A
Synthesizer	Frequency Range: 100 kHz Amplitude Range: -30 dBm to 0 dBm	HP 3325A	O,P
Milliwatt Power Meter	Frequency Range: 10 Hz - 300 MHz Power Range: 0 dBm to -10 dBm Accuracy: ±0.05 dB at 200 MHz	W&G EPM-1	O,P†
Power Meter	Input Range: -10 to +20 dBm HP-IB compatible	HP 436A Opt. 022	F,O,A,P†
Power Sensor	Flatness: ±0.2 dB to 200 MHz	HP 8482A	O,F,A,P†
Thermal Converter	Input Impedance: 50 Ω Input Voltage: 0.5 Vrms Frequency Response from DC to 20 MHz: ± 0.05 dB	HP 11051A Alternative 1395A-0.4§ with cable 12257A opt. 10	P†
Controller	HP 9000 Series 200 computer Basic 3.0 or later version		A,P†
Printer (optional)	HP 9000 Series 200 compatible		P†

*P = Performance Tests; A = Adjustments; F = Fault Isolation O = Operational Verification

† Alternate procedures which do not require the W&G EPM-1 power meter are included in this manual. The series 200 controller, optional printer, thermal converter, and HP-IB option on the HP 436 power meter are required for the alternate tests.

‡ Electro Scientific Industries
13900 N.W. Science Park Drive
Portland, Oregon 97229

§ Ballantine Laboratories, Inc.
P.O. Box 97
Boonton, NJ 07005

Table 1-2 Recommended Test Equipment (Cont'd)

Instrument	Critical Specifications	Recommended Model	Use*
Signature Multimeter	Setup Time: 15 ns Maximum Clock: 25 MHz	HP 5006A	F
Power Supply	0 to 15 V, 500 mA	HP 6235A	P
Frequency Standard	Frequency: 10 MHz The 10 MHz Frequency Standard may be derived from the National Bureau of Standards station WWVB using a Spectracom 8160A NBS Frequency Standard Receiver, an HP 105B Quartz Oscillator, and an HP 5087A Distribution Amplifier (with options to provide 10 MHz output) or equivalent		P,A
Power Splitter (2 required)	Frequency Range: DC - 200 MHz Impedance: 50 Ω Type N female connector	HP 11850A Alternative HP 11850C	P,O,A
Directional Bridge	Frequency Range: 100 kHz - 200 MHz Directivity: > 40 dB	HP 35677-63502	P,A
3 dB Coaxial Attenuator	Frequency Range: DC - 200 MHz Port Return Loss > 30 dB typical	HP 8491A Opt. 003	P,A
20 dB Coaxial Attenuator (3 required)	Frequency Range: DC - 200 MHz Port Return Loss > 30 dB typical	HP 8491A Opt. 020	P,O,A
10 dB Coaxial Attenuator (2 required)	Frequency Range: DC - 200 MHz Port Return Loss > 30 dB typical	HP 8491A Opt. 010	P,A
Precision Termination (2 required)	Impedance: 50 Ω Return Loss: > 52 dB, DC - 200 MHz Connector: N male Connector: N female	HP 909C Opt. 200, 012 Opt. 200, 013	P,A,O
Feedthrough Termination (3 required)	Impedance: 50 Ω BNC male 10 dB Return Loss	HP 11048C	P,O,A
RF Cable Kit (2 required)	Two 24 inch, 50 Ω cables	HP 35679A Alternative HP 11851A	F,P,O, A
RF Cable	24 inch, 50 Ω	HP 8120-2292	P,O
BNC Cable (3 required)	12 inch, 50 Ω	HP 8120-1838	P

*P = Performance Tests; A = Adjustments; F = Fault Isolation
O = Operational Verification

Table 1-2 Recommended Test Equipment (Cont'd)

Instrument	Critical Specifications	Recommended Model	Use*
BNC Cable (3 required)	24 inch, 50 Ω	HP 8120-1839	P,O,A
BNC Cable (3 required)	48 inch, 50 Ω	HP 8120-1840	P,O,A
1:1 Probe	DC - 200 MHz	HP 10021A	A,F
10:1 Probe	DC - 200 MHz	HP 10040A	A,F
Adapter (7 required)	N male to BNC female, 50 Ω	HP 1250-0780	P,O,A
Adapter	N female to N female, 50 Ω	HP 1250-1472	P,O,A
Adapter (2 required)	BNC female to Banana male	HP 1251-2277	P,O
Adapter	BNC female to alligator	Pomona 2631	P
Adapter	BNC Tee	HP 1250-0781	P
Adapter (2 required)	SMA male to BNC female	HP 1250-1200	P,A
Adapter	N male to N male	HP 1250-0778	P,A
Adapter	N male to N male	HP 1250-1475	P
Adapter	BNC female to BNC female	HP 1250-0080	P
Jumper	alligator to alligator	Pomona 3781-8	A
Resistor	1 Meg Ω, 1 %	HP 0698-7332	A
Capacitor	300 pF	HP 0160-5350	A
Error Correction Cable		HP 03577-61640	P,O
Buffer Amplifier Kit	HP 3577A Performance Test Kit	HP 03577-84403	P
	Kit Contents:		
	OP Amp (NE5534)	HP 1826-0715	
	Capacitor, 22 μF (2 each)	HP 0180-0228	
	Resistor, 475kΩ	HP 0757-0481	
	1kΩ	HP 0757-0280	
	499Ω	HP 0698-4123	
	100 Ω (4 each)	HP 0757-0401	
	BNC Connector (2 each)	HP 1250-0083	
	IC Socket	HP 1200-0564	
	Board	HP 5020-6893	
	Edge Connector	HP 1251-0159	
	Lug (2 each)	HP 0360-1190	
	Nut(2 each)	HP 2950-0043	
	Washer(2 each)	HP 2190-0016	
	Balun	HP 03577-84404	

*P = Performance Tests; A = Adjustments; F = Fault Isolation O = Operational Verification

Table 1-2 Recommended Test Equipment (Cont'd)

Instrument	Critical Specifications	Recommended Model	Use*
Service Accessory Kit	HP 3577A Service Kit	HP 03577-84401	F,A
	Kit Contents:		
	Cable Assembly Extender (7 each)	HP 03585-61601	
	Cable Assembly Adapter (2 each)	HP 03585-61616	
	Jack to Jack Adapter	HP 1250-0669	
	PC Extender Boards: (Dual 36/25 pin)	HP 03577-66541	
	22-pin (2 each)	HP 03577-66542	

*P = Performance Tests; A = Adjustments; F = Fault Isolation O = Operational Verification

SECTION II
FAULT ISOLATION

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SECTION II
FAULT ISOLATION

2-1 INTRODUCTION

The fault isolation procedures found in this section are designed to assist the experienced service technician. Each assembly in these procedures is referred to as a functional block, since they serve a single electrical function. Component groups within each functional block are referred to as functional sub-blocks, since they also serve a single electrical function. The goal of these procedures is to determine which functional block has failed within the HP 3577A under test. Once the faulty functional block has been found, the schematics provide sample waveforms and voltages which allow isolation to the sub-block level. The technician's experience is then used to isolate the components which have failed within the functional sub-block.

These procedures assume that all power supplies in the instrument are good. Before excessive time is spent in troubleshooting, it is strongly recommended that all power supplies be checked for correct voltage and ripple. A listing of the power supplies in the HP 3577A is shown in Table 2-6.

The first tests performed in this procedure do not require inside access to the HP 3577A. Numerous self tests are performed at power-on. Additional diagnostics can be called from the self test menu under the hardkey labeled "SPCL FCTN" (SPECIAL FUNCTION). The first step should always be to run these self tests as they will isolate a majority of the problems encountered.

NOTE

When executing the diagnostics, refer to Figures 2-3 through 2-6 (3577A Overall and Functional Block Diagrams).

2-2 SAFETY CONSIDERATIONS

Some of the fault isolation procedures require access to the interior of the HP 3577A while power is supplied to the instrument. Extreme care should be exercised when servicing the instrument.

WARNING

Maintenance described herein is performed with power supplied to the instrument and protective covers removed. Such maintenance should be performed by service-trained personnel who are aware of the hazards involved (for example, fire and electrical shock). Where maintenance can be performed without power applied, the power cord should be removed.

2-3 RECOMMENDED TEST EQUIPMENT

The test equipment required for the fault isolation procedures is listed in Table 1-2. Any equipment which meets the critical specifications may be substituted for the recommended model. These procedures are designed to be performed with a minimum amount of equipment.

2-4 TROUBLESHOOTING HINTS

When troubleshooting the HP 3577A, keep the following hints in mind:

- Intermittant cables can appear to be hardware failures.
- Noise or spikes on the dc power supplies can cause instrument failure.
- Interpret front panel symptoms before extensive troubleshooting.
- It is possible that one circuit board can load another circuit board resulting in an apparent failure in the first circuit board.
- Whenever possible, divide the circuit under test in half.
- Measurements made in the Fault Isolation section are approximate values unless otherwise specified. Some tests are as simple as GO/NO GO.

2-5 GETTING STARTED

Fault isolation in the HP 3577A is basically split into two separate sections; analog and digital. Digital failures quite often will prevent the HP 3577A from turning on correctly. The Fault Isolation Flow Diagram found in Figure 2-2 illustrates a procedure to determine the faulty functional block if an instrument does not power up correctly. Each of the tests indicated in the procedure are described in detail in sections 2-7 through 2-11. If any of these tests fail, refer to the individual description for that test and the critical parameters checked for.

Analog failures usually will not effect the digital portions of the instrument and will show up as dead inputs or outputs, or specification failures. Fault isolation for these problems is best approached by running the Confidence Tests listed under the SPCL FCTN (SPECIAL FUNCTION) hardkey and described in Section 2-9. After running these tests, the Covers Off Board Level Fault Isolation explanation listed in section 2-11 should be performed.

2-6 OVERALL INSTRUMENT DESCRIPTION

An overview of the entire instrument operation is given here to illustrate to the service technician the interaction of the 3577A's individual boards and functional blocks. The information in this section should be used in conjunction with the fault isolation and self test information. Since many of the functional blocks interact heavily, the more information known about the interaction, the easier troubleshooting becomes. Study the following section before any work is done on the instrument. By interpreting the self test data and knowing the instrument operation, many problems can be isolated to the board level quite readily.

Refer to Figures 2-3 through 2-6 when reading the overall circuit description. Refer to Section VII (Circuit Descriptions) for more detailed descriptions of each board's operation.

The HP 3577A can be basically split into two sections; a signal source and a tuned receiver. There is only one area that the two overlap, and that is the source frequency is the same as the receiver tune frequency. Since the frequency generation section is common to both the source and the input, it will be explained first.

The "heart" of the frequency generation section is the frequency reference. The HP 3577A can be run from an external frequency reference by using the rear panel external reference input. The frequency reference board (A6) can be driven by either the oven board (A31) or an external reference. When an external reference is sensed by the external reference detector, the shutdown line on the oven board is toggled and the oven signal is switched off using the oven board switchable filter. The threshold detector on the oven board senses whether the oven has warmed up. If the oven is cold, the threshold detector switches the oven signal off. The reference signal, either the oven or external signal, is used to lock a 10 MHz phase-locked loop. When the oven is cold and no external reference is connected, the HP 3577A free runs on the uncorrected 10 MHz phase-locked loop signal. The 10 MHz phase-locked loop signal is used for two purposes. First, it is divided by 100 to form the 100 kHz signal used by the synthesizer board (A7). Second, it is used to drive a 300 MHz phase-locked loop. The 300 MHz signal is mixed and divided to form all the reference frequencies used in the HP 3577A.

The oven board (A31) provides a stable 10 MHz frequency reference signal. This signal is controlled by the frequency reference board (A6). When an external reference signal is used on the HP 3577A, the frequency reference board forces the control line $\overline{\text{SHUTDOWN}}$ to go low which turns off the 10 MHz oven output signal.

The synthesizer board (A7) produces frequencies from 300.25 to 500.25 MHz. The reference frequency for the synthesizer is 100 kHz obtained from the frequency reference board (A6). The synthesis method used in the HP 3577A is called Fractional-N synthesis. The synthesizer board has two synthesized outputs, one for the output board (A8) and one for the local oscillator board (A4).

The 250 kHz offset board (A5) takes the 300 MHz frequency reference board (A6) signal and creates a phase-locked 300.25 MHz signal. Note that the first IF used on the input board (A1) is the 250 kHz offset frequency. The 300.25 MHz signal is used by the output board (A8). The 300.25 MHz signal is mixed with the synthesizer board (A7) 300.25 to 500.25 MHz signal to create the source output frequencies of 5 Hz to 200 MHz. This mixing scheme minimizes the number of mixings done and keeps phase noise products as low as possible.

The local oscillator board (A4) combines the 300.25 to 500.25 MHz synthesizer board (A7) signal and the 300 MHz reference board (A6) signal to produce a 0.25 to 200.25 MHz signal. This signal is used to drive the first IF mixer. Note that the local oscillator output signal and the source output (A8) signal are always 250 kHz apart, even when the source is swept. This allows for a tuned input with fixed frequency IF sections.

The output board (A8) mixes the 300.25 to 500.25 synthesizer board (A7) and the 300.25 MHz offset board (A5) signals to produce a 5 Hz to 200 MHz source signal. The 300.25 MHz signal is passed through a diode limiter before the mixing to allow leveling. After mixing, the 5 Hz to 200 MHz signal is filtered and amplified. The signal level at the input to the attenuator is variable between +11 and +15 dBm in

0.1 dB increments. The increments are set using a DAC in the Amplitude Reference. The leveling circuits correct for high frequency and low frequency source flatness errors. The low frequency errors are corrected by adjusting the gain of the first 20 dB amplifier after the mixer. The high frequency errors are corrected by the Amplitude Leveling. The attenuator is capable of attenuating between 4 and 60 dB in 4 dB steps. The 60 dB Step Attenuator also has a reverse power protection circuit. Whenever the peak voltage at the output connector is greater than 4 volts, the protection circuit disconnects the attenuator from the output connector.

The HP 3577A input board (A1) is a switchable 1M/50 ohm input. Relay K1 selects the input impedance of each channel. Note that only one input channel is shown in the block diagram. This is because all three input channels are electrically identical. The physical location in the instrument is the only distinguishable characteristic. Relays K2 and K3 set the input attenuation for each channel. Note that the two channel impedence paths have separate 20 dB attenuators. The signal is then mixed with the 0.25 to 200.25 MHz local oscillator (A4) signal in the first IF section. The output of the first IF is a constant 250 kHz signal whose instantaneous amplitude and phase are the same as the input signal. The 250 kHz signal is then converted to a 10 kHz signal by the second IF section and the 240 kHz frequency reference board (A6) signal. The 10 kHz signal, with the same amplitude and phase as the input signal, is then sampled at an 8 kHz rate with a sample and hold. This creates a 2 kHz "stairstep" third IF. The 2 kHz stairstep signal undergoes two Analog to Digital conversions. The first conversion is used to set the gain on the variable gain amplifier. This conversion is an 8-bit conversion. The gain of the variable gain amplifier is then set so the A to D is as near to its full scale input as possible. The A to D then undergoes a 12-bit conversion which is passed on to the digital filters. This A to D conversion technique allows for a 20-bit dynamic range with 12-bits of resolution. Note that this A to D sequence takes place during one stairstep level. The digital quadrature filters then process the data from the A to D converters. The quadrature filters separate the "real" and "imaginary" components of the A to D converter output. The resolution bandwidths are digitally implemented here.

The central intelligence of the HP 3577A Network Analyzer is the main processor-controller board (A13). The "heart" of the main processor is a 16-bit microprocessor. This board contains its own firmware (ROM) and RAM. The main processor bus of this board provides all the communication ports.

The keyboard (A15) is constantly being monitored by the main processor-controller via the keyboard data bus. If a key is stuck for a period longer than 10 seconds, an error message will then be displayed on the CRT.

The HP 1345A Digital Display is a 16-bit TTL data bus (positive logic) display. The display provides its own test pattern. This diagnostic is accessible under the SPCL FCTN (SPECIAL FUNCTION) hardkey. This function disconnects the 3577A digital section (main processor-controller) from the HP 1345A. When disconnected, the display module turns on its own resident test pattern which tests most of its display functions. This test pattern can also be shown by disconnecting the ribbon cable from the main processor-controller board (A13) to the display.

The HP-IB board (A16) provides an isolated link between the instrument's main processor-controller board (A13) and the "outside world." An HP-IB connector is provided at the rear panel of the instrument. This connector is used to connect the instrument to other instruments and controllers which have HP-IB (IEEE 488) capability.

The fast processor board (A11) performs floating point and fast numerical calculations (number crunching). This is done by taking data from the input boards (A1; Receivers R, A, B) and controlling the sweep timing of the HP 3577A. This board contains its own firmware (Micro Program ROMs), Micro Program Sequencer, and a Bit/Slice ALU (Arithmetric Logic Unit). The fast processor controls the accessibility of the Fast Data Bus. For example, the fast processor must grant the bus in order for the trace memory board (A12) to communicate with the main processor-controller board (A13).

The trace memory board (A12) provide the non-volatile storage capabilities. This board provides additional firmware (ROM) and RAM for the instrument. At turn-on, a ROM checksum and a marching ones test for the RAM section is performed.

2-7 POWER-ON SELF TESTS

The tests the HP 3577A performs when power is first applied are listed in Table 2-1.

As with any microprocessor based instrument, the "kernel" or microprocessor, ROM, RAM, clock, and common bus and buffers must be working for the instrument to turn on at all. At power-on, the HP 3577A tries to test its "kernel" and then gradually expands and tests the other branches of communication open to it. Please note that if the "kernel" is not functional, the HP 3577A will most likely not be able to run the self tests. On the other hand, if the HP 3577A passes the power-on self tests, there is an extremely high probability that the digital core of the instrument is functioning perfectly. The only digital sections not checked are the outermost I/O ports and buffers to the instrument measurement and control sections.

Table 2-1. Power-on Self Tests

Self Test Number	Test Description	Test Location
1	LED Test	Front Panel
2	Main Processor-Controller ROM Test	A13U12,U19 - U30 A13U73 - U76
3	Main Processor-Controller RAM Test	A13U9,U10,U15-U17,U71,U72
4	Total Main Processor-Controller RAM Test (Optional)	A13U9,U10,U15-U17,U71,U72,U81 U82
5	Keyboard Cable Test	A13U42,A15J1(8)
6	Timer Interrupt Test	A13U48,U49,U60, U78,U79
7	Trace Memory Test	A13U33 - U36 A12 all circuits
8	One MegaHertz Test	A13U77(8)
9	Eight kiloHertz Test	A13U47(2)
10	Fast Processor Self Test	A13U31 and A13U32

Self Test Number 1, LED Test

Immediately after the microprocessor (A13U1) starts its program, all front panel LEDs are turned on. The LEDs are left on until Power-On Self Test number 2 is completed.

Self Test Number 2, Main Processor-Controller ROM Test

The main processor-controller (A13) computes a checksum for each ROM and compares it to a known value. Please note that if the ROMs are bad, the main processor-controller will most likely not operate. The checksums and the test code reside on blocks 1 and 2 of ROM. At the beginning of this test, the main processor will clear the display's memory by writing a NOP instruction to all the display's memory locations. The $\overline{\text{POP}}$ (Power On Preset) signal to the main processor-controller turns on the ROM and RAM test LEDs (A13CR6 and A13CR5, respectively). The checksums are then calculated for ROM, and if an error is found, a message will be written to the display. If all tests pass, the ROM test LED (A13CR6) will be extinguished, and the next test will be performed. If a failure occurs, the ROM test LED will be left on, the main processor-controller will pause for approximately 5 seconds, and the next test will be performed.

Self Test Number 3, Main Processor-Controller RAM Test

The main processor-controller (A13) performs tests on the areas of its RAM that do not have non-volatile requirements (i.e., the dynamic stack). First, a checksum is computed for the non-volatile sections. Then a marching ones test is performed on the stack area of RAM. A marching ones test pushes zeros, ones, HEX 55's and HEX AA's through RAM. Each block of RAM as labeled on the A13 board is tested and errors are reported by these block numbers. Data is written to one block and other blocks are read to determine block interaction errors. Block interaction errors generally indicate failed decoders or chip select lines. If an error occurs, an error message will be displayed for approximately 5 seconds before the next test is performed. If the RAM test passes, the RAM test LED (A13CR5) will be extinguished.

Self Test Number 4, Total Main Processor-Controller RAM Test

This test is invoked by pressing the SAVE and RECALL hardkeys on the front panel simultaneously after a power-on and holding them down until the RAM test is complete. All RAM memory locations are checked during this test, even memory with non-volatile requirements. All saved instrument states and trace data is lost during this test. The test procedure is the same as the procedure in SELF TEST NUMBER 3.

Self Test Number 5, Keyboard Cable Test

The main processor-controller (A13) tests to see if the keyboard cable is connected to the motherboard. The main processor-controller looks for the keyboard MSB (Most Significant Bit) to be pulled low through A13U42. The keyboard pulls this line low at A15J1(8). If this test fails, the keyboard interconnection should be suspect.

Self Test Number 6, Timer Interrupt Test

The main processor-controller (A13) will check to see that the timer interrupt occurs, which is a divided down version of the 16 MHz from the phase-locked loop circuit (A13U48). The 16 MHz clock is divided by A13U49, U60, and U78 so that the main processor-controller can sense its presence. The timer interrupts are necessary for scanning the keyboard.

Self Test Number 7, Trace Memory Test

The main processor-controller tests the volatile portion of the trace memory board (A12). A marching ones test is then performed to the RAM section of trace memory. The marching ones test is described under SELF TEST NUMBER 3, MAIN PROCESSOR-CONTROLLER RAM TEST. This test checks blocks 1, 2, 3 and 4 of the trace memory RAM which corresponds to A12U5,U12,U6, and U13 respectively. A more exhaustive trace memory test is available using the SPCL FCTN (SPECIAL FUNCTIONS) menu and selecting the TRACE MEMORY test.

Self Test Number 8, 1 MHz Test

This test checks to see if a divided down version of the 1 MHz clock is present. A13U44 monitors U77(6) and waits for a transition to occur. This signal is generated on the frequency reference board (A6), and should be suspect if the test fails.

Self Test Number 9, 8 kHz Test

This test checks to see if the 8 kHz signal to the input board (A1) is present. This signal is generated on the frequency reference board (A6), and should be suspect if the test fails.

Self Test Number 10, Fast Processor Self Test

The fast processor board (A11) first tests its own logic for errors. It then tests its ability to access the trace memory board (A12) and the counter/receiver board interface. The following error messages are generated by this test:

1. NO REPONSE FROM FP

   This indicates that the main processor-controller board (A13) cannot access the fast processor board (A11). This usually indicates a serious fast processor failure.

2. FP LOGIC FAILURE

   This indicates the fast processor's associated logic circuitry is not operating correctly.

3. FP CNTR/RCVR FAILURE

   This indicates that the sweep timer counter and receiver board (A1) interface is not operating correctly.

4. FP CANNOT ACCESS TRACE MEMORY

   This indicates that the fast processor (A11) wrote data to trace memory (A12) and read the data back and the two were not the same.

5. FP-MP COMMUNICATION ERROR

   This indicates that the main processor-controller wrote data to the fast procesor, and read the data back and the two were not the same.

2-8 CONTINUOUSLY MONITORED DIAGNOSTICS

The tests listed in Table 2-2 are performed continuously while the HP 3577A is operating. The tests listed in Table 2-4 are obtainable from the 3577A front panel via the SPCL FCTN (SPECIAL FUNCTION) hardkey. For each of these tests, a test explanation is given and the suspect board identified for test failures. The continuously monitored tests are listed by the error message that is displayed on the HP 3577A.

Table 2-2. Continuously Monitored Diagnostics

Error Message	Test Name	Test Location	Suspect Board
Oscillator Unlocked Assembly A5,A6 or A7	Phase-Locked Loop Unlocked	A6U9(6) A5U50(4) A7U6(6)	Reference (A6) Offset (A5) Synthesizer (A7)
Reference Unlocked	10 MHz Reference Unlocked	A6U2(1)	Reference (A6)
Bus Error	Main Processor Hardware Error	A13U1(22)	Main Processor-Controller (A13)
Stack Overflow *Integer Overflow *Divide By Zero Real Math Overflow Real Math Underflow Spurious Interrupt Interrupt 1 Interrupt 2 Illegal Instruction Escape Code x	Main Processor Hardware Error	A13U1 Internal	Main Processor-Controller (A13)
System Error #x	Fast Processor/ System Errors	Software limit tests	Fast Processor (A11)
Front Panel Key Stuck	Keyboard	A15J1(8)	Keyboard (A15)

*Note: These error messages could be caused by data in registers D1, D2, D3, or D4.

Each of the continuously monitored diagnostics in Table 2-2 is listed below by test name. This information along with the schematics in Section VIII (Service) gives the service technician insight into the failure conditions.

Oscillator Unlocked, Assembly A5, A6 or A7

Each of the phase-locked loops in the HP 3577A is monitored by a loop unlock detector.

The frequency reference board (A6) is monitored by A6U10. If the output of A6U9 has an ac component, A6U10 detects the ac and pulls its output low. This causes an internal LED to turn-on and signals the main processor-controller (A13).

The synthesizer board (A7) phase-locked loop is monitored by A7U42. The output of the sample and hold is monitored. When the detector (A7U42) senses an out-of-range dc control voltage, it will then cause an internal LED to turn-on and interrupts the main processor-controller (A13). It is normal for the sythesizer to lose phase lock between sweeps due to the retrace.

The 250 kHz offset board (A5) phase-locked loop is monitored by U51. The output of the phase detector and loop filter is monitored. If an ac signal or a positve dc signal is present U51 pulls its output low. This causes an internal LED to turn-on and interrupts the main processor-controller (A13).

10 MHz Reference Unlock

The 10 MHz phase-locked loop has its own unlock detector and error message. This is because external signals can cause this loop to unlock. The 10 MHz phase-locked loop is monitored by A6CR3, CR4, and U2b. The diodes monitor the phase detector output. When an ac signal occurs at A6U2(1), the output of A6U2b runs to the positive supply voltage. This turns on an internal LED (A6CR20) and interrupts the main processor-controller (A13) through the inverter A6U1c.

Main Processor Hardware Error

The main processor-controller (A13) has error detection routines which are an integral part of the chip. Generally all these errors say is that something is wrong with the Address or Data Bus. Any components connected to the bus should be suspect.

The BUS ERROR message is generated when the processor writes to ROMs, writes outside the address space available, etc. A13U1(22) is the trigger for this error. When pin 22 is low, the main processor-controller trips. The following components are involved with the BUS ERROR decoding: A13U61, U64 through U67. It should be noted, however, that this error will occur for almost all failures on the address or data bus, therefore all components connected to either bus should be suspect.

All other main processor-controller hardware errors are detected by numerical software traps within the HP 3577A operating system. These errors cannot be used to isolate hardware problems easily and indicate a fault within the 3577A digital system.

Fast Processor/System Errors

The HP 3577A system errors are reported by the main processor-controller (A13). When the operating system senses an invalid instrument state or operation in the digital sections, a system error is generated. Since these errors are generated during a control or calculation operation, as opposed to a self test mode, the actual cause for an error cannot be exactly known. This information may be useful, along with other fault isolation data already received, for narrowing down digital failures. Each of the system errors are listed below, along with an explanation of what causes an error trip. Most of these errors indicate a problem with the fast processor (A11) and/or main processor-controller (A13) communication.

DATA ERROR #1

This error occurs when the main processor-controller gets a bad number after converting the fast processor's data from 32-bit floating point to 64-bit floating point format. Refer to the Proposed Floating Point Standard* for information as to which bits are invalid.

DATA ERROR #2

This error occurs after a bad 64-bit to 32-bit conversion in the main processor-controller resulting in a "Not A Number" error as outlined in the Proposed Floating Point Standard*. Refer to the standard for information as to which bits are invalid.

DATA ERROR #3

This error occurs after a bad 64-bit to 32-bit conversion in the main processor-controller resulting in an Underflow. Refer to the Proposed Floating Point Standard* for information as to which bits are invalid.

DATA ERROR #4

This error occurs after a bad 64-bit to 32-bit conversion in the main processor-controller resulting in an Overflow. Refer to the Propose Floating Point Standard* for information as to which bits are invalid.

DATA ERROR #5

This error occurs after a bad 64-bit to 32-bit conversion in the main processor-controller resulting in Infinity. Refer to the Proposed Floating Point Standard* for information as to which bits are invalid.

DATA ERROR #6

This error occurs after a bad 32-bit to 64-bit conversion resulting in an Invalid Zero. Refer to the Proposed Floating Point Standard* for information as to which bits are invalid.

SYSTEM ERROR #7

This error occurs when a status interrupt occurs during the processing of a data interrupt. Possible failures include the main processor-controller interrupt decoding or the fast processor interface.

SYSTEM ERROR #8

This occurs when the fast processor interrupts the main processor-controller but the data given to define the interrupt does not match the valid table. The interrupt defines an overload condition at one of the receiver ports.

SYSTEM ERROR #9

This error occurs if the main processor-controller told the fast processor to start or to abort and the fast processor did not understand the command. This means the fast processor did not get the right data. This error occurs when the fast processor is in its main loop.

*This Proposed Floating Point Standard is explained in Chapter 4 of the Basic Programming Techniques with Extension 2.0 for the 200 Series Computers Documentation Manual. The -hp- part number for this manual is 09826-90011.

SYSTEM ERROR #10

This error occurs if the main processor-controller told the fast processor to start or abort and the fast processor did not understand the command. This error occurs when the fast processor is in its trigger loop.

SYSTEM ERROR #11

This error occurs if the main processor-controller told the fast processor to start or abort and the fast processor did not understand the command. This error occurs when the fast processor is in its process loop.

SYSTEM ERROR #12

This error occurs if the main processor-controller told the fast processor to start or abort and the fast processor did not understand the command. This error occurs when the fast processor is in its settling loop.

SYSTEM ERROR #13

This error occurs when the fast processor tries to execute a trace arithmetic instruction, passed it through buffers into trace memory and the data instruction received was bad.

SYSTEM ERROR #14

The fast processor is not reading the fast processor/main processor-controller interface after a command was written to the interface by the main processor-controller. Check to see if the 30 MHz fast processor clock is present.

SYSTEM ERROR #15

This error occurs when the fast processor does not acknowledge the receipt of an ABORT command from the main processor-controller. This occurs when U44(6) is still low.

SYSTEM ERROR #16

This error occurs when the main processor-controller has tried to send a HALT command to the fast processor and the fast processor echoed back a bit pattern which is not an appropriate response.

SYSTEM ERROR #17

This error occurs when the fast processor data and instructions create an overflow condition. This error usually indicates a fast processor communication problem.

SYSTEM ERROR #18

This error occurs when the fast processor data and instructions create an underflow condition. This error usually indicates a fast processor communication problem.

SYSTEM ERROR #19

This error occurs when the main processor-controller has tried to send a HALT command to the fast processor and the fast processor echoed back a bit pattern which is a valid reply but not the HALTED reply.

SYSTEM ERROR #20

This command occurs when the fast processor does not allow the main processor-controller to access the interconnecting bus between fast and main processors. The BUSGNT line did not go active low.

SYSTEM ERROR #21

This error occurs when the main processor-controller encounters a software error and usually indicates a main processor-controller failure.

SYSTEM ERROR #22

This error occurs when the main processor-controller encounters a software error and usually indicates a main processor-controller failure.

SYSTEM ERROR #23

This error occurs when the main processor-controller encounters a software terminator error in its commands. This error usually indicates a main processor-controller failure.

SYSTEM ERROR #24

This error occurs if at the end of a log sweep segment the Frac N limit line, A13U45(13), was not toggled high. This usually indicates a fault in the synthesizer board (A7) or an error in the control bus and associated control lines.

KEYBOARD

The main processor-controller (A13) scans the keyboard constantly for any inputs. If a key is held down for more than 10 seconds, the microprocessor sends an error message to the display. A pressed key is sensed through A15J1(8) by a TTL low. Due to decoding uncertainties, the keyboard ignores all inputs when it senses a key is stuck.

2-9 CONFIDENCE TESTS

The HP 3577A has the ability to run an analog self test on its input channels and its source. These tests essentially check to see if the source and input channel agree. As many single channel specifications as possible are checked in these tests. This self test does not check to the instrument specifications since a cable is required to connect the source and input channel and the characteristics of the cable can affect the measured results. Table 2-3 lists the Confidence Tests.

These tests are available under the SPCL FCTN (SPECIAL FUNCTION) hardkey on the 3577A front panel. To run these tests, first press the SPCL FCTN hardkey and select the CONF TEST softkey.

Table 2-3. Confidence Tests

Test Number	Test Name	Error Message
1	LOG SWEEP FLATNESS TEST	Is cable connected?
		Failed: Log Sweep signal level test
		Failed: Log Sweep flatness test
2	LINEAR SWEEP FLATNESS TEST	Failed: Linear Sweep signal level test
		Failed: Linear Sweep flatness test
3	SYNTHESIZER AND L.O. TEST	Failed: Synthesizer and L.O. test
4	SOURCE AMPLITUDE TEST	Failed: Amplitude sweep accuracy test
5	OUTPUT LIMITER TEST	Failed: Output Limiter linearity test
6	IMPEDANCE AND ATTENUATOR TEST	Failed: Receiver Impedance test
		Failed: Receiver Attenuator test

Each of the Confidence Tests is described below. The description should be valuable in order to isolate any failures which occur with these tests. It is quite easy to isolate if a failure occurs on the input or output since the Confidence Tests can be run separately on each input channel. If a Confidence Test passes on one or two inputs, the problem is probably in the receiver.

The 3577A instrument state is also listed for each test. By repeating a test manually and varying the instrument setup, the faulty board can often be found. If repeating these tests manually, INSTR PRESET should be pressed between each test setup. If a Confidence Test fails, the test sequence stops, leaving the instrument in the failed test setup.

Due to the interactions mentioned previously, faulty boards for these tests cannot be determined in advance. The Confidence Tests are valuable when used with the overall block diagram and the overall circuit description. By running the tests manually, and varying the instrument state for each test slightly, faulty blocks can be isolated from the front panel.

Confidence Test Number 1, Log Sweep Flatness Test

Instrument State:
- Sweep Type .... Log
- Display Function .... Log Magnitude
- Resolution Bandwidth .... Auto BW On
- Start Frequency .... 400 Hz
- Stop Frequency .... 200 MHz
- Source Amplitude .... −9.1 dBm
- Sweep Time .... 3 seconds

Test Procedure:
- Trigger for a single sweep

Test Requirements:
- 1-(Maximum Amplitude) − (−9.1 dB) < 3.642 dB and (−9.1 dB) − (Minimum Amplitude) < 3.642 dB
  Error message: Failed: Log Sweep signal level test
- 2-(Maximum Amplitude) − (Minimum Amplitude) ≤ 2.16 dB
  Error message: Failed: Log Sweep Magnitude flatness test
- 3-(Maximum Amplitude) ≥ −60 dBm
  Error message: Is cable connected?

Confidence Test Number 2, Linear Sweep Flatness Test

Instrument State:
- Sweep Type .... Linear
- Display Functions .... Log Magnitude
- Resolution Bandwidth .... 1 kHz
- Start Frequency .... 2 MHz
- Stop Frequency .... 200 MHz
- Source Amplitude .... −9.1 dBm
- Sweep Time .... 1 second

Test Procedure:
Trigger for a single sweep.

Test Requirements:
1-(Maximum Amplitude) − (−9.1 dBm) < 3.642 dB and (−9.1 dB)
- (Minimum Amplitude) < 3.642 dB
Error message: Failed: Linear Sweep signal level test
2-(Maximum Amplitude) − (Minimum Amplitude) < 2.16 dB
Error message: Failed: Sweep magnitude flatness test

Confidence Test Number 3, Synthesizer and L.O. Test

Instrument State:

Sweep Type	Linear
Display Functions	Log Magnitude
Resolution Bandwidth	1 kHz
Start Frequency	0 Hz
Stop Frequency	50 MHz
Source Amplitude	−9.1 dBm
Sweep Time	1 second

Test Procedure:
Trigger for a single sweep.

Test Requirements:
1-(0 Hz Marker Value) < -33 dBm or Absolute Value of (50 MHz Marker Value
− (−9.1 dBm)) < 3.642 dBm
Error message: Failed: Synthesizer and L.O. test

Confidence Test Number 4, Source Amplitude Test

Instrument State:

Sweep Type	Amplitude
Display Function	Log Magnitude
Source Frequency	200 MHz
Start Amplitude	−49 dBm
Stop Amplitude	−5.1 dBm
Steps per Sweep	50
Time per Step	100 msec
Resolution Bandwidth	1 kHz

Test Procedure:
Trigger for a single sweep.

Test Requirements:

1-Absolute Value of ((X Marker Value) − (Y axis Amplitude))
< 3.642 dB and Absolute Value of (bin N+1 value − bin N value − 0.878 dB)
< 1.28 dB
Error Message: Failed: Amplitude Sweep accuracy test

Confidence Test Number 5, Output Limiter Test

Instrument State:

Sweep Type	Amplitude
Display Function	Log Magnitude
Source Frequency	90 kHz
Start Amplitude	−9 dBm
Stop Amplitude	−5.1 dBm
Steps Per Sweep	20
Time Per Step	50 msec
Resolution Bandwidth	1 kHz

Test Procedure:

Trigger for a single sweep.

Test Requirements and Suspect Block:

1-Absolute Value of (bin N+1 − bin N − 0.195 dB) < 0.2 dB
Error Message: Failed: Output Limiter linearity test

Confidence Test Number 6, Impedance and Attenuator Tests

Instrument State:

Sweep Type	CW
Display Function	Log Magnitude
Source Frequency	90 kHz
Source Amplitude	−30 dBm
Resolution Bandwidth	1 kHz

Test Procedure:

Take a data point on 50 ohm impedance, 20 dB input attenuation
Record measured value.
Switch impedance to 1 M ohm, 20 dB input attenuation.
Record measured value.
Switch impedance to 50 ohm, 0 dB input attenuation.
Record measured value.

Test Requirements:

1- Absolute Value of ((1 M ohm, 20 dB attenuation value) – (50 ohm, 20 dB attenuation value – 6 dB)) < 0.2 dB
Error Message: Failed: Receiver impedance test

2- (50 ohm, 20 dB value) – (50 ohm, 0 dB value) < 0.1 dB.
Error Message: Failed: Receiver attenuator test

2-10 SERVICE DIAGNOSTICS

The HP 3577A has the ability to run several diagnostic and service routines on itself. Some of these tests are a more complete version of the power-on self tests described in Section 2-6, others are servicing aides such as Signature Analysis (SA) pattern routines.

The diagnostics are accessible under the SPCL FCTN (SPECIAL FUNCTION) hardkey. To enter the diagnostic routines, press the SPCL FCTN hardkey and select the Service Diag (Diagnostics) softkey. Softkeys available under the Service Diagnostics are listed in Table 2-4.

Table 2-4. Service Diagnostics

Softkey Number	Diagnostic Name	Tests Location	Comments
1	LEVELING ON/OFF	A8U20(10)	Breaks source leveling loop for troubleshooting.
2	SETTLING ON/OFF	None	Turns off dwell time before each sweep.
3	SYN DIAG ON/OFF	None	Changes source frequency. Readout to read synthesizer (A7) frequency (300.25 to 500.25 MHz)
4	TEST PATTERN	Display Module	Turns on the display module test pattern.
5	TRC MEM TEST	A13U33 - U36, A12 all	Tests all trace memory board (A12) ROM and RAM locations.
6	FASTPROC TEST	A13U31 - U36, U62	Tests fast processor board (A11) logic and interfacing.
7	FAST BUS INT TEST	A13U31 - U36	Tests bidirectional main (A13) and fast processor (A11) port.
8	MORE	None	Selects menu listed below.
1 new menu	DISP MEM TEST	A13U39, U40	Tests display module memory. Will destroy all data in memory.
2	DISP HP-IB	A16 all circuits	Reads state of HP-IB connector pins through HP-IB IC (U21).
3	HP-IB SA	A16 all circuits	Runs signature analysis routine on HP-IB circuits.

Leveling On/Off

This function sets the output of A8U20(10) low and turns the high frequency source leveling loop off. This feature will aid in source output board (A8) troubleshooting.

Settling On/Off

This function turns off the settling time function implemented at the beginning of each sweep by the HP 3577A.

Syn Diag On/Off

This function allows programming of the HP 3577A in direct synthesizer frequencies (300.25 to 500.25 MHz). This feature will aid in synthesizer troubleshooting by offering simpler instrument programming.

Test Pattern

This function disconnects the 3577A digital section from the display module inside. When disconnected, the display module turns on its own resident test pattern which tests most display functions. Refer to the HP 1345A Digital Display Operating and Service Manual accompanying this manual.

TRC Mem Test

This function performs a checksum on the trace memory (A12). ROMs and a marching ones test on the trace memory RAMs. For explanation of marching ones and checksum tests, refer to the Power-On Self Test Number 3 in Section 2-7.

Fastsproc Test

This function performs the fast processor self test. This self test is described in detail in the Power-On Self Test Number 10 in Section 2-7.

Fast Bus Int (Interface) Test

This function tests the bidirectional port between the fast processor (A11) and the main processor-controller (A13). This test is performed by the main processor-controller. The main processor-controller writes information to the port, and then reads back the echoed data. The test is then repeated with the fast processor writing and reading.

Disp Mem Test

This function thoroughly tests the memory resident in the display module in the HP 3577A. The test is about 10 seconds long, with the display blank during this time. The instrument returns from the test in an INSTrument PRESET state. The test performed is a marching ones test as described in the Power-ON Self Test in Section 2-7.

Disp HP-IB Test

This function draws an HP-IB connector facsimile on the 3577A display. All connector pins are labeled. A dot is printed on the connector when the main processor-controller (A13) senses the pin pulled low. This connector is accessible from the rear panel of the HP 3577A. In order to display a dot on the appropriate control line, the line must be tied to logic ground (lgnd - pin 24). This diagnostic is used to test the communication port to and from the main processor-controller board (A13) via the HP-IB board (A16).

HP-IB SA

This function turns on a signature analysis routine for the HP-IB (A16) circuit board. Refer to the HP-IB service section in Section VIII for valid signatures and test points.

2-11 COVERS OFF BOARD LEVEL FAULT

This section includes fault isolation tests where the instrument covers are removed. Since hazardous signals are present in the HP 3577A with the covers removed, be sure to take all necessary safety precautions.

WARNING

Maintenance described herein is performed with power supplied to the instrument and protective covers removed. Such maintenance should be performed by service trained personnel who are aware of the hazards involved (for example, fire and electrical shock). Where maintenance can be performed without power applied, the power cord should be removed.

This section describes a procedure much like the factory procedure for bringing the HP 3577A to life for the first time. The procedure assumes that any board can be faulty. This procedure is written in a serial fashion but does not have to be performed in this order. If there is a strong suspicion that a particular functional area is faulty, that section of this procedure should be done first. If the HP 3577A passes all digital self tests, there is a high level of confidence that the digital section is working correctly. This section includes the Main Processor-Controller (A13), Trace Memory (A12), Fast Processor (A11) and HP-IB (A16) boards. If the digital self tests fail, then the area tested in each should be repaired before continuing with the fault isolation.

Table 2-5. Board Turn-On Hierarchy

Board Description	Board Designator
1. Main Power Supply	A21
2. Digital Display	1345A
3. Main Processor	A13
4. Keyboard	A15
5. Frequency Reference	A6
6. Trace Memory	A12
7. Fast Processor	A11
8. HP-IB	A16
9. Input (R,A,B)	A1
10. Synthesizer	A7
11. Local Oscillator	A4
12. 250k Offset	A5
13. Output	A8
14. Oven	A31

Table 2-5 lists the turn-on hierarchy for the HP 3577A, given that all boards are suspect of being faulty. Table 2-6 lists all the power supplies in the HP 3577A. The power supplies should be checked before extensive troubleshooting is performed. Table 2-7 lists all input and output signals between individual boards in the HP 3577A which are available from the top of the boards by coaxial cables and test points. Signal parameters are listed for each signal. All parameters listed are required parameters unless denoted by a ≅ character. All ≅ parameters are typical performance parameters of the instrument and only serious deviations should be investigated.

Table 2-6. Main Power Supply

Supply Name	Output Location	Return Location	Nominal Voltage	Voltage Tolerance	Ripple Tolerance
+15V	TP8	Chassis	+15V	+0.05, −0.00	80 mVp-p
−15V	TP9	Chassis	−15V	±0.05	80 mVp-p
+5V	TP26	Chassis	+5.1 V	±0.02	60 mVp-p
+8V	TP10	Chassis	+8V	±1	90 mVp-p
+5V (HP-IB)	TP11	TP12	+5V	±0.5	350 mVp-p

Remove the 3577A bottom cover and check the supplies listed above with the power distribution cables connected and all circuit boards in the HP 3577A. If all supplies check good, continue with the Covers Off Board Level Fault Isolation. If any supplies are incorrect, then refer to Section VIII (Service) for troubleshooting information.

CAUTION

Do not remove or insert circuit boards in the HP 3577A with the power applied to the instrument. Damage may result when circuit boards are removed or inserted while instrument is powered on.

NOTE

The voltage levels and ripple tolerances listed above are for fully loaded supplies. When removing individual boards, the supply levels will change with the various loads. Keep this in mind when performing fault isolation.

Table 2-7. Fault Isolation Test Signals

Board	Connector	Signal Parameters			
		Frequency	Amplitude	Level Flatness	Harmonics
A4	J3 J4 J5	.25-200 .25 MHz .25-200 .25 MHz .25-200 .25 MHz	≅+7 dBm ≅+7 dBm ≅+7 dBm	≅ ±1.0 dB ≅±1.0 dB ≅±1.0 dB	≅<−10 dB ≅<−10 dB ≅<−10 dB
A5	J1	300 .25 MHz	≅+7 dBm	N/A	≅<−18 dB
A6	J2 J3 J4 J5 J7	10 MHz 300 MHz 300 MHz 100 kHz 30 MHz	≅ 0 dBm ≅− 3 dBm ≅−26 dBm ≅ 2 Vpp 5 Vdc offset TTL Levels	N/A N/A N/A N/A N/A	≅<−40 dB ≅<−10 dB ≅<−15 dB ≅< 30 nS Pulsewidth ≅< 7 nS Risetime
A7	J1 J2	300.25 MHz− 500.25 MHz 300.25 MHz− 500.25 MHz	≅−1 dBm ≅−1 dBm	≅±1.5 dB ≅±1.5 dB	≅<−10 dB ≅<−10 dB
A31	J1	10 MHz	≅−0 dBm	N/A	≅<−25 dB
A8	Front Panel	5 Hz-200 MHz	−49 to +15 dBm	±1.5 dB	<−30 dB

NOTE

All amplitude measurements cited here are made using an HP 436A Power Meter and an HP 8482A Power Sensor. All flatness and harmonics measurements are made using an HP 8566A Spectrum Analyzer. All time domain measurements are made using an HP 1980B Oscilloscope.

SECTION III
PERFORMANCE TESTS

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3-1 INTRODUCTION

The procedures in this section test the electrical performance of the instrument using the specifications of Table 1-1 as the performance standards. Most tests can be performed without access to the interior of the instrument. A shorter test is included in this section under the Operational Verification Test. The performance tests must be performed in the sequence given, since some procedures rely on satisfactory results in previous tests. If a test measurement is out of tolerance, go to Section IV (Adjustments).

3-2 EQUIPMENT REQUIRED

Equipment required for the performance tests is listed in Table 1-2. Any equipment which meets the critical specifications given in the table may be substituted for the recommended model.

3-3 TEST RECORD

Results of the performance tests may be tabulated on the Test Record, Table 3-10, at the end of this section. The test record lists all tested specifications, and their acceptable limits. The test record may be removed from the manual and used as a permanent record of the incoming inspection or of routine performance verification. The performance test record may be reproduced without the written permission of Hewlett-Packard.

3-4 CALIBRATION CYCLE

This instrument requires periodic verification of performance. Depending on the use and environment the instrument is subject to, the performance tests should be performed at least every 12 months.

3-5 OPERATIONAL VERIFICATION TESTS

The Operational Verification Tests for the HP 3577A are designed to be run with a minimum amount of equipment. A comparison of the required equipment to run the tests is presented in Table 1-2. These tests give the user a high level of confidence that the HP 3577A meets all specifications as listed in Table 1-1, but do not guarantee that all specifications are met. The Operational Verification Tests require about 3 hours time to perform.

Table 3-1. Operational Verification Tests

Test Name	Paragraphs to Complete
Receiver Residuals and Noise Test	All
Magnitude and Phase Dynamic Accuracy Test	x through ii
Source Distortion and Spur Test	All
Source Flatness and Absolute Accuracy Test	All
Confidence Test (internal)	

3-6 INITIAL CONTROL SETTINGS

Each of the following performance tests assumes an initial condition of the 3577A control settings. This is due to the trace arithmetic and trace input functions possible with the HP 3577A. Initial conditions can be achieved by pressing the INSTR PRESET button. The setting of the INSTR PRESET are:

INPUT . . . . R
AMPTD . . . . −10 dBm
FREQ
  START FREQ . . . . 0 Hz
  STOP FREQ . . . . 200 MHz
SWEEP TYPE . . . . LIN FREQ SWEEP
SWEEP TIME . . . . 1 sec
RESOLUTION BANDWIDTH . . . . 1 kHz
SCALE
  REF LEVEL . . . . 0 dBm
  dB/DIV . . . . 10 dB

3-7 RECEIVER RESIDUALS AND NOISE TEST

SPECIFICATIONS:

Sensitivity:

Resolution Bandwidth	Minimum Frequency to 30 kHz		30 kHz to 200 MHz(50 Ω) 30 kHz to 20 MHz(1 MΩ)	
	Maximum Input Level		Maximum Input Level	
	0 dBm −13 dBV (20dB att)	−20 dBm −33 dBV (0dB att)	0 dBm −13 dBV (20dB att)	−20 dBm −33 dBV (0dB att)
1 Hz	−110 dBm	−130 dBm	−110 dBm	−130 dBm
10 Hz	−100 dBm	−120 dBm	−110 dBm	−130 dBm
100 Hz	− 90 dBm	−110 dBm	−105 dBm	−125 dBm
1 kHz	− 80 dBm	−100 dBm	− 95 dBm	−115 dBm

Residual Responses:
- Local Oscillator feedthrough: < −33 dB from maximum input.
- Line and Fan related spurious: < −100 dBm.
- Residual responses: < −100 dB from maximum input.

DESCRIPTION:
The receiver inputs to the HP 3577A are terminated in 50 Ω, and the receiver residual response is measured as indicated on the 3577A display. With the inputs still terminated, the average noise level is measured. The measurement consists of averaging the amplitude of eleven points in the linear magnitude of an amplitude sweep and converting to dBm.

EQUIPMENT:
- 50 Ω Termination (3 each) .... HP 11048C
- N male to BNC female Adapter (3 each) .... HP 1250-0780

PROCEDURE:

RECEIVER RESIDUALS TEST

a. Preset the 3577A.
b. Terminate the R, A, and B receivers of the 3577A with the 50 Ω terminations, using N male to BNC female adapters.
c. Set the 3577A controls as shown below:

SWEEP TYPE	CW
SWEEP TIME (SAMPLE TIME)	0.1 sec
AMPTD	−48 dBm
RES BW	10 Hz
AVG	256
ATTEN (all channels)	50 Ω, 20 dB

d. Press the FREQ hardkey and enter a FREQ of 149.625 MHz.
e. Press the INPUT hardkey and select R.
f. The marker MAG on the 3577A display should read < −100 dBm. Enter the reading in the test record.
g. Repeat steps e and f for inputs A and B.
h. Repeat steps d through g for all the frequencies listed in Table 3-2. For all frequencies the noise must be < −100 dBm. For 0 Hz, the L.O. Feedthrough must be < −33 dB.

Table 3-2. Receiver Residual Test Points

All frequencies listed are in MHz		
149.625	89.5	0.0080
149.875	120.0	0.0160
99.666 666 666	149.5	0.0240
99.833 333 333	180.0	0.027 777 7
74.6875	0.480	0.10
74.8125	0.960	0.20
59.7	0.0040	0.000 000 000
59.8		

NOISE TEST

k. Preset the 3577A.
l. Leave the 50 Ω terminations on the 3577A A, B, and R receivers.
m. Set the 3577A controls as shown below:

SWEEP TYPE .... AMPTD SWEEP
SWEEP MODE .... SINGLE
SWEEP TIME .... 0.5 sec
AMPLITUDE
  START AMPTD .... −48 dBm
  STOP AMPTD .... −48 dBm
  STEPS/SWEEP .... 10 STEPS
RES BW .... 10 Hz
DISPLY FCTN .... LIN MAG
SCALE
  /DIV .... 200 nV

n. Press the FREQ hardkey and enter a FREQ of 100 Hz.

o. Press the TRIG/RESET hardkey.

p. Press the INPUT hardkey and select R.

q. Use the 3577A RPG knob to measure the magnitude of the eleven points starting at the left. The RPG knob will move the marker directly from one point to the next. Record the magnitude of each point on the test record.

r. Calculate the noise level using the following equation:

$$\text{Noise Level (dBm)} = -150 + 10 \log_{10} \left[\frac{\sum_{n=1}^{11} (X_n^2)}{500} \right]$$

where X is the marker value in nV

s. The noise level should be < −100 dBm (−110 dBm for 30 kHz and 199 MHz). Record the reading in the test record.

t. Repeat steps q through s for the inputs A and B.

u. Repeat steps n through t for the 3577A FREQs of 30 kHz and 199 MHz. The noise level for both these frequencies should be < −110 dBm.

3-8 ON CARRIER RETURN LOSS TEST

SPECIFICATIONS:
Source Return Loss > 20 dB

DESCRIPTION:
The HP 3577A source return loss is measured using a signal generator (generates the incident signal) and a directional bridge. The sum of the HP 3577A source output and the generator signal reflected from the HP 3577A source is measured by channel R. In order to distinguish the two signals, the signal generator frequency is offset from the HP 3577A frequency. (The offset frequency is chosen to be within the loop bandwidth of the HP 3577A source leveling loop. This guarantees that the source return loss includes the effect of the leveling loop.) The summation of these two signals appear as a carrier (HP 3577A output) and one sideband (generator signal reflected from the HP 3577A source). If the sideband level is 20 dB below the HP 3577A source level, the two signals can be synthesized as simultaneous AM and PM modulation of the carrier where the modulation frequency is the frequency difference between the signal generator and the HP 3577A. The display function of channel R is set to linear magnitude, so that channel R acts as an AM detector. The peak-to-peak level of the AM signal is a measure of the sideband signal (signal reflected from the source). Given the reflected signal level, the source return loss can be computed.

EQUIPMENT:
3 dB Attenuator .... HP 8491A Opt 003
10 dB Attenuator .... HP 8491A Opt 010
Directional Bridge .... HP 35677-63502
Signal Generator .... HP 8660C
SMA male to BNC female Adapter (2 each) .... HP 1250-1200
N male to N male Adapter .... HP 1250-0778
N male to BNC female Adapter (2 each) .... HP 1250-0780
BNC Cables-48 inch (3 each) .... HP 8120-1840

PROCEDURE:

a. Preset the 3577A.

b. Set the 3577A as follows:

SWEEP MODE	SINGLE
FREQ	
FREQ SPAN	0 Hz
CENTER FREQ	175 MHz
AMPTD	12 dBm
RES BW	10 Hz
DISPLY FCTN	LIN MAG
SCALE	
REF POSN	50%
/DIV	10 mV
SAVE	SAVE REG 1

c. Connect the equipment as shown in Figure 3-1 except leave the HP 3577A source to directional bridge unconnected. (3577A EXT REF LED should be on.)

d. Set the signal generator frequency to the HP 3577A center frequency.

e. Set the signal generator amplitude to +10 dBm.

f. Press the TRIG/RESET hardkey.

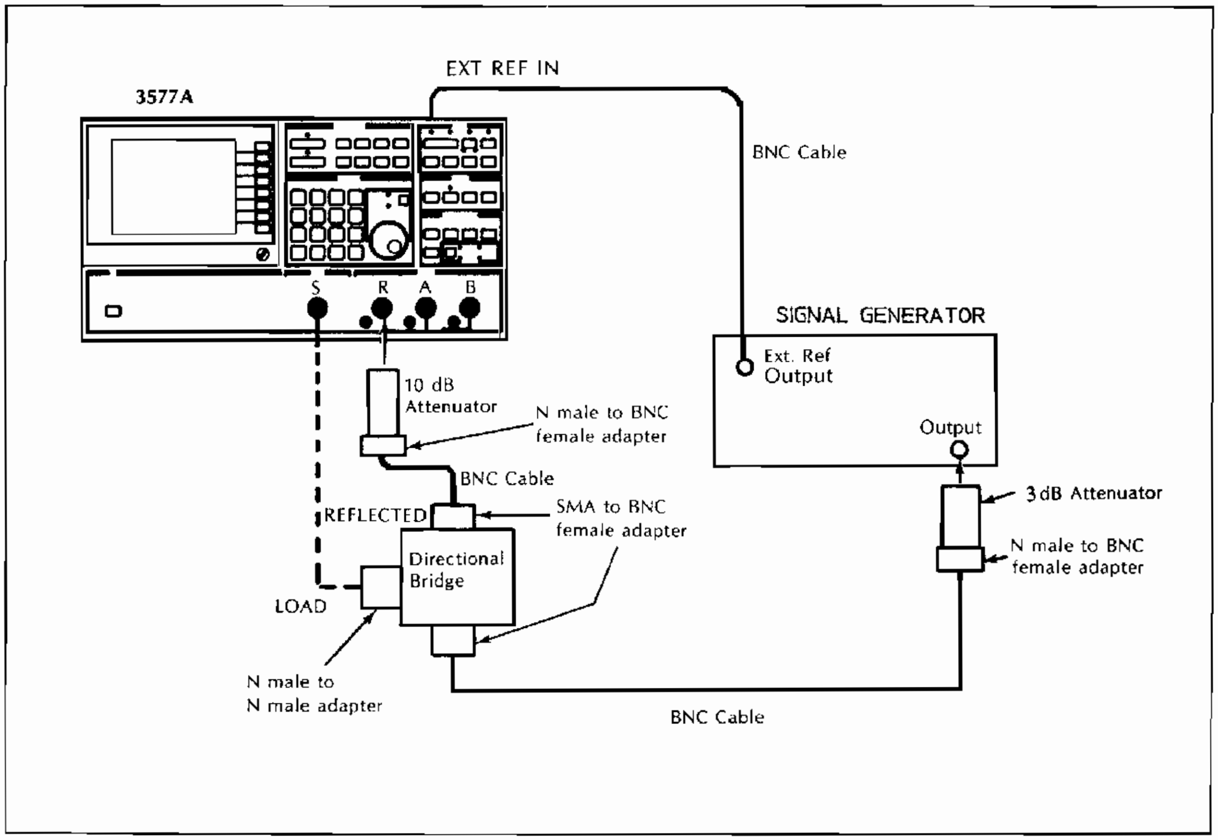


Figure 3-1 On Carrier Return Loss Test Set-Up

g. Note the marker MAG of the 3577A and record this reference voltage (Vref) in the test record. (The voltage should be approximately 40 mV).

h. Set the signal generator frequency 5 Hz above the HP 3577A frequency.

i. Connect the 3577A source to the directional bridge load port using an N male to N male adapter as shown in Figure 3-1.

j. Press the TRIG/RESET hardkey. Press the MKR→ hardkey and select MKR→REF LVL.

k. Press the SCALE hardkey and enter a /DIV of 1 mV.

l. Press the MKR→ hardkey and select MKR→MIN. Press the MKR hardkey and select ZERO MARKER. Using the 3577A RPG knob, set the marker to the next sinewave maximum and record this test voltage (Vtest) in the test record. (The voltage should be approximately 6 mV or less.)

m. Calculate the on carrier return loss using the following equation:

$$\text{On Carrier Return Loss (dB)} = -(3\ \text{dB} + 20 \log_{10} (\frac{\text{Vtest}}{2\ \text{Vref}}))$$

The 3 dB is added to compensate for the 3 dB insertion loss of a 5 Hz signal in a 10 Hz resolution bandwidth.

n. The on carrier return loss should be > 20 dB. Record the value in the test record.

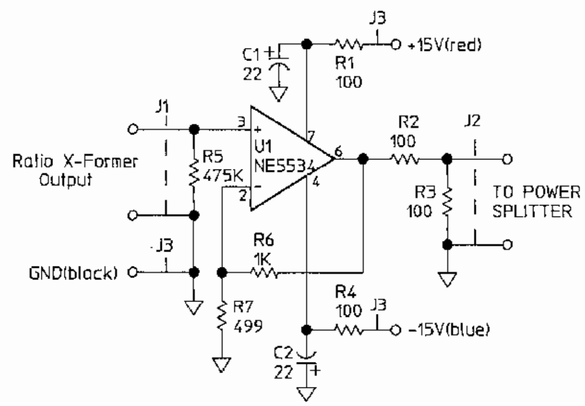
o. Press the RECALL hardkey and select RECALL REG 1. Repeat steps c through n for a 3577A FREQ of 200 MHz.

3-9 MAGNITUDE AND PHASE DYNAMIC ACCURACY TEST

SPECIFICATIONS:

Test or Reference Level	**Tolerance 1 k,100,10 Hz res BW**		**Tolerance 1 Hz res BW**	
dB from max. allowable	Magnitude	Phase	Magnitude	Phase
0 to −10 dB	0.04 dB	0.4 deg	0.04 dB	0.4 deg
−10 to −50 dB	0.02 dB	0.2 deg	0.02 dB	0.2 deg
−50 to −60 dB	0.05 dB	0.5 deg	0.05 dB	0.5 deg
−60 to −80 dB	0.15 dB	1.5 deg	0.25 dB	N/A
−80 to −90 dB	0.75 dB	7.5 deg	0.75 dB	N/A
−90 to −100 dB	0.75 dB	7.5 deg	3.00 dB	N/A

DESCRIPTION:
The dynamic accuracy test is a measure of receiver linearity or the ability of the receiver to measure a relative change in magnitude and/or phase. The measurement has a reference level of approximately −20 dBm (0 dBm maximum input level) at a phase of approximately 0 degrees. The test requires a source whose relative output level can be adjusted to an accuracy that exceeds the 3577A dynamic accuracy specification. This is done with the 3577A source and a ratio transformer with seven decimal place resolution.



Op Amp (NE5534) 1826-0715
100Ω (4ea) 0757-0401
22F (2ea) 0180-0228
475kΩ (1ea) 0757-0481
1kΩ (1ea) 0757-0280
499Ω (1ea) 0698-4123
BNC Conn (2ea) 1250-0083
IC Socket (1ea) 1200-0564
Board 5020-6893
Edge Conn 1251-0159
Lug (2ea) 0360-1190
Nut (2ea) 2950-0043
Washer (2ea) 2190-0016

Figure 3-2 Buffer Amplifier

You will have to build a buffer amplifier to match the impedance of the ratio transformer to the 50 Ω input of the HP 3577A receivers. See Figures 3-2 and 3-3 for construction details.

EQUIPMENT:

Ratio Transformer .... ESI DT72A
Power Splitter .... HP 11850A/C
Synthesizer .... HP 3325A
20 dB Attenuator .... HP 8491A Opt 020
RF Cables-24 inch (3 each) .... HP 35679A
BNC Cables-48 inch (3 each) .... HP 8120-1840
N male to BNC female Adapter (2 each) .... HP 1250-0780
BNC female to Banana Adapter (2 each) .... HP 1251-2277
Power Supply .... HP 6235A
Buffer Amplifier .... SEE FIGURE 3-2
RF Balun .... HP 03577-84404

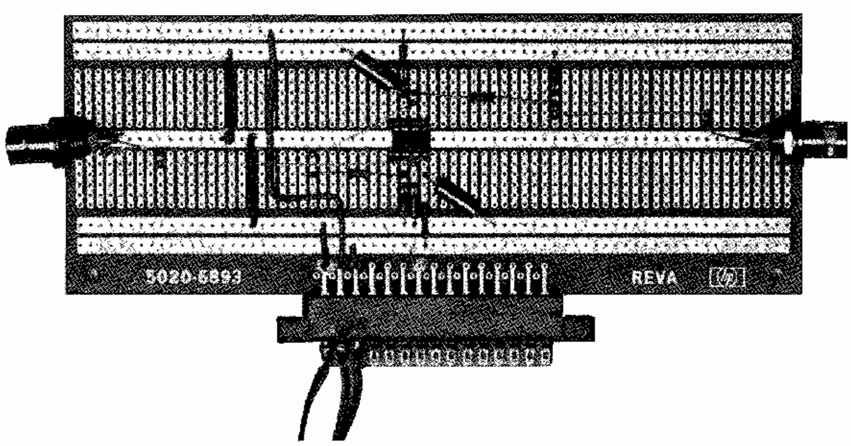


Figure 3-3 Suggested Layout for Buffer Amplifier

PROCEDURE:

a. Preset the 3577A.

b. Connect test equipment as shown in Figure 3-4.

NOTE

Test set up is critical to accurate results. Do not substitute equipment.

c. Set the 3577A to the following conditions:

SWEEP TYPE .... CW
SWEEP TIME (SAMPLE TIME) .... 0.1 sec
FREQ .... 2.1 kHz
RES BW .... 10 Hz
AMPTD .... 6 dBm
  STEP SIZE .... 0.1 dB

d. Set the Ratio Transformer to 0.1 and read the marker MAG of channel R.

e. Press the AMPTD hardkey, select AMPTD, and use the ↑ and ↓ hardkeys until the marker MAG reads −20.5 dBm ± 0.1 dBm.

f. Change the following 3577A conditions:

AVG 256
DEFINE MATH
  K1 REAL .... 0.1 UNITS
TRACE ONE
  DISPLY FCTN .... LOG MAG
  INPUT
    USER DEF INPUT K1*R/D1
    (select USER DEF INPUT, K__, 1, *, R, /, D__, 1, ENTER)
  SCALE
    REF LEVEL .... 0 dB
    /DIV .... 20 dB
TRACE TWO
  DISPLY FCTN .... PHASE
  INPUT .... COPY Trc 1→2
  SCALE
    /DIV .... 5 deg

g. Press the SAVE hardkey and select SAVE REG 1.

h. Press the INPUT hardkey and enter a USER DEF INPUT of K1*A/D2 (select USER DEF INPUT, K__, 1, *, A, /, D__, 2, ENTER).

i. Press the TRACE 1 hardkey, then the INPUT hardkey. Select COPY Trc 2→1.

j. Press the SAVE hardkey and select SAVE REG 2.

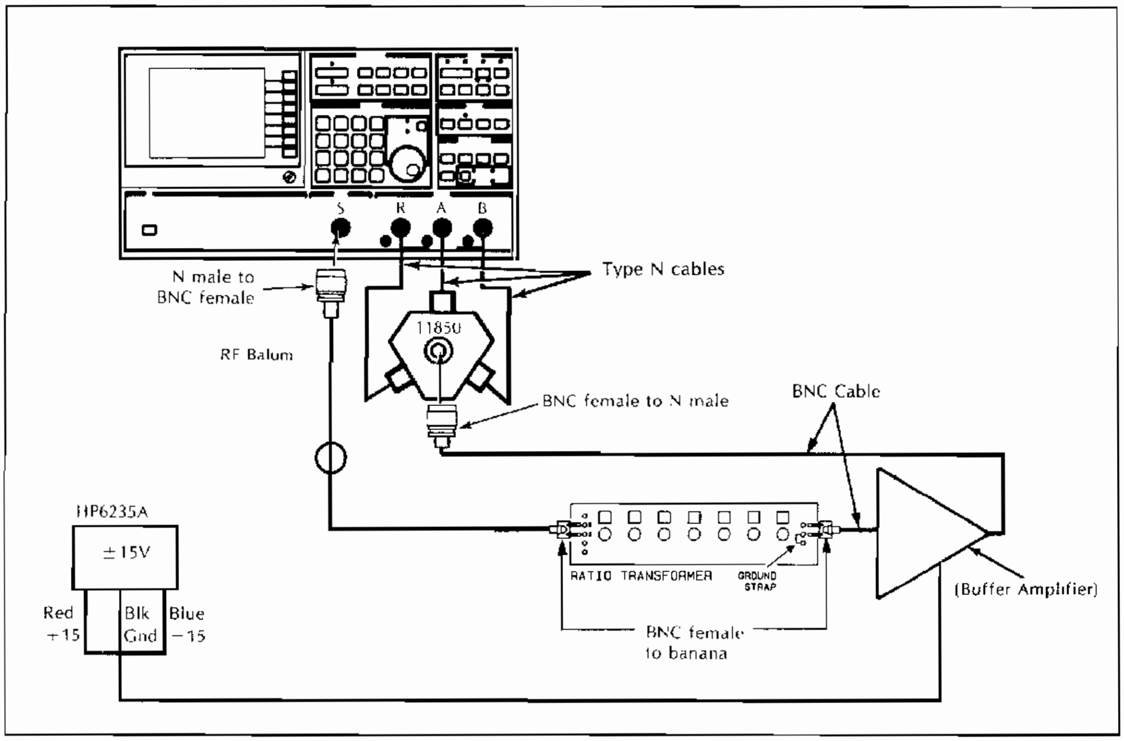


Figure 3-4 Dynamic Linearity Test Set-Up

k. Press the INPUT hardkey and enter a USER DEF INPUT of K1*B/D3 (select USER DEF INPUT, K__, 1, *, B, /, D__, 3, ENTER).

l. Press the TRACE 2 hardkey, then the INPUT hardkey. Select COPY Trc 1→2.

m. Press the SAVE hardkey and select SAVE REG 3.

n. Press the RECALL hardkey, select RECALL REG 1, and wait 10 sec.

o. Press the STORE DATA hardkey and store R into USER DEF STORE register D1 (select USER DEF STORE, R, → D__, → D1). Store A into D2 and B into D3 in the same manner. (RECALL REG 2 for A and RECALL REG 3 for B.)

p. Press the RECALL hardkey, select RECALL REG 1, and wait 5 sec.

q. The expected value of the MAG (Trace 1) should be -20.000 ± 0.003 dB and the PHASE (Trace 2) should be 0.00 ± 0.05 degrees. Record the values in the test record.

NOTE

This finishes the normalization procedure. If unable to normalize, repeat steps n through p until the magnitude at step q is −20.000 ± 0.003 dB.

r. Repeat steps p and q for channels A and B (for channel A, RECALL REG 2 and for channel B, RECALL REG 3).

s. Set the Ratio Transformer to 1.0.

t. Press the RECALL hardkey, select RECALL REG 1, and wait 5 sec.

u. The MAG should be 0.000 dB ±0.04 dB and the PHASE should be 0.0 deg ±0.4 deg. Record the values in the test record.

v. Test this Ratio Transformer setting on channels A and B by recalling registers 2 and 3 as in step r. Record the readings in the test record.

w. Repeat steps s through v for the Ratio Transformer settings in Table 3-3. The magnitude, phase and tolerances are listed in the table. For transformer settings below .01, wait 10 sec after recalling the registers, then press the SWEEP MODE hardkey and select SINGLE.

Table 3-3 Ratio Transformer Settings

Ratio Transformer	Magnitude (dB)	Tolerance (dB)	Phase (deg)	Tolerance (deg)
1.0	0.000	.04	0.0	.4
.31623	−10.000	.02	0.0	.2
.2	−13.979	.02	0.0	.2
.05	−26.020	.02	0.0	.2
.025	−32.041	.02	0.0	.2
.01	−40.000	.02	0.0	.2
.0031623	−50.000	.02	0.0	.2
.001	−60.000	.05	0.0	.5
.0001	−80.000	.15	0.0	1.5
.00001	−100.000	.75	0.0	7.5

x. Set up the equipment as in Figure 3-5. Make sure the HP 3577A 10 MHz OUT is connected to the synthesizer external reference input. The EXT REF LED on the front panel of the synthesizer should be on.

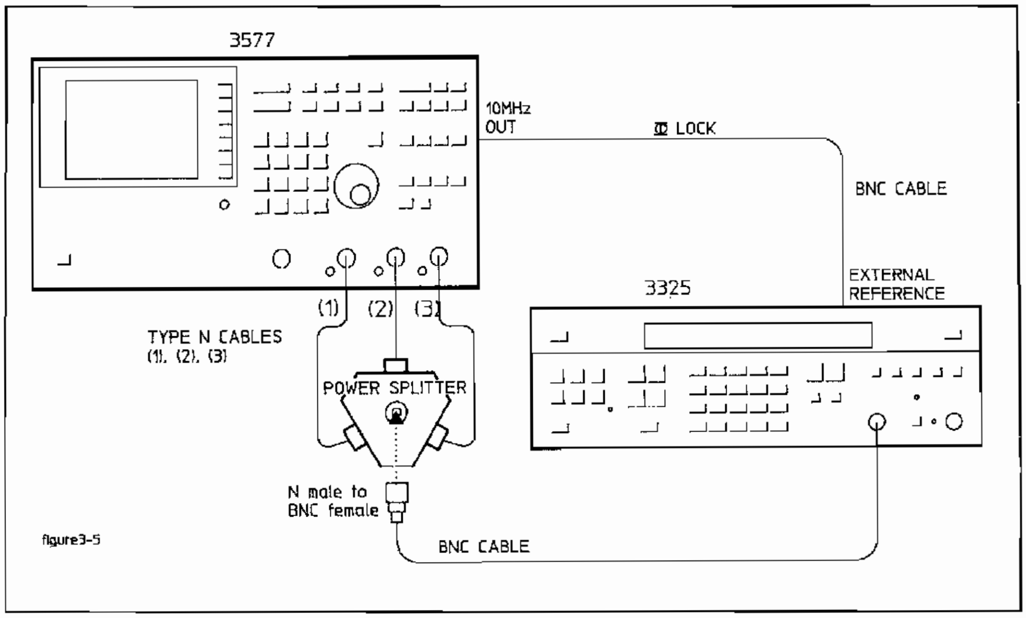


Figure 3-5 Dynamic Linearity (Magnitude vs. Phase) Test Set-Up

y. Preset the 3577A.

z. Set the 3577A to the following conditions:

SWEEP MODE .... SINGLE
SWEEP TIME (SAMPLE TIME) .... 50 sec
FREQ
  START FREQ .... 1.75 MHz
  STOP FREQ .... 1.75 MHz
AMPTD .... −48 dBm
RES BW .... 10 Hz
SCALE
  REF POSN 50%

aa. Set the synthesizer amplitude to -29 dBm and frequency to 1.75 MHz.

bb. Press the TRIG/RESET hardkey and let the 3577A complete a sweep.

cc. The marker MAG on the 3577A should read approximately −39 dBm.

dd. Press the SCALE hardkey and select AUTO SCALE.

ee. Increase the synthesizer frequency by 0.02 Hz.

ff. Press TRIG/RESET on the 3577A and let the 3577A complete a sweep.

gg. Press the MKR→ hardkey and select MKR→ MIN. Press the MKR hardkey and select ZERO MARKER. Press the MKR→ hardkey and select MKR→ MAX.

hh. The marker MAG should read < 0.04 dB. Record the reading in the test record.

ii. Repeat step gg and hh for channels A and B.

3-10A RECEIVER LEVEL FLATNESS AND ABSOLUTE ACCURACY TEST

NOTE

Perform test 3-10A (which uses a W&C EPM-1 power meter) or 3-10B (which uses a voltmeter, an HP 436A Opt. 022 power meter, and a thermal converter).

SPECIFICATIONS:
Absolute (at 100 kHz and full scale input): A B R Mode: ±0.2 dB
Flatness (at full scale input):

INPUT	MODE	20 Hz to 20 MHz	5 Hz to 20 MHz	5 Hz to 200 MHz
50 Ω	A B R	0.3 dB p-p	N/A	0.6 dB p-p
1 MΩ	A B R	0.5 dB p-p	1.0 dB p-p	N/A

DESCRIPTION:
The flatness and absolute accuracy of each receiver (R, A, and B) is verified by leveling the HP 3577A source to a known accuracy and splitting the output with a three-port power splitter, each port driving a receiver channel. The 3577A source is externally leveled, using a W&G EPM-1 power meter as detector and reference level. The EPM-1 outputs an error correction signal to the source through connector W6 on the source board, maintaining 0 dBm at the EPM-1 power head. The three-way resistive power splitter is a 50 Ω splitter with equal incident power at each port. Assuming all ports are terminated in 50 Ω (reflected power is 0), the power output of the other two power splitter ports is equal to the power output of the EPM-1 port. The second power splitter divides the source into three equal outputs which become the test level inputs for each of the receivers. Knowing the transmission loss from the output of power splitter #1 (PS #1) to each receiver port allows the user to normalize the receiver input level to the EPM-1 level of PS #1. Because the transmission loss for each channel is equal (assuming a symmetrical power splitter), it is necessary to find only the transmission loss from PS #1 to channel R of PS #2 to normalize the receiver level for all channels. The transmission loss is stored in register D1 for the 5 Hz to 200 MHz frequency span and in register D2 for the 5 Hz to 20 MHz span.

Following calibration, the receiver input levels are normalized to the EPM-1 level, and the receiver input levels are measured and compared to the calibrated level. This procedure verifies the flatness and absolute accuracy for receiver input impedances of 50 Ω. The Hi-Z (1 MΩ) response is verified by installing a 50 Ω feedthrough termination at each receiver input and repeating the procedure.

Because the 3577A receivers take data simultaneously, only one frequency sweep is necessary to verify receiver performance at a selected input level (0 dBm or −20 dBm). Therefore to measure the complete absolute frequency performance of the three receivers, it is necessary to complete only four sweeps—from 5 Hz to 200 MHz for each input level (50 Ω input impedance) and from 5 Hz to 20 MHz for each input level (1 MΩ input impedance).

EQUIPMENT:

Power Meter	W & G EPM-1
Power Splitter (2 each)	HP 11850A/C
RF Cables-24 inch (5 each)	HP 35679A
Precision Termination	HP 909C,Opt200,Opt012
Error Correction Cable	HP 03577-61640
20 dB Attenuator	HP 8491A,Opt020
N male to N male Adapter	HP 1250-1475
Feedthrough Termination (3 each)	HP 11048C
N male to BNC female Adapter (6 each)	HP 1250-0780
BNC Cables-12 inch (3 each)	HP 8120-1838

PROCEDURE:

NOTE

All information describing differences between the 50 Ω tests and 1 MΩ tests in steps d through ff is in parentheses.

a. Preset the HP 3577A.

b. Connect the EPM-1 power head to the port marked OUTPUT on the front panel of the power meter and adjust the CAL potentiometer for a 0 dBm level (red scale) on the EPM-1 meter. This calibrates the EPM-1.

c. Connect a 24-inch type N cable from the 3577A source to receiver R.

d. Set the 3577A controls for the following settings:

SWEEP TYPE .... LOG FREQ SWEEP
SWEEP MODE .... SINGLE
SWEEP TIME for 50 Ω .... 20 sec
(SWEEP TIME for 1 MΩ .... 15 sec)
FREQ
  START FREQ .... 5 Hz
  STOP FREQ for 50Ω .... 200 MHz
  (STOP FREQ for 1 MΩ .... 20 MHz)
RES BW .... 100 Hz
SCALE
  REF POSN 50%

e. Press the TRIG/RESET hardkey and let the 3577A complete a sweep.

f. Press the MEASR CAL hardkey and select NORMALIZE.

g. Disconnect the 24-inch cable from receiver R and connect it to the 20 dB attenuator. Connect the equipment as shown in Figure 3-6.

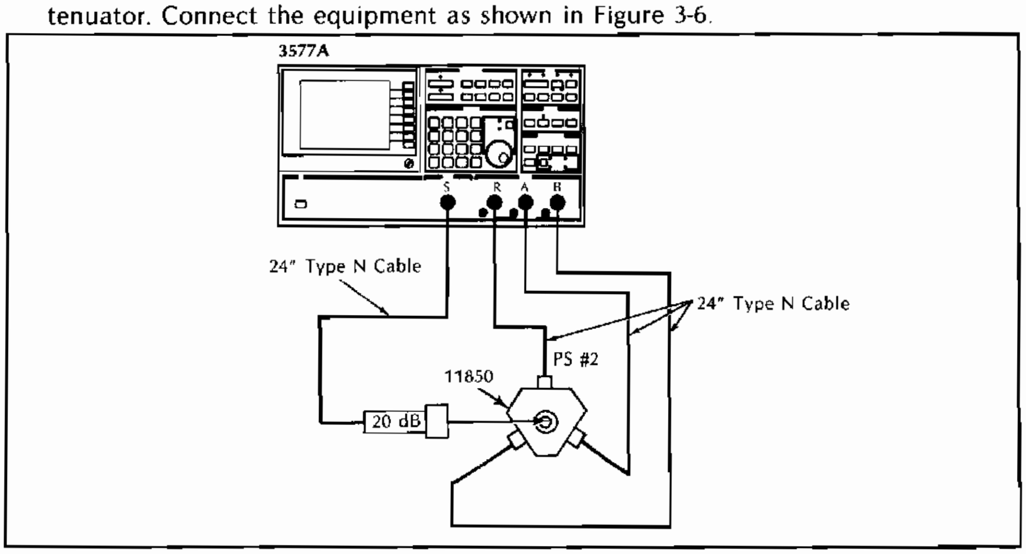


Figure 3-6 Calibration of Transmission Loss

h. Press the SCALE hardkey and set the /DIV to 0.5 dB and the REF LEVEL to −29.5 dB.

i. Press the TRIG/RESET hardkey to trigger a second sweep and store the data in register D1 (register D2 for 1 MΩ). The transmission loss should be approximately −30 dB.

j. Press AMPTD hardkey and enter AMPTD of +10 dBm.

k. Connect the equipment as shown in Figure 3-7 (Figure 3-8 for 1 MΩ). The EPM-1 Error Correction Cable connects to W6 at the top of the 3577A source board, A8, after removing the jumper. The EPM-1 level power meter will swing from −0.2 dBm to +0.2 dBm several times and settle to some level between the two points. Adjust the reference control on the front panel of the EPM-1 until the meter reads 0 dBm.

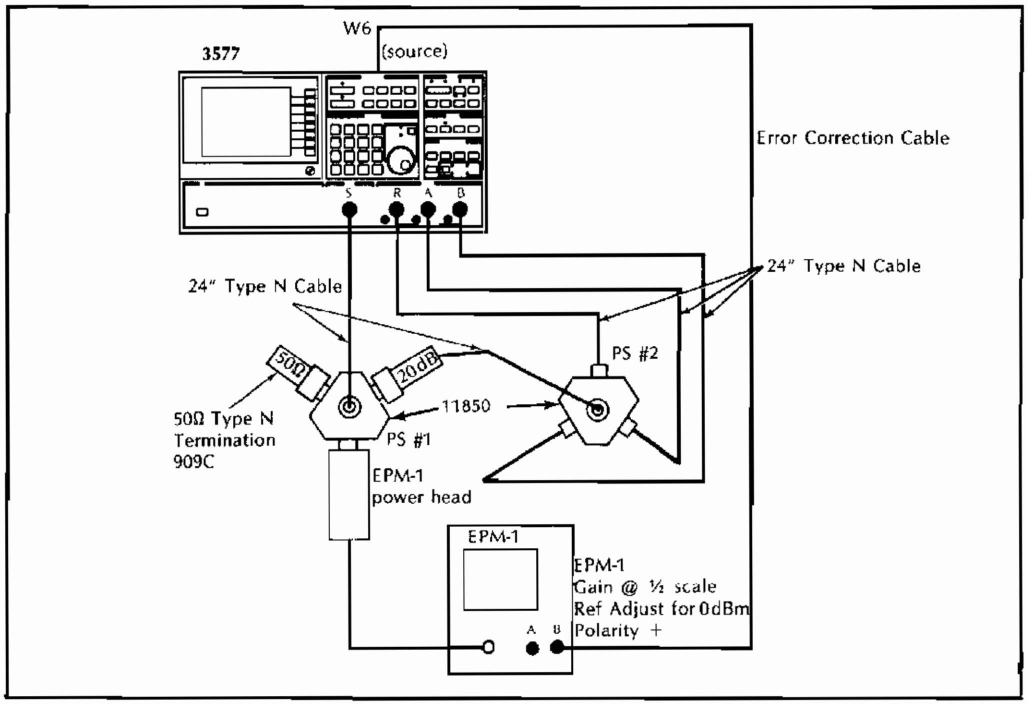


Figure 3-7 Receiver Flatness and Absolute Accuracy Test Set-Up (50 Ω)

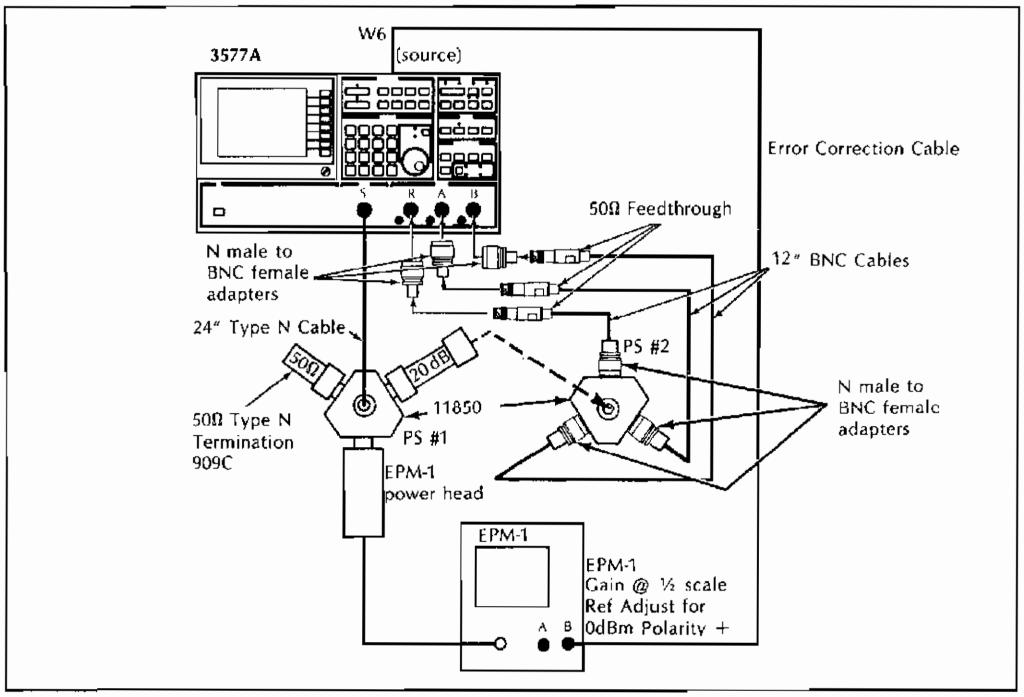


Figure 3-8 Receiver Flatness and Absolute Accuracy Test Set-Up (1 MΩ)

l. Preset the 3577A.

m. Set the 3577A controls to the following conditions:

SWEEP TYPE	LOG FREQ SWEEP
SWEEP MODE	SINGLE
SWEEP TIME for 50 Ω	100 sec
(SWEEP TIME for 1 MΩ	120 sec)
FREQ	
START FREQ	5 Hz
STOP FREQ for 50 Ω	200 MHz
(STOP FREQ for 1 MΩ	20 MHz)
ATTEN for 50 Ω	50 Ω for IMPED R, A, B
(ATTEN for 1 MΩ	1 MΩ for IMPED R, A, B)
AMPTD	+8 dBm
RES BW for 50 Ω	10 Hz
(RES BW for 1 MΩ	1 Hz)
SCALE	
REF POSN	50%
/DIV	0.2 dB

n. Press the DEFINE MATH hardkey and enter a value of 4.472 UNITS for K1 real.

o. Press the INPUT hardkey and enter a USER DEF INPUT of K1*R/D1 (K1*R/D2 for 1 MΩ).

p. Press the TRIG/RESET hardkey and follow the sweep marker. When the sweep marker reaches approximately 10 MHz, enter a longer sweep time by pressing the SWEEP TIME hardkey and then the ↑ hardkey twice. This increases the sweep time to 500 seconds for the remainder of the sweep. (This is not necessary for the 1 MΩ impedance.)

q. Disregarding the "Sweep Rate Uncalibrated" message which may appear at the completion of the sweep, set the SWEEP TIME back to 100 sec. (Skip this step for 1 MΩ impedance.)

r. Move the marker to 100 kHz. The marker MAG should read 0±0.2 dB. Record the reading in the test record.

s. Press the MKR→ hardkey and select MKR→MIN.

t. Press the MKR hardkey and select ZERO MARKER.

u. Press the MKR→ hardkey and select MKR→MAX.

v. The marker MAG should read <0.6 dB peak to peak (1.0 dB peak to peak for 1 MΩ). This is the flatness for channel R for the frequency range of 5 Hz to 200 MHz (frequency range of 5 Hz to 20 MHz for 1 MΩ). Record the reading in the test record.

w. Press the MKR hardkey and turn the MKR OFFSET off.

x. Move the marker to approximately 20 Hz.

y. Press the MKR hardkey and select ZERO MARKER.

z. Move the marker within the frequency range of 20 Hz to 20 MHz and find a minimum.

aa. Press the MKR hardkey and select ZERO MARKER.

bb. Move the marker within the frequency range of 20 Hz to 20 MHz and find a maximum — should be close to 20 MHz.

cc. The marker MAG should read < 0.3 dB peak-to-peak (0.5 dB peak-to-peak for 1 MΩ). Record the reading in the test record for the 20 HZ to 20 MHz range.

dd. Press the MKR hardkey and turn MKR OFFSET off.

ee. Select a USER DEF INPUT of K1*A/D1 (K1*A/D2 for 1 MΩ) and repeat steps r through dd for channel A.

ff. Select a USER DEF INPUT of K1*B/D1 (K1*B/D2 for 1 MΩ) and repeat steps r through dd for channel B.

gg. Press the ATTEN hardkey and change the attenuation of channels R, A, and B to the 0 dB mode.

hh. Repeat steps o through ff. All specifications remain the same.

ii. Repeat steps a through hh for 1 MΩ input impedance. Remember to replace the jumper on the source board for steps a through j. All settings will be the same except for those with a 1 MΩ option in parentheses.

3-10B ALTERNATE RECEIVER LEVEL FLATNESS AND ABSOLUTE ACCURACY TEST

(EPM-1 POWER METER NOT REQUIRED)

NOTE

Perform test 3-10A (which uses a W&G EPM-1 power meter) or 3-10B (which uses a voltmeter, an HP 436 Opt. 022 power meter, and a thermal converter).

SPECIFICATIONS:
Absolute (at 100 kHz and full scale input): A B R Mode: ±0.2 dB
Flatness (at full scale input):

INPUT	MODE	20 HZ TO 20 MHZ	5 HZ TO 20 MHZ	5 HZ TO 200 MHZ
50 Ω	A B R	0.3 dB p-p	N/A	0.6 dB p-p
1 MΩ	A B R	0.5 dB p-p	1.0 dB p-p	N/A

DESCRIPTION:
This procedure is an alternate approach for verifying 3577A receiver performance. The EPM-1 power meter is replaced by a thermal converter at frequencies below 20 MHz and an HP 436A power meter at frequencies from 20 MHz to 200 MHz. Discrete measurements must be made rather than the swept measurements possible with the EPM-1. Knowing the source output allows the user to compute the input signal. The difference between the computed level and the measured level is the absolute error of the receiver. This method is essentially the same as that in section 3-10 except that the source level at the output port of the first power splitter is not held constant at 0 dBm. This requires that the computed receiver input level be adjusted for the varying source level. Because manual computation for each measurement is tedious, the test procedure includes a short program which will read the source level, compute a source correction constant, output the correction constant to the 3577A, read each receiver level, and output the results to a computer display and a printer. The program is written in HP BASIC (3.0) and requires the user to input the verification frequency in MHz.

Before measuring receiver performance, the thermal converter and the power splitter transmission loss must be calibrated. The thermal converter output at a frequency of 1 kHz and a level of 0 dBm is stored in register Y of the HP 3456A voltmeter as the thermal converter calibration constant. The voltmeter math function (X−Y)/Z is used to display relative level of the thermal converter output. Transmission loss from the second power splitter input to each receiver input is measured and stored in registers D1, D2, and D3 for channels R, A, and B respectively.

EQUIPMENT:

Controller	HP Series 200 Compatible
Printer (optional)	
Synthesizer	HP 3325A
Voltmeter	HP 3456A
Thermal Converter	HP 11051A
Power Meter	HP 436A, Opt022
Power Head	HP 8482A
Power Splitter (2 each)	HP 11850A/C
RF Cables-24 inch (5 each)	HP 35679A
BNC Cables-12 inch (3 each)	HP 8120-1838
BNC Cables-48 inch (2 each)	HP 8120-1840
20 dB Attenuator (3 each)	HP 8491A, Opt020
BNC to dual banana Adapter (2 each)	HP 1251-2277
BNC to alligator Adapter	Pomona 2631
BNC Tee Adapter	HP 1250-0781
N male to BNC female Adapter (7 each)	HP 1250-0780
N male to N male Adapter	HP 1250-0778
Precision Termination, 50 Ω	HP 909C, Opt200, Opt012
BNC female to BNC female Adapter	HP 1250-0080
N female to N female Adapter	HP 1250-1472

PROCEDURE:
CALIBRATE RECEIVER POWER SPLITTER

a. Preset 3577A. Connect the 3577A source output to receiver R using a 24-inch type N cable.

b. Set the 3577A to the following conditions:

SWEEP TYPE	CW
FREQ	1 MHz
RES BW	1 Hz

c. After the MAG reading on the 3577A has settled, store the R input level in register D1 (press STORE DATA hardkey, select STORE REG D1).

d. Disconnect the cable from receiver R and connect it to receiver A. Press the INPUT hardkey and select A.

e. Repeat step c, storing the A input level in register D2.

f. Disconnect the cable from receiver A and connect it to receiver B. Press the INPUT hardkey and select B.

g. Repeat step c, storing the B input level in register D3.

h. Connect the equipment as shown in Figure 3-9, connecting the cable used in steps a through g between the 3577A source and the power splitter input.

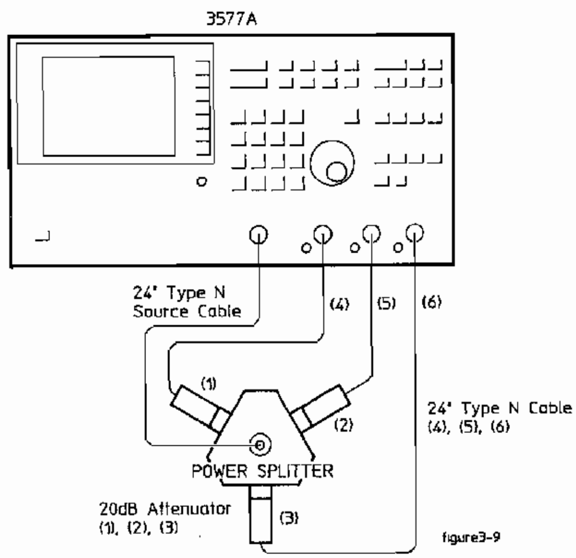


Figure 3-9 Receiver Power Splitter Calibration

i. After the marker MAG reading has settled, store R/D1 in register D1 (press the STORE DATA hardkey and select USER DEF STORE, R, /, D__,① → D__, → D1).

j. Store A/D2 in register D2 and B/D3 in register D3 as in step i.

k. Check the normalization data for receiver R by pressing the INPUT hardkey and selecting DATA REG and D1. The marker MAG should be −29.5 dB ± .3 dB. Enter the reading in the test record.

l. Check the normalization data for receivers A and B as in step k, selecting D2 for A and D3 for B.

CALIBRATE THERMAL CONVERTER

m. Using a BNC female to female adapter, connect a BNC Tee to the input of the thermal converter. Connect a BNC cable from each of the BNC Tee female connectors to one of the 4-wire inputs of the voltmeter, using BNC to dual banana adapters at the voltmeter inputs.

n. Set the voltmeter function to 4-wire ohms and record the reading in the test record (should be 50.0 ± 0.2 Ω).

o. Calculate the voltage reference level using the following equation and round the result to 4 decimal places:

Voltage reference level = SQR (.001 x resistance)

The calculated level should be between 0.2232 and 0.2240 Vrms. Record the calculated level in the test record.

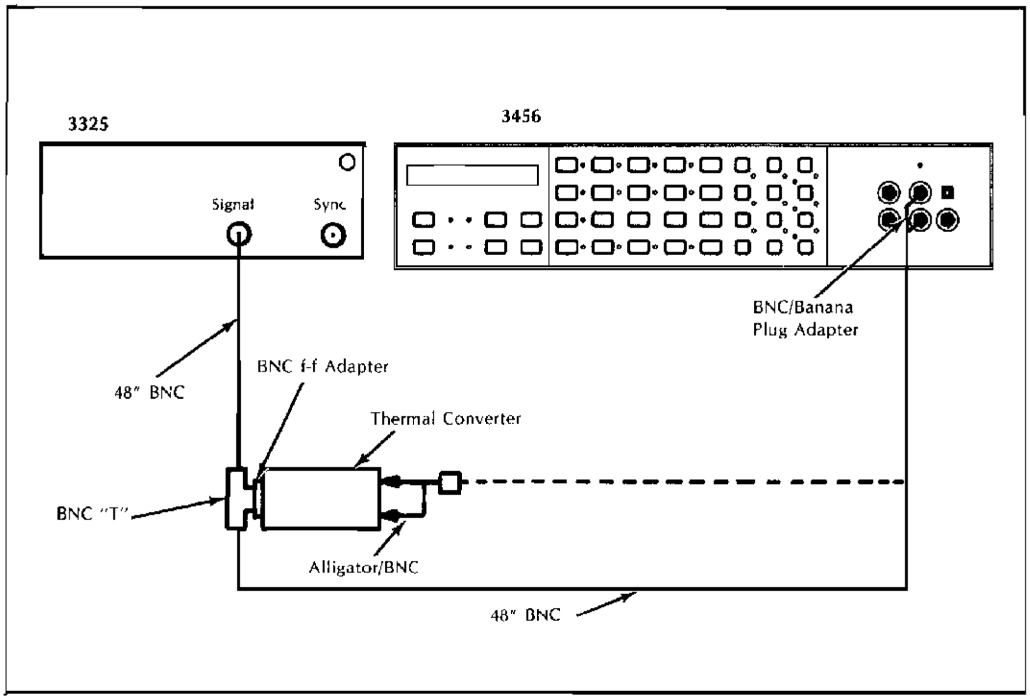


Figure 3-10 Thermal Converter Calibration

p. Reset the voltmeter and select the AC volts function. Press the FILTER hardkey.

q. Set the synthesizer frequency to 1 kHz, function to sine, and amplitude to 200 mVrms.

r. Connect the equipment as shown in Figure 3-10. (Adjust the synthesizer amplitude until the voltmeter reads the voltage reference level calculated in step o.)

CAUTION

Do not exceed maximum input of 500 mV RMS to thermal converter.

s. Disconnect the voltmeter BNC cable from the BNC Tee and connect it to the BNC-to-alligator adapter on the thermal converter. Set the number of digits displayed on the voltmeter to 6 (press the number 6 key, the STORE key, and the number 9 key).

t. Set the voltmeter function to DC volts and store the reading in register Y (press the STORE key and the number 8 key). Turn on the math function (X−Z)/Y (press the MATH key and the number 7 key). Reduce the number of digits displayed to 5 (press the number 5 key, the STORE key, and the number 9 key). The voltmeter display should read 1.0000 ± 0.0050. This completes the calibration of the thermal converter.

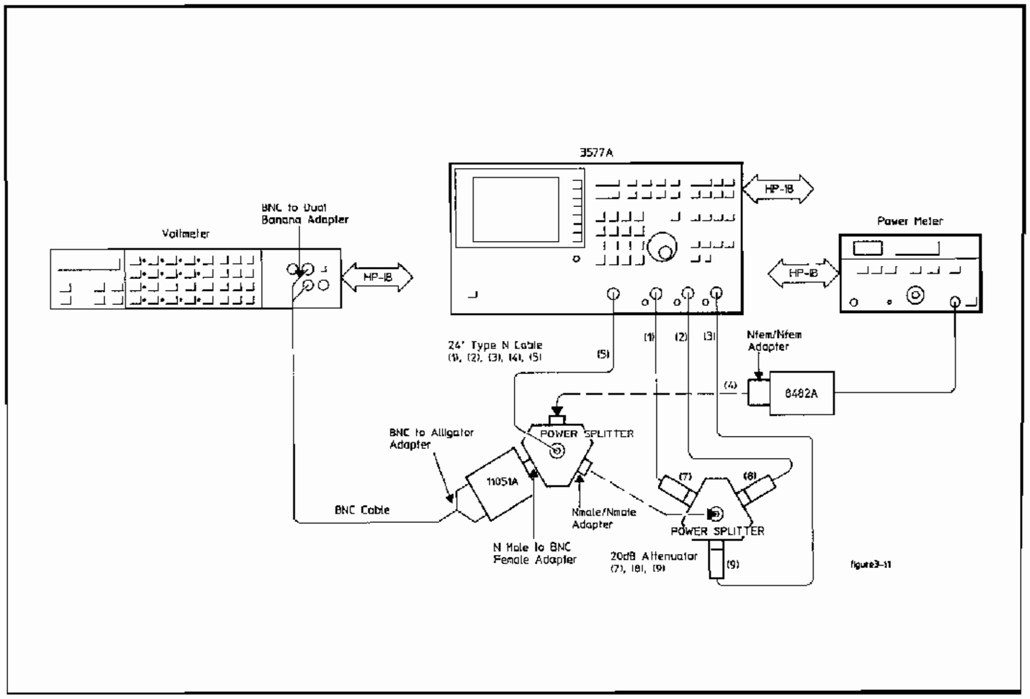


Figure 3-11 Absolute Accuracy and Flatness Test Set-Up (50 Ω)

FLATNESS AND ABSOLUTE ACCURACY TEST (50 Ω)

u. Set the CAL FACTOR on the power meter to the value found for 10 MHz on the power head. Set the power meter to the dBm mode and press SENSOR ZERO.

v. Connect the test equipment as shown in Figure 3-11. Also connect the voltmeter, power meter, and the HP 3577A to an HP-IB bus connected to a series 200 computer. The following addresses are used in the program:

Instrument	HP-IB Address
3577A	711
Voltmeter	722
Power Meter	713
Printer	706 (optional; if printout not desired, set print address to 1)

w. Enter the following test program into the HP 200 series calculator:

```
10      INPUT "ENTER THE POWER METER CALIBRATION READING AT 10MHZ (DBM)...",Pm_1
0mhz
20      INPUT "ENTER THE VOLTMETER READING AT 10MHZ...",Tc_10mhz
30      Pm_10mhz=Pm_10mhz-9.8*LGT(Tc_10mhz)
40      OUTPUT 706 USING "#,@"
50      OUTPUT 706 USING "#,3/"
60      OUTPUT 706;"           FREQ (MHz)   CHANNEL R (dB)        CHANNEL A (dB)
     CHANNEL B (dB)"
70      OUTPUT 706;""
80      Freq$=".1"
90      LOOP
100       OUTPUT 2 USING "#,K";Freq$;"ЖH"
110       LINPUT "ENTER THE FREQUENCY IN MHz...",Freq$
120       OUTPUT 711;"SFR"&Freq$&"MHz"
130       WAIT 10
140       IF VAL(Freq$)<21 THEN
150         ENTER 722;Vm
160         K1=SQR(20)*(ABS(Vm))^(-.512)
170         IF VAL(Freq$)<.0001 THEN
180           OUTPUT 711;"BW1"
190         ELSE
200           OUTPUT 711;"BW2"
210         END IF
220       ELSE
230         OUTPUT 713;"9D-V"
240         ENTER 713;Pm
250         K1=10^((-Pm-Pm_10mhz)/20)*SQR(20)
260         PRINT TABXY(8,9),"SET THE POWER HEAD CALIBRATION FACTOR ON THE 436A.
.."
270       END IF
280       OUTPUT 711;"KR1"&VAL$(K1)&";"
290       OUTPUT 711;"UDI K1*R/D1; TKM"
300       GOSUB Marker_dump
310       R=Marker
320       PRINT TABXY(5,11),"CHANNEL R ACCURACY AT "&Freq$&"MHZ IS "&VAL$(PROUND
(Marker,-2))&"DB     "
330       OUTPUT 711;"UDI K1*A/D2; TKM"
340       GOSUB Marker_dump
350       A=Marker
360       PRINT TABXY(5,13),"CHANNEL A ACCURACY AT "&Freq$&"MHZ IS "&VAL$(PROUND
(Marker,-2))&"DB     "
370       OUTPUT 711;"UDI K1*B/D3; TKM"
380       GOSUB Marker_dump
390       B=Marker
400       PRINT TABXY(5,15),"CHANNEL B ACCURACY AT "&Freq$&"MHZ IS "&VAL$(PROUND
(Marker,-2))&"DB     "
410       GOSUB Print_result
420     END LOOP
430 Marker_dump:OUTPUT 711;"DM1"
440     ENTER 711;Marker
450     RETURN
460 Print_result:PRINTER IS 706
470     PRINT "      ",Freq$,"     ",R,"        ",A,"         ",B
480     PRINTER IS 1
490     RETURN
500     END
```

NOTE

The "H" at the end of step 100 is actually entered as "SHIFT CTL –" simultaneously on the controller. For the 9816, disregard this as it is not available on that controller.

x. Preset the 3577A.

y. Set the 3577A to the following conditions:
SWEEP TYPE ....CW
FREQ ....10 MHz
AMPTD
  AMPTD ....9.5 dBm
  STEP SIZE ....1 dB
RES BW ....10 Hz
INPUT K1*R/D1

z. Press the HP 3577A AMPTD hardkey, select AMPTD, and vary the amplitude using the ↑ and ↓ keys until the power meter reads approximately 0 dBm. The HP 3577A amplitude should be 9.5 dBm ± 0.5 dB. The voltmeter should read 1.0000 ± 0.0500. Record the HP 3577A source amplitude level, the power meter reading, and the voltmeter reading in the test record.

aa. Press the RUN key on the 200 series controller and enter the reading of the power meter and of the voltmeter as directed by the program. Enter these readings on the test record as well.

bb. Disconnect the power head from the power splitter and terminate the power splitter port with a 50 Ω precision termination.

cc. Enter a frequency of .1 MHz on the controller (all frequencies must be entered in MHz).

NOTE

Each measurement takes approximately 10 seconds to complete. This allows time for the thermal converter, power meter, and voltmeter to settle.

dd. Record the readings for channels R, A, and B in the test record as the absolute level at 100 kHz. The readings should be 0.0 ± .2 dB.

ee. Enter each of the frequencies in Table 3-4 on the controller, recording the readings for channels R, A, and B in the test record or attach printout to the test record.

Table 3-4
Thermal Converter Test Frequencies

.000005 MHz	.01 MHz	1 MHz
.00002 MHz	.02 MHz	2 MHz
.0001 MHz	.05 MHz	5 MHz
.001 MHz	.1 MHz	10 MHz
.002 MHz	.2 MHz	15 MHz
.005 MHz	.5 MHz	20 MHz

ff. Disconnect the precision termination from the power splitter. Reconnect the power head through an N female to N female adapter and a 24″ type N cable to the power splitter. Disconnect the thermal converter and terminate the power splitter with a precision termination.

gg. Enter each frequency from Table 3-5 on the controller. Set the CAL FACTOR on the power meter to the value found for each frequency.

hh. Record the readings for channels R, A, and B in the test record for each frequency or attach printout to test record.

Table 3-5
Power Meter Test Frequencies

50 MHz 75 MHz 100 MHz	120 MHz 140 MHz 160 MHz 170 MHz	180 MHz 190 MHz 200 MHz

ii. To calculate the flatness from 5 Hz to 200 MHz for each channel, find the maximum reading in the test record column for that channel. Subtract the minimum reading from the column and record the result as the flatness (in dB) for the channel from 5 Hz to 200 MHz. The results should be < .6 dB.

jj. To calculate the flatness from 20 Hz to 20 MHz for each channel, find the maximum reading between 20 Hz (.00002 MHz) and 20 MHz in the test record column. Subtract the minimum reading in the frequency range and record the result as the flatness for the channel from 20 Hz to 20 MHz. The results should be < .3 dB.

kk. Press the LCL hardkey and set the 3577A input attenuation for all three channels to 0 dB (press the ATTEN hardkey and select ATTEN R 0 dB, ATTEN A 0 dB, and ATTEN B 0 dB).

ll. Set the CAL FACTOR on the power meter to the value found for 10 MHz on the power head. Repeat steps bb through jj for input attenuation of 0 dB.

FLATNESS AND ABSOLUTE ACCURACY TEST (1 MΩ)

NOTE

If this test is performed independent of the preceding 50 Ω test the thermal converter and receiver power splitter must be calibrated (steps a through z). If the thermal converter and receiver power splitter have been calibrated for the 50 Ω test they need not be recalibrated for the 1 MΩ test. The program in step w must also be entered into the controller if the 1 MΩ test is run independently.

mm. Connect the test equipment as shown in Figure 3-12.

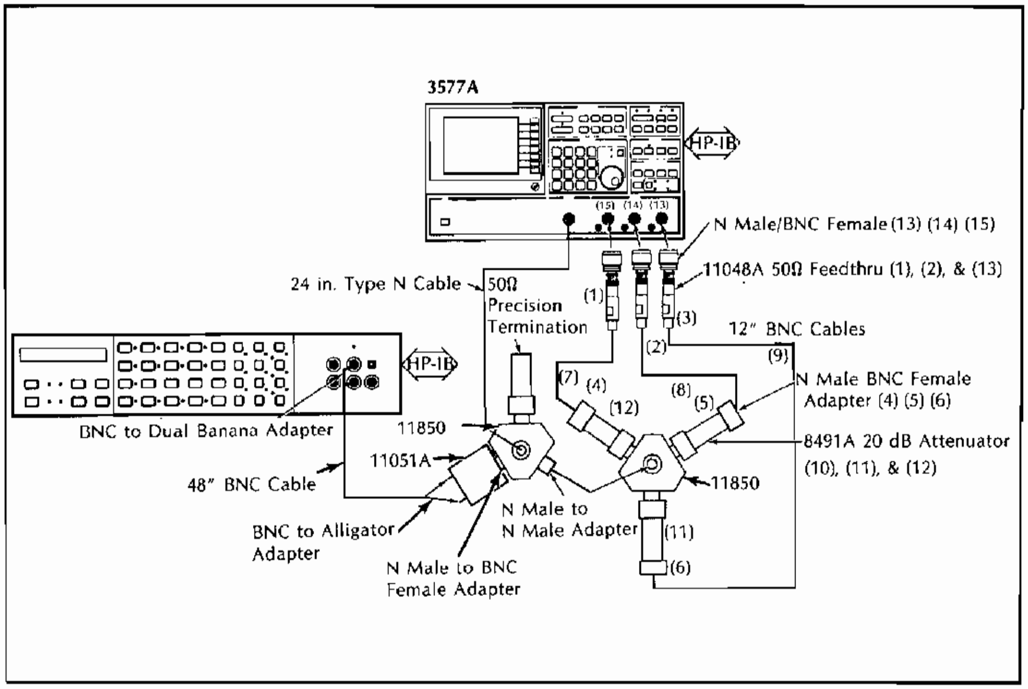


Figure 3-12 Absolute Accuracy and Flatness Test Set-Up (1 MΩ)

nn. Preset the 3577A.

oo. Set the 3577A to the following conditions:

SWEEP TYPE . . . . CW
FREQ . . . . 100 kHz
AMPTD . . . . level from step z
RES BW . . . . 10 Hz
ATTEN
IMPED . . . . 1 MΩ for channels R, A, B

qq. Press RUN on the series 200 controller. Enter a 0 when the program asks for the power meter reading. Enter the voltmeter reading from step z when the program asks for the voltmeter reading.

rr. Enter a frequency of 0.1 MHz on the controller. Record the receiver measurements in the test record as the absolute accuracy at 100 kHz. The reading should be 0.0 ± 0.2 dB.

ss. Enter each frequency from table 3-4 on the controller and record the receiver measurements at each frequency in the test record or attach printout to test record.

tt. To calculate the flatness from 5 Hz to 20 MHz for each channel, find the maximum reading in the test record column for that channel. Subtract the minimum reading from the column and record the result in the test record. The flatness should be < 1.0 dB.

uu. To calculate the flatness from 20 Hz to 20 MHz for each channel, find the maximum reading between 20 Hz (.00002 MHz) and 20 MHz in the test record column. Subtract the minimum reading in the frequency range and record the result in the test record. The flatness should be < .5 dB.

vv. Press the LCL hardkey. Set the 3577A input attenuation for all three channels to 0 dB.

ww. Repeat steps rr through uu for input attenuation of 0 dB.

3-11 RECEIVER RATIO AMPLITUDE AND PHASE ACCURACY

SPECIFICATIONS:

FLATNESS AND ABSOLUTE ACCURACY:
Absolute (at 100 kHz and full scale input):
Ratio: A/R B/R A/B Mode: 50 Ω input ±0.15 dB
1 MΩ input ±0.2 dB
Flatness (at full scale input):
Same Attenuator settings for ratio mode (column 1 of Table 3-6):

INPUT	MODE	20 Hz to 20 MHz	5 Hz to 20 MHz	5 Hz to 200 MHz
50 Ω	A/R,B/R,A/B	0 3 dB p-p	N/A	0.4 dB p-p
1 MΩ	A/R,B/R,A/B	0.3 dB p-p	0.6 dB p-p	N/A

Different Attenuator settings for ratio mode (column 2 Table 3-6):
50 Ω mode: add 0.15 dB to above for 20 Hz to 20 MHz
add 0.30 dB to above for 5 Hz to 200 MHz
1 MΩ mode: add 0.20 dB to above for 20 Hz to 20 MHz
add 0.40 dB to above for 5 Hz to 20 MHz

PHASE:
Absolute: ±2 degree at 100 kHz
Flatness:
Same attenuator settings for ratio mode:

FREQUENCY	50 Ω INPUT	1 MΩ INPUT
20 Hz to 20 MHz	2 deg p-p	5 deg p-p
5 Hz to 200 MHz	10 deg p-p	N/A
5 Hz to 20 MHz	N/A	10 deg p-p

Different Attenuator settings for ratio mode: add 8 deg to above

DESCRIPTION:
Ratio amplitude and phase accuracy are verified using a resistive three-way power splitter (HP 11850) and four 24-inch Type N cables (not phase matched). A brief calibration procedure compensates for the electrical length of each receiver cable, and the power splitter is assumed to be ideal. As a result, the ratio amplitude and phase accuracy of the 3577A can be measured directly without further error correction. Amplitude correction is not required because the transmission loss of the cables is low and a ratio measurement cancels that low loss if the cable lengths are approximately equal. The ratio performance will be verified in two frequency ranges: 5 Hz to 200 MHz and 20 Hz to 20 MHz. Two sweeps will be made for each frequency span: one at 20 dB input attenuation and the other at 0 dB. Ratio performance will be checked with equal and unequal input attenuators.

EQUIPMENT:
Power Splitter . . . . HP 11850A/C
RF Cables-24 inch (4 each) . . . . HP 35679A
Feedthrough Termination (3 each) . . . . HP 11048C
BNC Cables-24 inch (3 each) . . . . HP 8120-1839
N female to N female Adapter . . . . HP 1250-1472
N male to BNC female Adapter (6 each) . . . . HP 1250-0780

PROCEDURE:

NOTE

The four RF cables used in this test must be calibrated to determine their electrical length. The cables can be permanently marked with their name ("R", "A", "B", or "Source") and the length determined for each cable in steps b through t of this test procedure. If these marked cables are used for future 3577A calibration, steps a through t can be eliminated by presetting the 3577A, entering the length of the cables, and proceeding from step u.

a. Preset the 3577A.
b. Mark the four 24-inch RF cables "R", "A", "B", and "source". (See Note at the beginning of this procedure).
c. Connect the "source" cable between the source and receiver B.
d. Set the 3577A controls for the following settings:

INPUT . . . . B
FREQ
  START FREQ . . . . 1 MHz
  STOP FREQ . . . . 200 MHz
DISPLY FCTN . . . . PHASE
SCALE
  /DIV . . . . 2 deg

e. Press the MEASR CAL hardkey and select NORMALIZE.

f. Connect the "B" cable between the "source" cable and the receiver input B, using the N female to N female adapter between the two cables.

g. Press the LENGTH hardkey, select LENGTH B, and enter a value of −97 cm. This is an estimate of the length of cable "B".

h. Rotate the RPG to get the marker to 200 MHz.

i. Press the ENTRY hardkey for the RPG and rotate it to achieve a phase marker reading of 0 degrees at 200 MHz. The negative length displayed is an equivalent length of cable removed from receiver B. Record this length in the test record. (See Note at the beginning of this procedure.)

j. Press SWEEP MODE hardkey and select SINGLE.

k. Press the MKR→ hardkey and select MKR→ MIN. Press the MKR hardkey and select ZERO MARKER. Press the MKR→ hardkey and select MKR→ MAX. The marker PHASE should read <1 degree. If not, try another "B" cable.

l. Disconnect the "source" cable from the "B" cable, leaving the "B" cable connected to receiver B.

m. Press the INPUT hardkey and select A.

n. Press SWEEP MODE hardkey and select CONT. Press MKR hardkey and turn MKR OFFSET off. Press the RPG ENTRY hardkey to get back to the MARKER mode.

o. Connect the "source" cable between the source and receiver A.

p. Press the MEASR CAL hardkey and select the NORMALIZE.

q. Connect the "A" cable between the "source" cable and the receiver A, using the N female to N female adapter between the two cables.

r. Repeat steps g through l, replacing the A receiver where B is called out.

s. Press the INPUT hardkey and select R.

t. Repeat steps n through r, replacing the R receiver where B or A is called out.

u. Connect the equipment as shown in Figure 3-13.

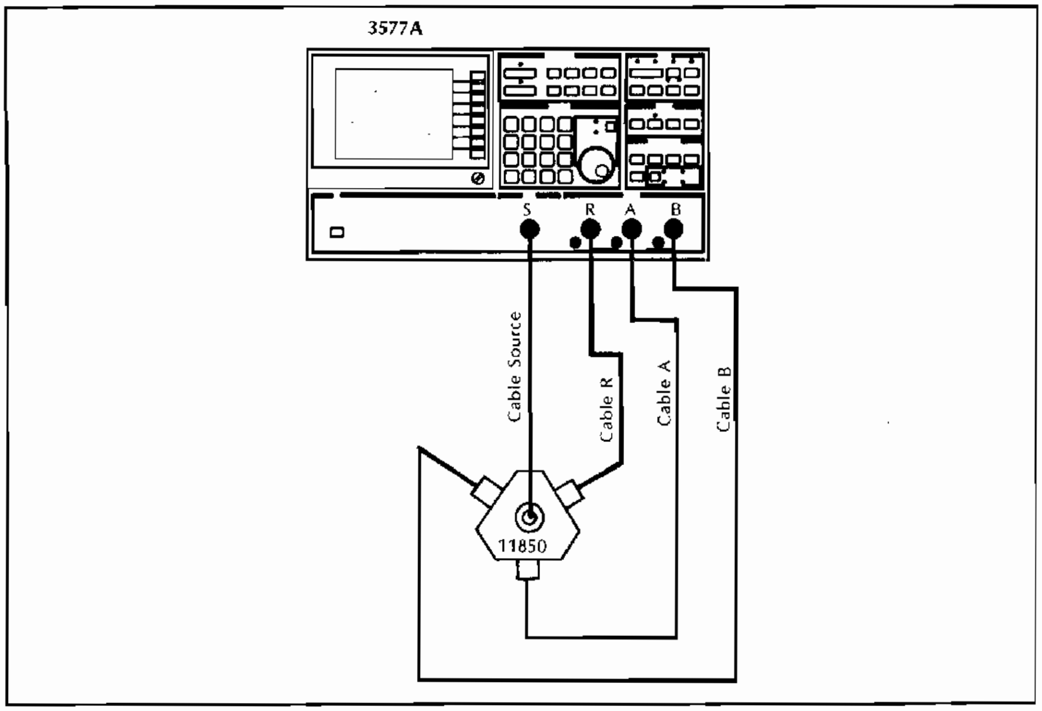


Figure 3-13 Ratio Test Set-Up (50 Ω)

v. **Do not preset the 3577A.** Change only the following 3577A settings:

SWEEP TYPE	LOG FREQ SWEEP
SWEEP MODE	SINGLE
SWEEP TIME	25 sec
FREQ	
START FREQ	5 Hz
STOP FREQ	200 MHz
AMPTD	−20 dBm
RES BW	100 Hz
DISPLY FCTN	LOG MAG
SCALE	
/DIV	0.2 dB
REF POSN	50%
INPUT	A/R
ATTEN (all receivers)	0 dB

NOTE

(Information pertaining to unequal attenuator settings is in parentheses.) [Information pertaining to the 1MΩ impedance tests is in brackets.]

w. Press the TRIG/RESET hardkey and let the 3577A complete a sweep.

x. Press the STORE DATA hardkey and enter a USER DEF STORE of R into D1. (Select USER DEF STORE, R, →D, →D1.)

y. Enter a USER DEF STORE of A into D2.

z. Enter a USER DEF STORE of B into D3.

aa. Press the ATTEN hardkey and set the R, A, and B attenuators to 20 dB.

bb. Press the TRIG/RESET hardkey and let the 3577A complete a sweep.

cc. Move the marker to approximately 100 kHz.

dd. The marker MAG should read 0±0.15 dB [±0.2 dB]. Enter the reading in the test record.

ee. Press the DISPLY FCTN hardkey and select PHASE. Press the SCALE hardkey and change /DIV to 5 deg.

ff. The marker PHASE should read 0±2 degrees. Enter the reading in the test record.

gg. Press the MKR→ hardkey and select MKR→ MIN. Press the MKR hardkey and select ZERO MARKER. Press the MKR→ hardkey and select MKR→ MAX.

hh. The marker PHASE should read < 10 degrees (18 deg) peak-to-peak. Enter the reading in the test record.

ii. Press the DISPLY FCTN hardkey and select LOG MAG.

jj. Measure the amplitude flatness using the MKR→ and MKR hardkeys as in step gg.

kk. The marker MAG should read < 0.4 dB (.7 dB) peak-to-peak [0.6 dB (1.0 dB)]. Enter the reading in the test record.

ll. Press MKR hardkey and turn MKR OFFSET off.

mm. Repeat steps cc through ll for the inputs in Table 3-6, using USER DEF INPUTs. The D1, D2, and D3 are for the 0 dB attenuator mode and R, A, and B are for the 20 dB attenuator mode. The specifications remain the same except for unequal attenuator settings (they are in parentheses). [The specifications for the 1 MΩ input impedance are in brackets.]

Table 3-6
Ratio Performance Inputs

Equal Input Attenuators	Unequal Input Attenuators
B/R (20,20)	D2/R (0,20)
A/B (20,20)	A/D1 (20,0)
D2/D1 (0,0)	A/D3 (20,0)
D3/D1 (0,0)	D2/B (0,20)
D2/D3 (0,0)	B/D1 (20,0)
	D3/R (0,20)

nn. Change the following 3577A settings:

SWEEP TIME . . . . 30 sec
FREQ
  START FREQ . . . . 20 Hz
  STOP FREQ . . . . 20 MHz
RES BW . . . . 10 Hz
DISPLY FCTN . . . . LOG MAG
ATTEN (for all receivers) . . . . 0 dB
INPUT . . . . A/R

oo. Repeat steps w through bb.

pp. Press the MKR hardkey and turn the MKR OFFSET off.

qq. Measure the amplitude flatness using the MKR→ and MKR hardkeys as in step gg.

rr. The marker MAG should read < 0.3 dB (.45 dB) peak-to-peak [0.3 dB (0.5 dB)]. Enter the reading in the test record.

ss. Press the DISPLY FCTN hardkey and select PHASE.

tt. Measure the phase flatness using the MKR→ and MKR hardkeys as in step gg.

uu. The marker PHASE should read < 2 degrees (10 deg) peak-to-peak [5 deg (13 deg)].

vv. Repeat steps pp through uu for the inputs in Table 3-6. (The unequal attenuators specifications are in parentheses.)

ww. Press the ATTEN hardkey and set the R, A, and B inputs to the 1 MΩ input impedance.

xx. Connect the equipment as shown in Figure 3-14 using the BNC cables and the 50 Ω Feedthrough Terminations.

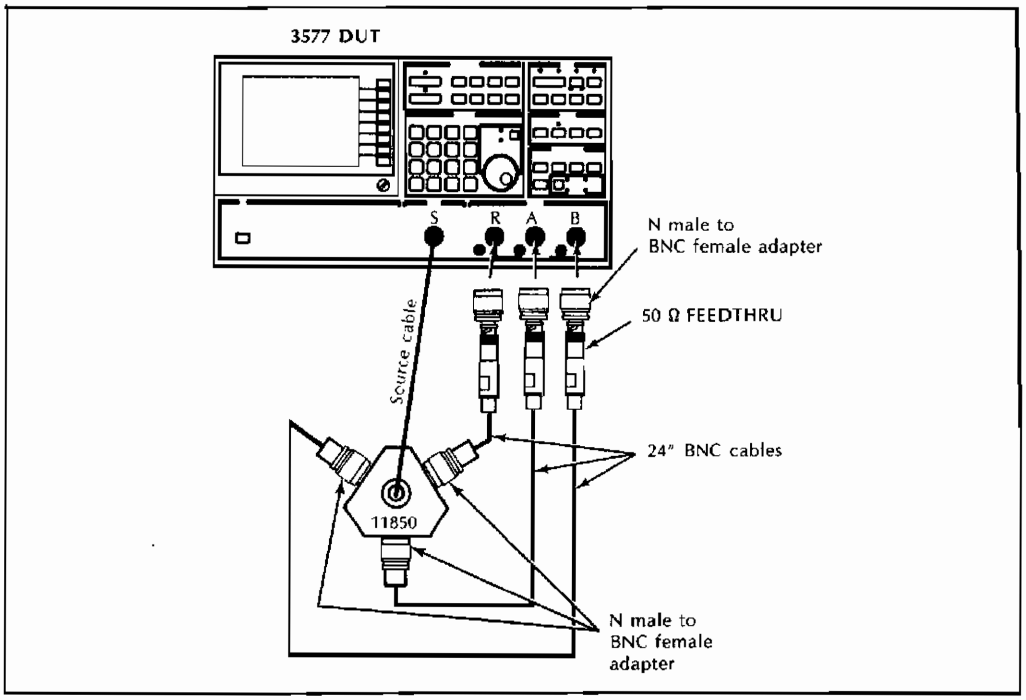


Figure 3-14 Ratio Test Set-Up (1 MΩ)

yy. Change the following 3577A settings:

FREQ
START FREQ . . . . 5 Hz
STOP FREQ . . . . 20 MHz
DISPLY FCTN . . . . LOG MAG
INPUT . . . . A/R
LENGTH (for all receivers) . . . . 0 cm
ATTEN (for all receivers) . . . . 0 dB

zz. Repeat steps w through vv for the 1 MΩ input impedance. [The specifications for the 1 MΩ input impedance are in brackets.]

3-12 RECEIVER CROSSTALK TEST

SPECIFICATIONS:
Channel isolation > 100 dB below maximum input level

DESCRIPTION:
The 3577A source is input to one channel at a time and the isolation measured on the other two channels.

EQUIPMENT:
RF cable . . . . HP 35679A

PROCEDURE:

a. Preset the HP 3577A.

b. Connect an RF cable between the 3577A source and receiver R.

c. Set the 3577A to the following conditions:

SWEEP TYPE	LOG FREQ SWEEP
SWEEP TIME	20 sec
FREQ	
START FREQ	10 kHz
AMPTD	−1 dBm
RES BW	10 Hz
SCALE	
REF POSN	50 %
REF LEVEL	−100 dBm
AVG	256
INPUT	A

d. Save these instrument conditions in Register 1. (Press hardkey SAVE, select SAVE REG 1.)

e. Allow the 3577A to complete two sweeps, then set SWEEP MODE to SINGLE.

f. The noise level at all points across the sweep should be < -100 dBm. Press the MKR→ hardkey and select MKR→MAX. Record the marker MAG reading in the test record.

g. Select an INPUT of B.

h. Find the maximum level as in step f; enter the value in the test record.

i. Move the RF cable from receiver R to receiver A.

j. Press the RECALL hardkey and select RECALL REG 1. (This resets the 3577A to the conditions set up in step c.)

k. Select an INPUT of B.

l. Allow the 3577A to complete two sweeps, then set SWEEP MODE to SINGLE.

m. Find the maximum level as in step f; enter the value in the test record.

n. Select an INPUT of R.

o. Find the maximum level as in step f; enter the value in the test record.

p. Move the RF cable from receiver A to receiver B.

q. Press the RECALL hardkey and select RECALL REG 1.

r. Allow the 3577A to complete two sweeps, then set SWEEP MODE to SINGLE.

s. Find the maximum level as in step f; enter the value in the test record.

t. Select an INPUT of R.

u. Find the maximum level as in step f; enter the value in the test record.

3-13 RECEIVER RETURN LOSS TEST

SPECIFICATIONS:
Return loss: Channels A, B, and R > 25 dB

DESCRIPTION:
A manual partial port calibration is performed to improve the accuracy of the measurements. Channels A and B are measured, using channel R as the reference. Channel A is then used as a reference to measure channel R.

EQUIPMENT:

Directional Bridge	HP 35677-63502
BNC Cables-24 inch (2 each)	HP 8120-1839
10 dB Attenuator	HP 8491A Opt 010
Precision Termination	HP 909C,Opt200,Opt012
SMA male to BNC female adapter (2 each)	HP 1250-1200
N male to BNC female adapter (2 each)	HP 1250-0780
N male to N male adapter	HP 1250-1475

PROCEDURE:

a. Preset the HP 3577A.

b. Connect the equipment as shown in Figure 3-15, leaving the load port of the directional bridge unconnected.

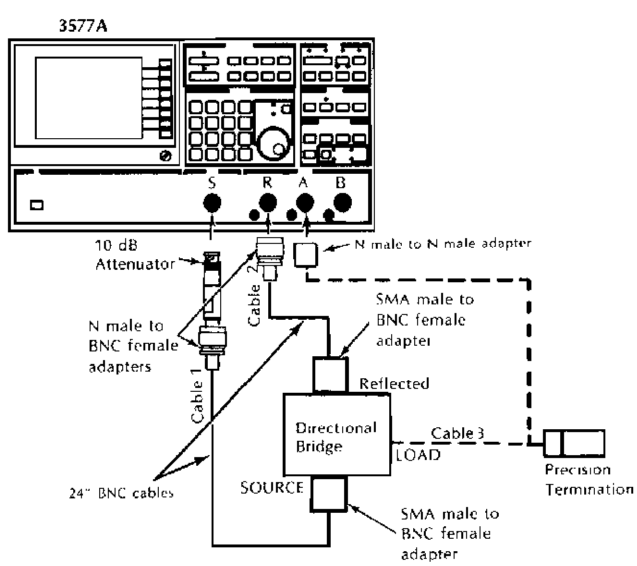


Figure 3-15 Receiver Return Loss Test Set-Up

c. Set the 3577A to the following conditions:
SWEEP TIME . . . . . 5 sec
FREQ
START FREQ . . . . . 100 kHz
AMPTD . . . . . −15 dBm
RES BW . . . . . 100 Hz
ATTEN . . . . . ATTEN R 0dB
INPUT . . . . . R

d. Allow the 3577A to complete one sweep.

e. Press the STORE hardkey and select STORE REG D1.

f. Terminate the directional bridge load port with the precision 50 Ω termination.

g. Allow the 3577A to complete one sweep.

h. Press the STORE DATA hardkey and select STORE REG D2.

i. Remove the precision termination and connect the directional bridge load port to 3577A receiver A using the N male to N male adapter.

j. Press the INPUT hardkey and enter a USER DEF INPUT of (R−D2)/D1 (select USER DEF INPUT, (, R, −, D__, 2,), /, D__, 1, ENTER).

k. Allow the 3577A to complete one sweep.

l. Press the MKR→ hardkey and select MKR→MAX.

m. The marker MAG should read < −25 dB; enter the reading in the test record.

n. Press the ATTEN hardkey and select ATTEN A 0dB.

o. Repeat steps k through m.

p. Connect the directional bridge load port to 3577A receiver B.

q. Repeat steps k through o, selecting ATTEN B 0dB in step n.

r. Move cable 2 from receiver R to receiver A and disconnect the directional bridge from receiver B.

s. Press the INPUT hardkey and select A.

t. Press the ATTEN hardkey and set ATTEN R to 20 dB.

u. Repeat steps d through o for channel R using channel A as a reference. Use channel A whenever channel R is called out, even in the equation of step j, and use channel R whenever channel A is called out.

3-14A SOURCE FLATNESS AND ABSOLUTE ACCURACY TEST

NOTE

Perform test 3-14A (which uses a W&G EPM-1 power meter) or test 3-14B (which uses a voltmeter and an HP 436 power meter).

SPECIFICATIONS:
Absolute Accuracy: ±1 dB at +15 dBm and 100 kHz
Flatness: 1.5 dB peak-to-peak from 5 Hz to 200 MHz

DESCRIPTION:
Source flatness and absolute accuracy are verified using channel R (calibrated receiver) to measure the source error directly. Before proceeding with the source verification, channel R is calibrated to remove its frequency response errors. Channel R error correction terms are stored in register D1 and test system error correction terms are stored in registers D2 (error correction for the transmission loss from the power splitter to channel R) and D3 (error correction terms for cable loss of the source cable).

The test configuration used for calibration of channel R is very similar to that used for the receiver performance test. The EPM-1 power meter levels the 3577A source, maintaining an output of 0 dB at each of the power splitter ports. One output of the power splitter is attenuated by 20 dB and input to channel R. A single sweep is made and the error response of channel R is displayed after error correction for the transmission loss from the attenuator to channel R [Chan-R-error(freq)]. The results are stored in register D1. The final sweep is the source accuracy and flatness measurement, which is made without the EPM-1 (Figure 3-18) and is the product of the source and receiver error response [Source-error × Chan-R-error]. The ratio of the final sweep with the receiver calibration sweep is the source frequency error.

Source-error(freq) = [Source-error × Chan-R-error] / Chan-R-error(freq)

Flatness and absolute accuracy of the source are read directly from the 3577A display.

EQUIPMENT:

Power Meter	W & G EPM-1
20 dB Attenuator	HP 8491A Opt 020
Error Correction Cable	HP 03577-61640
Power Splitter	HP 11850A/C
Precision Termination (2 each)	HP 909C,Opt200,Opt012
RF Cables-24 inch (2 each)	HP 35679A
N female to N female adapter	HP 1250-1472

PROCEDURE:
a. Preset the HP 3577A.

b. Set the 3577A controls to the following settings:

SWEEP TYPE	LOG FREQ SWEEP
SWEEP MODE	SINGLE
SWEEP TIME	20 sec
FREQ	
START FREQ	5 Hz
STOP FREQ	200 MHz
RES BW	100 Hz
INPUT	R/D1
SCALE	
REF POSN	50%
/DIV	0.2 dB
REF LEVEL	0 dB

c. Connect a 24-inch cable between the source and receiver R. This is labeled the "test" cable.

d. Press the TRIG/RESET hardkey to trigger a sweep and let the 3577A complete the sweep.

e. Press the MEASR CAL hardkey and select NORMALIZE.

f. Connect another 24-inch cable between the first cable and receiver R, using an N female to N female adapter between the two cables. This second cable is labeled the "source" cable.

g. Press the TRIG/RESET hardkey and let the 3577A complete a sweep.

h. Press the STORE DATA hardkey and select STORE REG D3. This is the cable loss of the source cable.

i. Connect the equipment as shown in Figure 3-16.

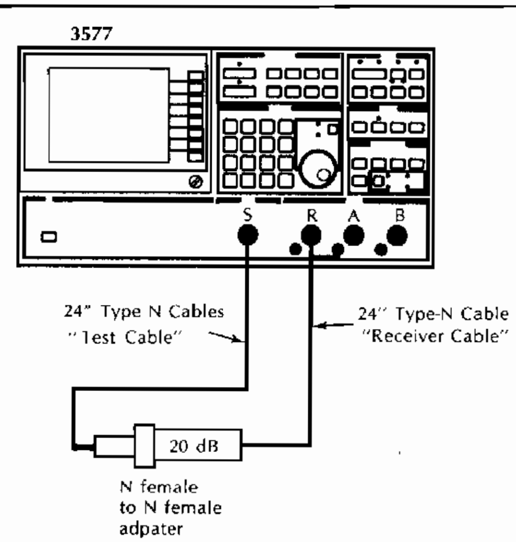


Figure 3-16 Calibration of Transmission Loss from Power Splitter to Channel R

j. Press the SCALE hardkey and set the REF LEVEL to −20 dB.

k. Press the TRIG/RESET hardkey and let the 3577A complete a sweep.

l. Press the STORE DATA hardkey and select STORE REG D2. This is the transmission loss from the output of the power splitter to receiver R.

m. Connect the equipment as shown in Figure 3-17.

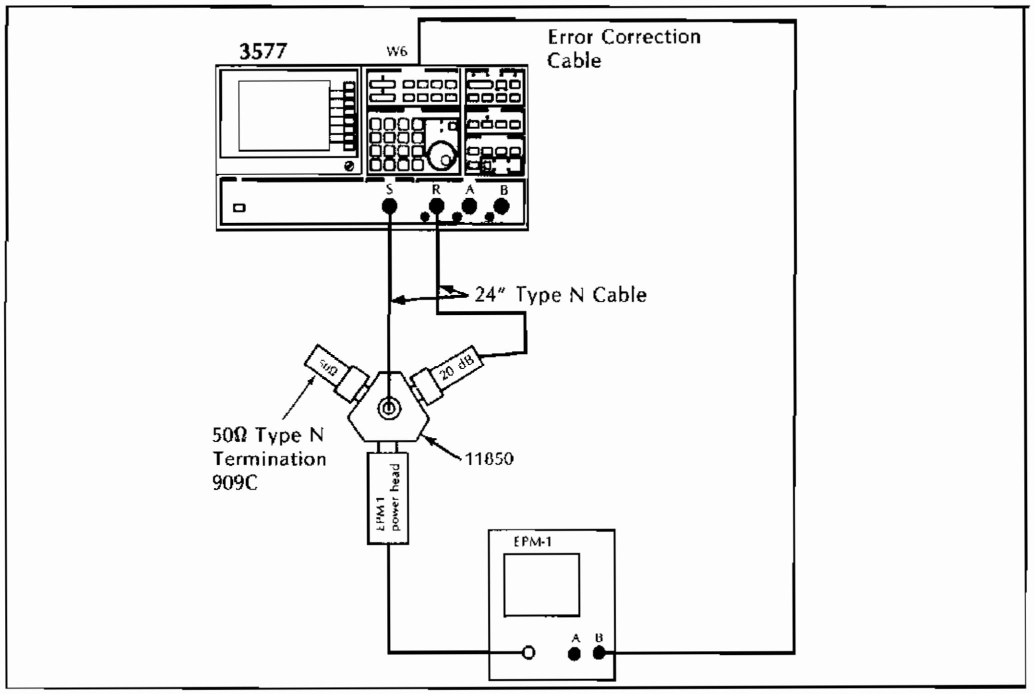


Figure 3-17 Channel R Calibration for Source Flatness and Accuracy

n. Change only the following 3577A settings:

SWEEP TIME .... 100 sec
RES BW .... 10 Hz
AMPTD .... +10 dBm
SCALE
  /DIV .... 0.5 dB
  REF LEVEL .... 0 dB
INPUT K1*R/D2
DEFINE MATH
  K1 REAL .... 4.472 UNITS

o. Set the EPM-1 controls for the following settings:

RANGE .... 0 dBm (red scale)
POLARITY SWITCH .... POS
GAIN .... Adjust to approximately half scale
REFERENCE .... Adjust for 0 dBm meter reading

p. Wait until EPM-1 settles at approximately 0 dBm and press the 3577A TRIG/RESET hardkey. When the sweep marker reaches approximately 20 MHz, enter a longer sweep time by pressing the SWEEP TIME hardkey and then the ↑ hardkey twice. This increases the sweep time to 500 seconds for the remainder of the sweep.

q. At the completion of the sweep, set the sweep rate back to 100 seconds. (Disregard the "Sweep Rate Uncalibrated" message which may appear.)

r. Press the STORE DATA hardkey and select STORE REG D1.

s. Disconnect the EPM-1 (including the Error Correction Cable—remember to reinstall the factory installed jumper) and set up the equipment as shown in Figure 3-18.

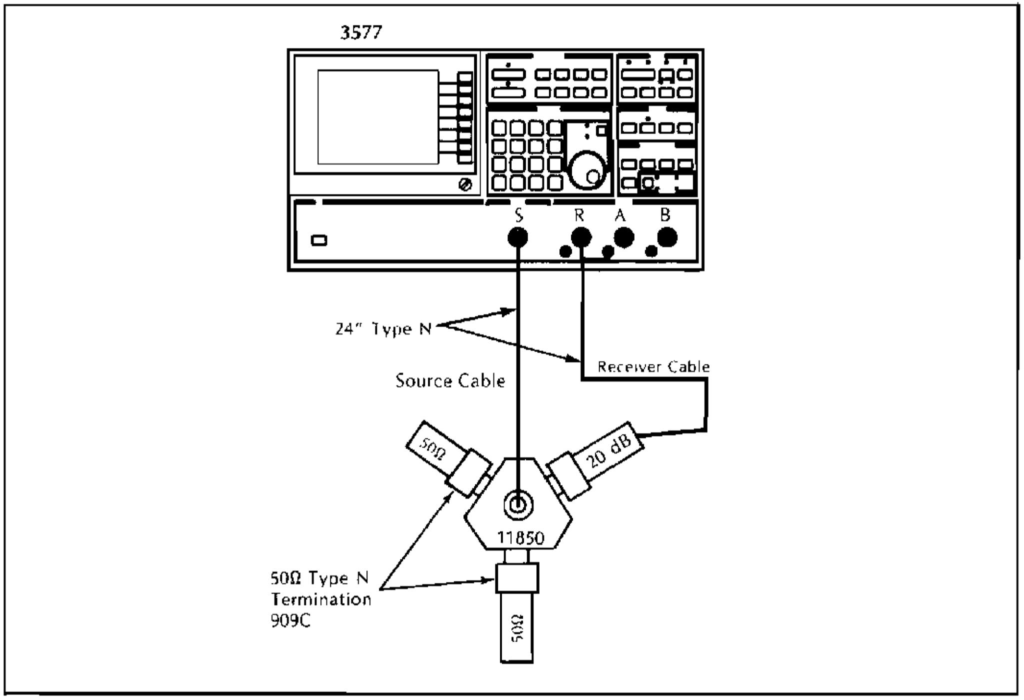


Figure 3-18 Source Flatness and Absolute Accuracy Test Set-Up

t. Press the DEFINE MATH hardkey and enter a value of 2.3823 UNITS for K1 REAL.

u. Press the INPUT hardkey and enter a USER DEF INPUT of K1*R/D1/D2/D3 (select USER DEF INPUT, K__, 1, *, R, /, D__, 1, /, D__, 2, /, D__, 3, ENTER).

v. Press AMPTD hardkey and enter an AMPTD of +15 dBm.

w. Press the TRIG/RESET hardkey. When the sweep marker reaches approximately 20 MHz, enter a longer sweep by pressing the SWEEP TIME hardkey and then the ↑ hardkey twice. This increases the sweep time to 500 seconds for the remainder of the sweep.

x. Move the marker to 100 kHz. The marker MAG should read $< \pm 1.0$ dB. Enter the reading in the test record.

y. Press the MKR→ hardkey and select MKR→MIN. Press the MKR hardkey and select ZERO MARKER. Press the MKR→ hardkey and select MKR→MAX. The marker MAG should read $<$ 1.5 dB peak-to-peak. Enter the reading in the test record (5 Hz - 200 MHz).

3-14B ALTERNATE SOURCE FLATNESS AND ABSOLUTE ACCURACY TEST

Note

Perform test 3-14A (which uses a W&G EPM-1 power meter) or test 3-14B (which uses a voltmeter and an HP 436 power meter).

SPECIFICATIONS:
Absolute Accuracy: ±1 dB at +15 dBm and 100 kHz
Flatness: 1.5 dB peak-to-peak from 5 Hz to 200 MHz

DESCRIPTION:
This procedure is an alternate approach for verifying the 3577A source accuracy using a voltmeter and HP 436A power meter rather than the EPM-1 power meter. Discrete measurements must be made rather than the swept measurements possible with the EPM-1. For frequencies less than 100 kHz, the source level is verified by measuring the voltage across an 11048C 50 Ω feedthrough using an HP 3456A voltmeter. For frequencies of 100 kHz and above the levels are measured using an HP 436A power meter.

EQUIPMENT:
Power Meter . . . . HP 436A
Power Head . . . . HP 8482A
Voltmeter . . . . HP 3456A
BNC Cable-48 inch . . . . HP 8120-1840
Feedthrough Termination . . . . HP 11048C
N male to BNC female adapter . . . . HP 1250-0780
BNC female to dual banana male adapter . . . . HP 1251-2277

PROCEDURE:
a. Preset the 3577A.

b. Set the 3577A to the following conditions:
SWEEP TYPE . . . . CW
FREQ . . . . 100 kHz
AMPTD . . . . +15 dBm

c. Connect the voltmeter to the HP 3577A source output using a BNC cable, feedthrough termination, and N male to BNC female adapter as shown in Figure 3-19.

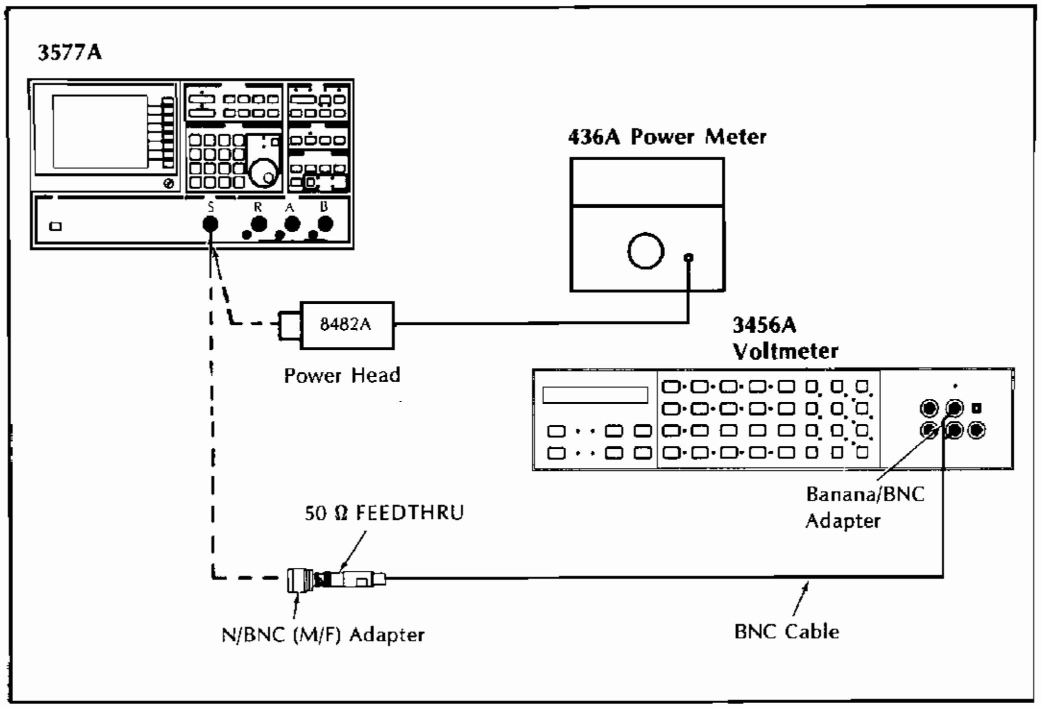


Figure 3-19 Alternate Source Flatness and Absolute Accuracy Test Set-Up

d. Reset the 3456A and press the AC volts function key.

e. Press the FILTER hardkey and enter the math dBm(R) function (press the blue MATH hardkey and the number 4 hardkey).

f. Store 50 in the ohms register (press the numbers 5 and 0, STORE hardkey, and number 4 hardkey).

g. The voltmeter display should read 15 dBm ± 1 dBm. (This is for information only. The absolute reading at 100 kHz will be made in a later step using the HP 436A power meter.)

h. Enter the following frequencies on the 3577A and record the voltmeter reading for each frequency in the test record:

5 Hz   10 Hz   100 Hz   1 kHz   10 kHz   20 kHz   50 kHz

i. Enter a frequency of 100 kHz on the 3577A. Disconnect the voltmeter from the 3577A source.

j. Set the 436A function to dBm and the CALIBRATION FACTOR to the 100 kHz value found on the 8482A power head. Press SENSOR ZERO on the 436A.

k. Connect the 8482A power head to the 3577A source as shown in Figure 3-19.

l. Record the 436A reading in the test record for 100 kHz. This level should be 15 dBm ± 1 dBm.

m. Enter each frequency from Table 3-7 on the 3577A, set the 436A CALIBRATION FACTOR to the level found on the calibration curve on the HP 8482A power head for each frequency, and enter the 436A reading on the test record.

Table 3-7
Source Flatness Test Frequencies

100 kHz	1 Mhz	10 MHz	100 MHz	160 MHz
200 kHz	2 MHz	20 MHz	120 MHz	180 MHz
500 kHz	5 MHz	50 MHz	140 MHz	200 MHz

n. To calculate the source flatness, find the maximum level from 5 Hz to 200 MHz and subtract from this level the minimum level in the frequency range. Enter the result in the test record as the flatness from 5 Hz to 200 MHz. The result should be < 1.5 dB.

3-15 SOURCE ATTENUATOR ACCURACY TEST

SPECIFICATIONS:
Attenuator Accuracy: ±0.02 dB/dB or ±0.2 dB, whichever is greater.

DESCRIPTION:
The 3577A R channel receiver is used to measure the attenuation of the source.

EQUIPMENT:
RF Cable ....HP 35679A
10 dB Attenuator (2 each) ....HP 8491A Opt 010
3 dB Attenuator ....HP 8491A Opt 003

PROCEDURE:
a. Preset the HP 3577A.
b. Connect the 3577A source to 3577A receiver R through the RF Cable and all three attenuators.
c. Set the 3577A to the following conditions:
SWEEP TIME ....5 sec
FREQ
START FREQ ....1 kHz
AMPTD ....+12 dBm
RES BW ....100 Hz
INPUT ....R

d. Allow the HP 3577A to complete a sweep. Press the MEASR CAL hardkey and select NORMALIZE.

e. Press the AMPTD hardkey and enter an AMPTD of +8 dBm. This sets the attenuator to the 4 dB position without disturbing the leveling loop settings.

f. Press the MKR→ hardkey and select MKR→MAX. The marker MAG on the 3577A display should read −4 dB ±0.2 dB. Record the reading in the test record.

g. Press the MKR→ hardkey and select MKR→MIN. The marker MAG on the 3577A display should read −4 dB ±0.2 dB. Record the reading in the test record.

h. Repeat steps e through g for the amplitude and attenuation settings as listed in Table 3-8. The marker MAG in steps f and g should read the attenuation value ± the attenuation accuracy.

Table 3-8
Source Attenuator Accuracy Tests

AMPLITUDE	ATTENUATION	ATTENUATION ACCURACY
+8 dBm	4 dB	±0.2 dB
+4 dBm	8 dB	±0.2 dB
−4 dBm	16 dB	±0.32 dB
−20 dBm	32 dB	±0.64 dB
−36 dBm	48 dB	±0.96 dB

3-16 SOURCE DISTORTION AND SPUR TEST

SPECIFICATIONS:
Harmonic Distortion: < −30 dB
Non-harmonic Spurious: < −50 dBc or < −70 dBm, whichever is greater.

DESCRIPTION:
The HP 3577A is connected to a spectrum analyzer and the spurious signals measured.

EQUIPMENT:
Spectrum Analyzer .... HP 8568B
RF Cable .... HP 35679A

PROCEDURE:
a. Preset the 3577A.

b. Connect the HP 3577A source to the spectrum analyzer input.

c. Press the SWEEP TYPE hardkey and select CW. Set the 3577A FREQ to the following frequencies, verifying that all harmonics are at least 30 dB below the fundamental:

250 kHz	10 MHz	150 MHz
459 kHz	100 MHz	200 MHz

Record the level of the largest harmonic for each frequency in the test record.

d. Set the 3577A FREQ to 50 MHz.

e. Adjust the spectrum analyzer to observe the frequencies listed in Table 3-9 for the 50 MHz 3577A frequency. These are spurious frequencies generated in the 3577A. While checking these frequencies, be sure to note any other spurious signals. All spurious signals other than harmonics should be < −50 dBc or < −70 dBm. Record the levels for the listed frequencies in the test record.

f. Repeat steps d and e for all HP 3577 frequencies in Table 3-9.

Table 3-9 Source Distortion Test Points

3577A Frequency	Spectrum Analyzer Frequency	Maximum Allowable Level
50 MHz	250.25 MHz	−50 dBc
	200.25 MHz	−50 dBc
	100.25 MHz	−50 dBc
	150.25 MHz	−50 dBc
100 MHz	200.25 MHz	−50 dBc
	100.25 MHz	−50 dBc
	99.75 MHz	−50 dBc
	200.50 MHz	−50 dBc
	0.25 MHz	−50 dBc
150 MHz	150.25 MHz	−50 dBc
	0.25 MHz	−50 dBc
	150.50 MHz	−50 dBc
	0.50 MHz	−50 dBc
	151.00 MHz	−50 dBc
	149.75 MHz	−50 dBc
200 MHz	100.25 MHz	−50 dBc
	99.75 MHz	−50 dBc
	0.50 MHz	−50 dBc
	199.50 MHz	−50 dBc
	201.00 MHz	−50 dBc
	199.00 MHz	−50 dBc
0.75 MHz	300.25 MHz	−50 dBc
	301.00 MHz	−50 dBc
99.75 MHz	400.00 MHz	−50 dBc

3-17 SOURCE PHASE NOISE TEST

SPECIFICATION:
SSB Phase Noise (1 Hz bandwidth, excluding spurious)

Offset Frequency	Level
100 Hz to 20 kHz	< −70 dBc

DESCRIPTION:
The 3577A source phase noise is measured normalized to a 1 Hz bandwidth using the noise level function of the 8568B spectrum analyzer. Measurements are made with three offsets for each of two 3577A frequencies.

EQUIPMENT:

Spectrum Analyzer .... HP 8568B
RF Cable-24 inch .... HP 35679A
BNC Cable-48 inch .... HP 8120-1840

PROCEDURE:

a. Preset 3577A.

b. Connect the RF cable from the HP 3577A source to the spectrum analyzer input 2. Connect the 10 MHz REF OUT from the spectrum analyzer to the HP 3577A EXT REF IN. The EXT REF LED on the HP 3577A front panel should be on.

c. Set the 3577A to the following conditions:

SWEEP TYPE .... CW
SWEEP TIME (SAMPLE TIME) .... 10 sec
FREQ .... 1.75 MHz

d. Preset spectrum analyzer.

e. Set spectrum analyzer to the following conditions:

CENTER FREQUENCY .... same as 3577A FREQ
FREQUENCY SPAN .... 1 kHz

f. Press the NORMAL key on the spectrum analyzer to obtain the marker mode.

g. After one complete sweep press PEAK SEARCH on the spectrum analyzer.

h. Select MKR—REF LEVEL on spectrum analyzer.

i. Press shift key (blue key) then NORMAL key in the marker mode block(this is the noise level key).

j. Move the spectrum analyzer marker to 100 Hz offset (first gradicule to the right of center). Record the marker reading and the ref level reading in the test record.

k. Calculate the noise level using the following equation:

Noise Level (dBc) = marker reading − ref level reading

l. The noise level should be < -70 dBc. Record the calculated value in the test record.

m. Repeat steps j through l for spectrum analyzer frequency spans of 10 kHz (1 kHz offset in step j) and 100 kHz (10 kHz offset in step j)

n. Repeat steps d through m for a 3577A frequency of 199.75 MHz.

3-18 API SPUR TEST

SPECIFICATIONS:
Fractional N spurs < −50 dBc

DESCRIPTION:
The API performance of the 3577A is verified by a measurement made with an spectrum analyzer to which the 3577A is phase locked.

EQUIPMENT:

Spectrum Analyzer . . . . HP 8568B
RF Cable-24 inch . . . . HP 35679A
BNC Cable-48 inch . . . . HP 8120-1840

PROCEDURE:

a. Preset the 3577A to its initial conditions.

b. Connect the HP 3577A source to input 2 of the spectrum analyzer with the RF cable. Also connect the 10 MHz REF OUT from the spectrum analyzer to the HP 3577A EXT REF IN. The EXT REF LED on the HP 3577A front panel should be on.

c. Set the 3577A to the following conditions:

SWEEP TYPE . . . . CW
FREQUENCY . . . . 1.7636 MHz

d. Preset the spectrum analyzer.

e. Set the spectrum analyzer to the following conditions:

CENTER FREQUENCY . . . . 3577A frequency
FREQUENCY SPAN . . . . 10 kHz
CENTER FREQ STEP SIZE . . . . 1360 Hz

f. In the marker block on the front panel of the spectrum analyzer press the following hardkey sequence: NORMAL, PEAK SEARCH, △.

g. Increase the spectrum analyzer center frequency 1360 Hz by pressing the CENTER FREQUENCY hardkey followed by the ↑ hardkey, and set the FREQUENCY SPAN to 100 Hz.

h. Let the spectrum analyzer complete the sweep.

i. Press the PEAK SEARCH hardkey in the marker block on the spectrum analyzer.

j. Record the marker value in the test record in the 1360 Hz offset column.

k. Increase the spectrum analyzer center frequency another 1360 Hz by pressing the CENTER FREQUENCY hardkey followed by the ↑ hardkey (total offset 2720 Hz).

l. Let the spectrum analyzer complete a sweep, then press the PEAK SEARCH hardkey in the marker block.

m. Record this value in the test record in the 2760 Hz offset column. The larger of the two offset columns is the API level for this frequency (test limit < -50 dBc).

n. Set the 3577A FREQUENCY to 199.7636 MHz and repeat steps d through m.

3-19 FREQUENCY STABILITY TEST

DESCRIPTION:
The 3577A must be powered up for at least one hour before the frequency stability is verified. A frequency standard is connected to an oscilloscope external trigger. The 3577A 10 MHz REF OUT is connected to the oscilloscope input and the display triggered externally. The oscilloscope controls are adjusted so that one complete cycle fills the screen. The 10 MHz REF OUT is adjusted so that the signal on the screen is stable (indicating that the two frequencies are the same).

As the 3577A REF OUT ages, the signal on the oscilloscope display will drift across the screen. The rate at which the display drifts after one hour of aging is the fractional stability, calculated from the following equation:

$$\text{Fractional stability} = \frac{(\text{Time/Div setting})\ (\#\ \text{of div of signal drift})}{\text{drift time in seconds}}$$

The frequency stability is defined as the drift rate after one day and is equal to 24 times the fractional stability.

EQUIPMENT:

Frequency Standard .... WWVB
Oscilloscope .... HP 1980B
BNC Cable-48 inch .... HP 8120-1840

PROCEDURE:

NOTE

The 3577A must be powered up for a minimum of one hour before testing.

a. Preset the 3577A.

b. Connect the 3577A rear panel 10 MHz OUT to the oscilloscope Channel A input.

c. Set the oscilloscope controls as follows for Channel A:

Volts/Div 0.02
Time/Div .... 10 nS
Trigger .... EXT

d. Connect the frequency standard to the EXT TRIG connector on the oscilloscope.

e. The display on the oscilloscope should be a sinewave that may drift across the screen. Adjust A31R2 and A31U1 for an oscilloscope display which does not drift.

f. Allow the 3577A to age for 1 hour.

g. Observe the drift rate of the signal. For the oscilloscope settings in step c, the display should not shift more than 1 division in five seconds ($\pm 5 \times 10^{-8}$ per day). Record the drift in the test record.

TABLE 3-10 PERFORMANCE TEST RECORD

HP Model 3577A	Tested by ____________
Network Analyzer	
Serial Number ____________	Date ____________

3-7 RECEIVER RESIDUAL AND NOISE TEST

RESIDUAL RESPONSE TEST

Frequency		Receiver R	Receiver A	Receiver B	Tolerance
149.625	MHz	______	______	______	< −100 dBm
149.875	MHz	______	______	______	< −100 dBm
99.666 666 666	MHz	______	______	______	< −100 dBm
99.833 333 333	MHz	______	______	______	< −100 dBm
74.687 5	MHz	______	______	______	< −100 dBm
74.812 5	MHz	______	______	______	< −100 dBm
59.7	MHz	______	______	______	< −100 dBm
59.8	MHz	______	______	______	< −100 dBm
89.5	MHz	______	______	______	< −100 dBm
120.0	MHz	______	______	______	< −100 dBm
149.5	MHz	______	______	______	< −100 dBm
180.0	MHz	______	______	______	< −100 dBm
0.480	MHz	______	______	______	< −100 dBm
0.960	MHz	______	______	______	< −100 dBm
0.004 0	MHz	______	______	______	< −100 dBm
0.008 0	MHz	______	______	______	< −100 dBm
0.016 0	MHz	______	______	______	< −100 dBm
0.024 0	MHz	______	______	______	< −100 dBm
0.027 777 700	MHz	______	______	______	< −100 dBm
0.10	MHz	______	______	______	< −100 dBm
0.20	MHz	______	______	______	< −100 dBm
0.000 000 000	MHz	______	______	______	< − 33 dBm

NOISE TEST

Frequency		Receiver R	Receiver A	Receiver B	Tolerance
100 Hz	Magnitude point 1	______	______	______	
	Magnitude point 2	______	______	______	
	Magnitude point 3	______	______	______	
	Magnitude point 4	______	______	______	
	Magnitude point 5	______	______	______	
	Magnitude point 6	______	______	______	
	Magnitude point 7	______	______	______	
	Magnitude point 8	______	______	______	
	Magnitude point 9	______	______	______	
	Magnitude point 10	______	______	______	
	Magnitude point 11	______	______	______	
	Average Noise Level	______	______	______	< −100 dBm

$$-150 + 10 \log_{10}\left[\frac{\sum_{n=1}^{11} (X_n^2)}{500}\right], X = \text{magnitude of each point in nV}$$

Frequency		Receiver R	Receiver A	Receiver B	Tolerance
30 kHz	Magnitude point 1				
	Magnitude point 2				
	Magnitude point 3				
	Magnitude point 4				
	Magnitude point 5				
	Magnitude point 6				
	Magnitude point 7				
	Magnitude point 8				
	Magnitude point 9				
	Magnitude point 10				
	Magnitude point 11				
	Average Noise Level				< −110 dBm

$$-150 + 10 \log_{10}\left[\frac{\sum_{n=1}^{11} (X_n^2)}{500}\right], X = \text{magnitude of each point in nV}$$

Frequency		Receiver R	Receiver A	Receiver B	Tolerance
199 MHz	Magnitude point 1				
	Magnitude point 2				
	Magnitude point 3				
	Magnitude point 4				
	Magnitude point 5				
	Magnitude point 6				
	Magnitude point 7				
	Magnitude point 8				
	Magnitude point 9				
	Magnitude point 10				
	Magnitude point 11				
	Average Noise Level				< −110 dBm

$$-150 + 10 \log_{10}\left[\frac{\sum_{n=1}^{11} (X_n^2)}{500}\right], X = \text{magnitude of each point in nV}$$

3-8 ON CARRIER RETURN LOSS TEST

Test Frequency	Vref	Vtest	Return Loss $-[3dB + 20 \log_{10} (\frac{Vtest}{2Vref})]$	Tolerance
175 MHz	______	______	______	> 20 dB
200 MHz	______	______	______	> 20 dB

3-9 MAGNITUDE AND PHASE DYNAMIC ACCURACY TEST

DYNAMIC LINEARITY TEST

Ratio Transformer	Magnitude/ Phase	R	Receiver A	B	Tolerance
1.0	Magnitude	______	______	______	0.00 ± .04 dB
	Phase	______	______	______	0.0 ± .4 deg
.31623	Magnitude	______	______	______	−10.00 ± .02 dB
	Phase	______	______	______	0.0 ± .2 deg
.2	Magnitude	______	______	______	−13.979 ± .02 dB
	Phase	______	______	______	0.0 ± .2 deg
.05	Magnitude	______	______	______	−26.020 ± .02 dB
	Phase	______	______	______	0.0 ± .2 deg
.025	Magnitude	______	______	______	−32.041 ± .02 dB
	Phase	______	______	______	0.0 ± .2 deg
.01	Magnitude	______	______	______	−40.000 ± .02 dB
	Phase	______	______	______	0.0 ± .2 deg
.0031623	Magnitude	______	______	______	−50.000 ± .02 dB
	Phase	______	______	______	0.0 ± .2 deg
.001	Magnitude	______	______	______	−60.000 ± .05 dB
	Phase	______	______	______	0.0 ± .5 deg
.0001	Magnitude	______	______	______	−80.000 ± .15 dB
	Phase	______	______	______	0.0 ± 1.5 deg
.00001	Magnitude	______	______	______	−100.00 ± .75 dB
	Phase	______	______	______	0.0 ± 7.5 deg

DYNAMIC LINEARITY (MAGNITUDE VS PHASE)

R	Receiver A	B	Tolerance
______	______	______	< 0.04 dB

3-10A RECEIVER LEVEL FLATNESS AND ABSOLUTE ACCURACY TEST

Input Mode: 50 Ω, 20 dB

Frequency	Receiver R	Receiver A	Receiver B	Tolerance
100 kHz	______	______	______	±0.2 dB
5 Hz - 200 MHz	______	______	______	±0.6 dB
20 Hz - 20 MHz	______	______	______	±0.3 dB

Input Mode: 50 Ω, 0 dB

Frequency	Receiver R	Receiver A	Receiver B	Tolerance
100 kHz	______	______	______	±0.2 dB
5 Hz - 200 MHz	______	______	______	±0.6 dB
20 Hz - 20 MHz	______	______	______	±0.3 dB

Input Mode: 1 MΩ, 20 dB

Frequency	Receiver R	Receiver A	Receiver B	Tolerance
100 kHz	______	______	______	±0.2 dB
5 Hz - 200 MHz	______	______	______	±1.0 dB
20 Hz - 20 MHz	______	______	______	±0.5 dB

Input Mode: 1 MΩ, 0 dB

Frequency	Receiver R	Receiver A	Receiver B	Tolerance
100 kHz	______	______	______	±0.2 dB
5 Hz - 200 MHz	______	______	______	±1.0 dB
20 Hz - 20 MHz	______	______	______	±0.5 dB

3-10B ALTERNATE RECEIVER LEVEL FLATNESS AND ABSOLUTE ACCURACY TEST

Power splitter calibration	**Tolerance**
D1 ____ dB D2 ____ dB D3 ____ dB	− 29.5 ± .3 dB

Thermal converter calibration

Resistance ______ Ω	50 ± .1 Ω
AC Reference level (SQR(.001 x Resistance)) ______ Vrms	.2236 ± .0002 Vrms

Flatness and absolute accuracy

3577A source AMPTD	________	
Power meter reading at 10 MHz	________	
Voltmeter reading at 10 MHz	________	1.000 ± .0500

Input impedance = 50 Ω, attenuation = −20 dB

	Receiver			
Frequency	**R**	**A**	**B**	**Tolerance**
Thermal converter measurements	(enter readings or attach printout)			
Absolute level at .1 MHz	________	________	________	0.0 ± .2 dB
.000005 MHz	________	________	________	
.00002 MHz	________	________	________	
.0001 MHz	________	________	________	
.001 MHz	________	________	________	
.002 MHz	________	________	________	
.005 MHz	________	________	________	
.01 MHz	________	________	________	
.02 MHz	________	________	________	
.05 MHz	________	________	________	
.1 MHz	________	________	________	
.2 MHz	________	________	________	
.5 MHz	________	________	________	
1 MHz	________	________	________	
2 MHz	________	________	________	
5 MHz	________	________	________	
10 MHz	________	________	________	
15 MHz	________	________	________	
20 MHz	________	________	________	
Power meter measurements	(enter readings or attach printout)			
50 MHz	________	________	________	
75 MHz	________	________	________	
100 MHz	________	________	________	
120 MHz	________	________	________	
140 MHz	________	________	________	
160 MHz	________	________	________	
170 MHz	________	________	________	
180 MHz	________	________	________	
190 MHz	________	________	________	
200 MHz	________	________	________	

Flatness (maximum — minimum)

5 Hz - 200 MHz	______	______	______	< .6 dB
20 Hz - 20 MHz	______	______	______	< .3 dB

Input impedance = 50 Ω, attenuation = 0 dB

	Receiver			
Frequency	**R**	**A**	**B**	**Tolerance**
Thermal converter measurements	(enter readings or attach printout)			
Absolute level at .1 MHz	______	______	______	0.0 ± .2 dB
.000005 MHz	______	______	______	
.00002 MHz	______	______	______	
.0001 MHz	______	______	______	
.001 MHz	______	______	______	
.002 MHz	______	______	______	
.005 MHz	______	______	______	
.01 MHz	______	______	______	
.02 MHz	______	______	______	
.05 MHz	______	______	______	
.1 MHz	______	______	______	
.2 MHz	______	______	______	
.5 MHz	______	______	______	
1 MHz	______	______	______	
2 MHz	______	______	______	
5 MHz	______	______	______	
10 MHz	______	______	______	
15 MHz	______	______	______	
20 MHz	______	______	______	
Power meter measurements	(enter readings or attach printout)			
30 MHz	______	______	______	
50 MHz	______	______	______	
75 MHz	______	______	______	
100 MHz	______	______	______	
120 MHz	______	______	______	
140 MHz	______	______	______	
160 MHz	______	______	______	
170 MHz	______	______	______	
180 MHz	______	______	______	
190 MHz	______	______	______	
200 MHz	______	______	______	

Flatness (maximum − minimum)

5 Hz - 200 MHz	_______	_______	_______	< .6 dB
20 Hz - 20 MHz	_______	_______	_______	< .3 dB

Input impedance = 1 MΩ, attenuation = −20 dB

	Receiver			
Frequency	**R**	**A**	**B**	**Tolerance**
Thermal converter measurements	(enter readings or attach printout)			
Absolute level at .1 MHz	_______	_______	_______	0.0 ± .2 dB
.000005 MHz	_______	_______	_______	
.00002 MHz	_______	_______	_______	
.0001 MHz	_______	_______	_______	
.001 MHz	_______	_______	_______	
.002 MHz	_______	_______	_______	
.005 MHz	_______	_______	_______	
.01 MHz	_______	_______	_______	
.02 MHz	_______	_______	_______	
.05 MHz	_______	_______	_______	
.1 MHz	_______	_______	_______	
.2 MHz	_______	_______	_______	
.5 MHz	_______	_______	_______	
1 MHz	_______	_______	_______	
2 MHz	_______	_______	_______	
5 MHz	_______	_______	_______	
10 MHz	_______	_______	_______	
15 MHz	_______	_______	_______	
20 MHz	_______	_______	_______	

Flatness (maximum − minimum)

5 Hz - 20 MHz	_______	_______	_______	< 1.0 dB
20 Hz - 20 MHz	_______	_______	_______	< .5 dB

Input impedance = 1 MΩ, attenuation = 0 dB

Frequency	Receiver R	Receiver A	Receiver B	Tolerance
Thermal converter measurements	(enter readings or attach printout)			
Absolute level at .1 MHz	______	______	______	0.0 ± .2 dB
.000005 MHz	______	______	______	
.00002 MHz	______	______	______	
.0001 MHz	______	______	______	
.001 MHz	______	______	______	
.002 MHz	______	______	______	
.005 MHz	______	______	______	
.01 MHz	______	______	______	
.02 MHz	______	______	______	
.05 MHz	______	______	______	
.1 MHz	______	______	______	
.2 MHz	______	______	______	
.5 MHz	______	______	______	
1 MHz	______	______	______	
2 MHz	______	______	______	
5 MHz	______	______	______	
10 MHz	______	______	______	
15 MHz	______	______	______	
20 MHz	______	______	______	
Flatness (maximum − minimum)				
5 Hz - 20 MHz	______	______	______	< 1.0 dB
20 Hz - 20 MHz	______	______	______	< .5 dB

3-11 RECEIVER LEVEL RATIO AMPLITUDE AND PHASE ACCURACY TEST

Length of Cables: B _____ A _____ R _____

Input Impedance = 50 Ω

Frequency = 100 kHz, Equal Attenuators

	A/R	B/R	A/B	D2/D1	D3/D1	D2/D3	Tolerance
Amplitude	_____	_____	_____	_____	_____	_____	±0.15 dB
Phase	_____	_____	_____	_____	_____	_____	±2.0 deg

Frequency = 5 Hz - 200 MHz, Equal Attenuators

	A/R	B/R	A/B	D2/D1	D3/D1	D2/D3	Tolerance
Phase	_____	_____	_____	_____	_____	_____	< 10 deg p-p
Amplitude	_____	_____	_____	_____	_____	_____	< 0.4 dB p-p

Frequency = 100 kHz, Unequal Attenuators

	D2/R	A/D1	A/D3	D2/B	B/D1	D3/R	Tolerance
Amplitude	_____	_____	_____	_____	_____	_____	±0.15 dB
Phase	_____	_____	_____	_____	_____	_____	±2.0 deg

Frequency = 5 Hz - 200 MHz, Unequal Attenuators

	D2/R	A/D1	A/D3	D2/B	B/D1	D3/R	Tolerance
Phase	_____	_____	_____	_____	_____	_____	< 18 deg p-p
Amplitude	_____	_____	_____	_____	_____	_____	< 0.7 dB p-p

Frequency = 20 Hz - 20 MHz, Equal Attenuators

	A/R	B/R	A/B	D2/D1	D3/D1	D2/D3	Tolerance
Amplitude	_____	_____	_____	_____	_____	_____	< 0.3 dB p-p
Phase	_____	_____	_____	_____	_____	_____	< 2 deg p-p

Frequency = 20 Hz - 20 MHz, Unequal Attenuators

	D2/R	A/D1	A/D3	D2/B	B/D1	D3/R	Tolerance
Amplitude	_____	_____	_____	_____	_____	_____	< 0.45 dB p-p
Phase	_____	_____	_____	_____	_____	_____	< 10 deg p-p

Input Impedance = 1 MΩ

Frequency = 100 kHz, Equal Attenuators

	A/R	B/R	A/B	D2/D1	D3/D1	D2/D3	Tolerance
Amplitude	______	______	______	______	______	______	±0.2 dB
Phase	______	______	______	______	______	______	±2.0 deg

Frequency = 5 Hz - 20 MHz, Equal Attenuators

	A/R	B/R	A/B	D2/D1	D3/D1	D2/D3	Tolerance
Phase	______	______	______	______	______	______	< 10 deg p-p
Amplitude	______	______	______	______	______	______	< 0.6 dB p-p

Frequency = 100 kHz, Unequal Attenuators

	D2/R	A/D1	A/D3	D2/B	B/D1	D3/R	Tolerance
Amplitude	______	______	______	______	______	______	±0.2 dB
Phase	______	______	______	______	______	______	±2.0 deg

Frequency = 5 Hz - 20 MHz, Unequal Attenuators

	D2/R	A/D1	A/D3	D2/B	B/D1	D3/R	Tolerance
Phase	______	______	______	______	______	______	< 18 deg p-p
Amplitude	______	______	______	______	______	______	< 1.0 dB p-p

Frequency = 20 Hz - 20 MHz, Equal Attenuators

	A/R	B/R	A/B	D2/D1	D3/D1	D2/D3	Tolerance
Amplitude	______	______	______	______	______	______	< 0.3 dB p-p
Phase	______	______	______	______	______	______	< 5 deg p-p

Frequency = 20 Hz - 20 MHz, Unequal Attenuators

	D2/R	A/D1	A/D3	D2/B	B/D1	D3/R	Tolerance
Amplitude	______	______	______	______	______	______	< 0.5 dB p-p
Phase	______	______	______	______	______	______	< 13 deg p-p

3-12 RECEIVER CROSSTALK TEST

Input Channel	Receivers		Maximum
R	A ______	B ______	< −100 dB
A	B ______	R ______	< −100 dB
B	A ______	R ______	< −100 dB

3-13 RECEIVER RETURN LOSS TEST

Receiver	Actual	Maximum
A	________	< −25 dB
B	________	< −25 dB
R	________	< −25 dB

3-14A SOURCE FLATNESS AND ABSOLUTE ACCURACY TEST

Frequency	Actual	Tolerance
100 kHz (Absolute)		±1 0 dB
5 Hz - 200 MHz (Flatness)		1.5 dB peak-to-peak

3-14B ALTERNATE SOURCE FLATNESS AND ABSOLUTE ACCURACY TEST

Frequency	Amplitude	Tolerance
5 Hz	________	
10 Hz	________	
100 Hz	________	
1 kHz	________	
10 kHz	________	
20 kHz	________	
50 kHz	________	
100 kHz	________	15 dBm ± 1 dB
200 kHz	________	
500 kHz	________	
1 MHz	________	
2 MHz	________	
5 MHz	________	
10 MHz	________	
20 MHz	________	
50 MHz	________	
100 MHz	________	
120 MHz	________	
140 MHz	________	
160 MHz	________	
180 MHz	________	
200 MHz	________	
Flatness (max. − min.)	________	< 1.5 dB

3-15 SOURCE ATTENUATOR ACCURACY

Amplitude	Attenuation	Max	Min	Tolerance
+12 dBm	0 dB	Ref	Ref	
+ 8 dBm	−4 dB	______	______	± 0.2 dB
+ 4 dBm	−8 dB	______	______	± 0.2 dB
−4 dBm	−16 dB	______	______	± 0.32 dB
−20 dBm	−32 dB	______	______	± 0.64 dB
−36 dBm	−48 dB	______	______	± 0.96 dB

3-16 SOURCE DISTORTION AND SPUR TEST

Harmonics

3577A Frequency	Actual	Maximum
250 kHz	______	< −30 dB
459 kHz	______	< −30 dB
10 MHz	______	< −30 dB
100 MHz	______	< −30 dB
150 MHz	______	< −30 dB
200 MHz	______	< −30 dB

HP 3577A Frequency	Test Frequency	Actual	Maximum
50 MHz	250.25 MHz	______	< −50 dBc
	200.25 MHz	______	< −50 dBc
	100.25 MHz	______	< −50 dBc
	150.25 MHz	______	< −50 dBc
100 MHz	200.25 MHz	______	< −50 dBc
	100.25 MHz	______	< −50 dBc
	99.75 MHz	______	< −50 dBc
	200.50 MHz	______	< −50 dBc
	0.25 MHz	______	< −50 dBc
150 MHz	150.25 MHz	______	< −50 dBc
	0.25 MHz	______	< −50 dBc
	150.50 MHz	______	< −50 dBc
	0.50 MHz	______	< −50 dBc
	151.00 MHz	______	< −50 dBc
	149.75 MHz	______	< −50 dBc
200 MHz	100.25 MHz	______	< −50 dBc
	99.75 MHz	______	< −50 dBc
	0.50 MHz	______	< −50 dBc
	199.50 MHz	______	< −50 dBc
	201.00 MHz	______	< −50 dBc
	199.00 MHz	______	< −50 dBc
0.75 MHz	300.25 MHz	______	< −50 dBc
	301.00 MHz	______	< −50 dBc
99.75 MHz	400.00 MHz	______	< −50 dBc
10.75 MHz	11.25 MHz	______	< −50 dBc
98.75 MHz	99.25 MHz	______	< −50 dBc
198.75 MHz	190.25 MHz	______	< −50 dBc

3-17 SOURCE PHASE NOISE TEST

3577A Source Frequency	Offset Frequency	Marker Reading		Ref Level		Noise Level	Maximum Level
1.75 MHz	100 Hz	______	−	______	=	______	< −70 dBc
	1 kHz	______	−	______	=	______	< −70 dBc
	10 kHz	______	−	______	=	______	< −70 dBc
199.75 MHz	100 Hz	______	−	______	=	______	< −70 dBc
	1 kHz	______	−	______	=	______	< −70 dBc
	10 kHz	______	−	______	=	______	< −70 dBc

3-18 API SPUR TEST

3577A Frequency	1360 Hz Offset	2720 Hz Offset	Maximum Level
1.7636 MHz	______	______	< −50 dBc
199.7636 MHz	______	______	< −50 dBc

3-19 TIMEBASE TEST Actual Maximum

10 MHz Drift (1 hour)	______	< 1 Div/5 sec

SECTION IV
ADJUSTMENTS

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SECTION IV
ADJUSTMENTS

4-1 INTRODUCTION

This section describes adjustments and checks required to bring the instrument within the specifications listed in Table 1-1. These procedures should only be performed if the specifications of Table 1-1 are not met, if instructed to do so in the troubleshooting section, or after part and/or component replacement. These procedures should not be performed as a routine maintenance procedure.

Table 4-1 lists the adjustment procedure in tabular form and the adjustment functions. Figures 4-4 and 4-5 illustrate the adjustment locations within the instrument. Table 4-2 lists all interrelated and interactive adjustments. Table 4-3 lists possible solutions for failing performance tests.

NOTE

Before performing any adjustments, allow the instrument to warm up for 1 hour. Adjustments must be made with all internal shields and covers in place and the instrument in thermal equilibrium.

4-2 EQUIPMENT REQUIRED

Table 1-2 lists the equipment required for the adjustment procedures. Any equipment which meets the critical specifications given in the table may be substituted for the recommended model.

4-3 SAFETY CONSIDERATIONS

Although the -hp- 3577A is designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure operation and to keep the unit in safe condition. Service and adjustments should be performed only by qualified personnel who are aware of the hazards involved.

WARNING

Any interruption of the protective (grounding) conductor inside or outside the unit, or disconnection of the protective earth terminal is likely to make the unit hazardous. Capacitors inside the -hp- 3577A may still be charged even though the -hp- 3577A has been removed from mains supply.

Only fuses with the required rated current and specified type should be used for replacement. The use of repaired fuses and short circuiting of fuse holders is not permitted. Whenever it is likely that the protection offered by the fuse has been impaired, the -hp- 3577A must be made inoperative and secured against unintended operation.

Adjustments described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

4-4 RELATED ADJUSTMENTS

The following adjustment procedures are written so that all interactive adjustments are made in the same paragraph. Adjustments in paragraphs which interact with those in other paragraphs are listed in Table 4-2. Also listed in Table 4-2 are the Performance Tests which should be run after an adjustment has been made to be sure the instrument meets the specifications listed in Table 1-1. Table 4-3 lists adjustment procedures, possible problems, and padding parts to correct failing performance tests.

Table 4-1 Adjustment List

Adjustment Name	Reference Designator	Adjustment Paragraph	Service Sheet	Description
	A1R44	4-28		VGA DC Offset
	A1C112	4-25		Input Capacitance
	A1C114	4-24		20 dB Attenuation
PHASE ADJ	A1R74	4-30		Input Phase Zero
RTN LOSS ADJ	A1R172	4-21		Return Loss
FLATNESS ADJ	A1R173	4-31		Level Flatness
LO FEED THRU	A1R141	4-26		L.O. Feedthrough
ADJ	A1L3	4-29		250 kHz Filter
	A1L4	4-29		250 kHz Filter
	A1L5	4-29		250 kHz Filter
50 Ω GAIN ADJ	A1R71	4-22		50 Ω Gain
HI Z GAIN ADJ	A1R76	4-23		HI Z Gain
	A1C26	4-27		10 kHz Filter
	A1C20	4-27		10 kHz Filter
R PHASE ADJ	A4C50	4-9		R Channel LO Output Level
A PHASE ADJ	A4C70	4-9		A Channel LO Output Level
B PHASE ADJ	A4C90	4-9		B Channel LO Output level
	A4L2	4-10		300 MHz Filter 1
	A4L3	4-10		300 MHz Filter 1
	A4L4	4-10		300 MHz Filter 2
	A4L5	4-10		300 MHz Filter 2
	A4L7	4-11		200 MHz Filter Zero
	A4L8	4-11		200 MHz Filter Zero
	A4L9	4-11		200 MHz Filter Flatness
	A4L100	4-11		200 MHz Filter Zero
	A4L101	4-11		200 MHz Filter Zero
	A4L102	4-11		200 MHz Filter Flatness
	A5R9	4-16		Offset Tuning Range

Table 4-1 Adjustment List (Cont'd)

Adjustment Name	Reference Designator	Adjustment Paragraph	Service Sheet	Description
10 MHz ADJ	A6R12	4-14		10 MHz Tuning Range
	A6L33	4-15		300 MHz peaking
API 1 ADJ	A7R76	4-8		API 1
API 2 ADJ	A7R74	4-8		API 2
API 3 ADJ	A7R73	4-8		API 3
API 4 ADJ	A7R88	4-8		API 4
	A7R161	4-6		VCO Tuning Range
100 kHz NULL ADJ	A7R107	4-7		100 kHz Pedestal Null
STEP 1	A8R142	4-19		Step Cal 1
LVL 1	A8R144	4-19		Level Cal 1
STEP 2	A8R157	4-19		Step Cal 2
LVL 2	A8R156	4-19		Level Cal 2
HIGH FREQ	A8C155	4-17		Source Flatness
RTN LOSS	A8C71	4-20		Output Return Loss
	A8L11	4-18		200 MHz Filter 1
	A8L12	4-18		200 MHz Filter 1
	A8L13	4-18		200 MHz Filter 1
	A8L14	4-18		200 MHz Filter 2
	A8L15	4-18		200 MHz Filter 2
	A8L123	4-18		300 MHz Filter 2
	A8L124	4-18		300 MHz Filter 2
	A8L223	4-18		300 MHz Filter 1
	A8L224	4-18		300 MHz Filter 1
+15 V ADJ	A21R122	4-5		+15 V Output Level
-15 V ADJ	A21R124	4-5		-15 V Output Level
+ 5 V ADJ	A21R22	4-5		+5 V Output Level
OVEN SHUT OFF ADJ	A31R9	4-13		Shutdown Level
FINE FREQ ADJ	A31R2	4-12		Fine Frequency
COARSE FREQ ADJ	A31U1	4-12		Coarse Frequency

TABLE 4-2 POST REPAIR/INTERACTIVE ADJUSTMENTS

Repaired/Adjusted sub-block	Recommended Performance Check and/or Adjustment procedure	Paragraph Number
All A1 board analog repairs	1. All receiver adjustments	4-21 through 4-31
	2. All receiver performance tests	3-7 & 3-9 through 3-13
All A1 board digital repairs	1. All Operational Verification tests for the receiver board	3-5
	2. Input 50 Ω Gain Adjustment	4-22
	3. Input 1 MΩ Gain Adjustment	4-23
All A4 board repairs	1. Receiver Level Flatness	3-10
	2. Input 50 Ω Gain Adjustment	4-22
	3. Input 1 MΩ Gain Adjustment	4-23
	4. Input Phase Zero Adjustment	4-30
All A5 board repairs	1. Check A5 Fault Isolation Signals	2-11
	2. Source Distortion & Spur Test	3-16
All A6 board repairs	1. Check A6 Fault Isolation Signals	2-11
All A7 API and VCO repairs and adjustments	1. Receiver Residuals & Noise Test	3-7
	2. Source Distortion and Spur Test	3-16
	3. Source Phase Noise Test	3-17
	4. API Spur Test	3-18
	5. Synthesizer 100 kHz Null Adjustment	4-7
	6. API Adjustments	4-8
All A8 Filter and Amplifier repairs and adjustments	1. Source Distortion and Spur Test	3-16
	2. Source Flatness and Absolute Accuracy Test	3-14
	3. Source Amplitude and Step Adjustments	4-19
	4. Source Flatness Adjustment	4-17
A8 Freq Gain Error Correction and Amplitude leveling repairs	1. Source Flatness and Absolute Accuracy Test	3-14
	2. On Carrier Return Loss Test	3-8
	3. Source Amplitude and Step Adjustments	4-19
	4. On Carrier Return Loss Adjustment	4-20

Table 4-2 POST REPAIR/INTERACTIVE ADJUSTMENTS (Cont'd)

Repaired/Adjusted sub-block	Recommended Performance Check and/or Adjustment procedure	Paragraph Number
All A11 board repairs	1. All Power On Self Tests 2. All Service Diagnostics	2-7 2-10
All A13 board repairs	1. All Power On Self Tests 2. All Service Diagnostics	2-7 2-10
All A16 board repairs	1. DISP HP-IB Service Diagnostic	2-10
All A21 board repairs	1. Main Power Supply Fault Isolation	2-11
All A31 board repairs	1. Time Base Stability Test 2. Oven Board 10 MHz Reference Frequency Adjustment	3-19 4-12

Table 4-3 Performance Test Adjustments

FAILING PERFORMANCE TEST	ADJUSTMENT PROCEDURE	POSSIBLE PROBLEM OR PADDING PART
3-7		
step h: frequency		
0.0277777 MHz	4-8 A7R76 4-26	
0.000 MHz	4-26	
Other		Low output from A4 A1 first IF mixer
step s: frequency		
100 Hz		A1 before the first mixer
30 kHz		A11U61
199 MHz		Boards not screwed into card nest Improperly seated input shield on receiver board Broken RF cables
3-8	4-20	60 dB attenuator on A8
3-9		
step u: magnitude		A1 first IF to third IF (mixer, op amps in 10 kHz IF) A4 local oscillator levels
step w: lower ratio transformer settings	4-28	Check for ground loops before doing any adjustments. Set up must be as specified in Fig. 3-3 Low power supply
step hh	A1R44 adj. until the test passes or do adj. 4-28	
3-10A		
step r: 50Ω	4-22	
step r: 1 MΩ	4-23	A1 input buffer relay A1 input buffer A1 first mixer A4 low local osc. levels
step v	4-31	A1 first mixer to input connector inclusive A1R140
step v: 1 MΩ frequencies <10 MHz	4-24	

Table 4-3 Performance Test Adjustments(cont)

FAILING PERFORMANCE TEST	ADJUSTMENT PROCEDURE	POSSIBLE PROBLEM OR PADDING PART
3-10B		
step dd	4-22	
step ii	4-31	Same as 3-10A step v
step rr	4-23	Same as 3-10A step r
step tt: 1 MΩ frequencies < 10 MHz	4-24	
3-11		
step dd	4-22	
step ff	4-30	
step hh		Cables in the box not properly hooked up If parts were replaced, see service notes HP 3577A-11/13
step kk	4-31	If parts were replaced, see service note HP 3577A-12
step rr		Vary the length of A1R140
step uu		Same as 3-11 step hh
step uu: frequencies < 100 Hz		A1C101
3-12		A1U43
3-13	4-21	If A1K1 or A1K2 was replaced, lead length can affect return loss
3-14A		
step y	4-17	
step x	4-19	
3-14B		
step g	4-19	
step h		A8
step m	4-17	
3-15		60 dB attenuator on A8
3-16		
step c: 2nd harmonic of 100MHz		A8Q45 and A8Q46
step f	4-6	
3-17	4-6	A7 voltage regulators A7 VCO
3-18	4-8	

4-5 POWER SUPPLY ADJUSTMENTS

DESCRIPTION:
This procedure checks and adjusts all power supplies on the A21 Main Power Supply board for correct voltage and minimum line related ripple.

EQUIPMENT:
DC Voltmeter .... HP 3456A

PROCEDURE:

WARNING

Adjustments made to the power supply are in close proximity to terminals with AC voltages capable of causing personal injury. The main power supply filter capacitors are charged to approximately 250 V. Even with the power switch in the OFF position, these voltages may be present. Before making equipment connections to the FET POWER and FET DRIVE circuits, turn OFF the instrument's power switch, remove the power cord, and place jumpers A21W1 and A21W2 into the TEST position using insulated pliers. The jumpers must remain in the TEST position for approximately 2 minutes to insure the capacitors are fully discharged. After performing these steps, make all equipment connections and connect the instrument to the power line.

a. Turn OFF the instrument's power switch, remove the power cord, and remove the bottom cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Set the voltmeter as follows:
   Function .... DC
   Range .... AUTO
   Trigger .... Internal
   Math .... OFF
   Sample Rate .... Maximum
c. The switching power supply monitors the +5 V power supply, so this supply must be loaded nominally when making adjustments. Verify connection of power supply cables to A21J1, A21J2, and A21J8.
d. Connect the voltmeter negative terminal to the instrument chassis.
e. Connect the voltmeter positive terminal to TP26. If necessary, adjust A21R22 for +5.10 ± 0.02 V.

NOTE

The +15 V and -15 V power supplies derive their reference from the +5 V supply. If the +5 V supply is not within specifications, do not adjust the 15 V supplies.

f. Connect the voltmeter positive terminal to TP8. If necessary, adjust A21R122 for +15.00 (0.00, +0.05) V.

g. Connect the voltmeter positive terminal to TP9. If necessary, adjust A21R124 for -15.00 ± 0.05 V.

h. Connect the voltmeter positive terminal to TP10. The voltmeter should read +8.0 ± 1.0 V.

NOTE

The +8 V power supply is not adjustable. This power supply feeds unregulated DC voltage to the A6 Reference and A7 Synthesizer boards. If the voltage is not correct, turn the POWER switch OFF and remove the A6 and A7 boards. Turn the POWER switch ON, and check the +8 V supply again. If there is no change in the supply voltage after the boards are removed, the problem is most likely on the A21 Main Power Supply board.

i. Move the voltmeter negative terminal to TP12.

NOTE

The isolated +5 V supply is isolated from the other instrument power supplies by transformer T1. Be sure to use the correct ground when checking this supply.

j. Connect the voltmeter positive terminal to TP11. The voltmeter should read +5.00 ± 0.25 V.

NOTE

The isolated +5 V supply is not adjustable. If the voltage is not correct, disconnect the cable from A21J2 while monitoring the supply to determine if the A16 HP-IB board is affecting the supply. If there is no change in the supply voltage when the cable is removed, the problem is most likely on the A21 Main Power Supply board.

k. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-6 SYNTHESIZER TUNING RANGE ADJUSTMENT

DESCRIPTION:
This procedure adjusts the A7 Synthesizer board tuning range. This insures that the A7 Synthesizer can tune to all required frequencies during environmental extremes.

EQUIPMENT:

Spectrum Analyzer	HP 8568B
BNC Cable-48 inch	HP 8120-1840
Service Accessory Kit	HP 03577-84401

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Place the A7 Synthesizer board on the extender board. Connect the instrument to the power line, and turn the POWER switch ON.

b. Connect the spectrum analyzer 10 MHz REF OUT to the HP 3577A EXT REF IN using a BNC cable. The EXT REF LED on the HP 3577A front panel should be lit.

c. Check that the green LED on the A7 Synthesizer board is lit. This indicates that the +8 V power supply is operational.

d. With J3 on the A7 board disconnected, the red Unlock LED should be lit.

e. Connect A7J3 to A6J5 (normal connection) using the extender cable. The Unlock LED should go out.

f. Connect the spectrum analyzer to A7J1 using the BNC to SMA cable.

g. Set the spectrum analyzer as follows:

Center Frequency	400 MHz
Frequency Span	300 MHz
Reference Level	0 dBm
Input Attenuation	10 dB
Resolution Bandwidth	Auto

h. Press and hold down the reset button on the A13 Main Processor board. The output frequency should be 290 ± 8 MHz. When the reset pushbutton is released, the signal should jump to the high end of the VCO tuning range for approximately 2 seconds.

i. Using the spectrum analyzer, note the frequency of the largest signal when the reset pushbutton is released.

j. Adjust A7R161 (within the shield) for a signal frequency of 515 ±10 MHz when the pushbutton is released and the VCO is running at the high end of the frequency range.

k. Check to see that the low end is below 298 MHz. Repeat steps h through j until both the lower and upper frequencies are within specification.

l. Disconnect the cable at A7J3. The frequency of the largest signal on the spectrum analyzer should be 290 ±8 MHz.

m. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-7 SYNTHESIZER 100 kHz NULL ADJUSTMENT

DESCRIPTION:
This procedure adjusts the 100 kHz synthesizer reference frequency sideband present on the synthesized signal to an acceptable level. This is required for proper signal purity of the A7 Synthesizer board.

EQUIPMENT:

Spectrum Analyzer	HP 8568B
BNC Cable-48 inch	HP 8120-1840
Service Accessory Kit	HP 03577-84401

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Place the A7 Synthesizer board on the extender board and connect A7J3 to A6J5. Connect the instrument to the power line, and turn the POWER switch ON.

b. Connect the spectrum analyzer 10 MHz REF OUT to the HP 3577A EXT REF IN using a BNC cable. The EXT REF LED on the HP 3577A front panel should be lit.

c. Set the HP 3577A sweep type to CW and frequency to 750 kHz.

d. Set the spectrum analyzer as follows:

Center Frequency	301 MHz
Frequency Span	225 kHz
Reference Level	+5 dBm

e. Connect the spectrum analyzer to A7J1. Note the level measured at 301 MHz.

f. Adjust A7R107 until the signal levels at 300.9 MHz and 301.1 MHz are at least 65 dB below the level seen at 301 MHz.

g. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-8 API (ANALOG PHASE INTERPOLATION) ADJUSTMENTS

DESCRIPTION:
This procedure adjusts the API circuits on the A7 Synthesizer board. This is required for proper operation of the fractional N circuits.

EQUIPMENT:
Signal Generator .... HP 8660C
BNC Cable-48 inch .... HP 8120-1840
N male to BNC female Adapter (2 each) .... HP 1250-0780

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Connect the signal generator 10 MHz REF OUT to the HP 3577A EXT REF IN. The EXT REF LED on the HP 3577A front panel should be lit.
c. Set the HP 3577A as follows:
Sweep Type .... CW
Res BW .... 1 Hz
FREQ .... 1.75038 MHz
d. Set the signal generator as follows:
Amplitude .... -5 dBm
Frequency .... 1.75038 MHz
e. Connect the signal generator output to Receiver Input R.
f. Press the MKR hardkey and the MKR ZERO softkey.
g. Increase the signal generator frequency 38 Hz to 1.750418 MHz.
h. Adjust A7R76 (API 1) for a marker level at least 50 dB below the reference level set in step f. Do not fine tune this if the level is in spec, as it may throw the API circuit out of balance and many adjustments may have to be made.
i. Increase the signal generator frequency 38 Hz twice and verify that the marker level is at least 50 dB below the reference level set in step f. The two check frequencies are 1.750456 MHz and 1.750494 MHz. Adjust A7R76 only as necessary.
j. Repeat steps c through i for 199.75038 MHz. The reference frequencies and test frequencies for both HP 3577A frequencies are listed below.

HP 3577A Frequency	Reference Frequency	First Test Frequency	Second Test Frequency	Third Test Frequency
1.75038	1.75038	1.750418	1.750456	1.750494
199.75038	199.75038	199.750418	199.750456	199.750494

k. Repeat steps c through i for the following frequencies, but increase the signal generator in steps of 1.36 kHz rather than 38 Hz. Adjust A7R76 only when necessary.

HP 3577A Frequency	Reference Frequency	First Test Frequency	Second Test Frequency	Third Test Frequency
1.7636	1.7636	1.76496	1.76632	1.76768
199.7636	199.7636	199.76496	199.76632	199.76768

l. Repeat steps c through k as necessary until the HP 3577A meets specification for all frequencies listed without adjustment.

NOTE

This adjustment is a compromise for each HP 3577A frequency and test frequency. The adjustment must be made so that all test points meet specifications simultaneously.

m. Set the signal generator frequency to 98.750038 MHz.
n. Change the HP 3577A frequency to 98.750038 MHz. Press the MKR hardkey and the MKR ZERO softkey. Increase the frequency 38 Hz to 98.750076 MHz.
o. Adjust API 2, A7R74, for a marker reading of less than -50 dB (typically -53 dB).
p. Increase the frequency 380 Hz from the value in step n to 98.750418 MHz.
q. Adjust API 3, A7R73, for a marker reading of less than - 50 dB.
r. Increase the frequency 3800 Hz from the value in step n to 98.753838 MHz.
s. Adjust API 4, A7R88, for a marker reading of less than - 50 dB.
t. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-9 LOCAL OSCILLATOR LEVELING LOOP/FLATNESS ADJUSTMENT

DESCRIPTION:
This procedure adjusts the A4 Local Oscillator board output for maximum level flatness with respect to frequency. This adjustment is required by the A1 Receiver boards in order to meet the dynamic accuracy and absolute amplitude accuracy specifications.

EQUIPMENT:
Power Meter .... HP 436A
Power Sensor .... HP 8482A
Service Accessory Kit .... HP 03577-84401

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Place the A4 Local Oscillator board on the extender board. Leave all interconnecting cables disconnected unless instructed to do otherwise in this procedure.
c. Connect A4J1 to A6J3 (normal connection), A4J2 to A7J1 (normal connection), and A6J5 to A7J3 (normal connection) using extender cables.
d. Connect the power sensor to A4J4 using the proper adapters. Terminate A4J3 and A4J5 into their normal A1 connections.
e. Connect the instrument to the power line, and turn the POWER switch ON.
f. Set the HP 3577A sweep type to CW and frequency to 1 MHz.
g. With the proper cal factor selected on the power meter, adjust A4R49 for a power meter reading of +7.00 dBm ± 0.05 dB. Record the final amplitude measured.
h. Connect the power sensor to A4J3 and terminate A4J4 into its normal connection. Record the power meter reading. It should be +7.0 dBm ± 0.2 dB.
i. Connect the power sensor to A4J5 and terminate A4J3 into its normal connection. Record the power meter reading. It should be +7.0 dBm ± 0.2 dB.
j. Turn OFF the instrument's power switch, remove the power cord, and place the A4 Local Oscillator board back into the instrument.

CAUTION

DO NOT insert or remove the circuit boards from the HP 3577A with power applied to the instrument. Power surges to circuit boards may cause unknown instrument states and/or damage the circuitry.

k. Connect the instrument to the power line, and turn the POWER switch ON.
l. Set the HP 3577A sweep type to CW and frequency to 200 MHz.
m. Connect the power sensor to A4J4. Terminate A4J3 and A4J5 into their normal A1 board connections.
n. With the proper cal factor selected on the power meter, adjust A4C70 for the same amplitude ± 0.05 dB as read at 1 MHz in step g above.
o. Connect the power sensor to A4J3 and terminate A4J4 into its normal connection.

p. Adjust A4C50 for the same amplitude ± 0.05 dB as read at 1 MHz in step h above.
q. Connect the power sensor to A4J5 and terminate A4J3 into its normal connection.
r. Adjust A4C90 for the same amplitude ± 0.05 dB as read at 1 MHz in step i above.
s. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-10 LOCAL OSCILLATOR 300 MHz FILTER ADJUSTMENTS

DESCRIPTION:
This procedure adjusts both of the 300 MHz filters on the A4 Local Oscillator board. These filters eliminate upper harmonics that can interfere with the peak detecting leveling loop.

EQUIPMENT:

Signal Generator	HP 8660C
Spectrum Analyzer	HP 8568B
3 dB Attenuator	HP 8491A Opt003
Service Accessory Kit	HP 03577-84401

PROCEDURE:
a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Remove the A4 Local Oscillator board. Remove the shield and place the A4 board on the extender board. Move jumper A4W1 to the top right position.
c. Connect the signal generator output to A4J1 and the spectrum analyzer input to A4J6 through the 3 dB attenuator.
d. Connect the instrument to the power line, and turn the POWER switch ON.
e. Set the signal generator for a 0 dBm, 300 MHz, CW signal.
f. Set the spectrum analyzer as follows:

Center Frequency	300 MHz
Frequency Span	0 Hz
Resolution Bandwidth	300 Hz
Reference Level	0 dBm
dB/Div	2 dB
Sweep Time	10 sec

g. Adjust A4L2 and A4L3 for a maximum reading on the spectrum analyzer.
h. Increase the spectrum analyzer dB/Div to 10 dB, and wait for a complete sweep. Then press Marker Normal, Marker Δ, and increase the center frequency to 600 MHz.
i. Increase the signal generator frequency to 600 MHz.
j. The spectrum analyzer reading should be at least 40 dB below the reading in step g.
k. Set jumper A4W1 to the bottom right position and jumper A4W2 to the bottom left position.
l. Connect the signal generator output to A4J6 and the spectrum analyzer input to A4J7 through the 3 dB attenuator.
m. Change the signal generator frequency to 300 MHz and the amplitude to +10dBm.

n. Change the spectrum analyzer center frequency to 300 MHz, the dB/div to 2dB, and the reference level to +5 dBm.
o. Adjust A4L4 and A4L5 for a maximum spectrum analyzer reading.
p. Increase the spectrum analyzer dB/Div to 10 dB, and wait for a complete sweep. Then press Marker Normal, Marker Δ, and increase the center frequency to 600 MHz.
q. Increase the signal generator frequency to 600 MHz.
r. The spectrum analyzer reading should be at least 35 dB below the reading in step o.
s. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-11 LOCAL OSCILLATOR 200 MHZ FILTER ADJUSTMENTS

DESCRIPTION:
This procedure adjusts the 200 MHz filters on the A4 Local Oscillator board. These filters eliminate the upper mixer harmonics that can interfere with the peak detecting leveling loop.

EQUIPMENT:

Spectrum Analyzer	HP 8568B
Signal Generator	HP 8660C
3 dB Attenuator	HP 8491A Opt003
Service Accessory Kit	HP 03577-84401

PROCEDURE:
a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Remove the A4 Local Oscillator board. Remove the shield and place the A4 board on the extender board. Move both A4W4 and A4W5 to the bottom left position.
c. Connect the signal generator output to A4J9 and the spectrum analyzer to A4J10 through the 3 dB attenuator.
d. Connect the instrument to the power line, and turn the POWER switch ON.
e. Set the signal generator for a +10 dBm, 200 MHz, CW signal.
f. Set the spectrum analyzer as follows:

Center Frequency	200 MHz
Frequency Span	0 Hz
Resolution Bandwidth	300 Hz
Reference Level	+5 dBm
dB/Div	1 dB
Sweep Time	10 sec

g. Adjust A4L7 and A4L9 for a maximum reading on the spectrum analyzer.
h. Increase the spectrum analyzer dB/Div to 10 dB, and wait for a complete sweep. Then press Marker Normal, Marker Δ, and increase the center frequency to 300 MHz.
i. Increase the signal generator frequency to 300 MHz.
j. Adjust A4L8 for a minimum reading on the spectrum analyzer.

k. Repeat steps e through j until no further improvement can be made. The final 300 MHz level should be at least 55 dB below the 200 MHz level.
l. Set A4W5 to the bottom right position and A4W6 to the top left position.
m. Connect the signal generator to A4J10 and the spectrum analyzer to A4J11 through the 3 dB attenuator.
n. Return the signal generator frequency to 200 MHz.
o. Change the spectrum analyzer center frequency to 200 MHz, dB/div to 1 dB, and sweep time to 20 sec.
p. Adjust A4L100 and A4L102 for a maximum reading on the spectrum analyzer.
q. Increase the spectrum analyzer dB/div to 10 dB and wait for a complete sweep. Then press Marker Normal, Marker Δ, and increase the center frequency to 300 MHz.
r. Increase the signal generator frequency to 300 MHz.
s. Adjust A4L101 for a minimum reading on the spectrum analyzer.
t. Repeat steps n through s until no further improvement can be made. The final 300 MHz level should be at least 55 dB below the 200 MHz level.
u. Move A4W6 to the top right position and A4W7 to the bottom left position.
v. Set the signal generator for -40 dBm, 200 MHz, CW signal.
w. Connect the signal generator to A4J11 and the spectrum analyzer to A4J12.
x. Set the spectrum analyzer as follows:

Center Frequency	200 MHz
Frequency Span	0 Hz
Resolution Bandwidth	300 Hz
Video Bandwidth	300 Hz
Sweep Time	10 sec
dB/Div	2 dB

y. Adjust A4L201 for a maximum reading. If necessary, adjust the reference level on the spectrum analyzer for a mid screen display.
z. Increase the spectrum analyzer dB/div to 10 dB and wait for a complete sweep. Then press Marker Normal, Marker Δ and increase the center frequency to 300 MHz.
aa. Increase the signal generator frequency to 300 MHz.
bb. The 300 MHz level should be at least 25 dB below the 200 MHz level.
cc. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-12 OVEN BOARD 10 MHz REFERENCE FREQUENCY ADJUSTMENT

DESCRIPTION:
This procedure adjusts the absolute frequency of the 10 MHz A31 Oven board. This is the absolute frequency reference in the HP 3577A.

EQUIPMENT:
Oscilloscope .... HP 1980B
Frequency Standard .... WWVB

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON. NOTE: THE HP 3577A MUST BE WARMED UP FOR AT LEAST 8 HOURS BEFORE THE ADJUSTMENT IS MADE.
b. Connect the frequency standard to the oscilloscope external trigger connector. Terminate the frequency standard as required.
c. Connect the HP 3577A REF OUT, located on the rear panel, to the oscilloscope channel 1 input. Terminate the channel 1 input in 50 Ω.
d. Set the oscilloscope time/div control to 0.1 μs per division.
e. Remove the screw on A31U1 and set the coarse frequency adjust for a stable (i.e., not moving) display as seen on the oscilloscope.
f. Set the oscilloscope time/div control to 10 ns per division.
g. Set the fine frequency adjust (A31R2) for a stable display as seen on the oscilloscope.
h. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-13 OVEN HEATER SHUTDOWN ADJUST

DESCRIPTION:
This procedure adjusts the heater shutdown trip point on the A31 Oven board. This is required so that the HP 3577A is disconnected from the oven reference when the oven is cold and connected when the oven has warmed up.

EQUIPMENT:
Spectrum Analyzer .... HP 8568B
Service Accessory Kit .... HP 03577-84401

PROCEDURE:

a. Turn OFF the instrument's power switch, and remove the power cord. Remove the top cover, and the cover above A31. Connect the instrument to the power line, but DO NOT turn the POWER switch ON.
b. Connect the spectrum analyzer to A31J1 and set as follows:
   Center Frequency .... 10 MHz
   Reference Level .... 0 dBm
   Span .... 1 MHz

c. Turn the HP 3577A line power ON. When the oven is cold, the 10 MHz signal on the spectrum analyzer should be approximately -100 dBm or lower. To check, set the spectrum analyzer reference level to -80 dBm and the span to 1 kHz.
d. After approximately 20 minutes, when the oven is sufficiently warm, the 10 MHz signal on the spectrum analyzer should be approximately 0 dBm. Adjust A31R9 until the 10 MHz signal on the spectrum analyzer drops out, then back off A31R9 (counter-clockwise) about 10 degrees or until the signal just appears.
e. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-14 REFERENCE BOARD 10 MHz OSCILLATOR ADJUSTMENT

DESCRIPTION:
This procedure adjusts the 10 MHz oscillator on the A6 Reference board. This 10 MHz oscillator is phase locked to the 10 MHz oven or external reference and is the source of all frequencies in the HP 3577A.

EQUIPMENT:

Spectrum Analyzer	HP 8568B
BNC Cable-48 inch	HP 8120-1840

PROCEDURE:
a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Remove the cable from A6J6 and any external reference from the rear panel.
c. Connect the spectrum analyzer to the rear panel 10 MHz output.
d. Set the spectrum analyzer to track the input signal and count its frequency.
e. Place the jumper A6W1 in the test position. This places the switchable loop filter in the wideband mode and allows the 10 MHz VCXO to free run.
f. Adjust A6R12 for a spectrum analyzer frequency reading of 10 MHz ± 5 Hz.
g. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-15 300 MHZ OUTPUT LEVEL PEAKING ADJUSTMENT

DESCRIPTION:
This procedure adjusts the 300 MHz output filter pass element on the A6 Reference board. Adjusting the filter center frequency controls the 300 MHz output level.

EQUIPMENT:

Spectrum Analyzer .... HP 8568B
Service Accessory Kit .... HP 03577-84401

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and and remove the top cover.
b. Place the A6 Reference board on the extender board. Reconnect the cables to their proper position using extender cables.
c. Connect the instrument to the power line, and turn the POWER switch ON.
d. Connect the spectrum analyzer to A6J3.
e. Adjust A6L33 for the maximum 300 MHz spectrum analyzer reading. (This adjustment is inside the shielded assembly and can be made through the top cover of the shield.) This reading should be between - 5 and -2 dBm (check 2nd [600MHz] harmonic to see if it is less than -40 dBm).
f. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-16 OFFSET BOARD OSCILLATOR TUNING RANGE ADJUSTMENT

DESCRIPTION:
This procedure adjusts the 300.25 MHz oscillator voltage controlled tuning range on the A5 Offset board. This is required to ensure that the oscillator remains phase-locked under all environmental conditions.

EQUIPMENT:

Spectrum Analyzer .... HP 8568B
Service Accessory Kit .... HP 03577-84401

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Place the A5 Offset board on the extender board.
c. Connect the instrument to the power line, and turn the POWER switch ON.
d. Connect A5J2 to A6J4 (normal connection) using extender cables. Set A5W3 to the test position.
e. Connect the spectrum analyzer to A5J1 and set as follows:

   Center Frequency .... 300.25 MHz
   Reference Level .... +10 dBm
   Span .... 50 MHz

f. Press the Max Hold function, if available, on the spectrum analyzer. The VCO ramps over its tuning range, and the spectrum analyzer display should show a waveform similar to a bandpass filter.

g. Adjust A5R9 (inside the shield) for a spectrum analyzer display where the range of the waveform is two-thirds above and one-third below 300.25 MHz. After any adjustment is performed, the spectrum analyzer Max Hold values must be reset. On the HP 8568B, this is done by pressing the Clear Write control.
h. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-17 SOURCE FLATNESS ADJUSTMENT

DESCRIPTION:
This procedure adjusts the source output level flatness with respect to frequency on the A8 Source board.

EQUIPMENT:

Power Meter .... HP 436A
Power Sensor .... HP 8482A

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Connect the power sensor to the A8 Source Output.
c. Adjust the cal factor on the power meter for 1 MHz.
d. Set the HP 3577A as follows:

   Sweep Type .... CW
   AMPTD .... 0 dBm
   FREQ .... 1 MHz

e. Press dB[REF] on the power meter.
f. Increase the HP 3577A frequency to 200 MHz.
g. Adjust the cal factor on the power meter for 200 Mhz.
h. Adjust A8C155 for 0.00 dB(REF) $\pm$ 0.02 dB on the power meter.
i. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and replace the top cover.

4-18 SOURCE OUTPUT BOARD FILTER ADJUSTMENT

DESCRIPTION:
This procedure adjusts the 200 and 300 MHz low pass filters on the A8 Source board. These filters are required for the specified spectral purity of the output and for the peak detectors in the amplitude leveling loop.

EQUIPMENT:

Power Meter	HP 436A
Power Sensor	HP 8482A
Service Accessory Kit	HP 03577-84401
Signal Generator	HP 8660C
Spectrum Analyzer	HP 8568B
3 dB Attenuator	HP 8491A Opt003

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Remove the A8 Source circuit board shields and place the board on the extender board. Connect A7J2 to A8J1 and A5J1 to A8J2 using extender cables.
c. Connect the power meter to A8J3.
d. Set the HP 3577A as follows:

SWEEP TYPE	CW
FREQ	99 kHz
AMPTD	+15 dBm

e. Adjust A8L124 and A8L123 for a maximum reading on the power meter. These adjustments interact, so repeat until a common maximum is obtained.
f. Adjust A8L224 and A8L223 for a maximum reading on the power meter. These adjustments interact, so repeat until a common maximum is obtained.
g. Increase the HP 3577A frequency to 200 MHz. Press the SPCL FCTN hardkey and the SERVICE DIAG softkey. Toggle LEVELING to the OFF state.
h. Adjust A8L14 and A8L15 for a maximum reading on the power meter.
i. Set A8W5 to the bottom right position. Connect the spectrum analyzer to A8J8 through the 3 dB attenuator.
j. Move A8W4 to the bottom left position, and connect the output of the signal generator to A8J7.
k. Set the signal generator for a 0 dBm, 200 MHz, CW signal.
l. Set the spectrum analyzer as follows:

Center Frequency	200 MHz
Frequency Span	0 Hz
Resolution Bandwidth	300 Hz
dB/Div	1 dB
Sweep Time	10 sec

m. Adjust A8L11 and A8L13 for a maximum spectrum analyzer reading.
n. Change the spectrum analyzer dB/div to 10 dB. Wait for a complete sweep, then press Marker Normal, Marker Δ. Increase the center frequency to 300 MHz.
o. Increase the signal generator frequency to 300 MHz.
p. Adjust A8L12 for a minimum reading on the spectrum analyzer.

q. Repeat steps k through p until the adjustments cannot be improved. With the final adjustment, the 300 MHz spectrum analyzer reading in step p should be at least 55 dB below the 200 MHz reading in step m.
r. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

4-19 SOURCE AMPLITUDE AND STEP ADJUSTMENTS

DESCRIPTION:
This procedure adjusts the A8 Source board leveling circuits. The step adjustment sets the increments of the DAC controlled "vernier". These adjustments are necessary for the instrument to meet output level specifications.

EQUIPMENT:

Power Meter	HP 436A
Power Sensor	HP 8482A

PROCEDURE:
a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Connect the power sensor to the A8 Source Output.
c. Adjust the cal factor on the power meter for 100 kHz.
d. Set the HP 3577A as follows:

SWEEP TYPE	CW
FREQ	101 kHz
AMPTD	+11 dBm

e. Adjust A8R144, LVL 1, for a power meter reading of 11.00 dBm ± 0.01 dB.
f. Increase the HP 3577A amplitude to +15 dBm.
g. Adjust A8R142, STEP 1, for a power meter reading of +15.00 dBm ± 0.01 dB.
h. Decrease the HP 3577A amplitude to +11 dBm and the frequency to 99 kHz.
i. Adjust A8R156, LVL 2, for a power meter reading of +11.00 dBm ± 0.01 dB.
j. Increase the HP 3577A amplitude to +15.00 dBm.
k. Adjust A8R157, STEP 2, for a power meter reading of +15.00 dBm ± 0.01 dB.
l. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and replace the top cover.

4-20 ON CARRIER RETURN LOSS ADJUSTMENT

DESCRIPTION:
This procedure adjusts the A8 Source board output impedance.

EQUIPMENT:

Signal Generator	HP 8660C
Directional Bridge	HP 35677-63502
3 dB Attenuator	HP 8491A Opt 003
10 dB Attenuator	HP 8491A Opt 010
SMA male to BNC female Adapter (2 each)	HP 1250-1200
N male to BNC female Adapter (2 each)	HP 1250-0780
N male to N male Adapter	HP 1250-0778
BNC Cables-48 inch (3 each)	HP 8120-1840

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.

b. Connect the equipment as shown in Figure 4-1 except leave the A8 Source Output to the directional bridge unconnected.

c. Set the HP 3577A as follows:

FREQ	
FREQ SPAN	0 Hz
CENTER FREQ	200 MHz
AMPTD	12 dBm
RES BW	10 Hz
DISPLY FCTN	LIN MAG
SCALE	
REF POSN	50%
/DIV	10 mV

d. Set the signal generator for a 200 MHz, 5 Hz step size, +10 dBm, CW signal.

e. Note the MARKER MAG on the HP 3577A. It should read approximately 33 mV.

f. Step the signal generator frequency up 5 Hz.

g. Connect the A8 Source Output to the directional bridge load port using a N male to N male adapter.

h. Change the HP 3577A scale /div to 1 mV. Press the MKR → hardkey and the MKR → REF LVL softkey.

i. Adjust A8C71 for a minimum peak-to-peak sine wave (must be less than 2.5 mV peak-to-peak). Press MKR → REF LVL if necessary to keep the signal on the screen.

j. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

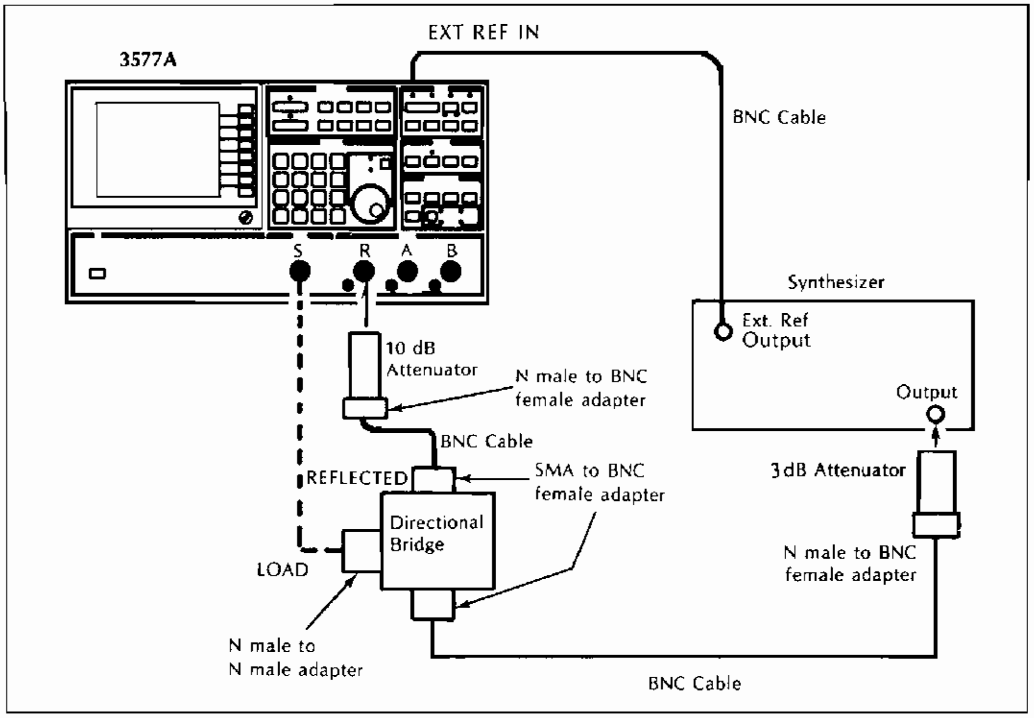

Figure 4-1. On Carrier Return Loss Adjustment Test Set Up

4-21 RECEIVER RETURN LOSS ADJUSTMENT

DESCRIPTION:
This procedure adjusts the A1 Receiver board return loss. An external return loss bridge, driven by the A8 Source board and measured by the A1 Receiver board in channel R, is used to verify the Receivers in channels A and B. The Receiver in channel R is then verified using the Receiver in channel A as the measurement channel.

EQUIPMENT:
Directional Bridge .... HP 35677-63502
RF Cable-24 inch (3 each) .... HP 35679A
10 dB Attenuator .... HP 8491A, Opt 010
Precision Termination (female) .... HP 909C,Opt200,Opt013

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Connect the A8 Source Output to the source input of the directional bridge through the 10 dB attenuator.
c. Set the HP 3577A as follows:
   FREQ
   START FREQ .... 100 kHz
   AMPTD .... 0 dBm
d. Connect the reflected output port on the directional bridge to Receiver Input R. Connect an RF cable to the load port on the directional bridge and leave the other end of the RF cable open.

e. Press the INPUT hardkey and select the R channel softkey.
f. Allow the HP 3577A to make 2 complete sweeps. Press the STORE hardkey and the D2 softkey. This is the load port open reference.
g. Connect the precision termination to the end of the load port cable.
h. Allow the HP 3577A to make two sweeps and store the display in register D1.
i. Press the INPUT hardkey and enter a USER DEFINED input of (R-D1)/D2. This is the one port partial cal error correction for the directional bridge.
j. Connect the load port cable to Receiver Input A.
k. Allow the HP 3577A to make two sweeps. Press the ATTEN hardkey and toggle the channel being adjusted to 0 dB. Press the MKR → hardkey and the MKR → MAX softkey. Adjust A1R172 for a minimum marker reading.
l. Repeat steps j and k for Receiver Input B.
m. Repeat steps d through k for Receiver Input R. All control settings will be the same except Input A must be used whenever Input R is specified (even in equations).
n. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and replace the top cover.

4-22 INPUT 50 Ω GAIN ADJUSTMENT

DESCRIPTION:
This procedure adjusts the A1 Receiver board IF gain when the input is in the 50 Ω termination mode. This is necessary for the instrument to meet absolute amplitude accuracy specifications.

EQUIPMENT:
Synthesizer .... HP 3335A
BNC Cables-48 inch (2 each) .... HP 8120-1840
BNC female to N male Adapter .... HP 1250-0780

PROCEDURE:
a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Connect the spectrum analyzer 10 MHz REF OUT to the HP 3577A EXT REF IN using a BNC cable. The EXT REF LED on the HP 3577A front panel should be lit.
c. Set the synthesizer as follows:
   Frequency .... 100 kHz
   Amplitude .... -30 dBm
d. Set the HP 3577A as follows: (RUT = Receiver under test)
   INPUT .... <RUT>
   SWEEP TYPE .... CW
   FREQ .... 100 kHz
   SCALE
      REF LEVEL .... -30 dBm
      REF POSN .... 50 %
      / DIV .... 0.1 dB
   ATTEN (all receiver inputs)
      ATTEN .... 0 dBm
      RES BW .... 10 Hz

e. Connect the synthesizer output to Receiver Input <RUT> using a BNC cable and adapter.
f. Adjust A1R71 for a marker reading of -30.00 dBm ± 0.01 dB.
g. Repeat steps d through f for all A1 Receiver boards requiring adjustment.
h. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and replace the top cover.

4-23 INPUT 1 MΩ GAIN ADJUSTMENT

DESCRIPTION:
This procedure adjusts the A1 Receiver board IF gain when the input is in 1 MΩ terminate mode. This is necessary for the instrument to meet absolute amplitude specifications.

EQUIPMENT:

Synthesizer	HP 3335A
BNC Cables-48 inch (2 each)	HP 8120-1840
BNC female to N male Adapter	HP 1250-0780
Feedthrough Termination	HP 11048C

PROCEDURE:
a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Connect the spectrum analyzer 10 MHz REF OUT to the HP 3577A EXT REF IN using a BNC cable. The EXT REF LED on the HP 3577A front panel should be lit.
c. Set the synthesizer as follows:

Frequency	100 kHz
Amplitude	-30 dBm

d. Set the HP 3577A as follows: (RUT = Receiver under test)

INPUT	<RUT>
SWEEP TYPE	CW
FREQ	100 kHz
SCALE	
REF LEVEL	-30 dBm
REF POSN	50 %
/ DIV 0.1	dB
ATTEN (all receiver inputs)	
ATTEN	0 dBm
IMPED	1 MΩ
RES BW	10 Hz

e. Connect a cable from the synthesizer output to the feedthrough termination. Connect the open end of the feedthrough termination to Receiver Input <RUT> using a BNC cable and adapter.
f. Adjust the 1 Meg level adjust, A1R76, for a marker reading of -30 dBm ± 0.01 dB.
g. Repeat steps d through f for all A1 Receiver boards requiring adjustment.
h. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and replace the top cover.

4-24 INPUT 1 MΩ ATTENUATOR ADJUSTMENT

DESCRIPTION:
This procedure adjusts the attenuation value of the 1 Meg, 20 dB attenuator on the A1 Receiver board.

EQUIPMENT:

BNC female to N male Adapter	HP 1250-0780
50 Ω Feedthrough Termination	HP 11048C
Service Accessory Kit	HP 03577-84401

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Connect the feedthrough termination to the A8 Source Output with the adapter.

NOTE

When adjusting the Receiver board in channel A, place the board on an extender board in channel R or B. Adjusting a Receiver board on an extender in channel A may cause the signal to jump erratically. Return the Receiver to channel A after completing the adjustment.

c. Connect A1J2 to the feedthrough termination with the proper cable and adapter. Place the Receiver under test on an extender board. Connect A1J1 to A4J3, J4, or J5 using an extender cable.
d. Connect the instrument to the power line, and turn the POWER switch ON.
e. Set the HP 3577A as follows: (RUT = Receiver Under Test)

INPUT	<RUT>
SWEEP TYPE	CW
AMPLITUDE	-25 dBm
FREQ	100 kHz
ATTEN	
ATTEN (RUT)	0 dB
IMPED (RUT)	1 Meg
RES BW	10 Hz

f. Allow the HP 3577A to settle, then press the MEASR CAL hardkey and the NORMALIZE softkey. Press the ATTEN hardkey, and select an ATTEN (RUT) of 20dB.
g. Adjust A1C114 for 0.00 ± 0.03 dB.
h. Repeat steps c through g for all A1 Receiver boards requiring adjustment. Remember to disconnect power to the HP 3577A before removing a A1 Receiver board.
i. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the instrument to its original state.

4-25 INPUT 1 MΩ CAPACITANCE ADJUSTMENT

DESCRIPTION:
The procedure adjusts the input capacitance of the Hi-Z (1 Meg) input mode on the A1 Receiver board. There is only a typical specification for input capacitance, but lower capacitance allows better high impedance, high frequency measurements.

EQUIPMENT:

BNC female to N male Adapter	HP 1250-0780
1 Meg Series Resistor	HP 0698-7332
Service Accessory Kit	HP 03577-84401

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Connect the 1 Meg series resistor to the A8 Source Output with the adapter.

NOTE

When adjusting the Receiver board in channel A, place the board on an extender board in channel R or B. Adjusting a Receiver board on an extender in channel A may cause the signal to jump erratically. Return the Receiver to channel A after completing the adjustment.

c. Connect A1J2 to the 1 Meg series resistor with a cable and adapter. Place the Receiver under test on an extender board. Connect A1J1 to A4J3, J4, or J5 using an extender cable.
d. Connect the instrument to the power line, and turn the POWER switch ON.
e. Set the HP 3577A as follows: (RUT = Receiver Under Test)

INPUT	<RUT>
SWEEP TYPE	CW
AMPTD	-25 dBm
FREQ	10 kHz
ATTEN	
ATTEN (RUT)	0 dB
IMPED (RUT)	1 Meg
RES BW	10 Hz

f. Allow the HP 3577A to settle, then press the MEASR CAL hardkey and the NORMALIZE softkey. Press the ATTEN hardkey and select an ATTEN (RUT) of 20dB.
g. Adjust A1C112 for 0 dB.
h. Repeat steps c through g for all A1 Receiver boards requiring adjustment. Remember to disconnect power to the HP 3577A before removing a Receiver board.
i. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the instrument to its original state.

NOTE

The 1M Ω Capacitance and 1M Ω Attenuator Adjustments interact. For best results, repeat both tests several times to obtain the optimum settings.

4-26 INPUT LOCAL OSCILLATOR FEEDTHROUGH ADJUSTMENT

DESCRIPTION:
This procedure adjusts the local oscillator feedthrough for the first IF mixer on the A1 Receiver board. This adjustment is necessary for the instrument to meet the receiver level flatness and dynamic accuracy specification.

EQUIPMENT:
None

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Set the HP 3577A as follows: (RUT = Receiver under test)
   INPUT .... <RUT>
   SWEEP TYPE .... CW
   FREQ .... 0 Hz
c. Adjust A1R141, LO feedthrough adjust, for a minimum marker amplitude reading. This reading must be at least 33 dB below the maximum input level.
d. Repeat steps b and c for all Receiver boards requiring adjustment.
e. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and replace the top cover.

4-27 INPUT NOTCH FILTER ADJUSTMENT

DESCRIPTION:
This procedure adjusts the 10 kHz IF filter notch on the A1 Receiver board. This filter rejects input image and noise signals. This is required for the A1 Receiver board to meet the flatness and dynamic accuracy specifications.

EQUIPMENT:
1:1 Probe .... HP 10021A
10:1 Probe .... HP 10040A
BNC female to N male Adapter (2 each) .... HP 1250-0780

PROCEDURE:

NOTE

This procedure requires that one of the A1 Receiver boards is operating within specification. This minimizes the required equipment list and simplifies the adjustment procedure.

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Place the Receiver, which requires adjustment, on an extender board into channel B. Note each Receiver board's original position in the unit.

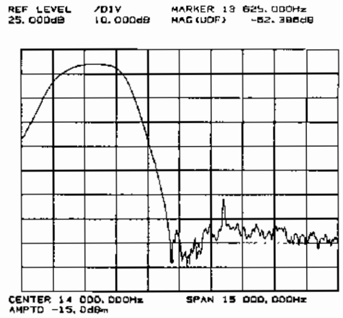

Figure 4-2: 14 kHz Filter Response

c. Place the operational Receiver board into channel R and connect A1J1 to A4J3.
d. Connect the instrument to the power line, and turn the POWER switch ON.
ATTEN
  IMPED (R) .... 1 MEG
FREQ
  CENTER FREQ .... 14 kHz
  FREQ SPAN .... 5 kHz

f. Connect the A8 Source Output to A1TP5 (channel B) using the 1:1 probe.
g. Connect Receiver Input R to the top of A1R28 (channel B) using the 10:1 probe.
h. Set the 10 kHz filter adjust, A1C20, for a null at 14 kHz.
i. Move the 1:1 Probe to the top of A1R28 and the 10:1 probe to A1TP6.
j. Set the 10 kHz filter adjust, A1C26, for a null at 14 kHz.
k. Move the 1:1 probe to A1TP5.
l. Change the HP 3577A frequency span to 15 kHz, resolution bandwidth to 100 Hz, and sweep time to 2 sec.
m. The HP 3577A display should resemble the wave shape shown in Figure 4-2. The most critical part of this filter is that the 14 kHz response should be at least 70 dB below the response at 10 kHz.
n. Repeat this procedure for all A1 Receiver boards requiring adjustment.
o. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the instrument to its original state.

4-28 INPUT VARIABLE GAIN AMPLIFIER DC OFFSET ADJUSTMENT

DESCRIPTION:
This procedure adjusts the DC offset for the variable gain amplifier and the sample and hold output on the A1 Receiver board. A1R44 is adjusted for an equal DC offset in both the A/D converter and the variable gain amplifier. A1R187 is adjusted for an offset of ± LSB so that the transition point of the MSB is not 0 V input. This adjustment is necessary for the instrument to meet the absolute amplitude specifications.

EQUIPMENT:
Computer .... HP 9000 Series 200
Jumper .... Pomona 3781-8
300 pF Capacitor .... HP 0160-5350
Service Accessory Kit .... HP 03577-84401

PROCEDURE:
a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.

NOTE

When adjusting the Receiver board in channel A, place the board on an extender board in channel R or B. Adjusting a Receiver board on an extender in channel A may cause the signal to jump erratically. Return the Receiver to channel A after completing the adjustment.

b. Remove the A1 Receiver board requiring adjustment. Move A1W2 and A1W3 to the test position. Solder the 300 pF capacitor between pins two and six of A1U15 and place a jumper across A1C30. Place the A1 Receiver board on an extender board.
c. Connect the instrument to the power line, and turn the POWER switch ON.
d. Connect the HP-IB cable from the computer to the HP 3577A.
e. Load and run the DC offset adjustment program.
f. Enter the A1 Receiver board channel you wish to adjust when prompted.
g. Adjust A1R44 for center screen (if measurement jumps erratically, try connecting a jumper from A1 ground to the chassis or moving the Receiver board to a different channel).
h. Press the softkey START OVER on the computer and turn the HP 3577A OFF.
i. Remove the jumper across A1C30 and the capacitor across A1U15.
j. Turn the instrument on and select the channel to be adjusted using the computer keyboard.
k. Adjust A1R187 for three divisions above or below the reference level.
l. Repeat this procedure for all A1 Receiver boards requiring adjustment.
m. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the instrument to its original state.

```
 10 !RE-STORE "USERS/DH/HIP_HOG_ADJ:REMOTE"
20  ASSIGN @Net_anl TO 711
30  ASSIGN @O TO 711;FORMAT OFF
40  COM /Flag/ Exit_flag
50  DIM Input_data(0:1),Output_data(0:1)
60 Start: !
70  CALL Clear_screen
80  PRINT TABXY(5,8);"PLACE CHANNEL UNDER TEST ON EXTENDER BOARD"
90  PRINT TABXY(5,9);"MOVE W2 AND W3 TO TEST"
100 OUTPUT 2 USING "#,K";"R";CHR$(255)&"H"
110 LINPUT "Enter the channel under test (R, A, or B ).",Input$
120 Input$=TRIM$(Input$)
130 CALL Clear_screen
140 PRINT TABXY(10,2);"NOTE: R44 must be adjusted before adjusting R187"
150 PRINT TABXY(16,3);"Response to adjustments will be slow due to averaging"
160 PRINT TABXY(5,5);"CONNECT A JUMPER ACROSS C30 AND A 300pf CAP FROM U15 PIN 2
 TO U15 PIN 6"
170 PRINT TABXY(5,6);"ADJUST R44 TO REFERENCE LINE"
180 PRINT TABXY(5,8);"REMOVE JUMPER AND CAP"
190 PRINT TABXY(5,9);"ADJUST R187 TO THREE DIVISIONS ABOVE OR BELOW REFERENCE LI
NE"
200 PRINT TABXY(5,12);"PRESS SOFTKEY k5 (START OVER) TO CHANGE CHANNEL"
210 OUTPUT @Net_anl;"UDS A/R TD1 ID1 DF3 ST5 SM2 MSR .5MSC "
220 OUTPUT @Net_anl;"REF  2048; DIV 1; FM2 BP0 "
230 Read_ad:  !
240 Const=2.05669908*2048
250 Mask=-32768
260 OUTPUT @Net_anl;"BP0 FM2 SE0"
270 REPEAT
280    ON KEY 5 LABEL "START OVER" CALL Flag
290    OUTPUT @Net_anl;"DR"&Input$
300    ENTER @O USING "#,2(A)";Dummy$;Dummy2$
310    ENTER @O;Input_data(*)
320    A_d=Const*Input_data(0)
330    WAIT .2
340    A_d=16*A_d
350    A_d=BINEOR(Mask,A_d)
360    A_d=A_d/16
370    A_d=2048+A_d
380    IF Avg_ad<2040 OR Avg_ad>2055 THEN
390       Avg_ad=.50*Avg_ad+.50*A_d
400    ELSE
410       Avg_ad=.95*Avg_ad+.05*A_d
420    END IF
430    OUTPUT @O USING "#,K";"LD1#I"
440    Output_data(0)=Avg_ad
450    OUTPUT @O;Output_data(*)
460    OUTPUT @Net_anl;"TKM"
470 UNTIL Exit_flag>0
480 Exit_flag=0
490 GOTO Start
500 END
510 SUB Flag
520    COM /Flag/ Exit_flag
530    Exit_flag=1
540 SUBEND
550 SUB Clear_screen
560    OUTPUT 2 USING "#,K";CHR$(255)&"K"
570 SUBEND
```

4-29 INPUT 250 kHz FILTER ADJUSTMENT

DESCRIPTION:
This procedure adjusts the 250 kHz filter shape on the A1 Receiver board. This filter rejects upper mixer products after the first IF mixing. This is required for the Receiver to meet absolute level and flatness specifications.

EQUIPMENT:
1:1 Probe .... HP 10021A
10:1 Probe .... HP 10040A
BNC female to N male Adapter (2 each) .... HP 1250-0780

PROCEDURE:

NOTE

This procedure requires that one of the A1 Receiver boards is operating within specifications. This minimizes the required equipment list and simplifies the adjustment procedure.

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Place the A1 Receiver board, which requires adjustment, on an extender board into channel B. Note each Receiver board's original position.
c. Place the operational Receiver board into channel R and connect A1J1 to A4J3.
d. Connect the instrument to the power line, and turn the POWER switch ON.
e. Connect the Source Output to A1TP3 (channel B) using the 1:1 probe.
f. Connect Receiver Input R to A1TP4 (channel B) using the 10:1 probe.
g. Set the HP 3577A as follows:
AMPTD .... +10 dBm
ATTEN
ATTEN (R) .... 0 dBm
IMPED (R) .... 1 Meg
SWEEP TYPE .... CW
FREQ .... 230 kHz

h. Adjust A1L4 (channel B) for a minimum marker reading.
i. Change the HP 3577A frequency to 250 kHz. Press the MKR→ hardkey and the MKR→ REF LVL softkey. Press the SCALE hardkey and enter a REF POSN of 50 % and a /DIV of 0.1 dB.
j. Adjust A1L3 and A1L5 (channel B) for a maximum as read by the marker readout.
k. Connect both the 1:1 and 10:1 probes to A1TP3 (channel B).
l. Press the HP 3577A DISP FCTN hardkey and the PHASE softkey. Press the MEASR CAL hardkey and the NORMALIZE softkey.
m. Move the 10:1 probe to A1TP4. Note the phase reading on the marker readout.
n. Adjust A1L5 (channel B) for a marker phase reading halfway between the value noted in step m and 90°. Adjust A1L3 for a marker reading of 90 degrees.

NOTE

This adjusts A1L3 and A1L5 for exactly the same value which is necessary if the A1 Receiver board is to meet its phase specifications.

o. Move the 10:1 probe to A1TP3 (channel B).

p. Make the following changes to the HP 3577A.

SWEEP TYPE .... LIN FREQ
FREQ
  FREQ SPAN .... 100 kHz
  CENTER FREQ .... 250 kHz
DISPLY FCTN .... LOG MAG
SCALE
  REF LEVEL .... 3 dB
  /DIV .... 6 dB
  REF POSN 100%
MEASR CAL .... NORMALIZE

q. Move the 10:1 probe to A1TP4. The HP 3577A display should be similar to that shown in Figure 4-3.

r. Repeat this procedure for all A1 Receiver boards requiring adjustment.

s. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the instrument to its original state.

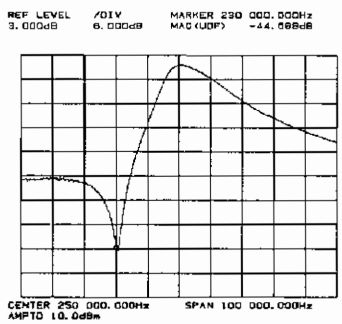

Figure 4-3. Input 250 kHz Filter Frequency Response

4-30 INPUT PHASE ZERO ADJUSTMENT

DESCRIPTION:
This procedure adjusts the A1 Receiver board phase circuits for a zero phase reference. This is required for the A1 Receiver board to meet phase specifications.

EQUIPMENT:
N male to BNC female Adapter (2 each) .... HP 1250-0780
BNC Cable-24 inch .... HP 8120-1839

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.

NOTE

All Receivers must be adjusted for the HP 3577A to meet the channel-tochannel ratio specifications.

b. Set the HP 3577A as follows:
INPUT .... R
SWEEP TYPE .... CW
FREQ .... 100 kHz
DISP FCTN .... PHASE
SCALE
/DIV .... 0.5 deg

c. Using a short cable, connect the Source Output to Receiver Input R.
d. Adjust the Phase Adjust, A1R74, for a marker phase reading of 0.0 ± 0.5 degrees.
e. Repeat steps b through d for Receiver Inputs A and B.
f. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the instrument to its original state.

NOTE

If you were unable to adjust the phase to zero, use the following procedure to select the switch setting in the phase initialization circuit on the A6 board (see steps 1 through 6).

1. Set the Phase Adjust, A1R74, on the Receiver in channel R for a midrange, multiple of 30 degrees phase reading. Note the Receiver R phase reading.
2. Turn OFF the instrument's power switch, remove the power cord, and remove the A6 Reference board.

3. Determine the current phase offset by comparing the A6S1 switch setting to Table 4-4.

Table 4-4 Reference Board Phase Offset

Switch Number				Phase Offset
4	3	2	1	
0	0	0	0	0
0	1	0	1	0
0	0	1	0	30
1	1	1	0	30
0	0	1	1	60
1	1	1	1	60
1	1	0	0	90
1	1	0	1	120
1	0	1	0	150
1	0	1	1	180
1	0	0	0	210
1	0	0	1	240
0	1	1	0	270
0	1	1	1	300
0	1	0	0	330
0	0	0	1	Not a valid setting

KEY 0 = closed
1 = open
No. 4 switch is at the bottom of A6S1
No. 1 switch is at the top of A6S1

4. Compute the new phase offset by subtracting the Receiver R phase reading from the current phase offset.
(current phase offset) - (R phase reading) = new phase offset
5. Use the table to determine the new switch setting and set A6S1 accordingly. An example follows:
Receiver R phase reading is approximately -30 degrees. A6S1 is presently set at "1 0 1 1" or 180 degrees of phase offset.
(current phase offset) - (R phase reading) = new phase offset
(180) - (-30) = 210
Match the new phase offset of 210 degrees to Table 4-4, and set A6S1 to the corresponding "1 0 0 0" switch number.
6. Replace the A6 Reference board and connect the instrument to the power line. Return to step b.

4-31 INPUT LEVEL FLATNESS ADJUSTMENT

DESCRIPTION:
This procedure adjusts the A1 Receiver board amplitude flatness with respect to frequency. The source output and power splitter are calibrated using a power meter. The calibration data is then stored into a data register in the HP 3577A. This allows you to display the receiver flatness on the HP 3577A.

EQUIPMENT:

Computer	HP 9000 Series 200
Power Meter	HP 436A Opt 022
Power Sensor	HP 8482A
Power Splitter	HP 11850A/C
20 dB Attenuator	HP 8491A Opt 020
N female to N female Adapter	HP 1250-1472
RF Cables-24 inch (4 each)	HP 35679A

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Set the power meter cal factor for 1 MHz and press SENSOR ZERO. (The power sensor must have a flatness of two percent or less from 1 MHz to 200 MHz.)
c. Connect the equipment as shown in Figure 4-4.
d. Load and run the receiver flatness adjustment program.

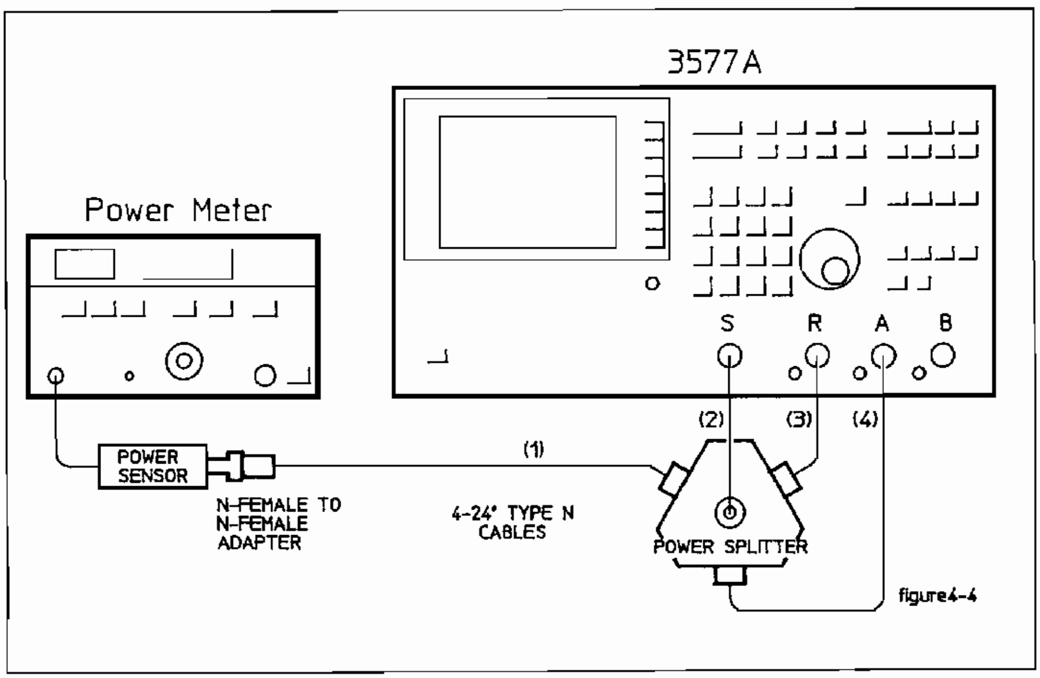

Figure 4-4 Input Level Calibration Test Set Up

```
10!RE-STORE "USERS/DH/RCVR_FLAT_ADJ:REMOTE"
20    !RCVR FLATNESS ADJ. USING 436A TO CAL THE SOURCE
30  DIM Sour_amptd(0:101)
40  COM Atten_label$[10]
50  COM /Input/ Input$[10]
60  Bin=0
70  Atten_label$="ATTEN_OUT"
80  Input$="R"
90  PRINTER IS 1
100 CALL Clear_screen
110 OUTPUT 711;"IPR;ST5;BW3;SAM0DBM;SFR1MHZ"
120 PRINT TABXY(5,5);"CONNECT 3577A SOURCE TO INPUT OF POWER SPLITTER"
130 PRINT TABXY(5,6);"CONNECT POWER METER TO ONE OUTPUT OF THE POWER SPLITTER TH
RU AN N TYPE CABLE"
140 PRINT TABXY(5,7);"CONNECT THE REMAINING TWO OUTPUTS TO TWO 3577A INPUTS"
150 PRINT TABXY(5,9);"SET THE CAL FACTOR ON THE 436A FOR 1 Mhz"
160 PRINT TABXY(5,10);"PRESS 'CONTINUE' WHEN READY"
170 PAUSE
180 CALL Clear_screen
190 DISP "PLEASE WAIT APPROX. 3 MINUTES FOR CAL DATA COLLECTION"
200 FOR Freq=1.0 TO 200 STEP 3.98
210    OUTPUT 711;"SFR",Freq,"MHZ"
220    WAIT .2
230    FOR N=1 TO 5
240       WAIT .20
250       OUTPUT 713;"9D-V"
260       ENTER 713;Pm_level
270       Sour_amptd(Bin)=10^(Pm_level/10)+Sour_amptd(Bin)
280    NEXT N
290    Sour_amptd(Bin)=SQR(Sour_amptd(Bin)/5)
300    Bin=Bin+2
310 NEXT Freq
320 OUTPUT 711;"ST1;RS1;SWT5SEC;FRA1MHZ;FRB200MHZ;UDI;R/D1"
330 OUTPUT 711;"FM1;LD1"
340 OUTPUT 711;Sour_amptd(*)
350 OUTPUT 711;"DIV.1DBR;RPS50%"
360 DISP " "
370 PRINT TABXY(5,5);"INSTALL A 20 dB PAD BETWEEN THE 3577A SOURCE AND THE CABLE
"
380 PRINT TABXY(5,6);"MOVE THE CABLE FROM THE POWER METER TO THE REMAINING 3577A
 INPUT"
390 PRINT TABXY(5,8);"PRESS 'CONTINUE' WHEN READY"
400 PAUSE
410 OUTPUT 711;"TKM;MTR;RST"
420 CALL Clear_screen
430 CALL Delta
440 LOOP
450    PRINT TABXY(5,3);"ADJUST A1R173 OF SELECTED INPUT FOR AN ABSOLUTE FLATNES
S OF < 0.6dB P-P"
460    PRINT TABXY(5,4);"(NORMALLY 1 Mhz = 200 Mhz)"
470    PRINT TABXY(5,6);"THEN CHECK RATIO FLATNESS FOR < 0.4dB P-P AND ADJUST AS
 REQUIRED"
471    PRINT TABXY(5,9);"USE SOFTKEYS TO: CHANGE SELCTED INPUT"
472    PRINT TABXY(22,10);"CHANGE ATTENUATOR POSITION"
473    PRINT TABXY(22,11);"CHECK P-P FLATNESS"
480    PRINT TABXY(1,15);"SELECTED INPUT IS ";Input$;"     "
490    IF Atten_label$="ATTEN_IN" THEN
500       PRINT TABXY(1,17);"20 dB ATTENUATORS ARE OUT"
510    ELSE
520       PRINT TABXY(1,17);"20 dB ATTENUATORS ARE IN  "
530    END IF
540    ON KEY 5 LABEL " R " CALL Input_r
550    ON KEY 6 LABEL " A " CALL Input_a
560    ON KEY 7 LABEL " B " CALL Input_b
570    ON KEY 0 LABEL " A/R " CALL Input_ar
580    ON KEY 1 LABEL " B/R " CALL Input_br
```

```
590    ON KEY 2 LABEL " A/B " CALL Input_ab
600    ON KEY 9 LABEL Atten_label$ CALL Atten
610    ON KEY 8 LABEL " DELTA P-P " CALL Delta
620 END LOOP
630 END
640 SUB Input_r
650    COM /Input/ Input$
670    DISP "PLEASE WAIT..."
680    OUTPUT 711;"UDIR/D1;TKM;MTR"
690    Input$="R"
700    CALL Delta
710 SUBEND
720 SUB Input_a
730    COM /Input/ Input$
750    DISP "PLEASE WAIT..."
760    OUTPUT 711;"UDIA/D1;TKM;MTR"
770    Input$="A"
780    CALL Delta
790 SUBEND
800 SUB Input_b
810    COM /Input/ Input$
830    DISP "PLEASE WAIT..."
840    OUTPUT 711;"UDIB/D1;TKM;MTR"
850    Input$="B"
860    CALL Delta
870 SUBEND
880 SUB Input_ar
890    COM /Input/ Input$
900    OUTPUT 711;"IAR;MTR"
910    Input$="A/R"
920    CALL Delta
930 SUBEND
940 SUB Input_br
950    COM /Input/ Input$
960    OUTPUT 711;"IBR;MTR"
970    Input$="B/R"
980    CALL Delta
990 SUBEND
1000 SUB Input_ab
1010    COM /Input/ Input$
1020    OUTPUT 711;"UDIA/B;MTR"
1030    Input$="A/B"
1040    CALL Delta
1050 SUBEND
1060 SUB Delta
1070    OUTPUT 711;"MTN;ZMK;MTX;DM1"
1080    ENTER 711;Marker_delta
1090    DISP "FLATNESS IS ";Marker_delta;"dB P-P"
1100 SUBEND
1110 SUB Atten
1120    COM Atten_label$
1130    SELECT Atten_label$
1140    CASE "ATTEN_IN"
1150       OUTPUT 711;"AR2;AA2;AB2;RST"
1160       Atten_label$="ATTEN_OUT"
1170    CASE "ATTEN_OUT"
1180       OUTPUT 711;"AR1;AA1;AB1;RST"
1190       Atten_label$="ATTEN_IN"
1200    END SELECT
1210    DISP "PLEASE WAIT..."
1220    WAIT 5.5
1230    CALL Delta
1240 SUBEND
1250 SUB Clear_screen
1260    OUTPUT 2 USING "#,K";"K"
1270 SUBEND
```

e. After the calibration data has been collected, connect the equipment as shown in Figure 4-5.

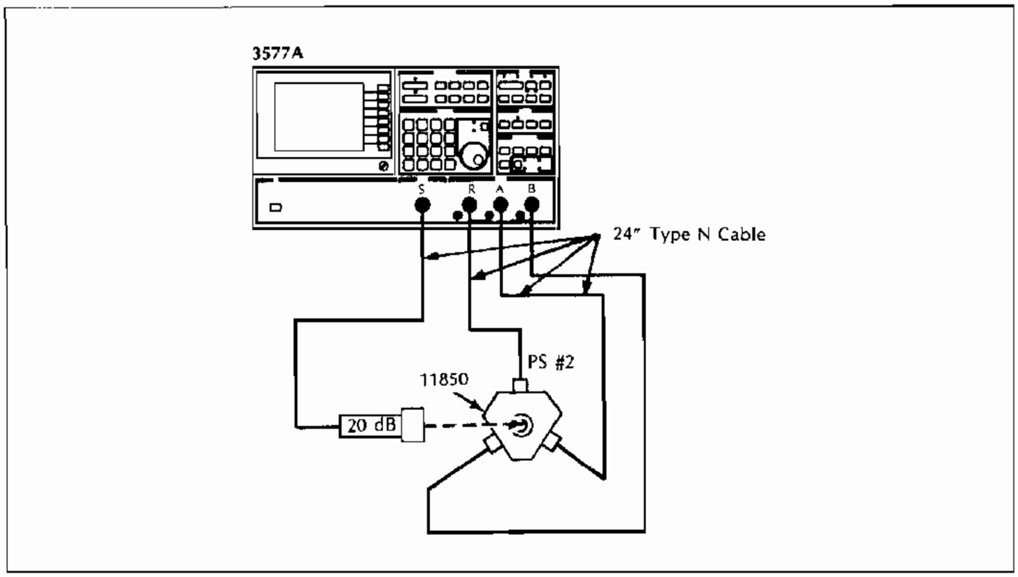

Figure 4-5 Input Level Flatness Test Set Up

f. Adjust A1R173 on the selected Receiver for the flattest response. (Normally 200 MHz level equal to the 1 MHz level.) Absolute flatness must be less than 0.6 dB peak-to-peak.
g. Verify that all ratios meet a flatness of less than 0.4 dB peak-to-peak and adjust if necessary.
h. Repeat steps f and g until all specs are met.
i. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and replace the top cover.

4-32 300 MHz BAND PASS FILTER ADJUSTMENT

DESCRIPTION:
This procedure adjusts the 300 MHz band pass filter on the A25 board. This filter eliminates 30 MHz harmonics.

EQUIPMENT:
Spectrum Analyzer .... HP 8568B
Service Accessory Kit .... HP 03577-84401

PROCEDURE:

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Connect the instrument to the power line, and turn the POWER switch ON.
b. Remove the cable connecting A25J2 to A4J1 and connect the spectrum analyzer to A25J2.
c. Set the spectrum analyzer as follows:
   Center Frequency .... 300 MHz
   Frequency Span .... 0 Hz
   Resolution Bandwidth .... 300 Hz
   Video Bandwidth .... 300 Hz
   Sweep Time .... 10 sec
d. Adjust A25L1 for a maximum reading on the spectrum analyzer.
e. This completes the adjustment. Turn OFF the instrument's power switch, remove the power cord, and return the instrument to its original state.

SECTION V
REPLACEABLE PARTS

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SECTION V
REPLACEABLE PARTS

5-1 INTRODUCTION

This section contains information for ordering parts. Table 5-1 lists abbreviations used in Table 5-3 (Replaceable Parts and throughout this manual). Table 5-2 lists the manufacturer's name and address by manufacturer's code numbers.

5-2 REPLACEABLE PARTS LIST

In Table 5-3, the Replaceable Parts List is organized as follows:

1. PC Board Assemblies: A1,A2,A3,...
2. Chassis Mounted Components
3. Chassis Components
4. Hardware

Table 5-3 headings include:

1. REFERENCE DESIGNATOR

Assembly Number   Component Type   Component Number

A31 R 5

2. HP PART NUMBER
3. CD - The Check Digit is used by -hp- to verify the order has been transmitted correctly.
4. QTY - The total quantity in the instrument.
5. DESCRIPTION - The -hp- description of the part.
6. MFR CODE - The manufacturer's code (see Table 5-2).
7. MFR PART NUMBER - The manufacturer's part number.

5-3 ORDERING INFORMATION

To order a part listed in Table 5-3, quote the -hp- part number, check digit, quantity required and address the order to the nearest Hewlett-Packard Sales and Service Office.

To order a part that is not listed in Table 5-3, describe the part, its function, the instrument model and serial number, the quantity required and address the order to the nearest Hewlett-Packard Sales and Service Office.

5-4 DIRECT MAIL SYSTEM

Within the U.S.A., Hewlett-Packard can supply parts throught a direct mail order system. Advantages of using this system are:

- Direct ordering and shipment from the -hp- Parts Center in Mountain View, California.
- No maximum or minumum on any mail order. There is a minumum order amount for parts ordered through a local -hp- sales and service office when the orders require billing and invoicing.
- Transportation charges are prepaid. A small handling charge is added to each order.
- No invoicing. A check or money order must accompany each order.

Mail order forms and specific ordering information are available throught your local Hewlett-Packard sales and service office. Addresses and phone numbers are located at the back of this manual.

5-5 SPECIAL HANDLING

The HP 3577A contains many static sensitive components. Use the appropriate precautions when removing, handling and installing all parts to avoid unnecessary damage.

Table 5-1 Abbreviations Used

ABBREVIATIONS

Ag	silver
Al	aluminum
A	ampere(s)
Au	gold
C	capacitor
cer	ceramic
coef	coefficient
com	common
comp	composition
conn	connection
dep	deposited
DPDT	double-pole double-throw
DPST	double-pole single throw
elect	electrolytic
encap	encapsulated
F	farad(s)
FET	field effect transistor
fxd	fixed
GaAs	gallium arsenide
GHz	gigahertz = 10^{+9} hertz
gd	guard(ed)
Ge	germanium
gnd	ground(ed)
H	henry(ies)
Hg	mercury
Hz	hertz (cycle(s) per second)
ID	inside diameter
impg	impregnated
incd	incandescent
ins	insulation(ed)
kΩ	kilohm(s) = 10^{+3} ohms
kHz	kilohertz = 10^{+3} hertz
L	inductor
lin	linear taper
log	logarithmic taper
mA	milliampere(s) = 10^{-3} amperes
MHZ	megahertz = 10^{+6} hertz
MΩ	megohm(s) = 10^{+6} ohms
met flm	metal film
mfr	manufacturer
ms	millisecond
mtg	mounting
mV	millivolt(s) = 10^{-3} volts
µF	microfarad(s)
µs	microsecond(s)
µV	microvolt(s) = 10^{-6} volts
my	Mylar ®
nA	nanoampere(s) = 10^{-9} amperes
NC	normally closed
Ne	neon
NO	normally open
NPO	negative positive zero (zero temperature coefficient)
ns	nanosecond(s) = 10^{-9} seconds
nsr	not separately replaceable
Ω	ohm(s)
obd	order by description
OD	outside diameter
p	peak
pA	picoampere(s)
pc	printed circuit
pF	picofarad(s) 10^{-12} farads
piv	peak inverse voltage
p/o	part of
pos	position(s)
poly	polystyrene
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
prec	precision (temperature coefficient, long term stability and/or tolerance)
R	resistor
Rh	rhodium
rms	root-mean-square
rot	rotary
Se	selenium
sect	section(s)
Si	silicon
sl	slide
SPDT	single-pole double-throw
SPST	single-pole single-throw
Ta	tantalum
TC	temperature coefficient
TiO_2	titanium dioxide
tog	toggle
tol	tolerance
trim	trimmer
TSTR	transistor
V	volt(s)
vacw	alternating current working voltage
var	variable
vdcw	direct current working voltage
W	watt(s)
w/	with
wiv	working inverse voltage
w/o	without
ww	wirewound
*	optimum value selected at factory, average value shown (part may be omitted)
**	no standard type number assigned selected or special type

® Dupont de Nemours

DESIGNATORS

A	assembly
B	motor
BT	battery
C	capacitor
CR	diode or thyristor
DL	delay line
DS	lamp
E	misc electronic part
F	fuse
FL	filter
HR	heater
IC	integrated circuit
J	jack
K	relay
L	inductor
M	meter
MP	mechanical part
P	plug
Q	transistor
QCR	transistor-diode
R(p)	resistor(pack)
RT	thermistor
S	switch
T	transformer
TB	terminal board
TC	thermocouple
TP	test point
TS	terminal strip
U	microcircuit
V	vacuum tube, neon bulb, photocell, etc
W	cable
X	socket
XDS	lampholder
XF	fuseholder
Y	crystal
Z	network

Table 5-2. Manufacturers Code List

MFR NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
H9027	Schurter A G H	Luzern	SW	
01121	Allen-Bradley Co	Milwaukee	WI	53204
01295	Texas Instr Inc Semicond Cmpnt Div	Dallas	TX	75222
02111	Spectrol Electronics Corp	City of Ind	CA	91745
03508	GE Co Semiconductor Prod Dept	Auburn	NY	13201
03888	K D I Pyrofilm Corp	Whippany	NJ	07981
04713	Motorola Semiconductor Products	Phoenix	AZ	85008
06665	Precision Monolithics Inc	Santa Clara	CA	95050
07263	Fairchile Semiconductor Div	Mountain View	CA	94042
11236	CTS of Berne Inc	Berne	IN	46711
13103	Thermalloy Co	Dallas	TX	75234
13606	Sprague Elect Co Semiconductor Div	Concord	NH	03301
14099	Semtech Corp	Newbury Park	CA	91320
15454	Ametek/Rodan Div	Anaheim	CA	92806
17856	Siliconix Inc	Santa Clara	CA	95054
18324	Signetics Corp	Sunnyvale	CA	94086
19701	Mepco/Electra Corp	Mineral Wells	TX	76067
20932	Emcon Div ITW	San Diego	CA	92129
24546	Corning Glass Works (Bradford)	Bradford	PA	16701
25403	N.V. Philips-Elcoma Department	Eindhoven	HL	02876
27014	National Semiconductor Corp	Santa Clara	CA	95051
27167	Corning Glass Works (Wilmington)	Wilmington	NC	28401
28480	Hewlett-Packard Co Corporate HQ	Palo Alto	CA	94304
3L585	RCA Corp Solid State Div	Somerville	NJ	
32997	Bourns Inc Trimpot Prod Div	Riverside	CA	92507
34335	Advanced Micro Devices Inc	Sunnyvale	CA	94086
34371	Harris Semicon Div Harris-Intertype	Melbourne	FL	32901
52063	Exar Integrated Systems Inc.	Sunnyvale	CA	94086
56289	Sprague Electric Co	North Adams	MA	01247
72136	Electro Motive Corp	Florence	SC	06226
72982	Erie Technological Products Inc	Erie	PA	16512
73138	Beckman Instruments Inc Helipot Div	Fullerton	CA	92634
75915	Littelfuse Inc	Des Plaines	IL	60016
84411	TRW Capacitor Div	Ogallala	NE	69153
91637	Dale Electronics Inc	Columbus	NE	68601

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
	3577A	7	1	NETWORK ANALYZER	28480	3577A
A1	**03577-66501**	**2**	**3**	**RECEIVER BD**	**28480**	**03577-66501**
A1C1	0160-4571	8	14	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A1C2	0160-2724	9	1	CAPACITOR-FXD 3600PF +-2% 500VDC MICA	09023	
A1C3	0140-0157	6	1	CAPACITOR-FXD 1857PF +-1% 500VDC MICA	00853	
A1C4	0160-2724	9		CAPACITOR-FXD 3600PF +-2% 500VDC MICA	09023	
A1C5	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A1C6	0180-0210	6	3	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS
A1C7	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A1C8	0180-0309	4	3	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A1C11-C12	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A1C13	0160-5349	0	1	CAPACITOR-FXD 200PF +-5% 100VDC CER	13606	292COOG201J100B
A1C14-C17	0160-6514	3	10	C-F 4700PF 1% 50V CERMLr	04222	SR215A472FAAHTR
A1C18	0160-4591	2	1	CAPACITOR-FXD .018UF +-1% 200VDC	84411	HEW-249
A1C19	0160-6514	3		C-F 4700PF 1% 50V CERMLr	04222	SR215A472FAAHTR
A1C20	0121-0491	1	2	CAPACITOR-V TRMR-CER 5-30PF 50V PC-MTG	74970	274-0030-005
A1C21	0160-2646	4	2	CAPACITOR-FXD 168.9PF +-1% 300VDC MICA	09023	
A1C22-C23	0160-6514	3		C-F 4700PF 1% 50V CERMLr	04222	SR215A472FAAHTR
A1C24	0160-4591	2		CAPACITOR-FXD .018UF +-1% 200VDC	84411	HEW-249
A1C25	0160-6514	3		C-F 4700PF 1% 50V CERMLr	04222	SR215A472FAAHTR
A1C26	0121-0491	1		CAPACITOR-V TRMR-CER 5-30PF 50V PC-MTG	74970	274-0030-005
A1C27	0160-4082	2	1	CAPACITOR-FXD 1000PF +-2.5% 180VDC POLYP	25088	B33062-A1102-H
A1C28-C29	0160-6513	2	2	C-F 68PF 5% 200V CERMLr	28480	RPE121-978C0G680J200V
A1C30	0160-2197	0	1	CAPACITOR-FXD 10PF +-5% 300VDC MICA	00853	
A1C31-C32	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A1C33	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS
A1C34	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M050A
A1C35	0180-0309	4		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A1C36	0180-0553	0	1	CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A1C37-C38	0180-1743	2	4	CAPACITOR-FXD .1UF+-10% 35VDC TA	13606	150D104X9035A2-DYS
A1C39	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A1C40	0160-6508	5	2	C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A1C41-C42	0180-1743	2		CAPACITOR-FXD .1UF+-10% 35VDC TA	13606	150D104X9035A2-DYS
A1C43-C44	0160-4787	8	2	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	04222	SA106A220JAA
A1C45	0180-0309	4		CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A1C46	0160-4819	7	1	CAPACITOR-FXD 2200PF +-5% 100VDC CER	04222	SA301A222JAA
A1C47-C49	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A1C50	0160-2646	4		CAPACITOR-FXD 168.9PF +-1% 300VDC MICA	09023	
A1C51-C52	0160-6514	3		C-F 4700PF 1% 50V CERMLr	04222	SR215A472FAAHTR
A1C53-C55	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A1C98-C99	0160-4532	1	2	CAPACITOR-FXD 1000PF +-20% 50VDC CER	13606	592CX7R102M050B
A1C100	0160-6515	4	1	C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A1C101	0180-2616	0	1	CAPACITOR-FXD 60UF+-20% 6VDC TA	13606	186D004
A1C102	0160-6511	0	1	C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A1C103-C104	0160-6506	3	11	C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A1C105	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A1C106	0160-0337	6	1	CAPACITOR-FXD 160PF +-1% 300VDC MICA	09023	
A1C107	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A1C108	0160-4507	0	1	CAPACITOR-FXD 1800PF +-2% 100VDC CER	54583	FD12C0G2A182G
A1C109	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A1C110-C111	0160-6510	9	6	C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A1C112	0121-0449	9		CAPACITOR-V TRMR-CER 3.5-10PF 63V PC-MTG	52763	5S-TRIKO-04 3.5-10 PF-N470
A1C113	0160-6521	2	1	C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A1C114	0121-0449	9	2	CAPACITOR-V TRMR-CER 3.5-10PF 63V PC-MTG	52763	5S-TRIKO-04 3.5-10 PF-N470
A1C115	0160-6524	5	1	C-F 6.8PF --% 200V CERMLr	28480	RPE121-978C0G6R8D200V
A1C116	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A1C118	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS
A1C119	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A1C120-C127	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A1C129	0160-6523	4	1	C-F 1PF --% 200V CERMLr	28480	RPE121-978C0G010C200V
A1C130	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A1C131	0160-5041	9	1	CAPACITOR-FXD .015UF +-10% 100VDC CER	04222	SR201C153KAA
A1C132-C133	0160-3914	1	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SR201C103KAA
A1C137	0160-6524	5	1	C-F 6.8PF --% 200V CERMLr	28480	RPE121-978C0G6R8D200V
A1C139-C140	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A1C141-C142	0180-3767	4	2	C-F 3.3UF 20% 25V TADPDr	28480	T350B335M025AS C-8310
A1C143	0180-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1C144	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M050A
A1C145	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A1C146	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M050A
A1C147	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A1C148-C149	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A1C150	0160-6505	2	1	C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A1C200-C201*	0160-4381	8		CAPACITOR-FXD 1.5PF +-.25PF 200VDC CER	54583	FD11C0G2D1R5C
A1C200-C201*	0160-6521	2		C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A1C200-C201*	0160-4382	9		CAPACITOR-FXD 3.3PF +-.25PF 200VDC CER	54583	FD12C0G2D3R3C
A1C200-C201*	0160-3873	1		CAPACITOR-F 4.7PF +-.25PF 200VDC CER	54583	FD11C0G2D4R7C
A1CR1	1902-0953	7	6	DIODE-ZNR 6.2V 5% DO-35 PD=.4W TC=+.053%	04713	SZ30035-11RL
A1CR2-CR3	1901-0376	6	2	DIODE-GEN PRP 35V 50MA DO-35	9N171	NDP202
A1CR4	1902-0951	5	1	DIODE-ZNR 5.1V 5% DO-35 PD=.4W TC=+.035%	04713	SZ30035-9RL
A1CR5	1902-0953	7		DIODE-ZNR 6.2V 5% DO-35 PD=.4W TC=+.053%	04713	SZ30035-11RL
A1CR6	1901-0050	3	2	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A1CR7-CR8	1901-1068	5	1	DIODE-SCHOTTKY SM SIG	28480	1901-1068
A1CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A1CR10	0122-0085	1	1	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	S0545	1S2208(B)
A1CR11-CR12	1901-1068	5		DIODE-SCHOTTKY SM SIG	28480	1901-1068
A1CR13	1901-0040	1	4	DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A1CR14-CR16	1902-0953	7		DIODE-ZNR 6.2V 5% DO-35 PD=.4W TC=+.053%	04713	SZ30035-11RL
A1CR17	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A1CR18	1902-0953	7		DIODE-ZNR 6.2V 5% DO-35 PD=.4W TC=+.053%	04713	SZ30035-11RL
A1CR19-CR20	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A1CR21	1902-0957	1	1	DIODE-ZNR 9.1V 5% DO-35 PD=.4W TC=+.069%	04713	SZ30035-016
A1CR22-CR23	1901-0179	7	2	DIODE-SWITCHING 15V 50MA 750PS	07263	FD7018
A1CR24	1901-0026	3	1	DIODE-PWR RECT 200V 750MA DO-29	04713	SR1358-8BRL
A1CR25	1901-0535	9	1	DIODE-SCHOTTKY SM SIG	28480	1901-0535
A1E3	9170-0894	0	3	CORE-SHIELDING BEAD	02114	56-590-65/4A6
A1H4	03577-04101	8	1	SHTF CVR-RECEIVER BDS	28480	03577-04101
A1H5	03577-04102	9	1	SHTF CVR-RECEIVER BD	28480	03577-04102
A1H6	03577-20601	7	1	CSTG-CIRC SIDE	28480	
A1H7	03577-20602	8	1	CSTG-COMP SIDE	28480	
A1H26	1810-0398	9	1	NETWORK-RES 10-SIP 22.0K OHM X 9	11236	750-101-R22K
A1H31-H39	4330-0496	3	9	INSULATOR-BEAD GLASS	53101	KG12
A1HDR17	1258-0141	8		CON-JUMPER REM .025P	00779	530153-2
A1J1	1250-1512	3	1	CONNECTOR-RF SMB M PC 50-OHM	98291	51-353-0039-226
A1J2	1250-1314	3	1	CONNECTOR-RF SM-SLD FEM PC 50-OHM	98291	52-054-0000-226
A1K1-K3	0490-1404	9	3	RELAY 2C 12VDC-COIL .5A 28VDC	T01014	412Y-0191
A1L1-L2	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A1L3	03577-60329	0	2	IND POT CORE VAR 101-108 UH	28480	03577-60329
A1L4	03577-60331	4	1	IND POT CORE VAR 247-263 UH	28480	03577-60331
A1L5	03577-60329	0		IND POT CORE VAR 101-108 UH	28480	03577-60329
A1L6	9100-2275	8	1	INDUCTOR RF-CH-MLD 82UH 10% .105DX.26LG	24226	10M822K
A1L7-L8	9140-0144	0	2	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A1L9	9100-1611	4	2	INDUCTOR RF-CH-MLD 220NH 20%	99800	1537-02
A1L10	9140-0129	1	1	INDUCTOR RF-CH-MLD 220UH 5% .166DX.385LG	99800	1537-92
A1L11	03577-67901	8	1	NDCTR-WIRE 22GA LOOP	A01130	
A1L12	9100-2574	0	2	INDUCTOR RF-CH-MLD 1.2MH 10%	24226	17S124K
A1L13	9100-1611	4		INDUCTOR RF-CH-MLD 220NH 20%	99800	1537-02
A1L14	9100-2574	0		INDUCTOR RF-CH-MLD 1.2MH 10%	24226	17S124K
A1P1	1251-8736	9	2	CONN-POST TYPE .100-PIN-SPCG 6-CONT	00779	103240-3
A1P1A	1251-5033	3	2	CONN-POST TYPE .100-PIN-SPCG 3-CONT	00779	103239-3
A1P2	1251-4822	6	9	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A1P3	1251-8735	8	1	CONN-POST TYPE .100-PIN-SPCG 8-CONT	28480	1251-8735
A1P3A	1251-7524	1	1	CONN-POST TYPE .100-PIN-SPCG 4-CONT	28480	1251-7524
A1P4	1251-8736	9		CONN-POST TYPE .100-PIN-SPCG 6-CONT	00779	103240-3
A1P4A	1251-5033	3		CONN-POST TYPE .100-PIN-SPCG 3-CONT	00779	103239-3
A1P5-P6	1251-4047	7	2	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-05-2031
A1P7-P15	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A1Q1-Q2	1854-0686	0	1	TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	25403	A400
A1Q3	1853-0553	8	1	TRANSISTOR PNP SI TO-72 PD=200MW FT=5GHZ	25403	A440
A1Q4	1854-0686	0		TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	25403	A400
A1Q5	1855-0081	1	1	TRANSISTOR J-FET N-CHAN D-MODE SI	04713	SPF819
A1Q6	1854-0686	0		TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	25403	A400
A1Q7-Q8	1853-0419	5	1	TRANSISTOR PNP SI PD=310MW FT=200MHZ	04713	SPS7476
A1Q11	1855-0232	4	1	TRANSISTOR-JFET DUAL 2N5565 N-CHAN	17856	2N5565
A1Q12	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	04713	SPS3612
A1Q13-Q21	03577-60339	2	1	PMISC SILICONE	28480	03577-60339
A1Q22-Q23	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1Q24	1853-0083	9	1	TRANSISTOR-DUAL PNP PD=600MW	07263	SP 12102
A1Q25	1854-0263	9	1	TRANSISTOR NPN 2N3019 SI TO-39 PD=800MW	04713	ST14B1
A1Q26	1854-0515	4	1	TRANSISTOR-DUAL NPN TO-77 PD=600MW	32293	ITS1015A
A1Q27	1853-0320	7	1	TRANSISTOR PNP 2N4032 SI TO-5 PD=800MW	07263	S44044
A1Q28	1854-0477	7	1	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	ST1288
A1Q29	1854-0666	0		TRANSISTOR NPN SI TO-72 PD=200MW FT=4GHZ	25403	A400
A1R1	0698-4445	4	1	RESISTOR 5.76K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A1R2	0683-2025	1	4	RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A1R3-R4	0683-3925	2	2	RESISTOR 3.9K 5% .25W CF TC=0-400	77902	R-25J
A1R5	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A1R6	0698-6971	4	1	RESISTOR 10K .5% .125W F TC=0+-50	19701	5033R
A1R7	0698-3581	7	1	RESISTOR 13.7K 1% .125W F TC=0+-100	19701	SFR25H
A1R8	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+-100	19701	SFR25H
A1R9	0698-3228	9	1	RESISTOR 49.9K 1% .125W F TC=0+-100	19701	SFR25H
A1R10	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A1R11	0683-6225	1	1	RESISTOR 6.2K 5% .25W CF TC=0-400	77902	R-25J
A1R12	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A1R13	0698-6965	7	1	RESISTOR 505 .1% .125W F TC=0+-25	19701	5033R
A1R14	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	SFR25H
A1R15	0698-4469	6	1	RESISTOR 28K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A1R17	0698-6362	8	2	RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A1R18	0698-6630	3	5	RESISTOR 20K .1% .125W F TC=0+-25	19701	5033R
A1R19	0699-7674	7	1	RESISTOR 13.19K .1% .125W F TC=0+-50	19701	5033R
A1R20	0698-6805	4	1	RESISTOR 1.078K .25% .125W F TC=0+-50	19701	5033R
A1R21	0698-6343	5	1	RESISTOR 9K .1% .125W F TC=0+-25	19701	5033R
A1R22	0698-6320	8	1	RESISTOR 5K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A1R23	0698-6630	3		RESISTOR 20K .1% .125W F TC=0+-25	19701	5033R
A1R24-R25	0698-7960	4	4	RESISTOR 7.87K 1% .125W F TC=0+-25	19701	5033R
A1R26	0698-5418	3	2	RESISTOR 50 .1% .125W F TC=0+-50	19701	5033R
A1R27	0699-0192	2	2	RESISTOR 3.894K .1% .125W F TC=0+-25	19701	5033R
A1R28	0757-0448	5	1	RESISTOR 18.2K 1% .125W F TC=0+-100	19701	SFR25H
A1R29	0698-6630	3		RESISTOR 20K .1% .125W F TC=0+-25	19701	5033R
A1R30	0698-7394	8	1	RESISTOR 698 .1% .125W F TC=0+-25	19701	5033R
A1R31	0698-6362	8		RESISTOR 1K .1% .125W F TC=0+-25	19701	5033R
A1R32	0698-6630	3		RESISTOR 20K .1% .125W F TC=0+-25	19701	5033R
A1R33-R34	0698-7960	4		RESISTOR 7.87K 1% .125W F TC=0+-25	19701	5033R
A1R35	0698-5418	3		RESISTOR 50 .1% .125W F TC=0+-50	19701	5033R
A1R36	0699-0192	2		RESISTOR 3.894K .1% .125W F TC=0+-25	19701	5033R
A1R38-R39	0698-3558	8	3	RESISTOR 4.02K 1% .125W F TC=0+-100	19701	SFR25H
A1R40	0698-3279	0	1	RESISTOR 4.99K 1% .125W F TC=0+-100	19701	SFR25H
A1R41	0698-3558	8		RESISTOR 4.02K 1% .125W F TC=0+-100	19701	SFR25H
A1R42	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	19701	SFR25H
A1R43	0698-3582	8	1	RESISTOR 41.2K 1% .125W F TC=0+-100	19701	SFR25H
A1R44	2100-3356	1	1	RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-204
A1R45	0757-0277	8	3	RESISTOR 49.9 1% .125W F TC=0+-100	19701	SFR25H
A1R46	0683-6815	5	1	RESISTOR 680 5% .25W CF TC=0-400	77902	R-25J
A1R47	0683-5625	3	1	RESISTOR 5.6K 5% .25W CF TC=0-400	77902	R-25J
A1R49	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A1R51	0683-3045	7	1	RESISTOR 300K 5% .25W CF TC=0-800	77902	R-25J
A1R63-R66	0683-4725	2	8	RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A1R67-R68	0698-6619	8	2	RESISTOR 15K .1% .125W F TC=0+-25	19701	5033R
A1R69	0698-4441	0	1	RESISTOR 3.74K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A1R70	0757-0427	0	1	RESISTOR 1.5K 1% .125W F TC=0+-100	19701	SFR25H
A1R71	2100-3273	1	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-202
A1R72-R73	0683-1045	3	2	RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A1R74	2100-3274	2	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-103
A1R76	2100-3352	7	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-102
A1R77	0757-0161	9	1	RESISTOR 604 1% .125W F TC=0+-100	19701	SFR25H
A1R78	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A1R79	0698-7934	2	1	RESISTOR 12.1K .1% .125W F TC=0+-25	19701	5033R
A1R80	0698-6706	4	1	RESISTOR 1.24K .25% .125W F TC=0+-100	19701	5033R
A1R81	0698-8191	5	1	RESISTOR 12.5K .1% .125W F TC=0+-25	91637	CMF-55-1, T-9
A1R82	0698-6630	3		RESISTOR 20K .1% .125W F TC=0+-25	19701	5033R
A1R83	0698-5323	9	1	RESISTOR 4K .5% .125W F TC=0+-50	19701	5033R
A1R87-R88	0683-1025	9	2	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A1R91	0683-5125	8	1	RESISTOR 5.1K 5% .25W CF TC=0-400	77902	R-25J
A1R92	0683-1015	7	2	RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A1R93	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0+-100	19701	SFR25H
A1R94	0757-0273	4	1	RESISTOR 3.01K 1% .125W F TC=0+-100	19701	SFR25H
A1R96	0683-1035	1	12	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1R100	0675-4721	1	1	RESISTOR 4.7K 10% .125W CC TC=-350/+857	01121	BB4721
A1R101	0683-1525	4	1	RESISTOR 1.5K 5% .25W CF TC=0-400	77902	R-25J
A1R102	0699-2130	2	2	R-F 61.1 OH .1% 1/20W HF04 T0	91637	CMF-50-21
A1R103	0699-2131	3	1	R-F 247 OHM .1% 1/20W HF04 T0	91637	CMF50-21
A1R104	0699-2130	2		R-F 61.1 OH .1% 1/20W HF04 T0	91637	CMF-50-21
A1R105	0699-2075	4	2	R-F 50 OHM .1% 1/20W HF04 T0	91637	CMF-50-21
A1R106	0698-3378	0	1	RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A1R107	0683-2035	3	1	RESISTOR 20K 5% .25W CF TC=0-400	77902	R-25J
A1R108	0699-2071	0	1	R-F 33.2 OH .1% 1/20W HF04 T0	91637	CMF-50-21
A1R109	0699-2083	4	3	R-F 100 OHM .1% 1/20W HF04 T0	91637	CMF-50-21
A1R110	0683-3325	6	2	RESISTOR 3.3K 5% .25W CF TC=0-400	77902	R-25J
A1R111	0757-0283	6	5	RESISTOR 2K 1% .125W F TC=0+-100	19701	SFR25H
A1R112	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	19701	SFR25H
A1R113	0683-1515	2	3	RESISTOR 150 5% .25W CF TC=0-400	77902	R-25J
A1R114	0683-5105	4	1	RESISTOR 51 5% .25W CF TC=0-400	77902	R-25J
A1R115	0699-2083	4		R-F 100 OHM .1% 1/20W HF04 T0	91637	CMF-50-21
A1R116	0698-5178	2	1	RESISTOR 1.5K 5% .125W CC TC=-350/+857	01121	BB1525
A1R117	0699-2083	4		R-F 100 OHM .1% 1/20W HF04 T0	91637	CMF-50-21
A1R118	0699-2075	4		R-F 50 OHM .1% 1/20W HF04 T0	91637	CMF-50-21
A1R119	0683-3325	6		RESISTOR 3.3K 5% .25W CF TC=0-400	77902	R-25J
A1R121	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A1R122	0698-5131	7	1	RESISTOR 900K .5% .25W F TC=0+-100	19701	5043R
A1R123	0698-6979	3	1	RESISTOR 111.1K .1% .125W F TC=0+-25	19701	5033R
A1R124	0699-1947	7	2	R-F 38.3 OH 1% 1/20W MFHF T0	91637	CMF-50-21
A1R125	0698-3378	0		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A1R126	0698-7332	4	1	RESISTOR 1M 1% .125W F TC=0+-100	19701	5033R
A1R127	0683-1225	1	1	RESISTOR 1.2K 5% .25W CF TC=0-400	77902	R-25J
A1R128	0698-3113	1	1	RESISTOR 100 5% .125W CC TC=-270/+540	01121	BB1015
A1R129	0698-4585	3	1	RESISTOR 348 1% .25W F TC=0+-100	91637	CMF-60-1, T-1
A1R130*	0699-1969	3		R-F 90.9 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A1R130*	0699-2077	6		R-F 75 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A1R130+	0698-3113	1		RESISTOR 100 5% .125W CC TC=-270/+540	01121	BB1015
A1R131	0699-1947	7		R-F 38.3 OH 1% 1/20W MFHF T0	91637	CMF-50-21
A1R132	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	CT3
A1R133	0686-4715	6	1	RESISTOR 470 5% .5W CC TC=0+529	01121	EB4715
A1R134	0683-3955	8	1	RESISTOR 3.9M 5% .25W CC TC=-900/+1100	01121	CB3955
A1R136	0698-8996	8	3	RESISTOR 100K 1% .05W F TC=0+-100	24546	CT3
A1R137	0698-4534	2	1	RESISTOR 309K 1% .125W F TC=0+-100	19701	SFR25H
A1R138	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	SFR25H
A1R139	0683-2045	5	1	RESISTOR 200K 5% .25W CF TC=0-800	77902	R-25J
A1R140	03577-67902	9	1	WIRE ASM-MAGNETIC	A01130	
A1R141	2100-3355	0	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-104
A1R142-R143	0698-8996	8		RESISTOR 100K 1% .05W F TC=0+-100	24546	CT3
A1R145	0757-0459	8	2	RESISTOR 56.2K 1% .125W F TC=0+-100	19701	SFR25H
A1R146	0683-1055	5	2	RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A1R147	0757-0459	8		RESISTOR 56.2K 1% .125W F TC=0+-100	19701	SFR25H
A1R148	0683-1055	5		RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A1R149	0683-3025	3	2	RESISTOR 3K 5% .25W CF TC=0-400	77902	R-25J
A1R150	0699-2163	1	1	R-F 31.6 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A1R151	0683-3025	3		RESISTOR 3K 5% .25W CF TC=0-400	77902	R-25J
A1R152-R155	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A1R156	0698-4461	4	2	RESISTOR 698 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A1R157-R158	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	19701	SFR25H
A1R161-R162	0698-6943	1	2	RESISTOR 20K .1% .125W F TC=0+-50	19701	5033R
A1R163	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	19701	SFR25H
A1R164	0698-4461	4		RESISTOR 698 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A1R165	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	19701	SFR25H
A1R166	0683-1015	7		RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A1R167	0686-3305	8	1	RESISTOR 33 5% .5W CC TC=0+412	01121	EB3305
A1R168	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A1R170-R171	0683-1515	2		RESISTOR 150 5% .25W CF TC=0-400	77902	R-25J
A1R172	2100-3207	1	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-502
A1R173	2100-3354	9	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-503
A1R175	0698-3378	0		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A1R176	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	19701	SFR25H
A1R177-R178	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A1R179	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A1R180	0699-2070	9	1	R-F 21. OHM .1% 1/20W HF04 T0	91637	CMF-50-21
A1R181	0757-0277	8		RESISTOR 49.9 1% .125W F TC=0+-100	19701	SFR25H
A1R182	0757-0412	3	1	RESISTOR 365 1% .125W F TC=0+-100	19701	SFR25H

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A1R183	0757-0407	6	2	RESISTOR 200 1% .125W F TC=0+-100	19701	SFR25H
A1R184-R185	0757-0284	7	2	RESISTOR 150 1% .125W F TC=0+-100	19701	SFR25H
A1R186	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	19701	SFR25H
A1R187	2100-1986	9	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	82PR1K
A1R188	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	19701	SFR25H
A1R189-R200	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A1R201-R202	0683-6815	5	2	RESISTOR 680 5% .25W CF TC=0-400	77902	R-25J
A1RP1	1810-0280	8	1	NETWORK-RES 10-SIP 10.0K OHM X 9	91637	CSC10A01-103G/MSP10A01-103G
A1RP2	1810-0279	5	1	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-472G
A1RP3	1QG8-0078	2	1	IC CUSTOM	28480	1QG8-0078
A1RP4	1810-0675	5	1	NETWORK-RES 10-SIP MULTI-VALUE	13606	216CK261
A1TP1-TP14	1251-0600	0	14	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A1U1	1820-1244	7	1	IC MUXR/DATA-SEL TTL LS 4-TO-1-LINE DUAL	01295	SN53619N
A1U3	03577-60307	4	1	PRGMD PROM	28480	03577-60307
A1U3	1816-1142	5	1	IC TTL S 4096 (4K) PROM 70-NS 3-S	18324	CK1753F
A1U5	1820-1997	7	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	27014	GDEA105
A1U6-U7	1SB9-0029	0	2	IC CUSTOM	28480	1SB9-0029
A1U8	03577-60308	5	1	PRGMD PROM	28480	03577-60308
A1U8	1816-1142	5	1	IC TTL S 4096 (4K) PROM 70-NS 3-S	18324	CK1753F
A1U9	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	27014	GDEA105
A1U10-U11	1820-1216	3	2	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN53522N
A1U12	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN53504N
A1U13	1820-3368	0	1	IC-9-BIT BIDIRECTIONAL I/O PORT	34335	AM2950DC
A1U14	1813-0257	5	1	A/D 12-BIT 28-CBRZ/SDR BPLR	24355	AD41152
A1U15	1826-0715	7	2	IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A1U16	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	27014	GDEA105
A1U17-U18	1826-0138	8	1	IC COMPARATOR GP QUAD 14-DIP-P PKG	27014	SL24958
A1U19	1820-2096	9	1	IC CNTR TTL LS BIN DUAL 4-BIT	01295	SN59197N
A1U20	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A1U21	1826-0503	1	1	SAMPLE AND HOLD 8 -METAL	27014	SL35198
A1U22	1826-0522	4	1	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	SN99856N
A1U23	1826-0889	6	1	IC OP AMP LOW-NOISE DUAL 14-DIP-C PKG	52063	XR5533AN
A1U24	1820-0427	6	1	IC MODULATOR TO-100 PKG	04713	SC8232G1
A1U25	03577-60309	6	1	PRGMD PROM	28480	03577-60309
A1U25	1816-1571	4	1	IC TTL S 256-BIT PROM 40-NS 3-S	01295	TBP18S030N
A1U26	1826-0412	1	2	IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	SL33675
A1U27	1826-0319	7	1	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	27014	SL31560
A1U28	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN53509N
A1U29	1826-0302	8	1	IC OP AMP GP TO-99 PKG	04713	SC61966G1
A1U31-U32	1820-1430	3	2	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN57191N
A1U33	1826-0635	0	2	IC OP AMP LOW-OFS 8-DIP-P PKG	06665	OP-07 138P
A1U34	1826-0412	1		IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	SL33675
A1U35-U36	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A1U37	1820-1417	6	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN57178
A1U38	1826-1116	4	1	IC OP AMP GP QUAD 14-DIP-P PKG	07933	RC4156DB
A1U42	1826-0635	0		IC OP AMP LOW-OFS 8-DIP-P PKG	06665	OP-07 138P
A1U43	03577-87900	9	1	MIX MWAV FC200-YHL 200MHZ 3	L01065	
A1U44	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN53506N
A1W1	1258-0223	7	2	CON-JUMPER 3 AMPS	28480	1258-0223
A1W2	1258-0141	8	11	CON-JUMPER REM .025P	00779	530153-2
A1W3	1258-0222	6	1	CON-JUMPER 3 AMPS MULT REM 2x3	28480	1258-0222
A1W4	1258-0223	7		CON-JUMPER 3 AMPS	28480	1258-0223
A1W5-W13	1258-0141	8		CON-JUMPER REM .025P	00779	530153-2
A1W16	7175-0057	5	1	RESISTOR-ZERO OHMS SOLID TINNED COPPER	62223	
A4	**03577-66504**	**5**	**1**	**LO BOARD**	**28480**	**03577-66504**
A4C1	0160-6508	5	8	C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A4C2	0160-6521	2	5	C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A4C3	0160-6511	0	6	C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A4C4	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A4C5	0160-6521	2		C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A4C6	0160-6511	0		C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A4C7-C8	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A4C10	0160-6507	4	15	C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C11	0160-6506	3	46	C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C12-C13	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4C14	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C15-C16	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C17	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C18-C20	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C21	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C22	0180-3768	5	22	C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C23	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C24	0180-0553	0	1	CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A4C25	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C26	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C27	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C28	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C29	0160-6523	4	2	C-F 1PF --% 200V CERMLr	28480	RPE121-978C0G010C200V
A4C30	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C31	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C32	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C33	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C34	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C35	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C36	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C37	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A4C38	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C39	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C40	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C41	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C48	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C49	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C50	0121-0512	7	3	CAPACITOR-V TRMR-CER 2-5PF 100V PC-MTG	59660	518-002 A 2-5
A4C51	0160-6521	2		C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A4C52	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C53	0180-3710	7	1	C-F 15UF 20% 25V TADPDr	28480	T350G156M025AS C-8310
A4C54	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C55	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C56	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C57	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A4C58	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C59	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C61	0160-6523	4		C-F 1PF --% 200V CERMLr	28480	RPE121-978C0G010C200V
A4C62	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C63	0180-3710	7		C-F 15UF 20% 25V TADPDr	28480	T350G156M025AS C-8310
A4C64	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C65	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C66	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C67	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A4C68	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C69	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C70	0121-0512	7		CAPACITOR-V TRMR-CER 2-5PF 100V PC-MTG	59660	518-002 A 2-5
A4C71	0160-6521	2		C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A4C72	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C73	0180-3710	7		C-F 15UF 20% 25V TADPDr	28480	T350G156M025AS C-8310
A4C74	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C75	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C76	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C77	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A4C78	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C79	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C80	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C81	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C88	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C89	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C90	0121-0512	7		CAPACITOR-V TRMR-CER 2-5PF 100V PC-MTG	59660	518-002 A 2-5
A4C91	0160-6521	2		C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A4C92	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C93	0180-3710	7		C-F 15UF 20% 25V TADPDr	28480	T350G156M025AS C-8310
A4C94	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C95	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C96	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C97	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A4C98	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C99	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4C101	0160-6515	4	4	C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A4C102	0160-4381	8	1	CAPACITOR-FXD 1.5PF +-.25PF 200VDC CER	54583	FD11C0G2D1R5C
A4C103	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A4C104	0160-6524	5	2	C-F 6.8PF --% 200V CERMLr	28480	RPE121-978C0G6R8D200V
A4C105	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A4C107	0160-6515	4		C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A4C108	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C111	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C112	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C113	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C114	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A4C115-C116	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C117	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C120	0160-6515	4		C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A4C121	0160-4381	8		CAPACITOR-FXD 1.5PF +-.25PF 200VDC CER	54583	FD11C0G2D1R5C
A4C122	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A4C123	0160-6524	5		C-F 6.8PF --% 200V CERMLr	28480	RPE121-978C0G6R8D200V
A4C124	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A4C125	0160-6515	4		C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A4C130	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C149	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C150-C151	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C152	0180-1746	5	3	CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A4C153	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C154	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A4C155-C156	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C157	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A4C160	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C161	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C162	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C163	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C164	0160-3914	1	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SR201C103KAA
A4C166	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C167	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M050A
A4C168	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4C180	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C190	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A4C200-C201	0160-6511	0		C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A4C202	0160-4382	9	1	CAPACITOR-FXD 3.3PF +-.25PF 200VDC CER	54583	FD12C0G2D3R3C
A4C203-C205	0160-6511	0		C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A4C207	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A4C208	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A4CR1-CR4	1901-0518	8	1	DIODE-SCHOTTKY SM SIG	28480	1901-0518
A4CR5	1902-1329	3	1	IC V RGLTR-V-REF-FXD 6.6/7.2V TO-46 PKG	27014	LM329CH
A4H1-H4	03577-00902	9	4	ETCH SPRNG-GROUNDING	N01063	
A4H5	03577-04104	1	1	SHTF COVER-L.O. BOARD	28480	03577-04104
A4H6	03577-04109	6	1	SHTF COVER-SHIELD	28480	03577-04109
A4H7	03577-20601	7	1	CSTG-CIRC SIDE	28480	
A4H8	03577-20605	1	1	CSTG-SHIELD - SLOTTED	28480	
A4H70-H74	9170-0894	0	5	CORE-SHIELDING BEAD	02114	56-590-65/4A6
A4J1-J5	1250-1512	3	5	CONNECTOR-RF SMB M PC 50-OHM	98291	51-353-0039-226
A4J6-J12	1250-1339	2	6	CONNECTOR-RF SM-SLD M PC 50-OHM	98291	52-051-0000-226
A4L2-L5	9140-0814	1	4	COIL-VAR 20NH-25NH Q=50 PC-MTG	28480	9140-0814
A4L6	9140-0144	0	11	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A4L7	9140-0815	2	5	COIL-VAR 50.6NH-41.4NH PC-MTG	28480	9140-0815
A4L8	9140-0813	0	2	COIL-VAR 23NH-52NH Q=65 PC-MTG	28480	9140-0813
A4L9	9140-0815	2		COIL-VAR 50.6NH-41.4NH PC-MTG	28480	9140-0815
A4L10-L90	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A4L100	9140-0815	2		COIL-VAR 50.6NH-41.4NH PC-MTG	28480	9140-0815
A4L101	9140-0813	0		COIL-VAR 23NH-52NH Q=65 PC-MTG	28480	9140-0813
A4L102	9140-0815	2		COIL-VAR 50.6NH-41.4NH PC-MTG	28480	9140-0815
A4L150-L152	9140-0607	0	3	INDUCTOR RF-CH-MLD 3.3UH 10% .2DX.45LG	24226	18M331K
A4L153-L154	9100-1618	1	2	INDUCTOR RF-CH-MLD 5.6UH 10%	99800	1537-30
A4L201	9140-0815	2		COIL-VAR 50.6NH-41.4NH PC-MTG	28480	9140-0815
A4Q30	1854-0591	6	1	TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A4Q31	1854-0720	3	1	TRANSISTOR NPN SI PD=500MW FT=4GHZ	25403	BFR96-S
A4Q50	1854-0591	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A4Q51	1854-0720	3		TRANSISTOR NPN SI PD=500MW FT=4GHZ	25403	BFR96-S
A4Q60	1854-0591	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A4Q61	1854-0720	3		TRANSISTOR NPN SI PD=500MW FT=4GHZ	25403	BFR96-S

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4Q70	1854-0591	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A4Q71	1854-0720	3		TRANSISTOR NPN SI PD=500MW FT=4GHZ	25403	BFR96-S
A4Q90	1854-0591	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A4Q91	1854-0720	3		TRANSISTOR NPN SI PD=500MW FT=4GHZ	25403	BFR96-S
A4R1	0699-2054	9	2	R-F 100 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A4R2	0699-1968	2	1	R-F 68.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R3	0699-2054	9		R-F 100 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A4R4	0698-7214	1	4	RESISTOR 121 1% .05W F TC=0+-100	24546	CT3
A4R5	0699-1903	5	15	R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R6-R7	0698-7214	1		RESISTOR 121 1% .05W F TC=0+-100	24546	CT3
A4R8	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R9	0698-7214	1		RESISTOR 121 1% .05W F TC=0+-100	24546	CT3
A4R10	0698-3445	2	2	RESISTOR 348 1% .125W F TC=0+-100	19701	SFR25H
A4R11-R12	0698-3132	4	4	RESISTOR 261 1% .125W F TC=0+-100	19701	SFR25H
A4R13	0698-7230	1	2	RESISTOR 562 1% 1/20W MF04	02995	5032R
A4R14	0699-1902	4	1	R-F 10 OHM 1% 1/20W MF04 TO	91637	CMF-50-21
A4R15	0698-7230	1		RESISTOR 562 1% 1/20W MF04	02995	5032R
A4R16-R17	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	19701	SFR25H
A4R18	0698-7223	2	17	RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R19	0699-2030	1	6	R-F 17.8 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R20	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R21	0698-3443	0	2	RESISTOR 287 1% .125W F TC=0+-100	19701	SFR25H
A4R22	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R23	0699-2030	1		R-F 17.8 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R24	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R25	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	19701	SFR25H
A4R26	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	19701	SFR25H
A4R27	0683-1025	9	6	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A4R30	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R31	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A4R32	0683-4715	0	6	RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A4R33	0683-2415	3	5	RESISTOR 240 5% .25W CF TC=0-400	77902	R-25J
A4R34	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R35	0699-1964	8	6	R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R36	0683-1215	9	2	RESISTOR 120 5% .25W CF TC=0-400	77902	R-25J
A4R37-R39	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R40	0698-7216	3	4	RESISTOR 147 1% .05W F TC=0+-100	24546	CT3
A4R41	0699-1947	7	2	R-F 38.3 OH 1% 1/20W MFHF T0	91637	CMF-50-21
A4R42	0698-7216	3		RESISTOR 147 1% .05W F TC=0+-100	24546	CT3
A4R43	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R44	0698-3159	5	2	RESISTOR 26.1K 1% .125W F TC=0+-100	19701	SFR25H
A4R45-R46	0757-0449	6	2	RESISTOR 20K 1% .125W F TC=0+-100	19701	SFR25H
A4R47	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+-100	19701	SFR25H
A4R48	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	19701	SFR25H
A4R49	2100-0554	5	1	RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-501
A4R50	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R51	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A4R52	0683-4715	0		RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A4R53	0683-2415	3		RESISTOR 240 5% .25W CF TC=0-400	77902	R-25J
A4R54	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R55	0699-1964	8		R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R56	0698-4417	0	6	RESISTOR 174 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A4R57	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R58	0698-4417	0		RESISTOR 174 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A4R60	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R61	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A4R62	0683-4715	0		RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A4R63	0683-2415	3		RESISTOR 240 5% .25W CF TC=0-400	77902	R-25J
A4R64	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R65	0699-1964	8		R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R66	0683-1215	9		RESISTOR 120 5% .25W CF TC=0-400	77902	R-25J
A4R67-R70	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R71	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A4R72	0683-4715	0		RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A4R73	0683-2415	3		RESISTOR 240 5% .25W CF TC=0-400	77902	R-25J
A4R74	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R75	0699-1964	8		R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R76	0698-4417	0		RESISTOR 174 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A4R77	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R78	0698-4417	0		RESISTOR 174 1% .125W F TC=0+-100	91637	CMF-55-1, T-1

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A4R90	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R91	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A4R92	0683-4715	0		RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A4R93	0683-2415	3		RESISTOR 240 5% .25W CF TC=0-400	77902	R-25J
A4R94	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R95	0699-1964	8		R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R96	0698-4417	0		RESISTOR 174 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A4R97	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R98	0698-4417	0		RESISTOR 174 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A4R100	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R101	0699-2030	1		R-F 17.8 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R102	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R105-R108	0699-1966	0	4	R-F 26.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R109	0698-7218	5	6	RESISTOR 178 1% .05W F TC=0+-100	24546	CT3
A4R110	0699-2163	1	3	R-F 31.6 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R111-R112	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	CT3
A4R113	0699-2163	1		R-F 31.6 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R114-R115	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	CT3
A4R116	0699-2163	1		R-F 31.6 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R117	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	CT3
A4R120	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A4R150	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R151	0699-2030	1		R-F 17.8 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R152-R170	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R171	0699-2030	1		R-F 17.8 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R172-R190	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R191	0699-2030	1		R-F 17.8 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4R192	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A4R201	0698-7216	3		RESISTOR 147 1% .05W F TC=0+-100	24546	CT3
A4R202	0699-1947	7		R-F 38.3 OH 1% 1/20W MFHF T0	91637	CMF-50-21
A4R203	0698-7216	3		RESISTOR 147 1% .05W F TC=0+-100	24546	CT3
A4R204	0699-1964	8		R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A4TP1-TP4	1251-0600	0	4	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A4U1	1813-0216	6	1	IC WIDEBAND AMPL TO-39 PKG	04713	SWA130
A4U10	1813-0215	5	1	IC WIDEBAND AMPL TO-39 PKG	04713	SWA133
A4U11	1813-0216	6		IC WIDEBAND AMPL TO-39 PKG	04713	SWA130
A4U20	0955-0193	7	1	MIX MWAV FC217-ZTF 200MHZ 3	L01065	FC217-ZTF
A4U21-U22	1813-0212	2	1	IC WIDEBAND AMPL TO-39 PKG	04713	SWA128
A4U23	0955-0194	8	1	MIX MWAV SRA-1-1 500MHZ 8	M0104B	SRA-1-1
A4U24	1813-0215	5		IC WIDEBAND AMPL TO-39 PKG	04713	SWA133
A4U25	1826-0043	4	1	IC OP AMP GP TO-99 PKG	27014	SL160762
A4U150	1826-0147	9	1	IC V RGLTR-FXD-POS 11.5/12.5V TO-220 PKG	04713	SC25174P1
A4W1-W7	1251-1636	4	6	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	71279	450-3388-01-03-00
A4W1-W7	1258-0214	6	1	CON-JUMPER WIRE PLUG-SHORTING	71279	461-2872-01-03-16
A5	**03577-66505**	**6**	**1**	**PC BOARD ASSY OFFSET**	**28480**	**03577-66505**
A5C1	0160-6510	9	4	C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A5C2-C3	0160-6511	0	2	C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A5C4*	0160-4774	3		CAPACITOR-FXD 16PF +-2% 200VDC CER 0+-30	54583	FD12C0G2D160G
A5C4*	0160-4887	9		CAPACITOR-FXD 25PF +-2% 200VDC CER 0+-30	54583	FD12C0G2D250G
A5C4+	0160-4493	3	1	CAPACITOR-FXD 27PF +-5% 200VDC CER 0+-30	54583	FD12C0G2D270J
A5C5	0160-6507	4	18	C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A5C6	0180-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A5C7	0160-4571	8	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A5C8	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A5C9	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A5C10	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A5C11	0160-6506	3	23	C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C12-C13	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A5C14-C17	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A5C18	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C19	0160-6523	4	1	C-F 1PF --% 200V CERMLr	28480	RPE121-978C0G010C200V
A5C21	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C23-C24	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A5C25	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C26	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A5C30-C31	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C32	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A5C33	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C34-C35	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A5C36-C39	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C40-C43	0160-3847	9	5	CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A5C44	0160-6526	6	1	C-F 47PF 5% 200V CERMLr	28480	RPE121-978C0G470J200V
A5C52-C53	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C54	0160-0162	5	1	CAPACITOR-FXD .022UF +-10% 200VDC POLYE	84411	HEW-238M
A5C55	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A5C56-C62	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C63-C64	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A5C65	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	13606	150D336X9010B2-DYS
A5C66-C69	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A5C70-C71	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A5C72	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C73	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A5C74-C75	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A5C76	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A5C77-C84	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A5C85	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C90	0160-6521	2	1	C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A5C91-C92	0160-6515	4	2	C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A5C93	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5C94-C95	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A5C100	0160-2940	1	1	CAPACITOR-FXD 470PF +-5% 300VDC MICA	00853	
A5C101	0140-0197	4	1	CAPACITOR-FXD 180PF +-5% 300VDC MICA	09023	
A5C102	0160-0154	5	1	CAPACITOR-FXD 2200PF +-10% 200VDC POLYE	84411	HEW-238M
A5C103	0160-0362	7	1	CAPACITOR-FXD 510PF +-5% 300VDC MICA	00853	
A5C104	0160-0156	7	2	CAPACITOR-FXD 3900PF +-10% 200VDC POLYE	84411	HEW-238M
A5C105	0140-0199	6	1	CAPACITOR-FXD 240PF +-5% 300VDC MICA	09023	
A5C106	0160-0156	7		CAPACITOR-FXD 3900PF +-10% 200VDC POLYE	84411	HEW-238M
A5C110-C111	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A5CR1	1901-0040	1	5	DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A5CR2	0122-0085	1	1	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	S0545	1S2208(B)
A5CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A5CR4	0122-0085	1		DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	S0545	1S2208(B)
A5CR50	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A5CR51	1990-1125	2	1	OPT LED LMP R XX LMP1002 TT1H	28480	1990-1125
A5CR52-CR53	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A5H1	03577-04103	0	1	SHTF SHIELD-COVER	28480	03577-04103
A5H2	03577-04105	2	1	SHTF COVER-OFFSET BD	28480	03577-04105
A5H3	03577-20601	7	1	CSTG-CIRC SIDE	28480	
A5H4	03577-20602	8	1	CSTG-COMP SIDE	28480	
A5J1-J2	1250-1512	3	2	CONNECTOR-RF SMB M PC 50-OHM	98291	51-353-0039-226
A5L1	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A5L2	9140-0144	0	12	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A5L3	03577-20301	4	1	NDCTR	A01130	1871
A5L3	8120-1543	2	0	CBL-RGD 50OHM .1430D	28480	8120-1543
A5L4	9100-2891	4	1	INDUCTOR RF-CH-MLD 50NH 10% .105DX.26LG	24226	10M050K-1
A5L5	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A5L7-L31	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A5L32	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	99800	1537-76
A5L40	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A5L60-L62	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A5L63-L64	9100-1618	1	2	INDUCTOR RF-CH-MLD 5.6UH 10%	99800	1537-30
A5L70-L77	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A5L79	9140-0158	6	1	INDUCTOR RF-CH-MLD 1UH 10% .105DX.26LG	32159	1A1002M +-10%
A5L81	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A5L90	9135-0074	4	1	INDUCTOR RF-CH-MLD 47NH 4% .102DX.26LG	24226	
A5L91	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A5L100	9100-1648	7	1	INDUCTOR RF-CH-MLD 560UH 5% .2DX.45LG	99800	2500-16
A5L101	9100-1650	1	1	INDUCTOR RF-CH-MLD 680UH 5% .2DX.45LG	99800	2500-20
A5L102	9140-0118	8	1	INDUCTOR RF-CH-MLD 500UH 5% .2DX.45LG	99800	2500-14
A5Q1	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	SRF5064
A5Q2	1853-0010	2	1	TRANSISTOR PNP SI TO-18 PD=360MW	04713	SM4713
A5Q10-Q11	1854-0591	6	1	TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A5Q20	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	SRF5064
A5Q80	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	SRF5064
A5R1-R2	0683-1035	1	15	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A5R3	0683-1015	7	2	RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A5R4	0683-1515	2		RESISTOR 150 5% .25W CF TC=0-400	77902	R-25J
A5R5	0683-3325	6	1	RESISTOR 3.3K 5% .25W CF TC=0-400	77902	R-25J
A5R6	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A5R7	0683-1516	2	2	RESISTOR 150 5% .25W CF TC=0-400	77902	R-25J
A5R8	0683-4735	4	1	RESISTOR 47K 5% .25W CF TC=0-400	77902	R-25J
A5R9	2100-3253	7	1	RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-503
A5R10	0699-2072	1	1	R-F 34.8 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A5R11	0683-1025	9	3	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A5R12	0683-4715	0	1	RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A5R13	0698-7221	0	2	RESISTOR 237 1% .05W F TC=0+-100	24546	CT3
A5R14	0699-2163	1	1	R-F 31.6 OH 1% 1/20W HF04 T0	91637	CMF-50 21
A5R15	0699-1903	5	7	R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A5R16	0698-7221	0		RESISTOR 237 1% .05W F TC=0+-100	24546	CT3
A5R17	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A5R21-R22	0698-7249	2	4	RESISTOR 3.48K 1% .05W F TC=0+-100	24546	CT3
A5R23	0699-1965	9	2	R-F 21.5 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A5R24	0683-5615	1	2	RESISTOR 560 5% .25W CF TC=0-400	77902	R-25J
A5R26-R30	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A5R31-R32	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A5R33	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	CT3
A5R34-R35	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A5R36	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A5R40	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A5R41	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A5R42	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A5R43-R53	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A5R54	0698-4467	0	1	RESISTOR 1.05K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A5R55	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	19701	SFR25H
A5R56	0683-2025	1	1	RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A5R57	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A5R58	0683-3345	0	1	RESISTOR 330K 5% .25W CF TC=0-800	77902	R-25J
A5R59	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0+-100	19701	SFR25H
A5R70	0698-7216	3	2	RESISTOR 147 1% .05W F TC=0+-100	24546	CT3
A5R71	0699-1947	7	1	R-F 38.3 OH 1% 1/20W MFHF T0	91637	CMF-50-21
A5R72	0698-7216	3		RESISTOR 147 1% .05W F TC=0+-100	24546	CT3
A5R76	0683-2715	6	2	RESISTOR 270 5% .25W CF TC=0-400	77902	R-25J
A5R78	0683-1015	7		RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A5R80	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A5R81-R82	0698-7249	2		RESISTOR 3.48K 1% .05W F TC=0+-100	24546	CT3
A5R83	0699-1965	9		R-F 21.5 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A5R84	0683-5615	1		RESISTOR 560 5% .25W CF TC=0-400	77902	R-25J
A5R86	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A5R91	0698-7214	1	2	RESISTOR 121 1% .05W F TC=0+-100	24546	CT3
A5R92	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A5R93	0698-7214	1		RESISTOR 121 1% .05W F TC=0+-100	24546	CT3
A5R94	0683-2715	6		RESISTOR 270 5% .25W CF TC=0-400	77902	R-25J
A5R102	0683-5125	8	1	RESISTOR 5.1K 5% .25W CF TC=0-400	77902	R-25J
A5R103	0683-1535	6	1	RESISTOR 15K 5% .25W CF TC=0-400	77902	R-25J
A5R104	0683-1525	4	1	RESISTOR 1.5K 5% .25W CF TC=0-400	77902	R-25J
A5R105	0683-2015	9	1	RESISTOR 200 5% .25W CF TC=0-400	77902	R-25J
A5TP	1251-0600	0	12	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A5U20	0955-0095	8	1	MIX MWAV SRA-1-85 500MHZ 8	M0104B	SRA-1-85
A5U30-U31	1820-0270	7	1	IC WIDEBAND AMPL VID TO-100 PKG	07263	SL21440
A5U40	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN57186N
A5U41	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A5U42	1820-1430	3	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN57191N
A5U43	1820-1282	3	1	IC FF TTL LS J-K BAR POS-EDGE-TRIG	01295	SN53656N
A5U50	1826-0222	1	1	IC OP AMP GP QUAD 14-DIP-P PKG	07933	RC4136DB
A5U51	1826-0412	1	1	IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	SL33675
A5U60	1826-0147	9	1	IC V RGLTR-FXD-POS 11.5/12.5V TO-220 PKG	04713	SC25174P1
A5U61	1826-0221	0	1	IC V RGLTR-FXD-NEG 11.5/12.5V TO-220 PKG	04713	SC25266P1
A5U70-U90	1813-0215	5	1	IC WIDEBAND AMPL TO-39 PKG	04713	SWA133
A5W1-W3	1251-4822	6	3	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A5W1-W3	1258-0141	8	3	CON-JUMPER REM .025P	00779	530153-2
A6	**03577-66506**	**7**	**1**	**REFERENCE BOARD**	**28480**	**03577-66506**
A6C2-C3	0180-0553	0	1	CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A6C5-C7	0160-4571	8	14	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A6C8	0160-2208	4	2	CAPACITOR-FXD 330PF +-5% 300VDC MICA	00853	
A6C9	0160-6505	2	18	C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C10	0160-6510	9	19	C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6C12	0160-6518	7	2	C-F 220PF 20% 100V CERMLr	28480	RPE121-978X7R221M100V
A6C13	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C14	0180-3370	5	1	CAPACITOR-FXD 22UF+-20% 25VDC AL NPOL	62643	SMBP(D)25VB22(M)
A6C15-C19	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M050A
A6C20	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A6C21	0160-6518	7		C-F 220PF 20% 100V CERMLr	28480	RPE121-978X7R221M100V
A6C22-C23	0160-4935	0	1	CAPACITOR-FXD 510PF +-1% 100VDC CER	04222	SR201A511FAA
A6C24	0160-6517	6	1	C-F 100PF 20% 200V CERMLr	28480	RPE121-978X7R101M200V
A6C25	0160-6508	5	1	C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A6C27-C28	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A6C32-C34	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C35	0160-5306	9	2	CAPACITOR FXD .1UF +-10% 100VDC	19701	719A1CA104PK101SA
A6C36	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C37	0160-5306	9		CAPACITOR-FXD .1UF +-10% 100VDC	19701	719A1CA104PK101SA
A6C38	0160-6507	4	13	C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C39	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C40	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C41	0140-0191	8	1	CAPACITOR-FXD 56PF +-5% 300VDC MICA	09023	CD15ED560J03C
A6C42	0160-3847	9	2	CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A6C43-C44	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C45	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C46	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C47	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C48	0160-6515	4	3	C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A6C49	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C51	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C52	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C53	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C54	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C55	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C56	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C57	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A6C58-C59	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C61-C62	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A6C63	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C64	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A6C65-C66	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C68	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121 978X7R104M50V
A6C69	0180-3768	5	1	C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A6C70	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C71	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M050A
A6C72	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A6C75-C77	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C78	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C79	0180-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A6C80-C81	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C82-C83	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C90-C93	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C95-C96	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A6C99	0160-6506	3	4	C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A6C100	0160-2208	4		CAPACITOR-FXD 330PF +-5% 300VDC MICA	00853	
A6C101	0160-2009	3	1	CAPACITOR-FXD 820PF +-5% 300VDC MICA	09023	
A6C102-C104	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A6C105	0160-4786	9	1	CAPACITOR-FXD 18PF +-5% 100VDC CER 0+-30	04222	SA101A180JAA
A6C106	0160-3914	1	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SR201C103KAA
A6C107-C108	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C109-C110	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A6C111-C112	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A6C113-C114	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A6C115	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C116	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A6C117	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C120	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A6C121	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A6C122-C123	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A6C125	0160-6515	4		C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A6C126	0160-6521	2	1	C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A6C127	0160-6515	4		C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A6C128	0160-3914	1	1	CAPACITOR-FXD .01UF +-10% 100VDC CER	04222	SR201C103KAA
A6CR2	0122-0162	5	1	DIODE-VVC 29PF 10% BVR=30V	25403	BB809

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6CR3-CR4	1901-0040	1	13	DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A6CR5	1902-1329	3	1	IC V RGLTR-V-REF-FXD 6.6/7.2V TO-46 PKG	27014	LM329CH
A6CR7	1902-3149	9	2	DIODE-ZNR 9.09V 5% DO-35 PD=.4W	04713	SZ30016-1170
A6CR8-CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A6CR11	1902-0041	4	2	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	04713	SZ30016-1098
A6CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A6CR13-CR14	0122-0085	1	1	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	S0545	1S2208(B)
A6CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A6CR16-CR17	1901-0376	6	2	DIODE-GEN PRP 35V 50MA DO-35	9N171	NDP202
A6CR20	1990-1125	2	1	OPT LED LMP R XX LMP1002 TT1H	28480	1990-1125
A6CR21	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A6CR23	1990-1125	2		OPT LED LMP R XX LMP1002 TT1H	28480	1990-1125
A6CR24-CR25	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A6CR26	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	04713	SZ30016-1098
A6CR27	1990-1125	2		OPT LED LMP R XX LMP1002 TT1H	28480	1990-1125
A6CR28-CR29	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A6CR31	1902-3149	9		DIODE-ZNR 9.09V 5% DO-35 PD=.4W	04713	SZ30016-1170
A6CR32	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A6CR33	1902-0958	2	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.075%	04713	SZ30035-16RL
A6CR34	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A6H4	03577-04106	3	1	SHTF COVER-REF BOARD	28480	03577-04106
A6H5	03577-04119	8	1	SHTF COVER-SHIELD REF	28480	03577-04119
A6H6	03577-20601	7	1	CSTG-CIRC SIDE	28480	
A6H7	03577-20602	8	1	CSTG-COMP SIDE	28480	
A6H8-H9	0360-0124	3	2	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	97300	
A6J1-J7	1250-1512	3	7	CONNECTOR-RF SMB M PC 50-OHM	98291	51-353-0039-226
A6L1-L3	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A6L4	9100-2279	2	2	INDUCTOR RF-CH-MLD 180UH 10% .105DX.26LG	24226	10M183K
A6L5-L6	9140-0144	0	10	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A6L7	03577-20301	4	1	NDCTR	A01130	1871
A6L7	8120-1543	2	0	CBL-RGD 50OHM .1430D	28480	8120-1543
A6L10-L12	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A6L14	9100-3551	5	2	INDUCTOR RF-CH-MLD 1UH 5% .166DX.385LG	24226	15M101J
A6L15-L17	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A6L18	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A6L19-L20	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A6L22-L23	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A6L24	9100-3551	5		INDUCTOR RF-CH-MLD 1UH 5% .166DX.385LG	24226	15M101J
A6L25	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A6L26	9140-0210	1	1	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	99800	1537-76
A6L28	9100-2279	2		INDUCTOR RF-CH-MLD 180UH 10% .105DX.26LG	24226	10M183K
A6L29-L31	9100-3345	5	3	INDUCTOR RF-CH-MLD 2UH 5% .166DX.385LG	24226	15M201J
A6L32	9140-0398	6	1	INDUCTOR RF-CH-MLD 12UH 5% .166DX.385LG	24226	15M122J
A6L33	9140-0814	1	1	COIL-VAR 20NH-25NH Q=50 PC-MTG	28480	9140-0814
A6Q1	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	17856	2N4391
A6Q2	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	SRF5064
A6Q4	1855-0410	0	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	27014	SF51006
A6Q5	1855-0081	1	1	TRANSISTOR J-FET N-CHAN D-MODE SI	04713	SPF819
A6Q6	1853-0448	0	1	TRANSISTOR PNP SI TO-92 PD=625MW	04713	SPS7848
A6Q7	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	SRF5064
A6Q8	1853-0010	2	1	TRANSISTOR PNP SI TO-18 PD=360MW	04713	SM4713
A6Q9-Q10	1854-0591	6	1	TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A6Q11	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	SRF5064
A6Q12	1853-0448	0		TRANSISTOR PNP SI TO-92 PD=625MW	04713	SPS7848
A6Q13-Q14	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	04713	SPS3612
A6R1	0683-6805	3	2	RESISTOR 68 5% .25W CF TC=0-400	77902	R-25J
A6R2	0683-1015	7	3	RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A6R3	0683-1545	8	2	RESISTOR 150K 5% .25W CF TC=0-800	77902	R-25J
A6R4	0683-5105	4	1	RESISTOR 51 5% .25W CF TC=0-400	77902	R-25J
A6R5	0698-3558	8	1	RESISTOR 4.02K 1% .125W F TC=0+-100	19701	SFR25H
A6R6	0683-2025	1	3	RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A6R7	0683-1025	9	7	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A6R8	0698-4502	4	1	RESISTOR 64.9K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A6R9	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	19701	SFR25H
A6R10	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A6R11	0683-3325	6	1	RESISTOR 3.3K 5% .25W CF TC=0-400	77902	R-25J
A6R12	2100-3274	2	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-103
A6R13	0757-0453	2	1	RESISTOR 30.1K 1% .125W F TC=0+-100	19701	SFR25H
A6R14	0757-0449	6	1	RESISTOR 20K 1% .125W F TC=0+-100	19701	SFR25H
A6R15	0757-0482	7	1	RESISTOR 511K 1% .125W F TC=0+-100	19701	5033R

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6R16	0757-0283	6	2	RESISTOR 2K 1% .125W F TC=0+-100	19701	SFR25H
A6R17	0683-1045	3	3	RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A6R18	0683-1055	5	4	RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A6R19	0698-3492	9	1	RESISTOR 2.67K 1% .125W F TC=0+-100	19701	SFR25H
A6R20	0683-1045	3		RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A6R21	0683-2055	7	1	RESISTOR 2M 5% .25W CF TC=0-900	77902	R-25J
A6R22	0683-1055	5		RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A6R23	0683-4715	0	1	RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A6R24	0757-0415	6	1	RESISTOR 475 1% .125W F TC=0+-100	19701	SFR25H
A6R25-R26	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A6R27	0698-0063	4	1	RESISTOR 5.23K 1% .125W F TC=0+-100	19701	SFR25H
A6R28	0698-4440	9	1	RESISTOR 3.4K 1% .125W F TC=0+-100	91637	CMF 55-1, T-1
A6R29	0757-0282	5	1	RESISTOR 221 1% .125W F TC=0+-100	19701	SFR25H
A6R30	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A6R32	0698-3458	7	1	RESISTOR 348K 1% .125W F TC=0+-100	19701	SFR25H
A6R34	0683-4705	8	3	RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A6R35*	0683-3035	5		RESISTOR 30K 5% .25W CF TC=0-400	77902	R-25J
A6R35+	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	19701	SFR25H
A6R36	0698-3497	4	1	RESISTOR 6.04K 1% .125W F TC=0+-100	19701	SFR25H
A6R37	0683-1055	5		RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A6R38	0698-3279	0	4	RESISTOR 4.99K 1% .125W F TC=0+-100	19701	SFR25H
A6R40-R44	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A6R45-R47	0699-1903	5	3	R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A6R48	0698-7231	2	1	RESISTOR 619 1% .05W F TC=0+-100	24546	CT3
A6R49	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A6R50	0698-7221	0	2	RESISTOR 237 1% .05W F TC=0+-100	24546	CT3
A6R51	0699-1965	9	4	R-F 21.5 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A6R52	0757-0409	8	1	RESISTOR 274 1% .125W F TC=0+-100	19701	SFR25H
A6R54-R56	0699-1965	9		R-F 21.5 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A6R57	0683-1525	4	1	RESISTOR 1.5K 5% .25W CF TC=0-400	77902	R-25J
A6R59	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A6R60	0698-4507	9	1	RESISTOR 76.8K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A6R61	0683-3625	9	1	RESISTOR 3.6K 5% .25W CF TC=0-400	77902	R-25J
A6R62	0683-1135	2	1	RESISTOR 11K 5% .25W CF TC=0-400	77902	R-25J
A6R63	0683-1515	2	1	RESISTOR 150 5% .25W CF TC=0-400	77902	R-25J
A6R64	0683-1015	7		RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A6R65	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A6R67	0698-7224	3	1	RESISTOR 316 1% .05W F TC=0+-100	24546	CT3
A6R68	0698-3700	2	1	RESISTOR 715 1% .125W F TC=0+-100	19701	SFR25H
A6R69	0698-4498	7	1	RESISTOR 53.6K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A6R70	0757-0272	3	1	RESISTOR 52.3K 1% .125W F TC=0+-100	19701	SFR25H
A6R71	0698-3439	4	1	RESISTOR 178 1% .125W F TC=0+-100	19701	SFR25H
A6R72	0698-4014	3	1	RESISTOR 787 1% .125W F TC=0+-100	19701	SFR25H
A6R73	0757-0442	9	4	RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A6R74	0698-3280	3	1	RESISTOR 63.4K 1% .125W F TC=0+-100	19701	SFR25H
A6R75	0698-7221	0		RESISTOR 237 1% .05W F TC=0+-100	24546	CT3
A6R76	0757-0280	3	2	RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A6R77	0698-7234	5	1	RESISTOR 825 1% .05W F TC=0+-100	24546	CT3
A6R81	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	19701	SFR25H
A6R82	0683-7505	2	1	RESISTOR 75 5% .25W CF TC=0-400	77902	R-25J
A6R85	0683-1005	5	1	RESISTOR 10 5% .25W CF TC=0-400	77902	R-25J
A6R86	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A6R87	0683-2035	3	1	RESISTOR 20K 5% .25W CF TC=0-400	77902	R-25J
A6R88	0757-0427	0	1	RESISTOR 1.5K 1% .125W F TC=0+-100	19701	SFR25H
A6R91	0683-1055	5		RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A6R92	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A6R93	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A6R94	0683-1045	3		RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A6R95	0698-3512	4	1	RESISTOR 1.18K 1% .125W F TC=0+-100	19701	SFR25H
A6R96	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A6R97-R99	0698-3279	0		RESISTOR 4.99K 1% .125W F TC=0+-100	19701	SFR25H
A6R100-R101	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A6R102	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+-100	19701	SFR25H
A6R103	0698-4399	7	1	RESISTOR 88.7 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A6R104	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	19701	SFR25H
A6R110	0683-6805	3		RESISTOR 68 5% .25W CF TC=0-400	77902	R-25J
A6R111	0683-1015	7		RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A6R112	0683-1545	8		RESISTOR 150K 5% .25W CF TC=0-800	77902	R-25J
A6R115	0698-4429	4	1	RESISTOR 1.87K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A6R116	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	19701	SFR25H

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A6R117-R118	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A6R120	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	19701	SFR25H
A6R121	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A6R122	0757-0472	5	1	RESISTOR 200K 1% .125W F TC=0+-100	19701	SFR25H
A6R123	0698-4473	8	1	RESISTOR 8.06K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A6R124	0757-0437	2	1	RESISTOR 4.75K 1% .125W F TC=0+-100	19701	SFR25H
A6S1	3101-2063	8	1	SWITCH-RKR DIP-RKR-ASSY 4-1A .05A 30VDC	81073	76YY2074S
A6TP1-TP14	1251-0600	0	14	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A6U1	1820-2634	1	1	IC INV TTL ALS HEX	01295	SN71332N
A6U2	1826-0522	4	1	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	SN99856N
A6U3	1820-0321	9	1	IC COMPARATOR GP TO-99 PKG	07263	SL21436
A6U4-U6	1820-1279	8	2	IC CNTR TTL LS DECD UP/DOWN SYNCHRO	01295	SN53645
A6U7	1820-2779	5	1	IC CNTR TTL ALS BIN SYNCHRO	01295	SN71537N
A6U8	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN53506N
A6U9	1826-0081	0	1	IC OP AMP WB TO-99 PKG	27014	SL160376
A6U10	1826-0412	1	1	IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	SL33675
A6U11	1820-0630	3	1	IC MISC TTL	04713	SC13265PK
A6U13	1820-1453	0	1	IC CNTR TTL S BIN SYNCHRO POS-EDGE-TRIG	01295	SN85499N
A6U14	1820-1888	5	1	IC PRESCR ECL	04713	SC63470L013
A6U15	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN53509N
A6U16	1820-1430	3	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN57191N
A6U17	1820-1991	1	1	IC CNTR TTL LS DECD DUAL 4-BIT	07263	SL66293
A6U18	1820-1282	3	1	IC FF TTL LS J-K BAR POS-EDGE-TRIG	01295	SN53656N
A6U19	1826-0147	9	1	IC V RGLTR-FXD-POS 11.5/12.5V TO-220 PKG	04713	SC25174P1
A6U20	1826-0418	7	1	IC V RGLTR-FXD-NEG 12.4/11.6V TO-220 PKG	27014	SL33741
A6U21	1820-0321	9		IC COMPARATOR GP TO-99 PKG	07263	SL21436
A6U22	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN53243N
A6U23	1826-0122	0	1	IC V RGLTR-FXD-POS 4.8/5.2V TO-220 PKG	07263	SL23241
A6U24	1820-1994	4	1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN58659N
A6U25	1826-0762	4	1	IC COMPARATOR HS TO-100 PKG	27014	SL160468
A6W1	1251-4047	7	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-05-2031
A6W1A	1258-0141	8	1	CON-JUMPER REM .025P	00779	530153-2
A6Y1	0410-0437	8	1	CRYSTAL-QUARTZ 9.99830 MHZ	33096	
A7	**03577-66507**	**8**	**1**	**PC BOARD ASSY SYNTHESIZER**	**28480**	**03577-66507**
A7C1	0140-0191	8	3	CAPACITOR-FXD 56PF +-5% 300VDC MICA	09023	CD15ED560J03C
A7C2-C3	0160-3847	9	42	CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C4	0180-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A7C6	0140-0191	8		CAPACITOR-FXD 56PF +-5% 300VDC MICA	09023	CD15ED560J03C
A7C7	0160-4571	8	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A7C8	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C13	0160-5306	9	3	CAPACITOR-FXD .1UF +-10% 100VDC	19701	719A1CA104PK101SA
A7C15	0160-4461	5	1	CAPACITOR-FXD 150PF +-2.5% 630VDC POLYP	25088	B33062/150PF/2.5%/630V
A7C16	0180-0553	0	18	CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C17	0160-4461	5		CAPACITOR-FXD 150PF +-2.5% 630VDC POLYP	25088	B33062/150PF/2.5%/630V
A7C18	0160-6510	9	25	C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C19	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C22	0160-5306	9		CAPACITOR-FXD .1UF +-10% 100VDC	19701	719A1CA104PK101SA
A7C23	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C24	0140-0149	6	1	CAPACITOR-FXD 470PF +-5% 300VDC MICA	00853	
A7C26	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C27	0160-4798	1	1	CAPACITOR-FXD 2.7PF +-.25PF 100VDC CER	54583	MA12C0G2A2R7C
A7C28	0160-2208	4	1	CAPACITOR-FXD 330PF +-5% 300VDC MICA	00853	
A7C30	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C31	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C34	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C35-C36	0160-4787	8	4	CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	04222	SA106A220JAA
A7C38	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C39	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A7C40-C41	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C42-C45	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C46-C50	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C51	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C52-C53	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C54	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C55-C57	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A7C58	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	04222	SA106A220JAA
A7C59	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A7C60-C75	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C76	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A7C77	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A7C78	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	13606	150D105X9035A2-DYS
A7C79-C80	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A7C81	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C82-C83	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A7C87	0140-0193	0	1	CAPACITOR-FXD 82PF +-5% 300VDC MICA	09023	
A7C88	0160-0134	1	1	CAPACITOR-FXD 220PF +-5% 300VDC MICA	09023	
A7C89	0160-0363	6	1	CAPACITOR-FXD 620PF +-5% 300VDC MICA	00853	
A7C90	0140-0195	2	1	CAPACITOR-FXD 130PF +-5% 300VDC MICA	09023	
A7C91	0140-0208	8	1	CAPACITOR-FXD 680PF +-5% 300VDC MICA	09023	
A7C92-C93	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C94	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C96	0180-0100	3	1	CAPACITOR FXD 4.7UF+-10% 35VDC TA	13606	150D475X9035B2-DYS
A7C98	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C99	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	13606	150D336X9010B2-DYS
A7C100	0180-2207	5	1	CAPACITOR-FXD 100UF+-10% 10VDC TA	13606	150D107X9010R2-DYS
A7C101-C102	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C103	0160-4787	8		CAPACITOR-FXD 22PF +-5% 100VDC CER 0+-30	04222	SA106A220JAA
A7C104-C106	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C107-C108	0180-0100	3		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	13606	150D475X9035B2-DYS
A7C109	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C116	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C117	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C118	0180-0309	4	1	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A7C119-C124	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C125	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C126-C130	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C131	0140-0191	8		CAPACITOR-FXD 56PF +-5% 300VDC MICA	09023	CD15ED560J03C
A7C132	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C134-C137	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C138	0140-0206	6	1	CAPACITOR-FXD 270PF +-5% 500VDC MICA	09023	
A7C139-C140	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C141	0180-0553	0		CAPACITOR-FXD 22UF+-20% 25VDC TA	28480	T362C226M025ASC8245
A7C142	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C144	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	13606	150D336X9010B2-DYS
A7C145	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A7C146-C149	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A7C150-C153	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C154	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2 DYS
A7C155	0160-6522	3	5	C-F 1000PF 5% 100V CERMLr	28480	RPE121-978C0G102J100V
A7C156	0160-6507	4	12	C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A7C158	0160-6522	3		C-F 1000PF 5% 100V CERMLr	28480	RPE121-978C0G102J100V
A7C159-C160	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A7C161	0160-5306	9		CAPACITOR-FXD .1UF + 10% 100VDC	19701	719A1CA104PK101SA
A7C162-C164	0160-6522	3		C-F 1000PF 5% 100V CERMLr	28480	RPE121-978C0G102J100V
A7C165	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C166	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A7C167-C169	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C170-C171	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A7C172-C173	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C176	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A7C177-C180	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C181-C182	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A7C183-C184	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C185	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A7C189-C190	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7C194-C197	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A7C204	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	13606	150D336X9010B2-DYS
A7C205	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A7CR1-CR2	1901-0040	1	13	DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A7CR3-CR4	1901-0518	8	4	DIODE-SCHOTTKY SM SIG	28480	1901-0518
A7CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A7CR6-CR7	1902-0777	3	3	DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	SZ14376RL
A7CR8-CR9	1901-0518	8		DIODE-SCHOTTKY SM SIG	28480	1901-0518
A7CR10	1902-1337	3	1	DIODE-ZNR 13V 2% DO-7 PD=.4W	M01099	DZ790614ADD07
A7CR11-CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A7CR17	1902-3054	5	1	DIODE-ZNR 3.65V 5% DO-35 PD=.4W	04713	SZ30016-050
A7CR20	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A7CR21	1902-0945	7	1	DIODE-ZNR 3V 5% DO-35 PD=.4W TC=-.043%	04713	SZ30035-003
A7CR23	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A7CR24	1990-1123	0	1	OPT LED LMP R AP LMP1301 TT1H	28480	1990-1123
A7CR25	1902-0777	3		DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	SZ14376RL
A7CR26-CR28	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A7CR29	1990-1122	9	1	OPT LED LMP G GP LMP1503 TT1H	28480	1990-1122
A7CR161-CR162	0122-0085	1	1	DIODE-VVC 2.2PF 7% C3/C25-MIN=4.5	S0545	1S2208(B)
A7CR163	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A7H1-H2	1251-4822	6	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A7H3	03577-04107	4	1	SHTF COVER-SYNTH	28480	03577-04107
A7H3	1251-4822	6		CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A7H4	03577-04110	9	1	SHTF COVER-SHIELD S	28480	03577-04110
A7H5	03577-04113	2	1	SHTF SHIELD-TOP COVER	28480	03577-04113
A7H6	03577-20601	7	1	CSTG-CIRC SIDE	28480	
A7H7	03577-20602	8	1	CSTG-COMP SIDE	28480	
A7H8	03577-20603	9	1	MCHD SHIELD-COVER	76854	
A7H9	03577-20604	0	1	MCHD SHIELD-FRAME	76854	
A7J1-J3	1250-1512	3	3	CONNECTOR-RF SMB M PC 50-OHM	98291	51-353-0039-226
A7L1-L2	9140-0748	0	1	INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A7L3	9100-1618	1	3	INDUCTOR RF-CH-MLD 5.6UH 10%	99800	1537-30
A7L5	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A7L9-L10	9140-0210	1	11	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	99800	1537-76
A7L11	9100-1645	4	1	INDUCTOR RF-CH-MLD 390UH 5% .2DX.45LG	99800	2500-08
A7L12	9100-1652	3	1	INDUCTOR RF-CH-MLD 820UH 5% .2DX.45LG	99800	2500-24
A7L13	9140-0748	0		INDUCTOR 250UH 25% .25DX 5LG Q=3	24226	CA-253-3
A7L14-L15	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	99800	1537-30
A7L16-L17	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	99800	1537-76
A7L57-L59	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	99800	1537-76
A7L131-L132	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A7L136-L138	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	99800	1537-76
A7L140-L148	9140-0144	0	17	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A7L149	9100-1791	1	1	CORE-FERRITE CHOKE-WIDEBAND;IMP:>360	02114	VK200-19/4B
A7L151-L152	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	99800	1537-76
A7L155-L164	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A7L165	03577-20300	3	1	NDCTR	A01130	
A7L165	8120-1543	2	0	CBL-RGD 50OHM .1430D	28480	8120-1543
A7L167-L168	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A7L169	9135-0076	6	1	INDUCTOR RF-CH-MLD 39NH 6% .102DX.26LG	24226	10M039X-1
A7L170-L180	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A7L181-L186	9140-0748	0		INDUCTOR 250UH 25% .25DX.5LG Q=3	24226	CA-253-3
A7Q1-Q2	1853-0448	0	1	TRANSISTOR PNP SI TO-92 PD=625MW	04713	SPS7848
A7Q3	1854-0345	8	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	SRF5064
A7Q4	1853-0448	0		TRANSISTOR PNP SI TO-92 PD=625MW	04713	SPS7848
A7Q6-Q8	1853-0597	0	5	XTR SML1PNP SI 2N4917 P92	07263	
A7Q17	1855-0308	5	1	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	17856	DN 324
A7Q18-Q19	1855-0081	1	1	TRANSISTOR J FET N CHAN D-MODE SI	04713	SPF819
A7Q21	1855-0689	5	1	XTR SML1	04713	SS3723RLRA
A7Q22-Q24	1854-0215	1	1	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A7Q27	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	04713	SPF819
A7Q28-Q30	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A7Q33	1855-0689	5		XTR SML1	04713	SS3723RLRA
A7Q34	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A7Q39	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	04713	SPF819
A7Q41-Q42	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A7Q43-Q44	1853-0597	0		XTR SML1PNP SI 2N4917 P92	07263	
A7Q50	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A7Q51	1853-0320	7	1	TRANSISTOR PNP 2N4032 SI TO-5 PD=800MW	07263	S44044
A7Q131	1853-0448	0		TRANSISTOR PNP SI TO-92 PD=625MW	04713	SPS7848
A7Q161	1854-1043	5	1	XTR SML1NPN SI 2N5179 @B72	04713	SRF3604
A7Q162	1853-0010	2	1	TRANSISTOR PNP SI TO-18 PD=360MW	04713	SM4713
A7Q163	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	SRF5064
A7R1	0698-4380	6	1	RESISTOR 45.3 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A7R2-R3	0757-0419	0	2	RESISTOR 681 1% .125W F TC=0+-100	19701	SFR25H
A7R4	0683-4705	8	15	RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R5	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	19701	SFR25H
A7R6	0757-0417	8	1	RESISTOR 562 1% .125W F TC=0+-100	19701	SFR25H
A7R7	0683-4715	0	4	RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A7R8	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R9	0698-3440	7	1	RESISTOR 196 1% .125W F TC=0+-100	19701	SFR25H
A7R10	0683-4715	0		RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A7R11	0683-2205	9	1	RESISTOR 22 5% .25W CF TC=0-400	77902	R-25J
A7R12-R13	0757-0429	2	2	RESISTOR 1.82K 1% .125W F TC=0+-100	19701	SFR25H

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A7R14	0757-0418	9	1	RESISTOR 619 1% .125W F TC=0+-100	19701	SFR25H
A7R15	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	19701	SFR25H
A7R16	0698-3515	7	1	RESISTOR 5.9K 1% .125W F TC=0+-100	19701	SFR25H
A7R17	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A7R18	0698-0064	5	2	RESISTOR 9.31K 1% .125W F TC=0+-100	19701	SFR25H
A7R19	0698-3225	6	1	RESISTOR 1.43K 1% .125W F TC=0+-100	19701	SFR25H
A7R20-R21	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R22	0698-4464	7	1	RESISTOR 887 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A7R23	0698-3178	8	1	RESISTOR 487 1% .125W F TC=0+-100	19701	SFR25H
A7R24	0698-4469	2	1	RESISTOR 1.15K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A7R25	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R26	0757-0395	1	1	RESISTOR 56.2 1% .125W F TC=0+-100	19701	SFR25H
A7R27-R28	0757-0317	7	2	RESISTOR 1.33K 1% .125W F TC=0+-100	19701	SFR25H
A7R29	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R30	0698-3156	2	2	RESISTOR 14.7K 1% .125W F TC=0+-100	19701	SFR25H
A7R31	0683-3325	6	2	RESISTOR 3.3K 5% .25W CF TC=0-400	77902	R-25J
A7R32	0683-4715	0		RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A7R33	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R34	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	19701	SFR25H
A7R36	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A7R37	0757-0281	4	3	RESISTOR 2.74K 1% .125W F TC=0+-100	19701	SFR25H
A7R38	0698-0083	8	5	RESISTOR 1.96K 1% .125W F TC=0+-100	19701	SFR25H
A7R39	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R40	0683-1015	7	4	RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A7R41	0698-4125	7	1	RESISTOR 953 1% .125W F TC=0+-100	19701	SFR25H
A7R42-R43	0757-0281	4		RESISTOR 2.74K 1% .125W F TC=0+-100	19701	SFR25H
A7R44	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	19701	SFR25H
A7R45	0683-1005	5	1	RESISTOR 10 5% .25W CF TC=0-400	77902	R-25J
A7R46	0698-3495	2	1	RESISTOR 866 1% .125W F TC=0+-100	19701	SFR25H
A7R53-R54	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A7R56	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	19701	SFR25H
A7R68	0683-0275	9	1	RESISTOR 2.7 5% .25W CF TC=0-400	77902	R-25J
A7R69	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+-100	19701	SFR25H
A7R71	0757-0450	9	1	RESISTOR 22.1K 1% .125W F TC=0+-100	19701	SFR25H
A7R72	0683-1025	9	9	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R73	2100-3354	9	1	RESISTOR TRMR 50K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-503
A7R74	2100-3352	7	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-102
A7R75	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A7R76	2100-3611	1	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	73138	67XR
A7R77	0683-1065	7	1	RESISTOR 10M 5% .25W CC TC=-900/+1100	01121	CB1065
A7R78	0757-0488	3	1	RESISTOR 909K 1% .125W F TC=0+-100	19701	5033R
A7R79	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	19701	SFR25H
A7R80	0698-4394	2	1	RESISTOR 76.8 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A7R81	0683-1035	1	15	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A7R82	0683-3625	9	1	RESISTOR 3.6K 5% .25W CF TC=0-400	77902	R-25J
A7R83	0683-2025	1	3	RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A7R84	0698-3484	9	1	RESISTOR 6.65K 1% .125W F TC=0+-100	19701	SFR25H
A7R85	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0+-100	19701	SFR25H
A7R86	0757-0436	1	1	RESISTOR 4.32K 1% .125W F TC=0+-100	19701	SFR25H
A7R87	0683-4715	0		RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A7R88	2100-0552	3	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-500
A7R89	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R90	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A7R91	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	19701	SFR25H
A7R92	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R93-R94	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R96	0757-0421	4	2	RESISTOR 825 1% .125W F TC=0+-100	19701	SFR25H
A7R97	0698-4424	9	1	RESISTOR 1.4K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A7R98	0757-0451	0	1	RESISTOR 24.3K 1% .125W F TC=0+-100	19701	SFR25H
A7R99	0757-0465	6	3	RESISTOR 100K 1% .125W F TC=0+-100	19701	SFR25H
A7R100	0757-0454	3	1	RESISTOR 33.2K 1% .125W F TC=0+-100	19701	SFR25H
A7R101	0698-4514	8	1	RESISTOR 105K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A7R102-R103	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	19701	SFR25H
A7R105	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R106	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A7R107	2100-3759	8	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	73138	67XR
A7R108	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	19701	SFR25H
A7R109	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R110	0683-6815	5	1	RESISTOR 680 5% .25W CF TC=0-400	77902	R-25J
A7R111	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A7R112	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	19701	SFR25H
A7R113-R114	0757-0416	7	2	RESISTOR 511 1% .125W F TC=0+-100	19701	SFR25H
A7R115	0757-0420	3	1	RESISTOR 750 1% .125W F TC=0+-100	19701	SFR25H
A7R116	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R117	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	19701	SFR25H
A7R118	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R119	0683-1835	9	1	RESISTOR 18K 5% .25W CF TC=0-400	77902	R-25J
A7R120-R121	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R122-R123	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A7R124	0683-1315	0	1	RESISTOR 130 5% .25W CF TC=0-400	77902	R-25J
A7R125	0683-1525	4	2	RESISTOR 1.5K 5% .25W CF TC=0-400	77902	R-25J
A7R126	0683-5625	3	1	RESISTOR 5.6K 5% .25W CF TC=0-400	77902	R-25J
A7R128	0698-4307	7	1	RESISTOR 14.3K 1% .125W F TC=0+-100	19701	SFR25H
A7R129	0683-2035	3	1	RESISTOR 20K 5% .25W CF TC=0-400	77902	R-25J
A7R130	0683-1045	3	1	RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A7R131	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R132	0757-0398	4	1	RESISTOR 75 1% .125W F TC=0+-100	19701	SFR25H
A7R133	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	19701	SFR25H
A7R134-R137	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A7R138	0698-0064	5		RESISTOR 9.31K 1% .125W F TC=0+-100	19701	SFR25H
A7R141	0698-4440	9	1	RESISTOR 3.4K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A7R142	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A7R143	0683-1015	7		RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A7R144	0683-3325	6		RESISTOR 3.3K 5% .25W CF TC=0-400	77902	R-25J
A7R146-R147	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A7R148	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A7R149-R153	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A7R159	0683-3015	1	1	RESISTOR 300 5% .25W CF TC=0-400	77902	R-25J
A7R160	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A7R161	2100-3252	6	1	RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-502
A7R162	0683-1015	7		RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A7R163	0683-5125	8	1	RESISTOR 5.1K 5% .25W CF TC=0-400	77902	R-25J
A7R164	0698-4207	6	1	RESISTOR 44.2K 1% .125W F TC=0+-100	19701	SFR25H
A7R165	0698-4429	4	1	RESISTOR 1.87K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A7R166	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A7R167	0683-1015	7		RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A7R168	0683-1515	2	1	RESISTOR 150 5% .25W CF TC=0-400	77902	R-25J
A7R169	0698-3558	8	1	RESISTOR 4.02K 1% .125W F TC=0+-100	19701	SFR25H
A7R170	0698-3581	7	1	RESISTOR 13.7K 1% .125W F TC=0+-100	19701	SFR25H
A7R172	0699-1903	5	2	R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A7R173	0699-2077	6	1	R-F 75 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A7R174	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A7R175	0683-1525	4		RESISTOR 1.5K 5% .25W CF TC=0-400	77902	R-25J
A7R177	0698-7224	3	1	RESISTOR 316 1% .05W F TC=0+-100	24546	CT3
A7R180	0699-1969	3	7	R-F 90.9 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A7R183	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R185	0683-2715	6	4	RESISTOR 270 5% .25W CF TC=0-400	77902	R-25J
A7R186	0699-1969	3		R-F 90.9 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A7R187	0699-2079	8	1	R-F 82.5 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A7R188	0699-1969	3		R-F 90.9 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A7R189-R190	0698-7229	8	2	RESISTOR 511 1% .05W F TC=0+-100	24546	CT3
A7R191	0699-1903	5		R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A7R192	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A7R195	0683-2715	6		RESISTOR 270 5% .25W CF TC=0-400	77902	R-25J
A7R196-R198	0699-2029	8	3	R-F 16.2 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A7R210-R210	0683-2715	6		RESISTOR 270 5% .25W CF TC=0-400	77902	R-25J
A7R212-R215	0699-1969	3		R-F 90.9 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A7R216-R217	0699-1968	2	2	R-F 68.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A7TP1-TP34	1251-0600	0	28	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A7U1	1820-0817	8	1	IC FF ECL D-M/S DUAL	04713	SC22631P
A7U2	1821-0001	4	1	TRANSISTOR ARRAY 14-PIN PLSTC DIP	3L585	80962
A7U3	1810-0294	4	1	NETWORK-RESISTOR 16 PIN DIP; RES	28480	1810-0294
A7U4	1820-1196	8	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53525N
A7U5	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A7U6	1826-0021	8	1	IC OP AMP GP TO-99 PKG	27014	SL11611
A7U7	1820-0629	0	1	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN23357N
A7U8	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A7U9	1820-1279	8	2	IC CNTR TTL LS DECD UP/DOWN SYNCHRO	01295	SN53645
A7U10	1826-0715	7	3	IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A7U11	1820-1279	8		IC CNTR TTL LS DECD UP/DOWN SYNCHRO	01295	SN53645

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A7U12	1820-0681	4	3	IC GATE TTL S NAND QUAD 2-INP	01295	SN24649N
A7U13	1820-0629	0	7	IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN23357N
A7U14-U15	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53525N
A7U17	1820-1322	2	1	IC GATE TTL S NOR QUAD 2-INP	01295	SN84050N
A7U18	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN23357N
A7U19	1820-2004	9	1	IC MISC NMOS	28480	1820-2004
A7U21	1820-0683	6	1	IC INV TTL S HEX 1-INP	01295	SN24651N
A7U22-U23	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN24649N
A7U24	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN23357N
A7U25	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A7U26	1820-0693	8	1	IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN24661N
A7U27	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN23357N
A7U28	1820-2102	8	1	IC LCH TTL LS D-TYPE OCTL	01295	SN59195N
A7U29-U30	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN23357N
A7U31	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN53243N
A7U32	1820-0629	0		IC FF TTL S J-K NEG-EDGE-TRIG	01295	SN23357N
A7U33	1820-1780	6	1	IC PRESCR ECL	07263	SL63346
A7U34-U36	1813-0215	5	1	IC WIDEBAND AMPL TO-39 PKG	04713	SWA133
A7U37	1820-1208	3	1	IC GATE TTL LS OR QUAD 2-INP	01295	SN53515N
A7U38	1826-0715	7	1	IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A7U39	1813-0215	5		IC WIDEBAND AMPL TO-39 PKG	04713	SWA133
A7U40	1826-0147	9	1	IC V RGLTR-FXD-POS 11.5/12.5V TO-220 PKG	04713	SC25174P1
A7U41	1826-0221	0	1	IC V RGLTR-FXD-NEG 11.5/12.5V TO-220 PKG	04713	SC25266P1
A7U42	1826-0412	1	1	IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	SL33675
A7U43	1826-0147	9		IC V RGLTR-FXD-POS 11.5/12.5V TO-220 PKG	04713	SC25174P1
A7U44	1826-0773	7	1	IC OP AMP GP TO-99 PKG	27014	SL41902
A7U45-U46	1826-0122	0	1	IC V RGLTR-FXD-POS 4.8/5.2V TO-220 PKG	07263	SL23241
A7U47	1826-0700	0	1	IC OP AMP WB 14-DIP-C PKG	34371	HA1-5195 B3053-016
A7U48	1826-0122	0		IC V RGLTR-FXD-POS 4.8/5.2V TO-220 PKG	07263	SL23241
A7U49	1826-0147	9		IC V RGLTR-FXD-POS 11.5/12.5V TO-220 PKG	04713	SC25174P1
A7U50	1826-0715	7		IC OP AMP LOW-NOISE 8-DIP-P PKG	18324	CC3802
A7W1-W2	1258-0141	8	2	CON-JUMPER REM .025P	00779	530153-2
A8	**03577-66508**	**9**	**1**	**PC BOARD ASSY OUTPUT**	**28480**	**03577-66508**
A8C1	0180-3768	5	3	C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A8C2-C3	0160-6506	3	82	C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C4-C5	0160-6508	5	12	C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C6-C7	0180-0374	3	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A8C8	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C11	0160-6515	4	3	C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A8C12	0160-4381	8	1	CAPACITOR-FXD 1.5PF +-.25PF 200VDC CER	54583	FD11C0G2D1R5C
A8C13	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C14	0160-6524	5	3	C-F 6.8PF --% 200V CERMLr	28480	RPE121-978C0G6R8D200V
A8C15	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C16	0160-6515	4		C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A8C21	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A8C22-C23	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C24-C25	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C26-C27	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A8C28	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C40	0180-3768	5		C-F 3.3UF 20% 35V TADPDr	28480	T350D335M035AS C-8310
A8C41-C42	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A8C43-C44	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C45-C46	0160-6507	4	8	C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A8C47-C48	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C49-C50	0160-6505	2	6	C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A8C51-C61	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C62	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A8C64-C68	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C69	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A8C71	0121-0512	7	2	CAPACITOR-V TRMR-CER 2-5PF 100V PC-MTG	59660	518-002 A 2-5
A8C72	0160-6523	4	3	C-F 1PF --% 200V CERMLr	28480	RPE121-978C0G010C200V
A8C83	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A8C84-C85	0180-1974	1	1	CAPACITOR-FXD 10UF+-10% 35VDC TA	13606	150D106X9035R2-DYS
A8C90-C108	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C110	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	13606	150D226X9015B2-DYS
A8C111-C113	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C114	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	13606	150D226X9015B2-DYS
A8C115	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A8C117-C118	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C120	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A8C121	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C122	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A8C123	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C124	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A8C125-C126	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C127	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A8C128	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C129	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A8C130	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C131	0160-6507	4		C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A8C132	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C133	0160-6521	2	6	C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A8C134	0160-6511	0	5	C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A8C135	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C136	0160-6511	0		C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A8C140-C145	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C146	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A8C147-C154	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C155	0121-0512	7		CAPACITOR-V TRMR-CER 2-5PF 100V PC-MTG	59660	518-002 A 2-5
A8C156	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C157	0160-6517	6	4	C-F 100PF 20% 200V CERMLr	28480	RPE121-978X7R101M200V
A8C158-C170	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C179-C180	0160-6505	2		C-F .01UF 20% 100V CERMLr	28480	RPE121-978X7R103M100V
A8C181-C182	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C183	0180-0228	6		CAPACITOR-FXD 22UF+-10% 15VDC TA	13606	150D226X9015B2-DYS
A8C184	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C185	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A8C190-C191	0160-6517	6		C-F 100PF 20% 200V CERMLr	28480	RPE121-978X7R101M200V
A8C192-C193	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C194	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C200	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C201	0180-1974	1	1	CAPACITOR-FXD 10UF+-10% 35VDC TA	13606	150D106X9035R2-DYS
A8C210-C223	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C232	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C233	0160-6521	2		C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A8C234	0160-6511	0		C-F 15PF 5% 200V CERMLr	28480	RPE121 978C0G150J200V
A8C235	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C236	0160-6511	0		C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A8C250	0160-6515	4		C-F 10PF --% 200V CERMLr	28480	RPE121-978C0G100D200V
A8C251	0160-4381	8		CAPACITOR-FXD 1.5PF +-.25PF 200VDC CER	54583	FD11C0G2D1R5C
A8C252	0160-6524	5		C-F 6.8PF --% 200V CERMLr	28480	RPE121-978C0G6R8D200V
A8C253	0160-6508	5		C-F 22PF 5% 200V CERMLr	28480	RPE121-978C0G220J200V
A8C254	0160-6521	2		C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A8C255	0160-6511	0		C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A8C260	0160-6521	2		C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A8C261-C262	0160-6523	4		C-F 1PF --% 200V CERMLr	28480	RPE121-978C0G010C200V
A8C280	0160-6517	6		C-F 100PF 20% 200V CERMLr	28480	RPE121-978X7R101M200V
A8C300-C301	0160-6506	3		C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A8C350	0160-4382	9	1	CAPACITOR-FXD 3.3PF +-.25PF 200VDC CER	54583	FD12C0G2D3R3C
A8C351-C352	0160-4381	8		CAPACITOR-FXD 1.5PF +-.25PF 200VDC CER	54583	FD11C0G2D1R5C
A8C353	0160-6524	5		C-F 6.8PF --% 200V CERMLr	28480	RPE121-978C0G6R8D200V
A8C354-C355	0160-6521	2		C-F 2.2PF --% 200V CERMLr	28480	RPE121-978C0G2R2C200V
A8CR41-CR42	1902-0920	8	1	DIODE-ZNR 1N5345B 8.7V 5% PD=5W	04713	SZP40119
A8CR43-CR46	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	07263	FDH536
A8CR60	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	04713	SZ30016-109B
A8CR62-CR63	1902-0920	8		DIODE-ZNR 1N5345B 8.7V 5% PD=5W	04713	SZP40119
A8CR71-CR72	1901-0047	8	2	DIODE-SWITCHING 20V 75MA 10NS	07263	FDH0835
A8CR73-CR74	1902-0025	4	2	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.06%	04713	SZ30016-1182
A8CR111-CR112	1901-0518	8	6	DIODE-SCHOTTKY SM SIG	28480	1901-0518
A8CR113-CR114	1901-0040	1	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A8CR140	1902-1329	3	1	IC V RGLTR-V-REF-FXD 6.6/7.2V TO-46 PKG	27014	LM329CH
A8CR160-CR163	1901-0518	8		DIODE-SCHOTTKY SM SIG	28480	1901-0518
A8CR164	1901-0025	2	6	DIODE-GEN PRP 100V 200MA DO-7	07263	FDH536
A8CR170	1902-1329	3		IC V RGLTR-V-REF-FXD 6.6/7.2V TO-46 PKG	27014	LM329CH
A8CR171	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	07263	FDH536
A8E1-E5	03577-00901	8	5	ETCH SPRNG-GROUNDING	N01063	
A8E6-E9	03577-00902	9	4	ETCH SPRNG-GROUNDING	N01063	
A8H16	03577-00903	0	1	ETCH BAR-GROUNDING	N01063	

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A8H17	03577-04108	5	1	SHTF COVER-OUTPUT BD.	28480	03577-04108
A8H18	03577-04109	6	1	SHTF COVER-SHIELD	28480	03577-04109
A8H19	03577-20601	7	1	CSTG-CIRC SIDE	28480	
A8H20	03577-20605	1	1	CSTG-SHIELD - SLOTTED	28480	
A8H21	03577-20606	2	1	MCHD COVER-SHIELD CAN	H01050	
A8H22	03577-20607	3	1	MCHD COVER-SHIELD CAN	H01050	
A8H54-H55	1258-0141	8	2	CON-JUMPER REM .025P	00779	530153-2
A8H88	4330-0496	3	12	INSULATOR-BEAD GLASS	53101	KG12
A8J1-J2	1250-1512	3	2	CONNECTOR-RF SMB M PC 50-OHM	98291	51-353-0039-226
A8J3	1250-1314	3	1	CONNECTOR-RF SM-SLD FEM PC 50-OHM	98291	52-054-0000-226
A8J4-J8	1250-1339	2	5	CONNECTOR-RF SM-SLD M PC 50-OHM	98291	52-051-0000-226
A8K1-K6	0490-1404	9	6	RELAY 2C 12VDC-COIL .5A 28VDC	T01014	412Y-0191
A8L1-L2	9140-0144	0	13	INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A8L11	9140-0815	2	3	COIL-VAR 50.6NH-41.4NH PC-MTG	28480	9140-0815
A8L12	9140-0813	0	2	COIL-VAR 23NH-52NH Q=65 PC-MTG	28480	9140-0813
A8L13	9140-0815	2		COIL-VAR 50.6NH-41.4NH PC-MTG	28480	9140-0815
A8L14	9140-0813	0		COIL-VAR 23NH-52NH Q=65 PC-MTG	28480	9140-0813
A8L15	9140-0815	2		COIL-VAR 50.6NH-41.4NH PC-MTG	28480	9140-0815
A8L31-L42	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A8L80	9100-1618	1	3	INDUCTOR RF-CH-MLD 5.6UH 10%	99800	1537-30
A8L81	9140-0607	0	1	INDUCTOR RF-CH-MLD 3.3UH 10% .2DX.45LG	24226	18M331K
A8L82	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	99800	1537-30
A8L90-L122	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A8L123-L124	9140-0814	1	4	COIL-VAR 20NH-25NH Q=50 PC-MTG	28480	9140-0814
A8L125-L180	9140-0144	0		INDUCTOR RF-CH-MLD 4.7UH 10% .105DX.26LG	99800	1025-36
A8L200	9100-1618	1		INDUCTOR RF-CH-MLD 5.6UH 10%	99800	1537-30
A8L223-L224	9140-0814	1		COIL-VAR 20NH-25NH Q=50 PC-MTG	28480	9140-0814
A8L250-L251	9140-1070	3	2	IND RF CHOKE VAR 78.4NH	28480	9140-1070
A8Q1	1853-0544	7	1	TRANSISTOR PNP SI PD=180MW	25403	BFQ51
A8Q2	1854-0591	6	1	TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A8Q3	1853-0544	7		TRANSISTOR PNP SI PD=180MW	25403	BFQ51
A8Q4-Q5	1854-0591	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A8Q6	1853-0544	7		TRANSISTOR PNP SI PD=180MW	25403	BFQ51
A8Q7	1855-0410	0	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	27014	SF51006
A8Q21	1853-0544	7		TRANSISTOR PNP SI PD=180MW	25403	BFQ51
A8Q22	1854-0591	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A8Q23	1853-0544	7		TRANSISTOR PNP SI PD=180MW	25403	BFQ51
A8Q24	1854-0591	6		TRANSISTOR NPN SI PD=180MW FT=4GHZ	25403	BFR90
A8Q25	1854-0720	3	1	TRANSISTOR NPN SI PD=500MW FT=4GHZ	25403	BFR96-S
A8Q26	1853-0527	6	1	TRANSISTOR PNP SI PD=500MW FT=4GHZ	25403	BFQ 32
A8Q27	1855-0410	0		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	27014	SF51006
A8Q41	1855-0410	0		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	27014	SF51006
A8Q43	1853-0527	6		TRANSISTOR PNP SI PD=500MW FT=4GHZ	25403	BFQ 32
A8Q44	1854-0720	3		TRANSISTOR NPN SI PD=500MW FT=4GHZ	25403	BFR96-S
A8Q45	1854-0876	0	1	TRANSISTOR NPN PD=1W FT=1GHZ	04713	SRF2955
A8Q46	1853-0495	7	1	TRANSISTOR PNP PD=1W FT=1GHZ	04713	SRF2954
A8Q61	1853-0037	3	1	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	04713	SS2109
A8Q62	1854-0039	7	1	TRANSISTOR NPN 2N3053S SI TO-39 PD=1W	3L585	72007
A8Q62	1205-0033	6	1	HEAT SINK TO-5/TO-39-CS	05820	207-CB
A8Q160	1855-0410	0		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	27014	SF51006
A8R1	0699-2069	6	2	R-F 13.3 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R2-R3	0698-7222	1	4	RESISTOR 261 1% .05W F TC=0+-100	24546	CT3
A8R4-R5	0699-1964	8	8	R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R6	0698-7216	3	2	RESISTOR 147 1% .05W F TC=0+-100	24546	CT3
A8R7	0683-1055	5	4	RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A8R8-R9	0699-1964	8		R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R10-R11	0757-0408	7	4	RESISTOR 243 1% .125W F TC=0+-100	19701	SFR25H
A8R12-R13	0698-4496	5	2	RESISTOR 45.3K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R14-R15	0699-1948	8	7	R-F 46.4 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R16-R17	0698-3228	9	5	RESISTOR 49.9K 1% .125W F TC=0+-100	19701	SFR25H
A8R18	0698-7223	2	4	RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A8R19	0699-2030	1	2	R-F 17.8 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R20	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A8R21	0683-1555	0	2	RESISTOR 1.5M 5% .25W CF TC=0-900	77902	R-25J
A8R22-R23	0698-7222	1		RESISTOR 261 1% .05W F TC=0+-100	24546	CT3
A8R24-R25	0699-1964	8		R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R26	0698-7216	3		RESISTOR 147 1% .05W F TC=0+-100	24546	CT3
A8R27	0683-1055	5		RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A8R28-R29	0699-1964	8		R-F 14.7 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R30-R31	0757-0408	7		RESISTOR 243 1% .125W F TC=0+-100	19701	SFR25H

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A8R32-R33	0757-0456	5	2	RESISTOR 43.2K 1% .125W F TC=0+-100	19701	SFR25H
A8R34-R35	0699-1948	8		R-F 46.4 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R36-R37	0698-3228	9		RESISTOR 49.9K 1% .125W F TC=0+-100	19701	SFR25H
A8R38	0683-1555	0		RESISTOR 1.5M 5% .25W CF TC=0-900	77902	R-25J
A8R41-R43	0699-1948	8		R-F 46.4 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R44-R45	0757-0427	0	2	RESISTOR 1.5K 1% .125W F TC=0+-100	19701	SFR25H
A8R46-R47	0699-1965	9	2	R-F 21.5 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R48-R49	0698-7221	0	2	RESISTOR 237 1% .05W F TC=0+-100	24546	CT3
A8R51	0698-4517	1	1	RESISTOR 127K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R52-R53	0698-3446	3	4	RESISTOR 383 1% .125W F TC=0+-100	19701	SFR25H
A8R54-R55	0699-1902	4	2	R-F 10 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A8R56-R59	0698-4123	5	6	RESISTOR 499 1% .125W F TC=0+-100	19701	SFR25H
A8R60	0683-1055	5		RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A8R61-R62	0757-0447	4	2	RESISTOR 16.2K 1% .125W F TC=0+-100	19701	SFR25H
A8R63	0683-1025	9	8	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A8R64-R65	0757-0442	9	10	RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A8R66-R69	0683-2215	1	6	RESISTOR 220 5% .25W CF TC=0-400	77902	R-25J
A8R70-R71	0683-4725	2	3	RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A8R72	0699-1480	3	1	RESISTOR 100 .5% .125W F TC=0+-50	P01078	PR8494-100
A8R73	0699-1483	6	1	RESISTOR 221 .5% .125W F TC=0+-50	P01078	PR8494-221
A8R74	0699-1477	8	1	RESISTOR 23.85 .5% .125W F TC=0+-50	P01078	PR8494-23.85
A8R75	0699-1483	6		RESISTOR 221 .5% .125W F TC=0+-50	P01078	PR8494-221
A8R76	0699-1481	4	1	RESISTOR 116.1 .5% .125W F TC=0+-50	P01078	PR8494-116.1
A8R77	0699-1478	9	1	RESISTOR 52.84 .5% .125W F TC=0+-50	P01078	PR8494-52.84
A8R78	0699-1481	4		RESISTOR 116.1 .5% .125W F TC=0+-50	P01078	PR8404-116.1
A8R79	0699-1479	0	1	RESISTOR 68.83 .5% .125W F TC=0+-50	P01078	PR8494-68.83
A8R80	0699-1482	5	1	RESISTOR 153.8 .5% .125W F TC=0+-50	P01078	PR8494-153.8
A8R81-R82	0699-1479	0		RESISTOR 68.83 .5% .125W F TC=0+-50	P01078	PR8494-68.83
A8R83	0699-1482	5		RESISTOR 153.8 .5% .125W F TC=0+-50	P01078	PR8494-153.8
A8R84-R85	0699-1479	0		RESISTOR 68.83 .5% .125W F TC=0+-50	P01078	PR8494-68.83
A8R86	0699-1482	5		RESISTOR 153.8 .5% .125W F TC=0+-50	P01078	PR8494-153.8
A8R87	0699-1479	0		RESISTOR 68.83 .5% .125W F TC=0+-50	P01078	PR8494 68.83
A8R88	0699-1480	3		RESISTOR 100 .5% .125W F TC=0+-50	P01078	PR8494-100
A8R90-R101	0683-3905	8	12	RESISTOR 39 5% .25W CF TC=0-400	77902	R-25J
A8R102-R103	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A8R110	0683-1035	1	5	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A8R111	0683-1045	3	3	RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A8R112	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A8R113	0698-3497	4	1	RESISTOR 6.04K 1% .125W F TC=0+-100	19701	SFR25H
A8R114	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A8R115	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A8R116	0683-2725	0	1	RESISTOR 2.7K 5% .25W CF TC=0-400	77902	R-25J
A8R117	0683-1045	3		RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A8R120	0683-3615	7	2	RESISTOR 360 5% .25W CF TC=0-400	77902	R-25J
A8R121-R122	0683-2715	6	2	RESISTOR 270 5% .25W CF TC=0-400	77902	R-25J
A8R123	0699-1903	5	1	R-F 51.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R124	0683-3615	7		RESISTOR 360 5% .25W CF TC=0-400	77902	R 25J
A8R125	0699-2054	9	5	R-F 100 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A8R126	0699-1968	2	2	R-F 68.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R127	0699-2054	9		R-F 100 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A8R128	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A8R129	0699-2030	1		R-F 17.8 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R130	0698-7223	2		RESISTOR 287 1% .05W F TC=0+-100	24546	CT3
A8R131	0699-2054	9		R-F 100 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A8R132	0699-1968	2		R-F 68.1 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R133	0699-2054	9		R-F 100 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A8R140	0757-0449	6	3	RESISTOR 20K 1% .125W F TC=0+-100	19701	SFR25H
A8R142	2100-3056	8	2	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89PR5K
A8R143	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	19701	SFR25H
A8R144	2100-3056	8	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89PR5K
A8R145	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A8R146	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	19701	SFR25H
A8R147	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	19701	SFR25H
A8R148	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	19701	SFR25H
A8R149-R150	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A8R151	0699-2054	9		R-F 100 OHM 1% 1/20W HF04 T0	91637	CMF-50-21
A8R153-R155	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A8R156	2100-3109	2	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	73138	89PR2K
A8R157	2100-3056	8		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	73138	89PR5K
A8R158	0698-0083	8	1	RESISTOR 1.96K 1% .125W F TC=0+-100	19701	SFR25H

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A8R159-R160	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A8R161	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A8R162-R163	0698-4123	5		RESISTOR 499 1% .125W F TC=0+-100	19701	SFR25H
A8R164	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A8R165	0683-4745	6	3	RESISTOR 470K 5% .25W CF TC=0-800	77902	R-25J
A8R166	0683-1045	3		RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A8R167	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A8R170	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A8R171	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A8R172	0698-4442	1	1	RESISTOR 4.42K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R180	0683-1055	5		RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A8R181-R182	0683-4745	6		RESISTOR 470K 5% .25W CF TC=0-800	77902	R-25J
A8R190	0683-1015	7	1	RESISTOR 100 5% .25W CF TC=0-400	77902	R-25J
A8R191	0698-4381	7	1	RESISTOR 48.7 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R192	0757-0415	6	1	RESISTOR 475 1% .125W F TC=0+-100	19701	SFR25H
A8R193	0698-3228	9		RESISTOR 49.9K 1% .125W F TC=0+-100	19701	SFR25H
A8R194	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	19701	SFR25H
A8R200	0699-2069	6		R-F 13.3 OH 1% 1/20W HF04 T0	91637	CMF-50-21
A8R210-R211	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	19701	SFR25H
A8R300-R307	0683-2015	9	8	RESISTOR 200 5% .25W CF TC=0-400	77902	R-25J
A8R310-R311	0683-2215	1		RESISTOR 220 5% .25W CF TC=0-400	77902	R-25J
A8R320	0698-3264	3	1	RESISTOR 11.8K 1% .125W F TC=0+-100	19701	SFR25H
A8R321	0698-4492	1	1	RESISTOR 32.4K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A8R322	0757-0453	2	1	RESISTOR 30.1K 1% .125W F TC=0+-100	19701	SFR25H
A8R323	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+-100	19701	SFR25H
A8R324	0698-4307	7	1	RESISTOR 14.3K 1% .125W F TC=0+-100	19701	SFR25H
A8R325	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	20940	106
A8R330-R331	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A8R332	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A8TP1-TP14	1251-0600	0	14	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A8U1-U3	1826-0043	4	1	IC OP AMP GP TO-99 PKG	27014	SL160762
A8U4-U5	1826-0139	9	2	IC OP AMP GP DUAL 8-DIP-P PKG	04713	SC25137P1
A8U6	1858-0047	5	1	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A8U7	1826-0412	1	1	IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	SL33675
A8U8	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN53243N
A8U9	1813-0215	5	1	IC WIDEBAND AMPL TO-39 PKG	04713	SWA133
A8U10	1813-0216	6	1	IC WIDEBAND AMPL TO-39 PKG	04713	SWA130
A8U11	0955-0193	7	1	MIX MWAV FC217-ZTF 200MHZ 3	L01065	FC217-ZTF
A8U13	0955-0095	8	1	MIX MWAV SRA-1-85 500MHZ 8	M0104B	SRA-1-85
A8U14	1813-0215	5		IC WIDEBAND AMPL TO-39 PKG	04713	SWA133
A8U15	1820-1934	2	1	D/A 8-BIT 16-CERDIP BPLR	06665	DAC-08 096Q
A8U16	1820-1730	6	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN58039N
A8U17	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN58039N
A8U18	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN53518N
A8U19	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN53504N
A8U20-U21	1826-0222	1	2	IC OP AMP GP QUAD 14-DIP-P PKG	07933	RC4136DB
A8U190	1826-0109	3	1	IC OP AMP WB TO-99 PKG	34371	HA2-2625 B3053-032
A8U200	1826-0147	9	1	IC V RGLTR-FXD-POS 11.5/12.5V TO-220 PKG	04713	SC25174P1
A8W1-W6	1251-1636	4	5	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	71279	450-3368-01-03-00
A8W1-W6	1258-0214	6	1	CON-JUMPER WIRE PLUG-SHORTING	71279	461-2872-01-03-16
A8W7	1251-4047	7	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-05-2031
A8W8	1251-4822	6	1	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A11	**03577-66511**	**4**	**1**	**PRINTED CIRCUIT BOARD-ASSEMBLY**	**28480**	**03577-66511**
A11C1-C4	0160-4571	8	40	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A11C5	0160-6511	0	1	C-F 15PF 5% 200V CERMLr	28480	RPE121-978C0G150J200V
A11C5-C29	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A11C30	0180-0229	7	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	13606	150D336X9010B2-DYS
A11C31-C32	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A11C33	0160-6507	4	1	C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A11C34-C44	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A11H1-H3	1258-0141	8	3	CON-JUMPER REM .025P	00779	530153-2
A11J2	1250-0543	8	1	CONNECTOR-RF SM-SNP M PC 50-OHM	98291	51-053-0000-226
A11J3	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	28480	1251-5202
A11L1	9100-1791	1	1	CORE-FERRITE CHOKE-WIDEBAND;IMP:>380	02114	VK200-19/4B
A11L2	9100-3345	5	1	INDUCTOR RF-CH-MLD 2UH 5% .166DX.385LG	24226	15M201J
A11R1-R4	0683-1025	9	1	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A11R5-R6	0683-2025	1	3	RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A11R9-R10	0683-4725	2	9	RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A11R11	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A11R12	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A11R13	0683-1035	1	1	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A11R14	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A11R17-R22	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A11RP1-RP2	1810-0280	8	2	NETWORK-RES 10-SIP 10.0K OHM X 9	91637	CSC10A01-103G/MSP10A01-103G
A11RP3-RP4	1810-0338	7	2	NETWORK-RES 16-DIP 100.0 OHM X 8	11236	761-3-R100
A11TP1-TP9	1251-0600	0	9	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A11U1	03577-60301	8	1	PRGMD PROM	28480	03577-60301
A11U1	1816-1572	5	1	IC TTL S 16384 (16K) PROM 35-NS 3-S	34335	AM27S191ADC
A11U2	03577-60302	9	1	PRGMD PROM	28480	03577-60302
A11U2	1816-1572	5	1	IC TTL S 16384 (16K) PROM 35-NS 3-S	34335	AM27S191ADC
A11U3	03577-60303	0	1	PRGMD PROM	28480	03577-60303
A11U3	1816-1572	5	1	IC TTL S 16384 (16K) PROM 35-NS 3-S	34335	AM27S191ADC
A11U4	03577-60304	1	1	PRGMD PROM	28480	03577-60304
A11U4	1816-1572	5	1	IC TTL S 16384 (16K) PROM 35-NS 3-S	34335	AM27S191ADC
A11U5	03577-60305	2	1	PRGMD PROM	28480	03577-60305
A11U5	1816-1572	5	1	IC TTL S 16384 (16K) PROM 35-NS 3-S	34335	AM27S191ADC
A11U6	03577-60306	3	1	PRGMD PROM	28480	03577-60306
A11U6	1816-1572	5	1	IC TTL S 16384 (16K) PROM 35-NS 3-S	34335	AM27S191ADC
A11U7-U12	1820-1677	0	9	IC FF TTL S D-TYPE OCTL	01295	SN88182N
A11U13-U14	1820-0998	6	2	IC MUXR/DATA-SEL TTL S 4-TO-1-LINE DUAL	01295	SN37508N
A11U15	1820-2378	0	1	IC-MICROPROGRAM CONTROLLER, 4K RANGE	34335	AM2910ADC
A11U16	1820-0694	9	1	IC GATE TTL S EXCL-OR QUAD 2-INP	01295	SN41018N
A11U17-U18	1820-1302	8	2	IC MUXR/DATA-SEL TTL S 8-TO-1-LINE 8-INP	01295	SN48018N
A11U19-U20	1820-2565	7	2	IC BFR TTL S LINE DRVR OCTL	34335	AM74S244N
A11U21	1820-1306	1	1	IC GEN TTL S LOOK-AHD-CRY	01295	SN48032
A11U22	1820-2287	0	2	IC MUXR/DATA-SEL TTL S 4-TO-1-LINE DUAL	27014	SD41869
A11U23	1820-1677	0		IC FF TTL S D-TYPE OCTL	01295	SN88182N
A11U24-U27	1820-2422	5	4	IC-BIT SLICE; 8 FUNCT ALU; 2 PORT	27014	SD42151
A11U28	1820-1319	7	2	IC MUXR/DATA-SEL TTL S 8-TO-1-LINE 8-INP	01295	SN84048N
A11U29	1820-0681	4	2	IC GATE TTL S NAND QUAD 2-INP	01295	SN24649N
A11U30	1820-1072	9	1	IC DCDR TTL S 2-TO-4-LINE DUAL 2-INP	01295	SN43265N
A11U31	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A11U32	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN57383N
A11U33-U34	1820-1278	7	4	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN53646N
A11U35	1820-1430	3	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN57191N
A11U36	1820-0693	8	2	IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN24661N
A11U37-U39	1820-1216	3	3	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN53522N
A11U40	1820-1322	2	1	IC GATE TTL S NOR QUAD 2-INP	01295	SN84050N
A11U41-U42	1820-1278	7		IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN53646N
A11U43	1820-1641	8	1	IC DRVR TTL LS BUS HEX 1-INP	01295	SN57698N
A11U44	1820-0683	6	2	IC INV TTL S HEX 1-INP	01295	SN24651N
A11U45	1820-1319	7		IC MUXR/DATA-SEL TTL S 8-TO-1-LINE 8-INP	01295	SN84048N
A11U46-U47	1820-1794	2	2	IC BFR TTL LS NON-INV OCTL	27014	SD32700
A11U48	1820-0683	6		IC INV TTL S HEX 1-INP	01295	SN24651N
A11U49	1820-1158	2	1	IC GATE TTL S AND-OR-INV DUAL 2-INP	01295	SN47460N
A11U50	1820-0681	4		IC GATE TTL S NAND QUAD 2-INP	01295	SN24649N
A11U51-U52	1820-1997	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	27014	GDEA105
A11U53	1820-2287	0		IC MUXR/DATA-SEL TTL S 4-TO-1-LINE DUAL	27014	SD41869
A11U54-U55	1820-1677	0		IC FF TTL S D-TYPE OCTL	01295	SN88182N
A11U56	1820-2697	6	1	IC SHF-RGTR TTL F MULTI-MODE	07263	SL82691
A11U57	1820-0688	1	1	IC GATE TTL S NAND DUAL 4-INP	01295	SN24656N
A11U58	1820-1275	4	1	IC GATE TTL S NOR DUAL 5-INP	01295	SN48015N
A11U59	1820-1470	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN53524N
A11U60	1820-0693	8		IC FF TTL S D-TYPE POS-EDGE-TRIG	01295	SN24661N
A11U61	1820-2634	1	1	IC INV TTL ALS HEX	01295	SN71332N
A11W1-W3	1251-6515	8	3	CONN-POST TYPE .100-PIN-SPCG 6-CONT	28480	1251-6515
A12	**03577-66512**	**5**	**1**	**PC BOARD ASSY TRACE MEMORY**	**28480**	**03577-66512**
A12BT1	1420-0278	7	1	BATTERY 2.9V .72A-HR LI/S-DIOX W-FLEX	P01121	B9511
A12C1	0160-4571	8	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A12C2	0180-2207	5	1	CAPACITOR-FXD 100UF+-10% 10VDC TA	13606	150D107X9010R2-DYS
A12C3-C8	0160-4571	8	16	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A12C9	0180-2207	5		CAPACITOR-FXD 100UF+-10% 10VDC TA	13606	150D107X9010R2-DYS
A12C10-C19	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A12CR1-CR2	1901-0535	9	1	DIODE-SCHOTTKY SM SIG	28480	1901-0535
A12CR3	1902-0946	8	1	DIODE-ZNR 3.3V 5% DO-35 PD=.4W TC=-.039%	04713	SZ30035-004
A12H1	03577-04112	1	1	SHTF COVER TRACY MEMO	28480	03577-04112
A12L1	9100-1791	1	1	CORE-FERRITE CHOKE-WIDEBAND;IMP:>360	02114	VK200-19/4B

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A12Q1	1853-0398	9	1	TRANSISTOR PNP SI PD=15W FT=65MHZ	04713	SJE1654
A12Q2	1854-0215	1	1	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A12R2	0683-8205	1	1	RESISTOR 82 5% .25W CF TC=0-400	77902	R-25J
A12R3	0683-2015	9	1	RESISTOR 200 5% .25W CF TC=0-400	77902	R-25J
A12R4	0683-4725	2	1	RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A12R5	0757-0450	9	1	RESISTOR 22.1K 1% .125W F TC=0+-100	19701	SFR25H
A12R9-R10	0683-1025	9	2	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A12R11	0683-1045	3	1	RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A12RP1	1810-0279	5	1	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-472G
A12TP1-TP3	1251-0600	0	3	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A12U1	1820-0681	4	1	IC GATE TTL S NAND QUAD 2-INP	01295	SN24649N
A12U3-U4	1820-1216	3	2	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN53522N
A12U5-U10	1818-3286	6	12	IC CMOS 16384 (16K) STAT RAM 200-NS 3-S	T01118	TC5516APL-2
A12U11	03577-60311	0	1	PROGRAMMED PROM	28480	03577-60311
A12U11	1816-1142	5	1	IC TTL S 4096 (4K) PROM 70-NS 3-S	18324	CK1753F
A12U12-U17	1818-3286	6		IC CMOS 16384 (16K) STAT RAM 200-NS 3-S	T01118	TC5516APL-2
A12U18	03577-60318	7	1	PRGMD PROM	28480	03577-60318
A12U18	1816-1142	5	1	IC TTL S 4096 (4K) PROM 70-NS 3-S	18324	CK1753F
A12U19	1820-2019	6	1	IC SCHMITT-TRIG CMOS HEX	04713	SC45114PK
A13	**03577-66513**	**6**	**1**	**PC BOARD ASSY MAIN PROCESSOR**	**28480**	**03577-66513**
A13C1	0160-4786	7	1	CAPACITOR-FXD 27PF +-5% 100VDC CER 0+-30	04222	SA101A270JAA
A13C2-C3	0160-3847	9	5	CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A13C4-C5	0160-4571	8	66	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A13C7	0180-0309	4	1	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A13C8-C9	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A13C10	0160-0161	4	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	84411	HEW-238M
A13C11	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A13C12	0180-0229	7	2	CAPACITOR-FXD 33UF+-10% 10VDC TA	13606	150D336X9010B2-DYS
A13C13-C73	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A13C74	0180-0229	7		CAPACITOR-FXD 33UF+-10% 10VDC TA	13606	150D336X9010B2-DYS
A13C75-C78	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A13CR1	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A13CR2	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	04713	SZ30016-1098
A13CR3	1902-0126	6	1	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.072%	04713	SZ30016-014
A13CR4	1990-1123	0	1	OPT LED LMP R AP LMP1301 TT1H	28480	1990-1123
A13CR5-CR6	1990-1124	1	1	OPT LED LMP Y AP LMP1401 TT1H	28480	1990-1124
A13CR7	1902-0946	8	1	DIODE-ZNR 3.3V 5% DO-35 PD=.4W TC=-.039%	04713	SZ30035-004
A13H1-H2	1258-0141	8	2	CON-JUMPER REM .025P	00779	530153-2
A13J1	1251-7229	3	1	CONN-POST TYPE .100-PIN-SPCG 26-CONT	56501	609-2607
A13J2	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	28480	1251-5202
A13L1	9100-1791	1	1	CORE-FERRITE CHOKE-WIDEBAND;IMP:>360	02114	VK200-19/4B
A13Q1	1854-0215	1	1	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A13Q2	1853-0398	9	1	TRANSISTOR PNP SI PD=15W FT=65MHZ	04713	SJE1654
A13Q3	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS3611
A13R1	0683-1025	9	3	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A13R2	0683-1035	1	2	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A13R3-R4	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A13R5	0683-4705	8	1	RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A13R6	0683-4725	2	12	RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A13R7	0698-4489	6	1	RESISTOR 28K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A13R8	0698-4472	7	1	RESISTOR 7.68K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A13R9	0698-4486	3	1	RESISTOR 24.9K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A13R10-R12	0683-1045	3	4	RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A13R13	0683-2735	0	1	RESISTOR 27K 5% .25W CF TC=0-400	77902	R-25J
A13R14	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A13R15	0683-1045	3		RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A13R16-R20	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A13R21	0683-3315	4	3	RESISTOR 330 5% .25W CF TC=0-400	77902	R-25J
A13R22-R23	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A13R24-R25	0683-3315	4		RESISTOR 330 5% .25W CF TC=0-400	77902	R-25J
A13R26-R29	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A13R31	0683-8205	1	1	RESISTOR 82 5% .25W CF TC=0-400	77902	R-25J
A13R32	0683-7525	6	1	RESISTOR 7.5K 5% .25W CF TC=0-400	77902	R-25J
A13R33	0683-2015	9	1	RESISTOR 200 5% .25W CF TC=0-400	77902	R-25J
A13R34	0757-0450	9	1	RESISTOR 22.1K 1% .125W F TC=0+-100	19701	SFR25H

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A13R35-R40	8159-0005	0	6	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	106
A13RP1-RP11	1810-0280	8	10	NETWORK-RES 10-SIP 10.0K OHM X 9	91637	CSC10A01-103G/MSP10A01-103G
A13S1	3101-2170	8	1	SWITCH-PB SPDT MOM	09353	8125-D8AE
A13SP1	0960-0483	9	1	ALRM-AUDIBLE	P01152	
A13TP1-TP8	1251-0600	0	8	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A13U1	1820-3532	0		IC-16 BIT MICROPROCESSOR /8 MHZ	04713	MC68000P8
A13U2	1820-2024	3	13	IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A13U3-U4	1820-2075	4	8	IC TRANSCEIVER TTL LS BUS OCTL	01295	SN59111N
A13U5-U7	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A13U9-U12	1820-1216	3	3	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN53522N
A13U13-U14	1820-2053	8	2	IC DCDR TTL LS BCD 4-TO-16-LINE	27014	SD34831
A13U15-U18	1818-3286	6	8	IC CMOS 16384 (16K) STAT RAM 200-NS 3-S	T01118	TC5516APL-2
A13U19	1818-3569	8	1	ICM MROM 23256 32Kx8 300NS P28	18324	23256A-30 CN84782N
A13U20	1818-3570	1	1	ICM MROM 23256 32Kx8 300NS P28	18324	23256A-30 CN84783N
A13U21	1818-3571	2	1	ICM MROM 23256 32Kx8 300NS P28	18324	23256A-30 CN84784N
A13U22	1818-3572	3	1	ICM MROM 23256 32Kx8 300NS P28	18324	23256A-30 CN84785N
A13U23	1818-3573	4	1	ICM MROM 23256 32Kx8 300NS P28	18324	23256A-30 CN84786N
A13U24	1818-3574	5	1	ICM MROM 23256 32Kx8 300NS P28	18324	23256A-30 CN84787N
A13U25	1818-3575	6	1	ICM MROM 23256 32Kx8 300NS P28	18324	23256A-30 CN84788N
A13U26	1818-3576	7	1	ICM MROM 23256 32Kx8 300NS P28	18324	23256A-30 CN84789
A13U31-U32	1820-3368	0	2	IC-8-BIT BIDIRECTIONAL I/O PORT	34335	AM2950DC
A13U33-U34	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN59111N
A13U35-U36	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A13U37-U38	1820-1112	8	6	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A13U39-U40	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN59111N
A13U41	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A13U42-U43	1820-2075	4		IC TRANSCEIVER TTL LS BUS OCTL	01295	SN59111N
A13U44-U45	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A13U46	1820-1851	2	1	IC ENCDR TTL LS	01295	SN70488N
A13U47	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A13U48	1826-1054	9	1	IC PL LOOP 16-DIP-P PKG	18324	CC3928
A13U49	1820-1194	6	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN53527N
A13U50	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A13U51	1820-1433	6	1	IC SHF-RGTR TTL LS R-S SERIAL-IN PRL-OUT	01295	SN57194N
A13U52	1820-1217	4	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN53523N
A13U53	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A13U54	1826-0412	1	1	IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	SL33675
A13U55	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN53243N
A13U56-U57	1820-1201	6	2	IC GATE TTL LS AND QUAD 2-INP	01295	SN53508N
A13U58	1820-1208	3	5	IC GATE TTL LS OR QUAD 2-INP	01295	SN53515N
A13U59	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN53509N
A13U60	1820-2096	9	3	IC CNTR TTL LS BIN DUAL 4-BIT	01295	SN59197N
A13U61	1820-1208	3		IC GATE TTL LS OR QUAD 2-INP	01295	SN53515N
A13U62	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A13U63	1826-0205	0	1	IC TIMER TTL	18324	NE556N
A13U64	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN53506N
A13U65	1820-1200	5	1	IC INV TTL LS HEX	01295	SN53507N
A13U66	1820-1197	9	2	IC GATE TTL LS NAND QUAD 2-INP	01295	SN53504N
A13U67	1820-2019	6	1	IC SCHMITT-TRIG CMOS HEX	04713	SC45114PK
A13U68	1820-1208	3		IC GATE TTL LS OR QUAD 2-INP	01295	SN53515N
A13U69	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN53504N
A13U70	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A13U71-U72	1818-3286	6		IC CMOS 16384 (16K) STAT RAM 200-NS 3-S	T01118	TC5516APL-2
A13U77-U78	1820-2096	9		IC CNTR TTL LS BIN DUAL 4-BIT	01295	SN59197N
A13U79	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A13U80	1820-1208	3		IC GATE TTL LS OR QUAD 2-INP	01295	SN53515N
A13U81-U82	1818-3286	6		IC CMOS 16384 (16K) STAT RAM 200-NS 3-S	T01118	TC5516APL-2
A13U83-U84	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A13U85	1820-1568	8	1	IC BFR TTL LS BUS QUAD	01295	SN57451N
A13U86	1820-1208	3		IC GATE TTL LS OR QUAD 2-INP	01295	SN53515N
A13W1-W2	1251-4822	6	2	CONN-POST TYPE .100-PIN-SPCG 3-CONT	27264	22-03-2031
A15	**03577-66515**	**8**	**1**	**PC BOARD ASSY KEYBOARD**	**28480**	**03577-66515**
A15C1-C10	0160-4571	8	10	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A15CR1-CR4	1990-0485	5	1	LED-LAMP LUM-INT=2MCD IF=30MA-MAX BVR=5V	28480	1990-0485
A15CR5-CR16	1990-0487	7	12	LED-LAMP LUM-INT=2MCD BVR=5V	28480	1990-0487
A15J1	1251-4429	9	1	CONN-POST TYPE .100-PIN-SPCG 20-CONT	76381	3492-1002
A15J2	1251-5041	3	1	CONN-POST TYPE .100-PIN-SPCG 5-CONT	28480	1251-5041

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A15R1	0683-1035	1	1	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A15R2	0683-1315	0	1	RESISTOR 130 5% .25W CF TC=0-400	77902	R-25J
A15R3-R6	0683-3915	0	4	RESISTOR 390 5% .25W CF TC=0-400	77902	R-25J
A15RP1-RP2	1810-0279	5	2	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-472G
A15RP3-RP4	1810-0271	7	2	NETWORK-RES 10-SIP 200.0 OHM X 9	91637	CSC10A01-201G/MSP10A01-201G
A15RPG	5061-8008	9	1	RPG CABLE ASSEMBLY	28480	5061-8008
A15SW1-SW52	5060-9436	7	52	SW--PB BILL WEST	28480	5060-9436
A15TP1-TP2	1251-0600	0	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A15U1-U2	1820-2024	3	2	IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A15U3	1820-1208	3	1	IC GATE TTL LS OR QUAD 2-INP	01295	SN53515N
A15U4	1820-1997	7	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	27014	GDEA105
A15U5	1820-1194	6	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN53527N
A15U6	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A15U8	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN53504N
A15U9-U10	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	27014	GDEA105
A16	**03577-66516**	**9**	**1**	**PC BOARD ASSY HPIB**	**28480**	**03577-66516**
A16C1	0160-4571	8	9	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A16C2	0180-1746	5	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A16C3	0160-3847	9	5	CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A16C4-C6	0160-6516	5	22	C-F .022UF 20% 100V CERMLr	28480	RPE121-978X7R223M100V
A16C8	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A16C9	0160-6519	8	1	C-F 470PF 20% 100V CERMLr	28480	RPE121-978X7R471M100V
A16C10-C12	0160-6516	5		C-F .022UF 20% 100V CERMLr	28480	RPE121-978X7R223M100V
A16C13	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	150D156X9020B2-DYS
A16C14	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A16C15	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A16C16-C23	0160-6516	5		C-F .022UF 20% 100V CERMLr	28480	RPE121-978X7R223M100V
A16C24-C25	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A16C26-C29	0160-6516	5		C-F .022UF 20% 100V CERMLr	28480	RPE121-978X7R223M100V
A16C30	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A16C31	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A16C32	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A16C33-C36	0160-6516	5		C-F .022UF 20% 100V CERMLr	28480	RPE121-978X7R223M100V
A16C37-C38	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A16C39-C40	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A16C41	0160-6507	4	1	C-F 1000PF 20% 100V CERMLr	28480	RPE121-978X7R102M100V
A16CR1-CR2	1990-1122	9	1	OPT LED LMP G GP LMP1503 TT1H	28480	1990-1122
A16E1	03577-04114	3	1	SHTF COVER PLATE-HPIB	28480	03577-04114
A16EP1-EP2	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	73957	GP24-063 X 250-17
A16J1	1251-8517	4	1	CONN-RECT MICRORBN 24-CKT 24-CONT	00779	554194-2
A16J3	1251-5202	8	1	CONN-POST TYPE .125-PIN-SPCG 5-CONT	28480	1251-5202
A16L1-L2	9100-1791	1	1	CORE-FERRITE CHOKE-WIDEBAND;IMP:>360	02114	VK200-19/4B
A16R1	0698-0083	8	3	RESISTOR 1.96K 1% .125W F TC=0+-100	19701	SFR25H
A16R2	0698-0084	9	3	RESISTOR 2.15K 1% .125W F TC=0+-100	19701	SFR25H
A16R3-R4	0683-4715	0	3	RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A16R5	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	19701	SFR25H
A16R6-R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	19701	SFR25H
A16R8	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	19701	SFR25H
A16R9	0683-4725	2	2	RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A16R10	0683-1025	9	1	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A16R11-R12	0683-2215	1	2	RESISTOR 220 5% .25W CF TC=0-400	77902	R-25J
A16R20	0683-4715	0		RESISTOR 470 5% .25W CF TC=0-400	77902	R-25J
A16R21	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A16RP1-RP6	1810-0722	3	6	R-N 120 OHMx4 2% SIP	91637	CSC08A03-121G/MSP08A03-121G
A16TP1-TP5	1251-0600	0	5	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A16U1	1820-2024	3	4	IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A16U2-U3	1820-1112	8	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A16U4	9100-4394	6	6	XFM WIREWND PLS DIP PKG	97722	EP8847
A16U5-U6	1820-1440	5	7	IC LCH TTL LS QUAD	01295	SN57201N
A16U7	9100-4394	6		XFM WIREWND PLS DIP PKG	97722	EP8847
A16U8	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A16U9	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN53030N
A16U10	1820-1196	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN53525N
A16U11	1820-1794	2	2	IC BFR TTL LS NON-INV OCTL	27014	SD32700
A16U12	1820-1997	7	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	27014	GDEA105
A16U13	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A16U14	9100-4394	6		XFM WIREWND PLS DIP PKG	97722	EP8847
A16U15-U16	1820-1440	5		IC LCH TTL LS QUAD	01295	SN57201N
A16U17	9100-4394	6		XFM WIREWND PLS DIP PKG	97722	EP8847
A16U18	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN58948N
A16U19	1820-1432	5	1	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN57193N
A16U20	1820-1440	5		IC LCH TTL LS QUAD	01295	SN57201N
A16U21	1820-2548	6	1	IC-GENERAL PURPOSE INTERFACE BUS ADAPTER	01295	MP9203NL
A16U22	1820-2483	8	1	IC RCVR TTL LS BUS OCTL	01295	SN100105N
A16U23	1820-2485	0	1	IC TRANSCEIVER TTL LS INSTR-BUS IEEE-488	01295	SN100104N
A16U24	9100-4394	6		XFM WIREWND PLS DIP PKG	97722	EP8847
A16U25-U26	1820-1440	5		IC LCH TTL LS QUAD	01295	SN57201N
A16U27	9100-4394	6		XFM WIREWND PLS DIP PKG	97722	EP8847
A16U28	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	27014	GDEA105
A16U29	1820-1794	2		IC BFR TTL LS NON-INV OCTL	27014	SD32700
A16U30	1990-0545	8	1	OPTO-ISOLATOR LED-PDIO/XSTR IF=40MA-MAX	28480	1990-0545
A20	**03577-66520**	**5**	**1**	**PC BOARD ASSY MOTHER BD**	**28480**	**03577-66520**
A20C1-C2	0160-6506	3	2	C-F .1UF 20% 50V CERMLr	28480	RPE121-978Z5U104M50V
A20J1-J8	1251-1365	6	10	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-301
A20J11	1251-5160	7	2	CONNECTOR-PC EDGE 36-CONT/ROW 2-ROWS	S01071	ESM36DRXN
A20J12	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-301
A20J13	1251-2915	4	1	CONNECTOR-PC EDGE 25-CONT/ROW 2-ROWS	71785	252-25-30-301
A20J14	1251-5160	7		CONNECTOR-PC EDGE 36-CONT/ROW 2-ROWS	S01071	ESM36DRXN
A20J15	1251-4634	8	1	CONN-POST TYPE .100-PIN-SPCG 20-CONT	76381	3492-2002
A20J16	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	252-22-30-301
A20J22	1251-4836	2	1	CONN-POST TYPE 2.5-PIN-SPCG 2-CONT	27264	22-12-1022
A20J26	1251-4837	3	1	CONN-POST TYPE 2.5-PIN-SPCG 4-CONT	27264	22-12-1042
A21	**03577-66521**	**6**	**1**	**PC BOARD ASSY PWR SUPPLY**	**28480**	**03577-66521**
A21C1	0150-0012	3	1	CAPACITOR-FXD .01UF +-20% 1KVDC CER	59660	818-584 Z5U 103M
A21C2-C3	0180-3389	6	2	CAPACITOR-FXD 1200UF+50-10% 250VDC AL	13606	36DX122F250AE2A
A21C4-C5	0160-4835	7	4	CAPACITOR-FXD .1UF +-10% 50VDC CER	04222	SA305C104KAA
A21C6-C7	0160-4914	3	1	CAPACITOR-FXD 470PF +-10% 600VDC POLYE	84411	636.2 471 10% 600V
A21C8-C9	0160-0314	9	1	CAPACITOR-FXD .01UF +-5% 400VDC POLYE	84411	663UW
A21C11-C12	0160-4913	2	1	CAPACITOR-FXD 1800PF +-10% 600VDC POLYE	84411	HEW-761
A21C13	0180-2944	7	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	13606	
A21C14	0160-3560	3	1	CAPACITOR-FXD 1UF +-2% 100VDC MET-POLYC	84411	HEW-249
A21C16-C20	0160-4571	8	23	CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A21C21	0160-2414	4	1	CAPACITOR-FXD .022UF +-5% 200VDC POLYE	84411	HEW-238M
A21C22	0160-0300	3	1	CAPACITOR-FXD 2700PF +-10% 200VDC POLYE	84411	HEW-238M
A21C23	0160-0170	5	1	CAPACITOR-FXD .22UF +80-20% 50VDC CER	13606	2C37Z5U224Z050A
A21C24	0160-0180	7	1	CAPACITOR-FXD .033UF +-5% 200VDC POLYE	84411	HEW-238M
A21C25	0160-3335	0	1	CAPACITOR-FXD 470PF +-10% 100VDC CER	13606	292CX7R471K100B
A21C28-C53	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A21C54	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	13606	150D685X9035B2-DYS
A21C55	0160-4801	7	1	CAPACITOR-FXD 100PF +-5% 100VDC CER	04222	SA101A101JAA
A21C56	0160-4682	2	1	CAPACITOR-FXD 1000PF +-2.5% 160VDC POLYP	25088	B33062-A1102-H
A21C57	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A21C58	0180-0309	4	1	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	13606	150D475X0010A2-DYS
A21C59	0180-0374	3	7	CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A21C60	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	13606	150D685X9035B2-DYS
A21C61-C63	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A21C70	0170-0040	9	1	CAPACITOR-FXD .047UF +-10% 200VDC POLYE	84411	HEW-238M
A21C71	0180-3368	1	1	CAPACITOR-FXD 3300UF+100-10% 20VDC AL	13606	674D338H020HL5A
A21C72	0160-6510	9	1	C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A21C80	0160-4915	4	1	CAPACITOR-FXD 3000PF +-5% 600VDC POLYE	84411	HEW-761
A21C81-C86	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A21C87	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A21C88-C89	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A21C90-C91	0180-3366	9	4	CAPACITOR-FXD 180UF+100-10% 60VDC AL	13606	674D187H060HE5A
A21C92-C93	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A21C94-C95	0180-3366	9		CAPACITOR-FXD 180UF+100-10% 60VDC AL	13606	674D187H060HE5A
A21C96	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A21C97	0180-2076	5	1	CAPACITOR-FXD 68UF+50-10% 100VDC AL	13606	674D686F100HE5A
A21C98	0180-2771	8	1	CAPACITOR-FXD 110UF+100-20% 30VDC AL	13606	672D153
A21C99	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A21C100	0180-3367	0	1	CAPACITOR-FXD 470UF+100-10% 40VDC AL	13606	674D477H040HE5A
A21C101	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A21C102-C104	0160-4914	3		CAPACITOR-FXD 470PF +-10% 600VDC POLYE	84411	636.2 471 10% 600V

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A21C105-C108	0160-6510	9		C-F .1UF 20% 50V CERMLr	28480	RPE121-978X7R104M50V
A21C109	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M050A
A21C110-C111	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A21C112	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	13606	2C37Z5U105M050A
A21C114-C116	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A21C117	0180-0210	6	1	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	13606	150D335X0015A2-DYS
A21C120	0180-3078	0	1	CAPACITOR-FXD 1000UF+50-10% 50VDC AL	62643	SL50VB1000
A21C121	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A21C122	0180-2986	7	1	CAPACITOR-FXD 330UF+-20% 50VDC AL	62643	SMC50VB331M12X20
A21C123	0160-4571	8		CAPACITOR-FXD .1UF +80-20% 50VDC CER	04222	SA105E104ZAA
A21C124-C125	0180-0374	3		CAPACITOR-FXD 10UF+-10% 20VDC TA	13606	150D106X9020B2-DYS
A21CR2	1902-0945	7	2	DIODE-ZNR 3V 5% DO-35 PD=.4W TC=-.043%	04713	SZ30035-003
A21CR3	1901-0050	3	22	DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR5	1902-0945	7		DIODE-ZNR 3V 5% DO-35 PD=.4W TC=-.043%	04713	SZ30035-003
A21CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR7	1906-0080	9	1	DIODE-FW BRDG 600V 10A	27777	VJ647
A21CR10	1902-0777	3	1	DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.4W	04713	SZ14376RL
A21CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR14	1990-1124	1	1	OPT LED LMP Y AP LMP1401 TT1H	28480	1990-1124
A21CR17	1884-0317	7	1	THY SCR	P01202	C203YY
A21CR20	1902-0953	7	2	DIODE-ZNR 6.2V 5% DO-35 PD=.4W TC=+.053%	04713	SZ30035-11RL
A21CR21	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR22	1990-1124	1		OPT LED LMP Y AP LMP1401 TT1H	28480	1990-1124
A21CR23-CR26	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR30-CR31	1902-0950	4	2	DIODE-ZNR 4.7V 5% DO-35 PD=.4W TC=+.025%	04713	SZ30035-008
A21CR33-CR36	1901-0026	3	4	DIODE-PWR RECT 200V 750MA DO-29	04713	SR1358-8BRL
A21CR40	1906-0278	7	1	DIODE-CT-RECT 50V 60A	27777	VSK231
A21CR41	1990-1122	9	1	OPT LED LMP G GP LMP1503 TT1H	28480	1990-1122
A21CR42	1901-0673	6	1	DIODE-PWR RECT 100V 5A 5US	T01118	
A21CR45-CR46	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR50	1906-0277	6	1	DIODE-CT-RECT 300V 30A	9N171	UES2605
A21CR52-CR53	1901-1108	4	1	DIODE-SWITCHING 300V 3A 50NS	9N171	UES1305
A21CR57-CR59	1901-0704	4	3	DIODE-GEN PRP 1N4002 100V 1A DO-41	P01202	1N4002
A21CR60	1901-0049	0	1	DIODE-PWR RECT 50V 750MA DO-29	04713	SR1358-6B
A21CR61	1901-0673	6		DIODE-PWR RECT 100V 5A 5US	T01118	
A21CR62	1990-1122	9		OPT LED LMP G GP LMP1503 TT1H	28480	1990-1122
A21CR63	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR64	1901-0673	6		DIODE-PWR RECT 100V 5A 5US	T01118	
A21CR65	1990-1122	9		OPT LED LMP G GP LMP1503 TT1H	28480	1990-1122
A21CR70	1901-0669	0	1	DIODE-PWR RECT 400V 1A 150NS	14099	SS2676
A21CR71-CR72	1901-1112	0	1	DIODE-SWITCHING 150V 2A 25NS	25403	BYV27-150
A21CR73	1901-0669	0		DIODE-PWR RECT 400V 1A 150NS	14099	SS2676
A21CR74-CR75	1901-1112	0		DIODE-SWITCHING 150V 2A 25NS	25403	BYV27-150
A21CR76	1902-0522	6	1	DIODE-ZNR 1N5340B 6V 5% PD=5W IR=1UA	04713	SZP40117
A21CR81	1902-0958	2	1	DIODE-ZNR 10V 5% DO-35 PD=.4W TC=+.075%	04713	SZ30035-16RL
A21CR82	1902-0589	5	2	DIODE-ZNR 10V 2% DO-35 PD=.4W TC=+.066%	04713	SZ11651
A21CR84	1990-1124	1		OPT LED LMP Y AP LMP1401 TT1H	28480	1990-1124
A21CR85	1884-0317	7		THY SCR	P01202	C203YY
A21CR86-CR89	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR90	1902-0589	5		DIODE-ZNR 10V 2% DO-35 PD=.4W TC=+.066%	04713	SZ11651
A21CR91	1902-0953	7		DIODE-ZNR 6.2V 5% DO-35 PD=.4W TC=+.053%	04713	SZ30035-11RL
A21CR92	1990-1124	1		OPT LED LMP Y AP LMP1401 TT1H	28480	1990-1124
A21CR93	1884-0317	7		THY SCR	P01202	C203YY
A21CR94	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR95	1990-1123	0	1	OPT LED LMP R AP LMP1301 TT1H	28480	1990-1123
A21CR96	1884-0317	7		THY SCR	P01202	C203YY
A21CR97	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR98	1902-3160	4	1	DIODE-ZNR 10V 2% DO-35 PD=.4W TC=+.06%	04713	SZ30016-11B3
A21CR100	1990-1123	0		OPT LED LMP R AP LMP1301 TT1H	28480	1990-1123
A21CR101	1884-0317	7		THY SCR	P01202	C203YY
A21CR102	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR103	1990-1123	0		OPT LED LMP R AP LMP1301 TT1H	28480	1990-1123
A21CR104	1884-0317	7		THY SCR	P01202	C203YY
A21CR105	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21CR106	1990-1123	0		OPT LED LMP R AP LMP1301 TT1H	28480	1990-1123
A21CR107	1884-0317	7		THY SCR	P01202	C203YY
A21CR110-CR113	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	07263	FDH 6308
A21F3-F5	2110-0001	8	3	FUSE 1A 250V NTD 1.25X.25 UL	75915	312 001
A21J1	1251-5863	7	1	CONN-POST TYPE 2.5-PIN-SPCG 5-CONT	27264	22-11-1051
A21J2	1251-5862	6	1	CONN-POST TYPE 2.5-PIN-SPCG 4-CONT	27264	22-11-1041

See introduction to this section for ordering information
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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A21J3-J5	1251-6932	3	3	CONN-POST TYPE 2.5-PIN-SPCG 3-CONT	27264	22-11-1031
A21J6	1251-6091	5	1	CONN-POST TYPE 2.5-PIN-SPCG 2-CONT	27264	22-11-1021
A21J8	03577-61639	7	1	CBL-ASM DSC MHSG/STP 085MM ML	28480	
A21J8	8150-2150	2	0	WIRE 12AWG G 600V PVC 65X30 105C	J01037	
A21J8	8150-2153	5	0	WIRE 12AWG BK 600V PVC 65X30 105C	J01037	
A21J10	1251-6310	1	1	CONN-UTIL METMAT 6-CKT 6-CONT	00779	207583-5
A21L1	03577-60334	7	1	IND TOROID SW 50UH 21A	28480	03577-60334
A21L2	03577-60338	1	1	IND TOROID SW 200UH 5A	28480	03577-60338
A21L3	03577-60333	6	1	IND TOROID SW 60UH 5A	28480	03577-60333
A21L4	03577-60337	0	1	IND TOROID SW 200UH 2A	28480	03577-60337
A21L5	03577-60332	5	1	IND POT CORE FIX 62UH 1.6A	28480	03577-60332
A21L6	03577-60336	9	1	IND TOROID SW 2.5MH .6A	28480	03577-60336
A21L7-L8	03577-60335	8	2	IND TOROID SW 500UH 1A	28480	03577-60335
A21MP21	2110-0643	4	3	FUSEHOLDER-CLIP TYPE 15A 250 V	E01120	FH-8000
A21MP22	2110-0643	4		FUSEHOLDER-CLIP TYPE 15A 250 V	E01120	FH-8000
A21MP23	2110-0643	4		FUSEHOLDER-CLIP TYPE 15A 250 V	E01120	FH-8000
A21Q1-Q2	1855-0536	1	2	TRANSISTOR MOSFET N-CHAN E-MODE TO-3 SI	04713	STM3007
A21Q12	1853-0086	2	1	TRANSISTOR PNP SI PD=310MW FT=40MHZ	04713	SPS3322
A21Q13	1205-0250	9	1	THERMAL LINK SGL TO-5/TO-39-CS	05820	2604 TH 5E
A21Q13	1854-0263	9	1	TRANSISTOR NPN 2N3019 SI TO-39 PD=800MW	04713	ST1481
A21Q14	1853-0320	7	1	TRANSISTOR PNP 2N4032 SI TO-5 PD=800MW	07263	S44044
A21Q15	1854-0210	6	1	TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	ST1269
A21Q21	1853-0203	5	1	TRANSISTOR PNP SI PD=360MW FT=700MHZ	04713	SS5651
A21Q22	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	07263	S-6516
A21Q35-Q36	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	07263	S-6516
A21Q37	1853-0086	2		TRANSISTOR PNP SI PD=310MW FT=40MHZ	04713	SPS3322
A21Q38	1854-0087	5	1	TRANSISTOR NPN SI PD=360MW FT=75MHZ	13606	T-1260
A21R3	0699-1167	3	2	RESISTOR-FUSE 18 OHM +-1%; .5W AT 70 DEG	91637	CMF60-64
A21R4	0683-2025	1	2	RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A21R5	0699-1167	3		RESISTOR-FUSE 18 OHM +-1%; .5W AT 70 DEG	91637	CMF60-64
A21R6	0683-2025	1		RESISTOR 2K 5% .25W CF TC=0-400	77902	R-25J
A21R7-R8	0698-3624	9	1	RESISTOR 150 5% 2W MO TC=0+-200	102360	GS-3
A21R9-R10	0686-4725	8	1	RESISTOR 4.7K 5% .5W CC TC=0+647	01121	EB4725
A21R12	0683-2725	8	5	RESISTOR 2.7K 5% .25W CF TC=0-400	77902	R-25J
A21R13	0683-1025	9	3	RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A21R14	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	19701	SFR25H
A21R15	0757-0280	3	5	RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A21R16	0698-3558	8	1	RESISTOR 4.02K 1% .125W F TC=0+-100	19701	SFR25H
A21R17	0698-3382	6	1	RESISTOR 5.49K 1% .125W F TC=0+-100	19701	SFR25H
A21R18	0683-3035	5	10	RESISTOR 30K 5% .25W CF TC=0-400	77902	R-25J
A21R19	0683-4725	2	4	RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A21R20	0683-1225	1	8	RESISTOR 1.2K 5% .25W CF TC=0-400	77902	R-25J
A21R21	0683-7515	4	1	RESISTOR 750 5% .25W CF TC=0-400	77902	R-25J
A21R22	2100-3252	6	1	RESISTOR-TRMR 5K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-502
A21R23	0683-1535	6	2	RESISTOR 15K 5% .25W CF TC=0-400	77902	R-25J
A21R24	0683-4325	8	1	RESISTOR 4.3K 5% .25W CF TC=0-400	77902	R-25J
A21R25	0683-2035	3	2	RESISTOR 20K 5% .25W CF TC=0-400	77902	R-25J
A21R26	0683-1235	3	1	RESISTOR 12K 5% .25W CF TC=0-400	77902	R-25J
A21R27	0683-3025	3	2	RESISTOR 3K 5% .25W CF TC=0-400	77902	R-25J
A21R28	0683-1045	3	1	RESISTOR 100K 5% .25W CF TC=0-400	77902	R-25J
A21R29-R30	0683-1335	4	3	RESISTOR 13K 5% .25W CF TC=0-400	77902	R-25J
A21R31	0683-1035	1	8	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A21R32	0683-5635	5	1	RESISTOR 56K 5% .25W CF TC=0-400	77902	R-25J
A21R33	0698-5439	8	2	RESISTOR 1K .25% .125W F TC=0+-50	19701	5033R
A21R34	0699-0033	0	2	RESISTOR 56.84K .25% .125W F TC=0+-50	19701	5033R
A21R35	0698-5439	8		RESISTOR 1K .25% .125W F TC=0+-50	19701	5033R
A21R36	0699-0033	0		RESISTOR 56.84K .25% .125W F TC=0+-50	19701	5033R
A21R37	0683-3625	9	8	RESISTOR 3.6K 5% .25W CF TC=0-400	77902	R-25J
A21R38	0683-3035	5		RESISTOR 30K 5% .25W CF TC=0-400	77902	R-25J
A21R39	0683-1225	1		RESISTOR 1.2K 5% .25W CF TC=0-400	77902	R-25J
A21R40	0698-4499	8	2	RESISTOR 54.9K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A21R41	0698-3572	6	2	RESISTOR 60.4K 1% .125W F TC=0+-100	19701	SFR25H
A21R42	0683-1535	6		RESISTOR 15K 5% .25W CF TC=0-400	77902	R-25J
A21R50	0757-0198	2	1	RESISTOR 100 1% .5W F TC=0+-100	19701	5053R
A21R51	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A21R52	0683-3035	5		RESISTOR 30K 5% .25W CF TC=0-400	77902	R-25J
A21R53	0757-0433	8	1	RESISTOR 3.32K 1% .125W F TC=0+-100	19701	SFR25H
A21R54	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A21R55	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A21R56	0683-1325	2	1	RESISTOR 1.3K 5% .25W CF TC=0-400	77902	R-25J

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A21R57	0698-3332	6	1	RESISTOR 60.6 1% .5W F TC=0+-100	19701	5053R
A21R80-R81	0683-2725	8		RESISTOR 2.7K 5% .25W CF TC=0-400	77902	R-25J
A21R83	0683-6215	9	1	RESISTOR 620 5% .25W CF TC=0-400	77902	R-25J
A21R84	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A21R85	0683-2725	8		RESISTOR 2.7K 5% .25W CF TC=0-400	77902	R-25J
A21R86	0698-4482	9	1	RESISTOR 17.4K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A21R87	0683-2725	8		RESISTOR 2.7K 5% .25W CF TC=0-400	77902	R-25J
A21R88	0683-5115	6	1	RESISTOR 510 5% .25W CF TC=0-400	77902	R-25J
A21R89	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A21R90	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A21R91	0683-3025	3		RESISTOR 3K 5% .25W CF TC=0-400	77902	R-25J
A21R92	0757-0403	2	1	RESISTOR 121 1% .125W F TC=0+-100	19701	SFR25H
A21R93	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+-100	19701	SFR25H
A21R94	0757-0282	5	2	RESISTOR 221 1% .125W F TC=0+-100	19701	SFR25H
A21R95	0757-0431	6	1	RESISTOR 2.43K 1% .125W F TC=0+-100	19701	SFR25H
A21R96-R97	8159-0005	0	2	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	20940	106
A21R98-R101	0698-3615	8	1	RESISTOR 47 5% 2W MO TC=0+-200	I02360	GS-3
A21R102	63312-80001	4	1	R-F SENSING .005	28480	63312-80001
A21R103	0766-0029	7	1	RESISTOR 10 2% 3W MO TC=0+-250	24546	FP-3
A21R104	0683-2215	1	1	RESISTOR 220 5% .25W CF TC=0-400	77902	R-25J
A21R105	0698-3618	1	1	RESISTOR 82 5% 2W MO TC=0+-200	I02360	GS-3
A21R106-R107	0698-3618	1		RESISTOR 82 5% 2W MO TC=0+-200	I02360	GS-3
A21R108	0757-0444	1	2	RESISTOR 12.1K 1% .125W F TC=0+-100	19701	SFR25H
A21R109	0757-0429	2	1	RESISTOR 1.82K 1% .125W F TC=0+-100	19701	SFR25H
A21R110-R111	0698-3633	0	1	RESISTOR 390 5% 2W MO TC=0+-200	I02360	GS-3
A21R112	0812-0049	0	1	RESISTOR 500 5% 2W PW TC=0+-20	91637	RS-2B-136
A21R114	0698-3633	0		RESISTOR 390 5% 2W MO TC=0+-200	I02360	GS-3
A21R115	0699-1060	5	1	RESISTOR .05 1% 3W MFS TC=0+-337	01686	LO-3-0.05-1
A21R116	0699-1165	1	1	R-F .1 OHM 1%	01686	
A21R117	0698-3633	0		RESISTOR 390 5% 2W MO TC=0+-200	I02360	GS-3
A21R118	0757-0440	7	1	RESISTOR 7.5K 1% .125W F TC=0+-100	19701	SFR25H
A21R119	0757-0427	0	1	RESISTOR 1.5K 1% .125W F TC=0+-100	19701	SFR25H
A21R120	0757-0282	5		RESISTOR 221 1% .125W F TC=0+-100	19701	SFR25H
A21R121	0698-4432	9	1	RESISTOR 2.1K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A21R122	2100-3211	7	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-102
A21R123	0757-0283	6	1	RESISTOR 2K 1% .125W F TC=0+-100	19701	SFR25H
A21R124	2100-0568	1	1	RESISTOR-TRMR 100 10% C TOP-ADJ 1-TRN	32997	3386P-Y46-101
A21R125	0757-0410	1	1	RESISTOR 301 1% .125W F TC=0+-100	19701	SFR25H
A21R126	0764-0020	4	1	RESISTOR 5.6K 5% 2W MO TC=0+-200	I02360	GS-3
A21R128-R129	0686-7515	0	2	RESISTOR 750 5% .5W CC TC=0+529	01121	EB7515
A21R130	0757-0424	7	4	RESISTOR 1.1K 1% .125W F TC=0+-100	19701	SFR25H
A21R131	0698-3162	0	1	RESISTOR 46.4K 1% .125W F TC=0+-100	19701	SFR25H
A21R132	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A21R133	0683-2035	3		RESISTOR 20K 5% .25W CF TC=0-400	77902	R-25J
A21R134	0683-1025	9		RESISTOR 1K 5% .25W CF TC=0-400	77902	R-25J
A21R135	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A21R136	0698-3450	9	1	RESISTOR 42.2K 1% .125W F TC=0+-100	19701	SFR25H
A21R137	0698-3226	9	1	RESISTOR 49.9K 1% .125W F TC=0+-100	19701	SFR25H
A21R138	0683-1335	4		RESISTOR 13K 5% .25W CF TC=0-400	77902	R-25J
A21R139	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A21R140	0683-3035	5		RESISTOR 30K 5% .25W CF TC=0-400	77902	R-25J
A21R141	0683-3625	9		RESISTOR 3.6K 5% .25W CF TC=0-400	77902	R-25J
A21R142	0683-1225	1		RESISTOR 1.2K 5% .25W CF TC=0-400	77902	R-25J
A21R143	0683-1035	1		RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A21R144	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	19701	SFR25H
A21R145	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A21R146	0698-3279	0	3	RESISTOR 4.99K 1% .125W F TC=0+-100	19701	SFR25H
A21R147	0698-3488	3	2	RESISTOR 442 1% .125W F TC=0+-100	19701	SFR25H
A21R150	0698-3572	6		RESISTOR 60.4K 1% .125W F TC=0+-100	19701	SFR25H
A21R151	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	19701	SFR25H
A21R152	0683-3625	9		RESISTOR 3.6K 5% .25W CF TC=0-400	77902	R-25J
A21R153-R154	0683-3035	5		RESISTOR 30K 5% .25W CF TC=0-400	77902	R-25J
A21R155	0683-3625	9		RESISTOR 3.6K 5% .25W CF TC=0-400	77902	R-25J
A21R156	0683-1225	1		RESISTOR 1.2K 5% .25W CF TC=0-400	77902	R-25J
A21R158	0698-4499	8		RESISTOR 54.9K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A21R159	0698-4503	5	1	RESISTOR 66.5K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A21R160	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	19701	SFR25H
A21R162	0698-3279	0		RESISTOR 4.99K 1% .125W F TC=0+-100	19701	SFR25H
A21R163	0698-3488	3		RESISTOR 442 1% .125W F TC=0+-100	19701	SFR25H
A21R164	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H

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Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A21R169	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	19701	SFR25H
A21R170	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A21R171	0698-4425	0	1	RESISTOR 1.54K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A21R174	0698-3279	0		RESISTOR 4.99K 1% .125W F TC=0+-100	19701	SFR25H
A21R175	0757-0451	0	1	RESISTOR 24.3K 1% .125W F TC=0+-100	19701	SFR25H
A21R176	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A21R177	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	19701	SFR25H
A21R179-R182	0683-3035	5		RESISTOR 30K 5% .25W CF TC=0-400	77902	R-25J
A21R183	0683-3625	9		RESISTOR 3.6K 5% .25W CF TC=0-400	77902	R-25J
A21R184	0683-1225	1		RESISTOR 1.2K 5% .25W CF TC=0-400	77902	R-25J
A21R193-R195	0683-3625	9		RESISTOR 3.6K 5% .25W CF TC=0-400	77902	R-25J
A21R196-R198	0683-1225	1		RESISTOR 1.2K 5% .25W CF TC=0-400	77902	R-25J
A21R202	0757-0456	5	1	RESISTOR 43.2K 1% .125W F TC=0+-100	19701	SFR25H
A21R203	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A21R204	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+-100	19701	SFR25H
A21R205-R206	0683-4725	2		RESISTOR 4.7K 5% .25W CF TC=0-400	77902	R-25J
A21R207	0698-4472	7	1	RESISTOR 7.68K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A21R208	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	19701	SFR25H
A21R209	0757-0435	0	1	RESISTOR 3.92K 1% .125W F TC=0+-100	19701	SFR25H
A21R210	0698-3518	0	1	RESISTOR 7.32K 1% .125W F TC=0+-100	19701	SFR25H
A21RT1	0837-0144	8	1	THERMISTOR DISC 5-OHM TC=-3.3%/C-DEG	15454	5DA5R0
A21RT2-RT3	0837-0215	4	1	THERMISTOR-SURGE PTCTR USED AS SURGE	15454	SG-220S
A21S1	3103-0118	4	1	SWITCH-THRM FXD +221F 15A OPN-ON-RISE	14604	3450-83-130
A21SG1	1970-0094	0	1	TUBE-ELECTRON SURGE V PTCTR	G01114	CG2-250AL+-10%
A21T1	9100-4361	7	1	TRANSFORMER-POWER PRI V:110/215 V;FOPR	28480	9100-4361
A21T2	9100-4348	0	1	INDUCTOR-FIXED CURRENT SENSE INDUCTOR;L	09161	51719
A21T3	9100-4364	0	1	TRANSFORMER-SWITCHING GATE DRIVE XFMR	28480	9100-4364
A21T4	9100-4360	6	1	TRANSFORMER-POWER 115/230V 47-440HZ	28480	9100-4360
A21T5	9100-4370	8	1	XFM LAMINATE PWR	C01081	CSI 6733
A21TP1-TP33	1251-0600	0	33	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	27264	16-06-0034
A21U1	1826-1116	4	1	IC OP AMP GP QUAD 14-DIP-P PKG	07933	RC4156DB
A21U2	1826-0138	8	4	IC COMPARATOR GP QUAD 14-DIP-P PKG	27014	SL24958
A21U3	1820-1288	9	1	IC DRVR TTL CLK TTL-TO-MOS 1-INP	27014	SD31013
A21U4	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	27014	SL24958
A21U5	1826-1040	3	1	IC V RGLTR-SWG 4.85/5.15V 16-DIP-C PKG	34333	SG3526J
A21U6	1826-0412	1	2	IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	SL33675
A21U7	1826-0059	2	1	IC OP AMP GP TO-99 PKG	27014	SL180702
A21U8	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	27014	SL24958
A21U10	1826-0677	0	1	IC V RGLTR-ADJ-POS 1.2/32V TO-3 PKG	27014	SL39385
A21U11	1813-0127	8	1	IC V RGLTR-ADJ-NEG 2.23/24V TO-3 PKG	07263	SH1269/UA79HGKC
A21U12	1826-0144	6	1	IC V RGLTR-FXD-POS 4.8/5.2V TO-220 PKG	04713	SC25171P1
A21U13	1826-0393	7	1	IC V RGLTR-ADJ-POS 1.2/37V TO-220 PKG	27014	SL33076
A21U14	1826-0527	9	1	IC V RGLTR-ADJ-NEG 1.2/37V TO-220 PKG	27014	SL35761
A21U15	1826-0412	1		IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	SL33675
A21U17	1826-0138	8		IC COMPARATOR GP QUAD 14-DIP-P PKG	27014	SL24958
A21W1	1251-1636	4	6	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	71279	450-3388-01-03-00
A21W1	1258-0224	8	2	CON-JUMPER PROGRAMMING	71279	461-2872-02-03-10
A21W2	1251-1636	4		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	71279	450-3388-01-03-00
A21W2	1258-0224	8		CON-JUMPER PROGRAMMING	71279	461-2872-02-03-10
A25	**03577-66525**	**0**	**1**	**PC BOARD R.F. FILTER**	**28480**	**03577-66525**
A31	**03577-66531**	**8**	**1**	**PC BOARD ASSY OSC**	**28480**	**03577-66531**
A31C1	0180-1794	3	1	CAPACITOR-FXD 22UF+-10% 35VDC TA	13606	150D226X9035R2-DYS
A31C2	0160-3847	9	2	CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A31C3-C4	0160-2222	2	2	CAPACITOR-FXD 1500PF +-5% 300VDC MICA	00853	
A31C5	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	04222	SA105C103KAA
A31C6	0160-6510	9	1	C-F .1UF 20% 50V CERML	28480	RPE121-978X7R104M50V
A31CR1-CR2	1901-0040	1	2	DIODE-SWITCHING 30V 50MA 2NS DO-35	07263	FDH1088
A31J1	1250-1611	3	1	CONNECTOR-RF SMB M PC 50-OHM	98291	51-051-0289
A31J2	1251-5971	8	1	CONN-POST TYPE 2.5-PIN-SPCG 3-CONT	27264	22-12-1032.
A31L1	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH 10%	99800	1537-30
A31L2	9100-2486	3	1	INDUCTOR RF-CH-MLD 330NH 5% .166DX.385LG	24226	15M330J
A31L3	9140-0238	3	1	INDUCTOR RF-CH-MLD 82UH 5% .166DX.385LG	99800	1537-72
A31Q1-Q2	1853-0020	4	1	TRANSISTOR PNP SI PD=300MW FT=150MHZ	04713	SPS3609
A31Q3-Q4	1855-0386	9	1	TRANSISTOR J-FET 2N4392 N-CHAN D-MODE	04713	SFE1552
A31R1	0757-0442	9	1	RESISTOR 10K 1% .125W F TC=0+-100	19701	SFR25H
A31R2	2100-3207	1	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-502

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
A31R3	0683-2225	3	1	RESISTOR 2.2K 5% .25W CF TC=0-400	77902	R-25J
A31R4-R6	0683-4705	8	3	RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A31R7	0698-3279	0	1	RESISTOR 4.99K 1% .125W F TC=0+-100	19701	SFR25H
A31R8	0757-0449	6	1	RESISTOR 20K 1% .125W F TC=0+-100	19701	SFR25H
A31R9	2100-3351	6	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-501
A31R10	0698-4442	1	1	RESISTOR 4.42K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A31R11	0698-4309	8	1	RESISTOR 16.9K 1% .125W F TC=0+-100	19701	SFR25H
A31R12	0683-1055	5	2	RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A31R13	0698-4438	5	1	RESISTOR 3.09K 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A31R14	0683-4705	8		RESISTOR 47 5% .25W CF TC=0-400	77902	R-25J
A31R15-R16	0698-4453	4	2	RESISTOR 402 1% .125W F TC=0+-100	91637	CMF-55-1, T-1
A31R17	0683-1055	5		RESISTOR 1M 5% .25W CF TC=0-800	77902	R-25J
A31R18	0683-1035	1	1	RESISTOR 10K 5% .25W CF TC=0-400	77902	R-25J
A31U1	0960-0465	7	1	OSC 10.00 MHZ	12020	OSC 73-52
A31U2	1826-0026	3	1	IC COMPARATOR PRCN TO-99 PKG	27014	SL11762
	5040-7278	9	8	MOLD KCAP EXT	28480	5040-7278
	5041-0376	6	8	MOLD KCAP-BLANK	28480	5041-0376
	5041-0093	4	1	MOLD KCAP-PLOT	28480	5041-0093
	5041-0095	6	1	MOLD KCAP-SAVE	28480	5041-0095
	5041-0202	7	1	MOLD KCAP ON/OFF	28480	5041-0202
	5041-0309	5	1	MOLD KCAP CAP PTY GRAY	28480	5041-0309
	5041-0720	4	1	MOLD KCAP INSTR PRESET	28480	5041-0720
	5041-0726	0	1	MOLD KCAP Q-LCL	28480	5041-0726
	5041-0775	9	1	MOLD KCAP RECALL	28480	5041-0775
	5041-2894	7	1	MOLD KCAP DISPLY FCTN	28480	5041-2894
	5041-2895	8	1	MOLD KCAP MEASR CAL	28480	5041-2895
	5041-2896	9	1	MOLD KCAP DEFINE MATH	28480	5041-2896
	5041-2897	0	1	MOLD KCAP MKR ARROW	28480	5041-2897
	5041-2898	1	1	MOLD KCAP SWEEP MODE	28480	5041-2898
	5041-2899	2	1	MOLD KCAP TRIG MODE	28480	5041-2899
	5041-2900	6	1	MOLD KCAP AVG	28480	5041-2900
	5041-2901	7	1	MOLD KCAP LENGTH	28480	5041-2901
	5041-2902	8	1	MOLD KCAP TRIG/RESET	28480	5041-2902
	5041-2903	9	1	MOLD KCAP STORE DATA	28480	5041-2903
	5041-2904	0	1	MOLD KCAP SPCL FCTN	28480	5041-2904
	5041-2905	1	1	MOLD KCAP TRACE 1	28480	5041-2905
	5041-2906	2	1	MOLD KCAP TRACE II	28480	5041-2906
	5041-2907	3	1	MOLD KCAP SWEEP TYPE	28480	5041-2907
	5041-2908	4	1	MOLD KCAP ENTRY OFF	28480	5041-2908
	5041-2909	5	1	MOLD KCAP BACK SPACE	28480	5041-2909
	5041-2910	8	1	MOLD KCAP -	28480	5041-2910
	5041-2911	9	1	MOLD KCAP .	28480	5041-2911
	5041-2912	0	2	MOLD KCAP ARROW UP/DN	28480	5041-2912
	5041-2913	1	1	MOLD KCAP 1	28480	5041-2913
	5041-2914	2	1	MOLD KCAP 2	28480	5041-2914
	5041-2915	3	1	MOLD KCAP 3	28480	5041-2915
	5041-2916	4	1	MOLD KCAP 4	28480	5041-2916
	5041-2917	5	1	MOLD KCAP 5	28480	5041-2917
	5041-2918	6	2	MOLD KCAP 6	28480	5041-2918
	5041-2919	7	1	MOLD KCAP 7	28480	5041-2919
	5041-2920	0	1	MOLD KCAP 8	28480	5041-2920
	5041-2922	2	1	MOLD KCAP 0	28480	5041-2922
	5041-2923	3	1	MOLD KCAP INPUT	28480	5041-2923
	5041-2924	4	1	MOLD KCAP SCALE	28480	5041-2924
	5041-2925	5	1	MOLD KCAP MKR	28480	5041-2925
	5041-2926	6	1	MOLD KCAP SWEEP TIME	28480	5041-2926
	5041-2927	7	1	MOLD KCAP FREQ	28480	5041-2927
	5041-2928	8	1	MOLD KCAP AMPTD	28480	5041-2928
	5041-2929	9	1	MOLD KCAP RES BW	28480	5041-2929
	5041-2930	2	1	MOLD KCAP ATTEN	28480	5041-2930
	0370-3033	0	1	KNOB-BASE 1-1/2 JGK .25-IN-ID	28480	0370-3033
	2110-0056	3	1	FUSE 6A 250V NTD 1.25X.25 UL	75915	312 006
	2110-0003	0	1	FUSE 3A 250V NTD 1.25X.25 UL5	75915	312 003
	2110-0564	8	1	FUSEHOLDER BODY 12A MAX FOR UL	H9027	031.1657
	2110-0565	9	1	FUSEHOLDER CAP 12A MAX FOR UL	H9027	031.1666
	2110-0569	3	1	FUSEHOLDER COMPONENT NUT; THREAD M12.7	H9027	563.0016
	03577-04116	5	1	SHTF GRD-FUSE HLDR PLCR	28480	03577-04116
	3150-0218	4	1	FILTER-AIR 32 STD MESH MET SCREEN	28480	LZ60
	3160-0408	5	1	FAN-TBAX 90-CFM 19-28VDC	C02294	032274
	03582-04104	8	1	SHTF GUARD-FAN SW SCREEN	28480	03582-04104

See introduction to this section for ordering information
* Indicates factory selected values

Table 5-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty.	Description	Mfr. Code	Mfr. Part Number
	03577-61608	0	1	KEYBOARD CABLE 330MM GY	28480	
	03577-61609	1	1	OVEN CABLE 570MM ML	28480	
	03577-61610	4	1	FAN CABLE 475MM ML	28480	
	03577-61611	5	1	POP/TRIG CABLE 460MM ML	28480	
	03577-61601	3	4	CABLE ASSEMBLY FRONT PANEL 69MM	98291	
	03577-61638	6	1	CABLE ASSY 180MM ML	28480	
	03577-61612	6	1	15V SUPPLY CABLE 400MM ML	28480	
	03577-61615	9	1	EXTERNAL TRIG CABLE 270MM WH	28480	
	03577-61616	0	1	PROBE POWER CABLE - SHORT 270MM ML	28480	
	03577-61617	1	1	PROBE POWER CABLE - MEDIUM 285MM ML	28480	
	03577-61618	2	1	PROBE POWER CABLE - LONG 315MM ML	28480	
	5060-0467	6	3	PLST CONNECTOR PROBE	28480	5060-0467
	03577-61619	3	1	TEST ST CONN CBL 48MM ML	28480	
	1251-8628	8	1	REAR PANEL CONNECTOR 4-PIN	82389	TB4M
	1345A # C16	6	1	CRT MONITOR	28480	1345A # C16
	03577-29301	2	1	LENSE-CRT FILTER,SMOKED:3577A	22670	
	03577-61603	5	1	DISPLAY POWER CABLE 730MM ML	28480	
	03577-61201	9	1	SHTF BRKT-UPR DSPLY	28480	03577-61201
	9135-0225	7	1	LINE FILTER	05245	F3071E
	03577-61614	8	1	POWER SWITCH CABLE ASSEMBLY 750MM ML	28480	
	3101-2749	7	1	POWER SWITCH	I01021	N30
	5061-8008	9	1	RPG CABLE ASSEMBLY	28480	5061-8008

See introduction to this section for ordering information
* Indicates factory selected values

	Parts Common to All Cabinet Depths	Qty.	Part No.
1.	Front Frame	1	5021-5807
	Screw, Front Frame	13	0515-0657
	Screw, Attaches to CRT Bezel	4	0515-0889
2.	Rear Frame	1	5021-5808
	Screw, Corner Struts/Front and Rear Frames	16	0515-1331
	Caution Label	1	7121-2527
3.	Front Handle Assy	2	5060-9901
4.	Trim, Front Handle	1	5020-8898
5	Top Trim, Front Frame	1	5040-7202
6	Foot	4	5040-7201
7.	Tilt Stand	2	1460-1345
8.	Front Cap, Strap Handle	2	5041-6819
9.	Rear Cap, Strap Handle	2	5041-6820
	Screw, Strap Handle	4	0515-1132
11	Rack Mt Flange with Front Handle	2	5020-8876
12.	Side Cussett†	2	5001-0434
13.	Side Trim, Front Frame w/o Front Handle	2	5001-0441
14.	Rack Mt Flange w/o Front Handle	2	5020-8864

	Parts Unique to Each Cabinet Depth	Qty.	23"
15.	Corner Strut, w/Tapped Holes	4	5020-8823
15a.	Corner Strut, w/o Tapped Holes	4	5021-5838
16.	Top Cover	1	5061-9436
17	Bottom Cover	1	5061-9448
17a.	Bottom Cover, Perf	1	5060-9994
18.	Side Cover, w/Handle Recess	2	5060-9889
18a.	Side Cover, Perf. w/Handle Recess	2	5060-9948
19.	Strap Handle	2	5060-9805

	Parts Unique to Each Instrument	Qty.	
20	Front Dress Panel	1	03577-04301
21.	Front Sub Panel	1	03577-00202
22.	Rear Panel	1	03577-00203

† Optional

Figure 5-1. Cabinet Parts, Exploded View

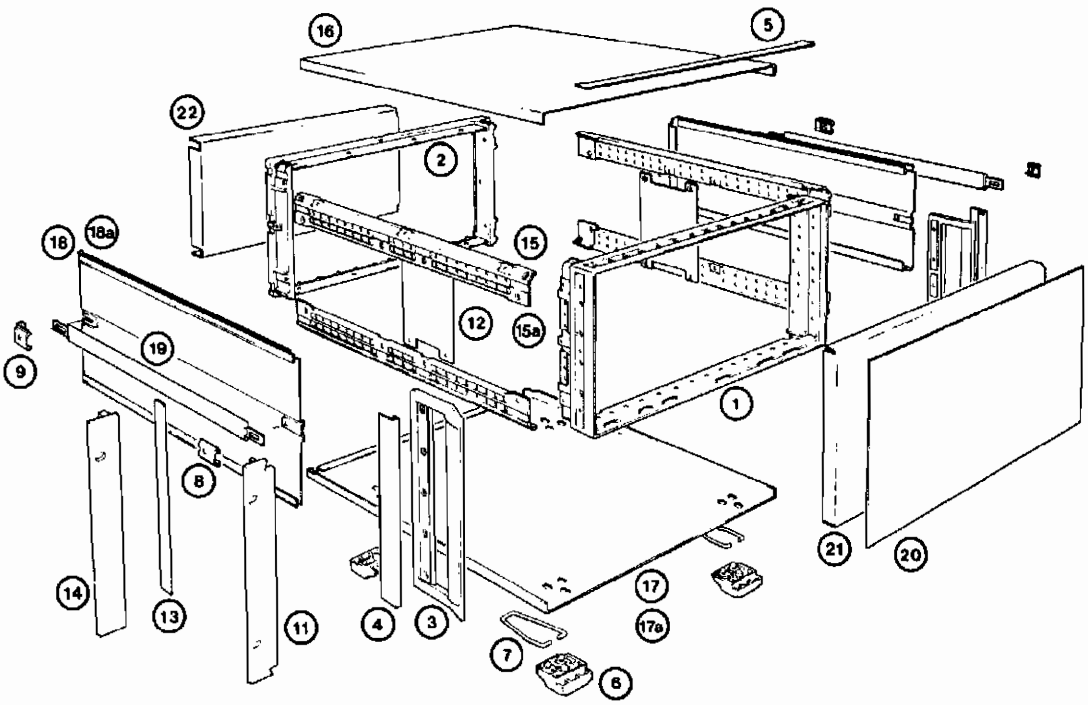


Figure 5-2. Cabinet Parts, Exploded View

SECTION VI
MANUAL BACKDATING

Table of Contents

SECTION VI
MANUAL BACKDATING

6-1 INTRODUCTION

The revision of this manual applies directly to instruments in the serial number range indicated on the title page. Earlier versions of this instrument (serial numbers lower than shown on the title pate) differ slightly in design and in some cases appearance. To adapt this manual to your instrument, refer to Table 6-1 and make all of the changes listed opposite your instrument serial number.

Table 6-1 Manual Changes.

Instrument Serial Number	Make Manual Changes
2333A10101 to 2333A10150	A through W
2333A10151 to 2333A10185	B through W
2333A10186 to 2333A10210	C through W
2333A10211 to 2333A10222	D through W
2333A10223 to 2333A10239	E through W
2333A10240 to 2333A10284	F through W
2333A10285 to 2333A10315	G through W
2333A10316 to 2333A10389	H through W
2333A10390 to 2333A10459	I through W
2333A10460 to 2333A11054	J through W
2333A11055 to 2333A11071	K through W
2333A11072 to 2333A11392	L through W

Table 6-1 Manual Changes.

Instrument Serial Number	Make Manual Changes
2333A11393 to 2333A11420	M through W
2333A11421 to 2333A11490	N through W
2333A11491 to 2333A11701	O through W
2503A11702 to 2503A11931	P through W
2503A11932 to 2503A11970	Q through W
2503A11971 to 2503A12050	R through W
2503A12051 to 2503A12239	S through W
2503A12240 to 2503A12271	T through W
2503A12272 to 2503A12446	U through W
2503A12247 to 2702A12798	V and W
2702A12799 to 2702A12977	W

6-2 MANUAL CHANGE SHEETS

As Hewlett-Packard continues to improve the performance of the HP3577A, corrections and modifications to the manual may be required. Required changes are documented by a yellow "MANUAL CHANGES" supplement and/or revised pages. In order to keep the manual up to date, one should periodically request the most recent supplement which is available from the nearest Hewlett-Packard sales and service office. Any changes shown on the supplement sheet which apply to your instrument (identified by serial number), should be implemented into the manual.

6-3 MANUAL CHANGE INSTRUCTIONS

CHANGE A

Replaceable Parts List, Table 5-3:

Delete A5C77 and A5L77.

Delete A6CR34, A6R31, and A6R124.

Change the part numbers and values of A6R27 to 0698-4480, 15.8K; A6R32 to 0698-3558, 4.02K; A6R35 to 0683-3035, 30K; and A6R36 to 0757-0439, 6.81K.

Delete A11C44, A11R17-R22, and A11U61.

Add A11C35 and A11C36, 0160-3847, .01 μF; A11L3, 9100-3560, 5.6 μH; A11R16, 0683-1025, 1K; and A11R17, 0683-3025, 3K.

Delete A16U10 and A16U19.

Change the part number and value of A16U20 to 1820-1144, IC GATE TTL LS NOR QUAD 2-INP.

Page 8-47/48, Figure 8-8.

Below the 300.25 MHz VCO block delete the +12V3 supply (C77 and L77). Change the supplies in the 300.25 MHz buffer, mixer divider, and mixer buffer blocks from +12V3 to +12V2.

Page 8-55/56, Figure 8-9.

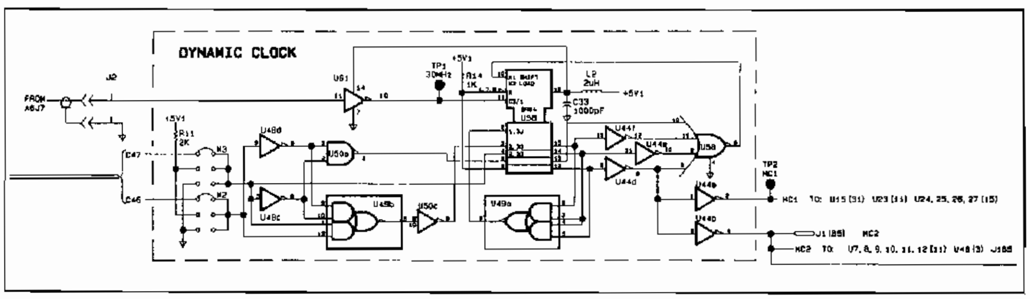
In the 10MHz Reference VCXO block, change the value of R27 to 7.8K and C8 to 320 pF.

Page 8-103/104, Figure 8-15.

Delete the following 4.7K pull-up resistors: R21 in the Read/Write Control block; R22 in the Timing block; and R17-R19 at the inputs to U23 in the Micro Program Sequencer block.

Page 8-105/106, Figure 8-16.

In the Dynamic Clock block, change the circuit feeding TP1 as shown in the following figure. Delete U61 information from the table on the apron page.



Page 8-147/148, Figure 8-22.

Replace the A16 schematic in the Service section with the A16 backdating schematic.

CHANGE B

Replaceable Parts List, Table 5-3:

Change the part number and value of A7C108 to 0180-2817, 47 μF.

Page 8-69/8-70, A7 Component Locator.

Delete R46 from the component locator.

Page 8-71/8-72, Figure 8-11.

In the 5V regulator section, change the value of C108 to 47 μF.

Page 8-73/8-74, Figure 8-12.

In the Fraction N Control block, add an inverter (U21c) in the FDAT(not) line to U19 pin 26 (EXT CLK).

CHANGE C

Replaceable Parts List, Table 5-3:

Change the part number of A1R44 to 2100-3356. The value does not change.

CHANGE D

Replaceable Parts List, Table 5-3:

Add A82C63 and A8C264, 0160-4380, 1 pF.

Delete A8R88.

Change the part numbers and values of A8C260 to 0160-3872, 2.2 pF and A8R72 to 0699-1188, 100 Ω.

Change the part numbers of the following resistors on the A8 board: R73 and R75 to 0699-1189; R74 to 0699-1190; R76 and R78 to 0699-1191; R77 to 0699-1192; R79, R81, R82, R84, R85, and R87 to 0699-1193; and R80, R83, and R86 to 0699-1194. The values for R73 through R87 remain the same, but the newer parts are less inductive than the old parts, which have TRW markings. If any of the old parts are changed, all 15 resistors must be replaced with the new parts and the capacitors C260-C264 changed to the new layout. The parts for R73-R78 must be installed with glass beads (4330-0496) on the leads.

Page 8-83/8-84, Figure 8-13.

In the output of the 15dB amplifier block, delete R88 and change the value of R72 to 50 Ω.

Page 8-85/8-86, Figure 8-14.

In the 60dB Attenuator block move the positive end of C260 to the connection between R74 and R74. Move the positive end of C261 to the connection between R77 and R78. Move the positive end of C262 to the connection between R80 and R81. Add C263 from the connection of R83 and R84 to ground. Add C264 from the connection of R86 and R87 to ground. The value of all five capacitors (C260-264) should be 1 pF.

CHANGE E

Replaceable Parts List, Figure 5-3:

Change the part number and description of A13U86 to 1820-1208, IC GATE TTL LS AND QUAD 2-INP.

Page 8-131/8-132, Figure 8-18.

At the right edge of the Fast Bus Interface block, change U86 to an AND gate and connect pin 1 to +5V1 instead of ground.

Page 8-133/8-134, Figure 8-19.

Delete the OR gate between U59 and the VPA input to U1. Pin 6 of U59 should connect directly to pin 21 of U1. In the Trigger block, change the output gate U86 to an AND gate and connect pin 4 to +5V1 instead of ground.

Page 8-135/8-136, Figure 8-20.

Below the Display Interface block, delete the connection from U59 pin 1 to INTO(not) U59(6). Connect U59 pin 1 to U2 pin 6. U52 pin 13 should connect to U51 pin 13 rather than pin 12.

CHANGE F

Replaceable Parts List, Table 5-3:

Change the parts numbers and values of A16C4-C7, C10-C12, C16-C23, C26-C29, and C33-36 to 0160-3879, .01 μF.

Change the part numbers and values of A16R1, R6, and R7 to 0683-2225, 2.2K; and A16RP1-RP6 to 1810-0219, 220 ohm.

Delete A16C41 and A16U3.

CHANGE G

Page 8-151/8-152.

In the upper left corner of the circuit-side component locator change the color label of the WHT/BLU under "TO OVEN" to read WHT/BLK.

CHANGE H

Replaceable Parts List, Table 5-3:

Change the part number and value of A5C66 and A5C67 to 0180-0553, 0.1 μF.

Delete A5C110 and A5C111.

Page 8-47/8-48, Figure 8-8

In the ± 12 V supplies, change the value of C66 and C67 to 0.1 μF and delete C110 and C111.

CHANGE I

Replaceable Parts List, Table 5-3:

Change the part number and value of A6C69 to 0160-0576, 0.1 μF .

Page 8-55/8-56, Figure 8-9

In the 300 MHz VCO, change C69 to 0.1μF, non-polarized.

CHANGE J

Replaceable Parts List, Table 5-3:

Cable W7 must be replaced with part number 03577-61607 to be compatible with the display used in these serial numbers. Rev D of the A13 board was also effected at this time.

A21CR17, CR85, CR93, CR96, CR101, CR104, and CR107 may be loaded with part number 1884-0052 (GE,C103YY,TO-18 package). This part is no longer available and has been replaced with 1884-0317 (GE,C203YY,TO-92 package). The parts are interchangeable but 1884-0317 must be turned 180° from the orientation of 1884-0052.

A5U42 may be loaded with part number 1820-1432. If this part is replaced with 1820-1420, C4 may need to be padded to meet the 300.25 MHz VCO specification. Padding parts are 0160-4887 (25 pF) or 0160-4774 (24 pF).

CHANGE K

Replaceable Parts List, Table 5-3, and page 8-141/8-142, Figure 8-21.

If A15 is Rev A, delete R3-R6

CHANGE L

Replaceable Parts List, Table 5-3:

The 5V supply cable (01377-61613) used in these instruments has been replaced by cables 03577-61638 and 03577-61639. The parts are not interchangeable. To repair Rev A or Rev B boards, refer to the Service Note for instructions and parts to be ordered.

CHANGE M

Replaceable Parts List, Table 5-3:

Delete A8C350, A8C351, A8C352, A8C353, A8C354, A8C355, A8L250 and A8L251

Page 8-83/8-84, Figure 8-13.

In the Mixer Buffer block, delete C350, C351, C352, C353, C354, C355, L250, and L251 .

CHANGE N

Replaceable Parts List, Table 5-3:

Delete A4J12, A4W7, A4L201, A4C203, A4C205, A4C202, A4R201, A4R202, A4R203, and A4R204. Change the part number and value of A4C167 to 0160-3558, 0.1 μF; A4C53, A4C63, A4C73, and A4C93 to 0180-2794, 3.3 μF. Add A4R28, 0698-7205, 51.1 Ω.

Page 8-39/8-40, Figure 8-6.

In the 10 dB Buffer, delete R201, R202, and R203.

Page 8-41/8-42, Figure 8-7.

In the first 20 dB Amplifier, delete L201, C202, C203, C205 and R204. Between the 20 dB Amplifier and the Leveling Loop, delete J12 and W7. In the 20 dB Amplifiers at the output, change the value of C53, C73, and C93 to 3.3 μF. In the leveling loop, change the value of C167 to 0.1 μF and add resistor R28, 51.1 Ω from C167 to ground. In the second 20 dB Amplifier, change the value of C63 to 3.3 μF.

CHANGE O

Page 1-4, Paragraph 1-5, OPTIONS

Change the part numbers of the Front Handle Kit (Option 907) to 5061-0091, Rack Mounting Kit (Option 908) to 5061-0079, and Front Handle and Rack Mount Kit (Option 909) to 5061-0085.

Page 5-49/5-50, Figure 5-1.

Change the part numbers of the Front Frame to 5020-8807; Rear Frame to 5020-8808; Front Cap, Strap Handle to 5040-7219; Rear Cap, Strap Handle to 5040-7220; Corner Strut, w/o Tapped Holes to 5020-8838; Top Cover to 5060-9836; Bottom Cover to 5060-9848; Screw, Attaches to CRT Bezel to 0515-0218; Screw, Front Frame to 0515-0657; Screw, Corner Struts/Front and Rear Frames to 2510-0192; and Screw, Strap Handle to 2680-0172.

CHANGE P

Replaceable Parts List, Table 5-3:

Change the part number of A15RPG (also listed at the end of the table as RPG) to 03585-61630.

CHANGE Q

Replaceable Parts List, Table 5-3:

Delete A20C1 and A20C2.

CHANGE R

Replaceable Parts List, Table 5-3:
Change the part numbers and values of A1RP2 to 1810-0398, 22 k; A1R46 to 0683-4725, 4.7 k; A1R47 to 0683-3935, 39 k; A1R49 to 0683-4735, 47 k. Delete A1R201 and A1R202.

Page 8-29/8-30, Figure 8-5.
Delete R201 and R202 from the Sample and Hold/Variable Gain Amplifier. Also change the value of RP2 to 22 k, R46 to 4.7 k, R47 to 39 k, and R49 to 47 k.

CHANGE S

Replaceable Parts List, Table 5-3:

Delete A4C207 and A4C208.

Page 8-41/8-42, Figure 8-7.

In the first 14 dB Amplifier, delete C207 and C208.

CHANGE T

Replaceable Parts List, Table 5-3:

Delete A6C128.

Page 8-55/8-56, Figure 8-9.

In the 10 MHz Reference VCXO, delete C128

CHANGE U

Replaceable Parts List, Table 5-3:

Change the part numbers and values of A6C24 to 0160-6525, 47 pF; A6R8 to 0698-3226, 6.49 k; A6R9 to 0698-3155, 4.6 k.

Page 8-55/8-56, Figure 8-9.

In the 10 MHz Reference VCXO, change the value of C24 to 47 pF, R8 to 6.49 k, and R9 to 4.6 k.

CHANGE V

Replaceable Parts List, Table 5-3:

Delete A25.

Page 5-51/5-52, Figure 5-3.

Delete Filter board and Filter to LO Cable. Change Ref to Filter Cable to Ref to LO Cable. Alter Figure 4-5 to reflect these changes.

Page 2-27/2-28, Figure 2-4.

At the A6J3 connector, change the TO location from A25J1 to A4J1.

Page 2-29/2-30, Figure 2-5.

Delete the A25 board and label the input of the A4J1 connector FROM A6J3.

CHANGE W

Replaceable Parts List, Table 5-3:

Change the part numbers and values of A4R13 and A4R15 to 0689-7223, 287 Ω; A4R14 to 0699-2030, 17.8 Ω.

Page 8-39/8-40, Figure 8-6.

In the 1.7 dB pad, change the value of R13 and R15 to 287 Ω and R14 to 17.8 Ω.

SECTION VII
CIRCUIT DESCRIPTIONS

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SECTION VII
CIRCUIT DESCRIPTIONS

7-1 INTRODUCTION

This section provides circuit descriptions to be used along with the schematics of Section VIII (Service). This information should be used after isolating faults to the functional block level. The descriptions here and the schematics in Section VIII provide information for fault isolation inside each functional block. The technician's expertise is then relied upon to isolate the faulty component(s) within the functional block.

If more general information is desired, the overall instrument operation description in Section II (Fault Isolation) gives a broader explanation of the instrument's operation.

7-2 A1 INPUT BOARD

Circuit Board Description

The input board (A1) is a tuned, low noise receiver. The input board is tuned to the source output (A8) frequency and tracks it as the source is swept. The receiver can be tuned from 5 Hz to 200 MHz with tuning bandwidth of 1 Hz to 1 kHz in decade values. This board processes the input signal using both analog and digital signal processing. The analog processing includes input impedance, input attenuation, and frequency conversion from the source frequency to a 10 kHz intermediate frequency (IF) with amplitude and phase information preserved. The digital signal processing includes sampling the 10 kHz IF at an 8 kHz rate, creating a 2 kHz digital IF. The real and imaginary phasor components are extracted using quadrature mixing via the digital filters. These filters also set the receiver tuning bandwidth.

50/1M Ohm Input Attenuator

Relay K1 selects the receiver input impedance. The relaxed state for the relay is the 1M ohm position. Relays K2 and K3 select the input attenuation, 0 or 20 dB. Each impedance path has its own 20 dB attenuator. The relaxed state for relays K2 and K3 are in the 0 dB attenuation position. Relays K2 and K3 are always switched together. The 1M ohm path also has a buffer amplifier which is used as an impedance converter. It converts from a 1M ohm to a 50 ohm environment where the rest of the instrument operates.

Buffer Amplifier

The unity gain buffer amplifier consists of a 12 dB amplifier and a 12 dB attenuator. Both the amplifier and the attenuator are used to increase isolation between the first mixer and the "outside world." The buffer amplifier consists of Q1, Q2, Q3, and Q29. U42 is used in a dc servo loop to compensate for mixer feedthrough.

First Mixer

The first mixer down converts the 5 Hz to 200 MHz source frequency to a 250 kHz IF using the 0.25 MHz to 200.25 MHz local oscillator signal from the local oscillator board (A4).

Overload Detection

Diodes CR11 and CR12 detect the positive and negative peaks of the input signal. If the input signal is greater than ±1.1 V peak, the comparators will signal an overload. This sets the input impedance relay to the 1M ohm position and signals the main processor-controller board (A13) that an overload has occurred.

250 kHz Bandpass Filter

The 250 kHz bandpass filter rejects all higher frequency mixer products from the first mixer. This filter also provides a zero at 230 kHz. The zero is to cancel any signals at 230 kHz, which is the image frequency for the next IF (10 kHz). At the beginning of this section there is an IF buffer used (A1Q4). This buffer presents a good 50 ohm load to the mixer. A good load is required in order to obtain a flat frequency response at the output of the mixer.

Second Mixer

The second mixer down converts the 250 kHz first IF frequency to the 10 kHz second IF. The local oscillator signal (240 kHz) is obtained from the frequency reference board (A6). L14, L12, and C106 are used to drop the gain of the mixer at input frequencies other than 250 kHz (Note: the two inductors provide magnetic field cancellation to reduce receiver-to-receiver cross talk).

IF Amplifier

The second IF amplifier provides isolation between the second mixer and the 10 kHz bandpass filter. It also sets the overall receiver gain to unity for both the 50 ohm and 1M ohm impedance positions.

10 kHz Active Bandpass Filter

The 10 kHz active bandpass filter cancels all upper frequency second mixer products. It also provides a zero at 14 kHz to cancel the 254 kHz first mixer feedthrough when the source is programmed for 4 kHz.

Sample and Hold

The sample and hold circuit samples the 10 kHz IF at an 8 kHz rate. This sampling action effectively down converts the 10 kHz IF to a 2 kHz digital IF. The 2 kHz signal is a stairstep output.

Variable Gain Amplifier

This section is a programmable 8-bit binary amplifier. The gain of the amplifier is variable between 1 and 128 in octave steps. The gain of the amplifier is set by the Analog to Digital converter. The A to D makes an 8-bit conversion with the amplifier set to a gain of 1.1. The conversion value is then used to program the amplifier for an A to D input voltage as close as possible to the A to D full scale input. This amplifier gives the A to D seven more bits of dynamic range.

Analog to Digital (A - D) Converter

The Analog to Digital converts the analog 2 kHz stairstep signal to a 2 kHz digital IF. The A to D first sets the gain of the variable gain amplifier with an 8-bit conversion, and then makes a 12-bit conversion on the amplified signal. This 8-bit/12-bit cycle is repeated for every stairstep on the digital 2 kHz IF signal.

Look Up Table Variable Gain Amplifier

This section provides optimum gain settings stored for a given 8-bit conversion in one-half of the ROM (A1U8). The other half of this section provides the number of zeros the digital filters should append to the 12-bit conversion result.

Digital Filters

The quadrature digital filters process the A to D output values by digitally mixing the values with the 2 kHz signal from the fast processor board (A11). The output is simultaneously mixed with two filters. One of the mixers is fed with the equivalent of a 2 kHz sine wave, the other with a cosine wave. The output of the filters is a digital representation of the "real" and "imaginary" components of the input. These values are then fed to the fast processor (A11) for storage and processing.

32 μS Timer

The timer is used for timeouts in the operation of the algorithmic state machine.

Algorithmic State Machine

This is a ROM based state machine. U31 & U32 latch present state and qualifier information, which is used by the ROM (U3) to determine the next state. The multiplexer (U1) determines which qualifiers will be used in making a decision.

Look Up Table For Control

The ROM (U25) is used to decode state information into various control signals.

I/O Port

The bidirectional latch handshakes data to the fast processor board (A11) via the Fast Data Bus.

NOTE

There are three (3) identical input boards (A1). Receivers: R, A, B

7-3 A4 LOCAL OSCILLATOR BOARD

Circuit Board Description

The local oscillator board (A4) is used to provide a signal (0.25 to 200.25 MHz) for mixing into the first IF conversion section of the input board (A1). This section has two input signals: a 300 MHz signal from the frequency reference board (A6) and a VCO signal (300.25 to 500.25 MHz) from the synthesizer board (A7).

10dB/20dB Buffer

These sections are used to provide amplification and isolation between the frequency reference (A6) and synthesizer board (A7) respectively.

300 MHz LPF

The 300 MHz low pass filters are used to reduce high frequency harmonic distortion.

Mixer

The mixer multiplies the signals from the frequency reference board (A6) and the synthesizer board (A7) to produce a signal ranging from 0.25 to 200.25 MHz.

200 MHz LPF

The 200 MHz low pass filters are used to remove all but the difference frequency produced by the mixer.

20dB/14dB Amplifiers

These sections are used to amplify the signal (0.25 to 200.25 MHz) by 48dB.

Leveling Loop

The leveling loop is used to maintain a constant amplitude level regardless of the incoming frequency. The signal (0.25 to 200.25 MHz) is first sent to a 10dB buffer amplifier via a power splitter. This signal is then peak detected. This sensed signal is then compared with a reference voltage by the servo amplifier. When an error signal has been sensed, the servo amplifier increases or decreases the current drive to the limiting mixer to maintain a constant output level.

20dB Amplifier/Power Splitter

These sections take the signal from the leveling loop and amplify it by 20dB. This signal is then distributed into three-ways by the power splitter.

20dB Amplifiers

The 20dB amplifiers provide amplification and isolation from the input boards (A1).

NOTE

There are three (3) identical input boards (A1). Receivers: R, A, B

7-4 A5 250 KHZ OFFSET BOARD

Circuit Board Description

The 250 kHz offset board (A5) offsets the 300 MHz signal from the frequency reference board (A6) to 300.25 MHz. The 300.25 MHz signal converts the 300.25 to 500.25 MHz synthesizer board (A7) signal to the 5 Hz to 200 MHz output board (A8) frequency.

6 MHz Divider

The 6 MHz from the frequency reference board (A6) is divided-by 24 to yield the 250 kHz offset frequency. This 250 kHz is the reference frequency for this board. The INIT line is from the main processor-controller board (A13) to insure that the divide by 24 signal is properly synchronized.

Phase Detector/Loop Filter/Oscillator Unlock Detector

The phase detector compares the 250 kHz reference signal from the 6 MHz divider and the 250 kHz difference frequency from the mixer. The loop filter integrates the phase detector output to create a dc tuned signal. The output of the loop filter is monitored by the oscillator unlock detector. When the loop filter output is a negative voltage or is greater than +9 volts, the unlock detector trips and sets the oscillator unlock to an active low line signal. The main processor-controller board (A13) then displays an error message ("OSCILLATOR UNLOCKED, Assembly A5, A6 or A7").

250 kHz Filter

This low pass filter removes any 250 kHz harmonics feedthrough from the phase detector and loop filter. Any feedthrough shows up as residual FM on the 300.25 MHz output.

300.25 MHz VCO

The 300.25 MHz VCO produces a 300.25 MHz signal phase locked to the 250 kHz reference signal. Phase locking is accomplished with the phase detector and varactor diode tune voltage.

300.25 MHz Buffer

The 300.25 MHz buffer drives the output board (A8) with the 300.25 MHz phase locked signal. The 6 dB pad and 10 dB amplifier isolate the offset board (A5) from the output board (A8).

Mixer Driver

The mixer driver amplifies the 300.25 MHz signal to drive the LO port of the mixer. A strong LO signal is required for good mixer translation.

Mixer Buffer

The buffer filter and pad provide additional isolation between the 300.25 MHz VCO and mixer.

300 MHz Buffer

The 300 MHz buffer amplifies the 300 MHz frequency reference board (A6) signal and provides isolation between the frequency reference board and the 250 kHz offset board (A5).

Mixer

The mixer multiplies the 300.25 MHz VCO signal (LO port) and the frequency reference board (A6) 300 MHz signal (RF port). The 250 kHz difference signal (IF port) is used to phase lock the 300.25 MHz VCO to the 250 kHz reference signal described earlier.

250 kHz Amplifier

This section amplifies the 250 kHz difference signal from the mixer. The signal is then used by the phase detector to lock the 300.25 MHz VCO to the 250 kHz reference.

7-5 A6 FREQUENCY REFERENCE BOARD

Circuit Board Description

The frequency reference board (A6) generates all of the reference frequencies used in the HP 3577A. It will lock to an external frequency reference of 10 MHz/N, where N = 1,2,3,... and the external frequency reference is ≥100 kHz. This board is always connected to the oven board (A31). However, when an external frequency reference is connected, the oven board will then be turned off automatically so that the frequency reference board may lock to the external frequency reference. When the instrument is first turned on, the oven assembly is cold. During this time, the frequency reference board will free run on its own 10 MHz VCXO.

External Reference Path, Oven Path, and Differentiator

This section squares the signal from the external reference input or the oven (A31) input. This square wave is then fed to a differentiator which generates narrow pulses. This process is necessary in order for a 10 MHz harmonic to be generated when a sub-harmonic of 10 MHz is used as the external reference.

External Reference Detector

The square wave generated in the previous section is sensed by the external reference detector. The detector drives an LED on the frequency reference board (A6) to indicate that an external reference is present. The external reference detector also passes this information to the main processor-controller board (A13) via the EXT REF line which also drives an LED on the front panel. This same line is used to shut down the oven board (A31) output when an external reference signal is detected.

Phase Detector and Switchable Loop Filter/Reference Lock Detector

The phase detector is used to compare the external reference input signal or the oven (A31) input signal with the 10 MHz reference VCXO signal. The phase error signal generated by the phase detector is monitored by the reference lock detector. Whenever an ac signal is present at the phase detector output, this will indicate that the phase-locked loop is unlocked. During this time, the reference lock detector senses this condition and switches the switchable loop filter into a wide band configuration. The phase-locked loop captures the frequency reference by switching the loop filter to the wide band configuration. Once the loop is locked, the reference lock detector allows the switchable loop filter to switch back to a narrow band configuration. Whenever the loop is unlocked (and consequently, whenever the loop is in the wideband configuration), the detector lights up the unlock LED on the frequency reference board (A6). The reference lock detector pass this information to the main processor-controller (A13) via the REF LOCK line and displays on the front panel "OSCILLATOR UNLOCKED, Assembly A5, A6 or A7."

10 MHz Reference VCXO

The output of the switchable loop filter is fed into the 10 MHz reference VCXO and then the output is buffered and fed back to the phase detector, thus closing the loop.

10 MHz Buffers

This section buffers the 10 MHz output from the phase-locked loop. This signal is then fed to the HP 3577A rear panel, "10 MHz OUT, 0 dBm" connector. This section also provides an additional separate 10 MHz signal for the HP-IB board (A16).

100 kHz Dividers

This section takes the output of the 10 MHz phase-locked loop and divides the frequency by 100 to generate the 100 kHz signal used in the synthesizer board (A7).

Phase Detector and Loop Filter/300 MHz Lock Detector

This section is very similar to the phase and lock detectors shown in the 10 MHz phase-locked loop section. The only difference is that the 300 MHz lock detector indicates whether or not the loop is locked (i.e., it does not switch any bandwidths in the loop filter).

300 MHz VCO

This section takes the output of the phase detector and uses it to control the frequency of the 300 MHz VCO. This frequency is then fed to the 250 kHz offset (A5) and output (A8) board.

Prescaler

The output of the 300 MHz VCO is divided down in two stages. The first stage divides the 300 MHz VCO signal down to 30 MHz. This signal is then sent to the fast processor board (A11). The second stage takes the 30 MHz signal output and divides it down to 10 MHz. This signal is then fed back to the phase detector to close the loop.

÷ 2.5, ÷ 5, ÷ 3, ÷ 2 Dividers

The output of the first stage of the prescaler (30 MHz) is divided down appropriately to generate the necessary reference frequencies used in the HP 3577A.

÷ 50 & ÷ 30 Dividers and Phase Initialization

The phase initialization circuitry operates in conjunction with the divide by 15 counter to produce an 8 kHz signal. This is done by loading a start count once when the HP 3577A is initialized and thereafter allowing the counter to operate normally. Phase may be offset in 30° increments by configuring a switch in the phase initialization circuitry to change the count that is loaded initially.

7-6 A7 SYNTHESIZER BOARD

Circuit Board Description

The synthesizer board (A7) generates a signal in the frequency range of 300.25 to 500.25 MHz with 0.001 Hz resolution. This board uses the Fractional-N synthesis technique which will not be discussed in this manual. For a full explanation of Fractional-N, refer to the following Hewlett-Packard Service Manuals: 3325A Synthesizer/Function Generator, 3336A/B/C Synthesizer/Level Generator, and 3586A/B/C Selective Level Meter. The only input to this board is the 100 kHz signal from the frequency reference board (A6). This signal is used as a frequency reference by the synthesizer for phase-locked loop capabilities. The output signal of this board is sent to the source output board (A8) and the local oscillator board (A4).

Fractional N Control

The data and control latches of this section provide the Fractional-N chip (U19) with the appropriate data bus commands from the main processor-controller (A13). The following signal names are used:

1. $\overline{\mathrm{FDAT}}$ loads the data for the Fractional-N.
2. $\overline{\mathrm{FINST}}$ is used as an instruction load for the Fractional-N.
3. $\overline{\mathrm{FHOLD}}$ tells the Fractional-N to hold until trigger. This signal is used for synchronizing the start of a sweep.
4. $\overline{\mathrm{STATWR}}$ is a main processor-controller status interrupt. This signal is used to synchronize the start of a sweep. This signal comes from the fast processor board (A11).
5. The 8 kHz signal is used for final start-of-sweep. This insures that the Fractional-N, input board (A1), and the fast processor board (A11) are synchronized properly so that the appropriate data is taken.

Fractional N

The Fractional-N chip (U19) is the "heart" of the frequency synthesis technique. This chip controls the divide by N counter and the API & Bias Current Sources. The FRACLMT signal is the sweep limit control which comes from the main processor controller board (A13). This signal is used to interface with a sweep input on the Fractional-N chip. The FRACFLG signal is a sweep limit flag which goes to the output (A8) and main processor-controller board (A13). This signal indicates that the sweep frequency has exceeded the value in the limit register in the Fractional-N chip.

÷N Counter

The ÷N counter consists of the following sections:

- MSD ÷10 (Max)
- 2nd MSD ÷10 (Max)
- Least Significant Digit ÷5 (Max)
- 9's Complement of N Storage
- Preload One Shot
- PreLoad
- Pulse Remove Logic

- Pulse Remove Sync
- Dual Modulus Divider
- Chip Clock and Cycle Start
- VCO/N.F. Reclock

The purpose of the ÷N counter (where N is an integer from 300 to 500) is dividing the prescaled VCO (VCO/10) by some number (N) and producing the 100 kHz signal required by the phase detector.

API (Analog Phase Interpolation) & Bias Current Sources

The API & Bias Current Sources consist of the following sections:

- API & Bias Current Control
- Bias Current Source
- Current Sinks

These current sources discharge the integrator after it has been charged by the phase detector. By discharging (subtracting) current from the integrator, this insures that the dc control voltage from the sample and hold maintains a steady dc state.

Phase Detector

The phase detector compares the 100 kHz from the frequency reference (A6) with the ÷N counter output (VCO/N.F.). The output of the phase detector is a series of pulses of equal width. The width of the pulses depends on the phase difference detected between the 100 kHz reference and the VCO/N.F.

Integrator/Sample and Hold

The integrator and sample and hold convert the phase detector output pulses, with the help of the API correction currents, to the dc control voltage required to drive the 300.25 to 500.25 MHz VCO.

PLL Unlock Detector

This section determines if the phase-locked loop (PLL) is unlocked. When the detector senses an out-of-range dc control voltage, it turns on an internal LED and interrupts the main processor-controller board (A13). A message will then appear on the display. Refer to the Section II (Fault Isolation) for further details.

500 kHz Filter

This section reduces sidebands of 100 kHz and its harmonics induced by the sample and hold.

300.25 - 500.25 MHz VCO

The dc control voltage produced by the sample and hold controls the output frequency (300.25 to 500.25 MHz) of the VCO. The output frequency signal of this section is inversely proportional to the dc control voltage from the sample and hold. The output frequency of the VCO is distributed to the output board (A8), the local oscillator board (A4), and the prescaler section.

Prescaler

Before the output frequency of the VCO is sent to the ÷N counter, the VCO is first divided by 10 (prescaled).

+5 API Supply

This section provides the APIs with an isolated +5 voltage supply.

7-7 A8 OUTPUT BOARD

Circuit Board Description

The output board provides a sinusoidal signal with a frequency range of 5 Hz to 200 MHz and a amplitude level range of +15 dBm to -49 dBm. This output signal is generated by mixing the 300.25 to 500.25 MHz signal of the synthesizer board (A7) with the 300.25 signal from the 250 kHz offset board (A5).

Mixer Buffer

The 10 dB amplifiers and 3 dB pad provide isolation between the synthesizer board (A7) and the mixer (A8U11).

Variable Limiter

This section varies the amplitude of the 300.25 MHz signal coming from the 250 kHz offset board (A5) depending on the level signal generated by the Amplitude Leveling section.

300 MHz Low Pass Filter

This section reduces high frequency harmonic distortion.

Mixer

The mixer multiplies the frequency signals from the 250 kHz offset board (A5) and the synthesizer board (A7) to produce a signal with a frequency range of 0 to 200 MHz.

200 MHz Low Pass Filters/20dB Amplifiers

The output signal from the mixer (U11) is first filtered to reduce harmonic distortion, amplified by 40dB, and then it is filtered again to reduce any harmonic distortion induced by the 20dB amplifiers.

15dB Amplifier

The output signal level of this section is maintained between 11.0 to 15.0 dBm, with 0.1 dB of resolution. At low frequencies (approximately 5 Hz and below), the DC Servo senses the dc component of that waveform. This dc signal is then sent to the Low Frequency Gain Error Correction section. Note that for frequencies above 5 Hz the DC Servo is no longer in the feedback loop.

Low Frequency Gain Error Correction

For frequencies below 100 kHz, negative feedback is used to stabilize the gain of the amplifiers. The feedback path comes from the output of the 15 dB Amplifier and through a 60 dB voltage divider formed by R191 and R193. U190 compares the feedback signal to the output signal from the 200 MHz Low Pass Filter. The difference from these two signals drives the 20 dB Amplifier. In addition, the signal from the DC Servo is added to the input of the 20 dB Amplifier via R192 and U190.

Amplitude Leveling

For frequencies below 100 kHz the main processor-controller board (A13) signals the Amplitude Leveling, via the Control Bus, to turn off. This is done by setting the voltage at U20(8) to zero, thereby forcing U20 to act like an voltage-follower. During this frequency range, the output of this section has a referenced dc voltage which is independent of the output frequency from the 15 dB Amplifier. This section obtains its dc reference from the Amplitude Reference.

For frequencies equal to and above 100 kHz, the dc reference from the Amplitude Reference is compared with the amplitude output level from the 15 dB Amplifier. This is done by peak detecting the amplitude output level from the 15 dB Amplifier and opening the switch Q180.

Amplitude Reference

The Amplitude Reference is controlled by the main processor-controller board (A13) via the Control Bus. This section provides the Amplitude Leveling with a dc referenced signal. This dc referenced signal, compared with the amplitude output level from the 15 dB Amplifier, provides the necessary information to maintain an amplitude output level between 11.0 to 15.0 dBm with 0.1 dB of resolution.

60 dB Step Attenuator

This section attenuates the amplitude output level from the 15 dB Amplifier (11.0 to 15.0 dBm with 0.1 dB of resolution) by 60 dB. The attenuator works in the following binary sequence:

K1 :	4 dB
K2 :	8 dB
K3 :	16 dB
K4&K5 :	32 dB
K6 :	OVERVOLTAGE PROTECTION

For example, if an output level between 11.0 and 15.0 (inclusive) is desired, the signal would go straight through without any attenuation. A chart is shown in Section VIII (Service) under the output board schematic demonstrating the operation of the relays pertaining to a given programmed output level. This section also provides overvoltage protection. When a voltage of 4 Vdc or greater is sensed at A8J3, the relay K6 will trip to disconnect the instrument from the "outside world." The 60 dB Step Attenuator receives its control data from the main processor-controller board (A13) via the Control Bus.

Private 5 Volt Supplies

This section provides the output board (A8) with ±5 volts. Voltage regulators are used to monitor the ±5 supplies, U5a & Q82 and U5b & Q81, respectively.

7-8 A11 FAST PROCESSOR BOARD

Circuit Board Description

The fast processor board (A11) is a floating point processor. The main purpose of this board is to perform floating point and fast numerical calculations (number crunching). This is done by taking data from the input boards (A1; Receivers R, A, B) and controlling the sweep timing of the HP 3577A. This board contains its own firmware (Micro Program ROMs), Micro Program Sequencer, and a Bit/Slice ALU (Arithmetic Logic Unit). The ROMs provide microcodes which define the instruction steps for the fast processor board. The Micro Program Sequencer contains a microprogram controller which handles program flow. The Bit/Slice ALU provides 16-bits of data. This is where floating point and fast numerical calculations are performed.

Input Data Buffer

The buffer provides isolation which has data from the input (A1), trace memory (A12), and main processor-controller board to the Bit/Slice ALU.

Data Immediate

This section provides data to the Bit/Slice ALU when performing arithmetic constant calculations.

Dynamic Clock

This dynamic clock is used as the system clock for the fast processor. It is controlled by the microprogram controller. The frequency of the dynamic clock is a function of the instructions executed by the fast processor.

Bit/Slice ALU (Arithmetic Logic Unit)

This section is the "heart" of the floating point processor. The ALU provides a 16-bit word length. The functions that are performed in the ALU are:

- 16-Bit Adder/Subtractor
- 16-Bit x 16 Word RAM
- 16-Bit (Q) Register
- Shift Registers
- Multiplexers

Output Data Registers

These tri-state registers provide isolation between the Bit/Slice ALU and the Fast Data Bus.

Read/Write Control

This section is used to read and write data to the input (A1), trace memory (A12), and the main processor-controller board (A13). For example, the signal name BUSGNT (Bus Grant) is used to notify the main processor-controller (A13) that the Fast Data Bus is now available.

Micro Program ROM

This section provides the fast processor with a 2k x 48-bit program storage capabilities.

Micro Program Sequencer

The sequencer controls the program flow for the fast processor.

Timing

This section provides the sweep control counter and the digital filters on the input board (A1) with a 4 kHz and 2 kHz reference signal, respectively.

Sweep Control Counter

This section is used as a loadable counter. This counter controls the input board's (A1) sweep time and settling time.

7-9 A12 TRACE MEMORY BOARD

Circuit Board Description

The trace memory board (A12) is used to provide non-volatile storage capabilities. At turn-on a ROM chesksum and a marching ones for the RAM test is performed. A more exhaustive test can be summoned using the SPCL FCTN (SPECIAL FUNCTION) hardkey as shown in Section II (Fault Isolation), under Service Diagnostics.

Read/Write Memory (RAM)

Blocks 1 through 4 (U5, U12, U6, U13, respectively) are used to store data from the input receivers (A1; R, A, B) and as a scratch pad memory for the fast processor board (A11). The remaining blocks are used to store data in registers D1 through D4. For this reason, only the first four blocks are tested at turn-on.

Read Only Memory (ROM)

This section contains the coefficients corresponding to trigonometric and logarithmic functions for the fast processor board (A11).

Battery Backup

This section provides power backup for the RAMs. If the voltage at test point 1 (+VDD) drops below 3 volts, the battery (BT1) supplies power.
Chip Select and Read/Write Control (DECODING)
This section insures that the data is received and sent by the appropriate RAM/ROM chips.

7-10 A13 MAIN PROCESSOR-CONTROLLER BOARD

Circuit Board Description

The central or main intelligence of the HP 3577A Network Analyzer is the main processor-controller board (A13). The "heart" of the main processor is a 16-bit microprocessor which runs at 8 MHz. This board contains its own firmware (ROM) and RAM. The main processor bus on this board provides all interfacing between the microprocessor and other portions of the instrument. This interfacing includes the I/O (Input/Output), Display Interface, and Fast Bus Interface. The I/O section includes the Keyboard Bus, HP-IB Bus, Control Bus, and Status Bus. The Display Interface section provides all display functions. The Fast Bus Interface ties the main processor-controller's communication port with that of the Fast Data Bus. The following boards communicate via the Fast Data Bus: input (A1), fast processor (A11), and trace memory (A12).

Interrupt Encoding

This section is used to interrupt the microprocessor when the HP-IB (A16) is requesting service or when the front panel INSTRument PRESET key is pressed. This section is also used as a timer and fast processor (A11) interrupt.

Reset

This section ensures that the microprocessor (A13U1) begins its program at a initial (known) state.

Data/Address Bus Buffer

These 16-bit buffers provide the microprocessor (A13U1) isolation from the rest of the board.

Trigger

This section is used to trigger the sweep on the fast processor board (A11) whenever an external trigger signal is connected on the rear panel or whenever the user wants to trigger off the ac line. If neither of these two conditions are used, the fast processor board will then free run.

Address Decoding

The address decoding is used to read/write and send control data to various boards throughout the instrument.

Beeper

The beeper is used to inform the user that attention is required. For example, when an error message is displayed the beeper will alert the user that the main processor-controller (A13) has detected an unsatisfactory operating condition.

8 MHz Clock Phase-Locked Loop (PLL)

This section provides an 8 MHz clock signal necessary to run the microprocessor (A13U1). This is done by multiplying the 1 MHz signal, which comes from the frequency reference board (A6), by sixteen (16), and then dividing it by two to produce 8 MHz. If the 1 MHz is not present, the 16 MHz PLL will free run in order to turn-on the microprocessor. An error message will then appear on the display.

Display Interface

This section is a 16-bit bidirectional data buffer. The signal name "DISCONNECT SENSE" is used to show the display's test pattern.

I/O

The I/O port contains the Control Bus, Keyboard Bus, HP-IB Bus, and Status Bus.

ROM/RAM

The ROM/RAM provide the main processor-controller (A13) with 16-bits of data.

Fast Bus Interface

This section provides the main processor-controller a means of communicating with the fast processor (A11), trace memory (A12), and input (A1; Receivers R,A,B) boards. In order for the main processor-controller to communicate with the trace memory and input boards, the fast processor must grant the bus. The latches and buffers used in this section are bidirectional.

Battery Back-up

This section provides power backup for the RAMs. If the voltage at test point 8 (+VDD) drops below 3 volts, the battery (BT1) located on the trace memory board (A12) supplies power.

7-11 A15 KEYBOARD

Circuit Board Description

The keyboard is responsible for two prime functions:

- To recognize the closure of switches.
- Light up the appropriate LEDs.

The keyboard is constantly being monitored by the main processor-controller (A13) via the keyboard data bus lines (KBO - KB7). If a key is stuck for a period longer than 10 seconds, an error message will then be displayed on the CRT.

Key Matrix

A 7 $\times$ 8 keyboard matrix is used to recognize the closure of switches. This information is then buffered and sent to the main processor-controller board (A13).

Read/Write Control

This section reads the data entered in the key matrix via the main processor-controller board (A13) and sends a command signal to LED annunciators.

LED Annunciators

This section drives the LEDs on the front panel.

RPG Control

The rotary pulse generator (RPG) control is used to enter data or use the marker function capabilities. This section is also buffered from the main processor-controller board (A13).

Instrument Preset

This section is used to set the instrument to its turn-on preset conditions.

7-12 A16 HP-IB BOARD

Circuit Board Description

This board provides an isolated link between the instrument's main processor-controller (A13) and the "outside world." An HP-IB connector is provided at the rear panel of the instrument. This connector is used to connect the instrument to other instruments and controllers which have HP-IB (IEEE 488) capability.

This board also provides electrical isolation between the interface bus and analog sections of the instrument. Isolated power for the interface section of this board is supplied from a separate transformer winding (A21 Main Power Supply Board). All digital signals between the isolated and non-isolated sections of this board are coupled through pulse transformers. The buffer amplifiers drive the pulse transformers and latches which convert pulses to constant signal levels.

HP-IB Interface

The HP-IB interface section implements the IEEE 488 protocol.

Interrupt

This section couples the HP-IB interface circuit signal $\overline{\text{INT}}$ from the main processor bus. The interrupt circuit is activated by the HP-IB interface section whenever it requests main processor-controlled (A13) service.

Reset

This section uses the instrument reset line ($\overline{\text{INIT}}$) to initialize interaction of hardware.

Register Select

This section couples the register select signals from the HP-IB interface circuitry. This section provides the register select signals necessary to perform sequential data processing.

Read/Write

This section is used to instruct the HP-IB interface to accept incoming or outgoing data.

5 MHz Clock

This section provides a 5 MHz clock signal necessary to run the HP-IB interface circuitry.

Data Input/Output

Each of these sections handles the sequential data being sent from and to the main processor-controller board (A13).

7-13 A20 MOTHERBOARD

Circuit Board Description

The motherboard does not have any active or passive electrical components. The only purpose of this board is to be a common focal point where signals are distributed throughout the instrument. The signal names that are distributed via the motherboard are listed in Section VIII (Service) under the mother assembly number.

7-14 A21 MAIN POWER SUPPLY BOARD

Circuit Board Description

This board is an off line half-bridge switching power supply. The main power supply board provides regulated (+5 Vdc, ±15 Vdc) and unregulated (+8 Vdc) voltages. It also has isolated supplies (HP-IB and Fan Output). MOS FET transistors provide the switching power supply capabilities. The "heart" of this switching power supply is the Pulsewidth Modulator (PWM). In addition, the power supply has the capabilities of sensing output current and overvoltage, monitoring the ac line voltage, and turning off due to excess temperature. For further details on switching power supplies, refer to the HP "Power Supplies, An Introduction" Manual (-hp- part number 5952-0158).

Line Filter

The line filter provides RFI isolation between the ac line voltage and the main power supply.

Turn On

This section is used to signal the Pulsewidth Modulator (PWM) when to turn on. For example, when the instrument has been turned off due to over or under ac line voltage. This section is also used to insure that the power supply turns on in an orderly manner.

Power On Preset ($\overline{POP}$)

After the output voltages are up and running, this section presents the microprocessor (A13U1). This section is also used to turn-on the battery back-up circuit on the trace memory (A12) and main processor-controller board (A13).

Bias Supply

The bias supply provides power for the control and protection circuitry. The signal name LINE SYNC synchronizes the fast processor's (A11) sweep triggering with the ac line.

FET Power

In this section the ac line is rectified and filtered to provide a high dc power supply. This high voltage supply is then switched across the primary of the transformer (T1) by Q1 and Q2.

FET Drive

The FET drive takes the signal from the Pulsewidth Modulator (PMW) and develops two anti-phase signals to drive the FETs (Q1 & Q2). These transistors are used to switch the dc high voltage created in the FET power section. This section also provides isolation between the PWM, which is connected to circuit ground, and FET power, which is connected to the ac line.

Pulsewidth Modulator (PWM)

The PWM is the "heart" of the switching power supply (A21). The outputs of the power supply are controlled by the PWM. The PWM takes the error signal from the Loop Shaping section and uses it to control the pulsewidth to the FET drive. The PWM contains its own internal oscillator, which has a frequency of 40 kHz and a +5 voltage reference. The PWM also contains a soft-start circuit to prevent large current surges at turn-on. In addition, the PWM can be turned off by any of the protection circuitry, including the Turn On section, when a fault is detected.

Primary Current Limit (PCL)

The PCL circuit senses the primary current via the transformer (T2) and latches off the Pulsewidth Modulator (PWM) when excess current is detected.

+5V Output

The signal from the FET Drive via the transformer (T1) is first rectified and then filtered to produce a +5 dc voltage. This section also contains a current sensing resistor for the +5V Current Limit (+5CL) section.

+5V Current Limit (+5CL)

This section senses the +5V current and latches off the Pulsewidth Modulator (PWM) when excess current is detected.

Loop Shaping (Loop S.)

The error signal from this section adjusts the pulsewidth of the Pulsewidth Modulator (PWM). This section has two inputs. One of the inputs is the dc loop, from the +5V Output, which provides good steady state voltage accuracy. The second input is the ac loop, also from the +5V Output, which helps improve transient responses.

+15V

The signal from the FET Drive via the transformer (T1) is first rectified and then filtered to produce a +15 dc voltage. The regulator (U10) used in this section provides an accurate, low output impedance, +15 voltage. This section also contains a current sensing resistor for the ±15V Current Limit (LMT) section.

−15V

The signal from the FET Drive via the transformer (T1) is first rectified and then filtered to produce a −15 dc voltage. The regulator (U11) used in this section provides an accurate, low output impedance, −15 voltage. This section also contains a current sensing resistor for the ±15V Current Limit (LMT) section.

Isolated Supply

This section provides a regulated dc supply for the HP-IB and an unregulated dc supply for the fan output. Note that these supplies are fused and are floating from chassis ground.

+8V

This section provides a fused, unregulated +8 dc supply for the synthesizer (A7) and frequency reference board (A6).

±15V Current Limit (LMT)

The ±15V Current LMT senses the current from the +15V and −15V supplies and latches off the Pulsewidth Modulator (PWM) when excess current is detected.

Overvoltage

This section senses the voltage from the ±15V and +5V supplies and latches off the Pulsewidth Modulator (PWM) when overvoltage is detected.

Hi Temp

This section senses the temperature of CR40 located in the +5V Output section and latches off the Pulsewidth Modulator (PWM) when excess temperature is detected.

Connector (Conn.)

This section distributes the power supplies throughout the entire instrument via the motherboard (A20). This section also provides probe power.

7-15 A31 OVEN BOARD

Circuit Board Description

The oven board generates a stable 10 MHz frequency reference signal, that is controlled by the frequency reference board (A6). When an external reference signal is used on the HP 3577A, the frequency reference board forces the control line "$\overline{\text{SHUTDOWN}}$" to go low which turns off the 10 MHz oven output signal.

Threshold Detector

At turn-on before the oven assembly warms up, large heater currents are drawn through L1 by the oven assembly. Regardless of the signal on the control line "$\overline{\text{SHUTDOWN}}$", U2 senses this current and shuts down the oven output signal at J1 by turning off the switchable filter. During this time, the HP 3577A uses its own VCXO as a frequency reference. After the oven assembly has warmed up (i.e., frequency output is stable), the heater current through L1 is reduced which allows U2 to turn-on the switchable filter and have a 10 MHz signal present at J1. This signal is dependent upon the control input at J2(1) ($\overline{\text{SHUTDOWN}}$: TTL HIGH = ON, TTL LOW = OFF).

Oven Assembly

When the oven assembly has warmed up, it provides a stable 10 MHz frequency reference signal. The oven assembly takes approximately 10 minutes to warm up from room temperature.

Buffer

The buffer provides isolation between the oven assembly and the switchable filter. In the on state (U2 is high), CR2 acts as a open and allows Q3 and Q4 to be biased separately from Q1. In the off state (U2 is low), U2 effectively grounds the emitter of Q1 and the gates of Q3 & Q4.

Switchable Filter

In the on state, this section provides a 10 MHz low pass filter to reduce harmonic distortion. In the off state, this section provides additional isolation between the buffer and the oven output.

7-16 1345A DIGITAL DISPLAY

The HP 1345A is a 16-bit TTL data bus (positive logic) display. Its input power requirements are +15 Vdc, -15Vdc, and +5 Vdc. The Display Interface section, located on the main processor-controller board (A13), is used as a bidirectional data bus buffer. The signal name "DISCONNECT SENSE" is used to show the display's test pattern. When disconnected, via the SPCL FCTN (SPECIAL FUNCTION) hardkey, the display module turns on its own resident test pattern which test most of its display functions. This test pattern can also be shown by disconnecting the ribbon cable from the main processor-controller board to the display.

NOTE

In order to show the display's test pattern, the display needs to be biased by its proper input power requirements (±15 Vdc and +5 Vdc). Refer to the 1345A Operating and Service Manual for further details.

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SECTION VIII
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8-1 INTRODUCTION

This section provides information for troubleshooting and repairing the HP 3577A Network Analyzer. Circuit descriptions are provided in Section VII to explain circuit function to the service technician, so troubleshooting time can be spent troubleshooting and not learning instrument operation.

Troubleshooting voltages and waveforms are provided on or next to the schematic diagram foldout. Parts locators are provided opposite the foldout service sheets.

This section is to be used after isolating the faulty functional block using the Fault Isolation Procedures in Section II. The functional blocks are described in Section VII (Circuit Descriptions). Fault isolation to the sub-block level is accomplished here. Each functional sub-block consists of a small number of components, and the technician's expertise is relied upon for isolating the faulty component.

8-2 RECOMMENDED TEST EQUIPMENT

The recommended test equipment for troubleshooting is listed in Table 1-2. Any item which meets or exceeds the critical requirements can be substituted for the model listed.

8-3 LOGIC CONVENTIONS

Positive logic convention is used in this manual unless otherwise noted. Positive logic conventions define a logic "1" or "High" as the more positive voltage and a logic "0" or "Low" as the more negative voltage.

8-4 LOGIC SYMBOLOGY

The logic symbology used in this manual is based on ANSI Y32.14-1973. The reference designations and general schematic notes are shown in Figure 8-1 and Table 8-1, respectively. Basic logic symbols and examples of symbols are shown in Figure 8-2. Table 8-2 provides an explanation of function labels used in the schematics. Refer to the Logic Symbology Training Manual (-hp- part number 5951-6116) for a full explanation of the logic symbology used in the schematics.

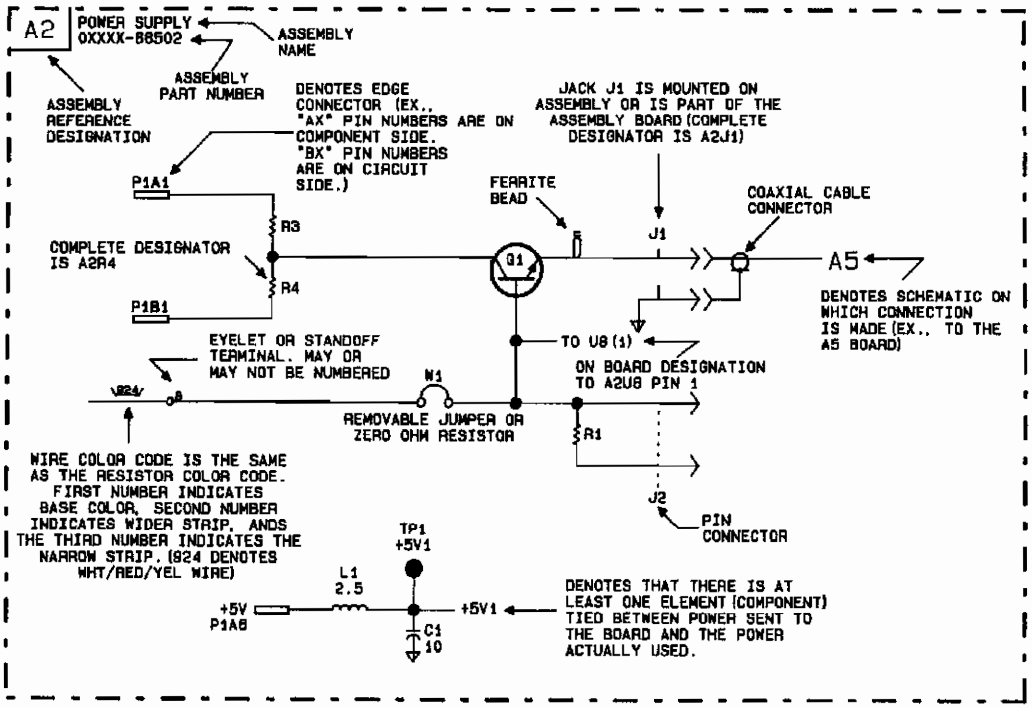


Figure 8-1. Reference Designations

Table 8-1. General Schematic Notes

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH ASSEMBLY DESIGNATION FOR COMPLETE DESIGNATION.
2. COMPONENT VALUES ARE SHOWN AS FOLLOWS UNLESS OTHERWISE NOTED.
   RESISTANCE IN OHMS
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MILLIHENRYS
3. DENOTES EARTH GROUND
   USED FOR TERMINALS WITH NO LESS THAN A NO. 18 GAUGE WIRE CONNECTED BETWEEN TERMINAL AND EARTH GROUND TERMINAL OF AC POWER RECEPTACLE
4. DENOTES FRAME GROUND.
   USED FOR TERMINALS WHICH ARE PERMANENTLY CONNECTED WITHIN APPROXIMATELY 0.1 OHM OF EARTH GROUND.
5. DENOTES GROUND ON PRINTED CIRCUIT ASSEMBLY (ELECTRICALLY CONNECTED TO FRAME GROUND).
6. DENOTES ISOLATED (I) OR SIGNAL(S) CIRCUIT GROUND.
7. SCREWDRIVER GROUND
8. DENOTES ASSEMBLY
9. DENOTES MAIN SIGNAL PATH
10. DENOTES FEEDBACK PATH
11. DENOTES FRONT PANEL MARKING.
12. DENOTES REAR PANEL MARKING.
13. DENOTES SCREWDRIVER ADJUST
14. * AVERAGE VALUE SHOWN. OPTIMUM VALUE SELECTED AT FACTORY. THE VALUE OF THESE COMPONENTS MAY VARY FROM ONE INSTRUMENT TO ANOTHER.
15. DENOTES RF SHIELD

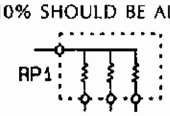
Table 8-1. General Schematic Notes (Cont.)

16. 924 DENOTES WIRE COLOR. COLOR CODE SAME AS RESISTOR COLOR CODE. FIRST NUMBER IDENTIFIES BASE COLOR. SECOND NUMBER IDENTIFIES WIDER STRIP. THIRD NUMBER IDENTIFIES NARROWER STRIP (e.g. 924 = WHITE, RED, YELLOW).

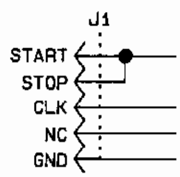
17. ALL RELAYS ARE SHOWN DEENERGIZED. ALL ANALOG SWITCH IC'S ARE SHOWN NOT ACTIVE.

18. WAVEFORMS AND AC VOLTAGE MEASUREMENTS WERE MADE WITH RESPECT TO CHASSIS GROUND USING AN OSCILLOSCOPE WITH A 10:1 PROBE. THE VOLTAGE LEVELS SHOWN FOR THE WAVEFORMS ARE ACTUAL VOLTAGE LEVELS AND ARE NOT TO BE CONFUSED WITH OSCILLOSCOPE SETTING. THE VOLTAGE LEVELS SHOWN ARE NOMINAL AND MAY VARY FROM ONE INSTRUMENT TO ANOTHER. A VARIATION OF ±10% IN MEASUREMENTS SHOULD BE ALLOWED. ALL WAVEFORMS SHOWN WERE AC-COUPLED UNLESS OTHERWISE NOTED. DC VOLTAGE LEVELS OF WAVEFORM TEST POINTS ARE INDICATED SEPARATELY.

19. DC VOLTAGE LEVELS WERE MEASURED WITH RESPECT TO CIRCUIT GROUND USING A DVM. THE VOLTAGE LEVELS SHOWN ARE NOMINAL AND MAY VARY FROM ONE INSTRUMENT TO ANOTHER DUE TO CHANGE IN TRANSISTOR CHARACTERISTICS. A VARIATION OF ±10% SHOULD BE ALLOWED.

20. 

DENOTES RESISTOR PACK

21. 

DENOTES SIGNATURE ANALYSIS TESTING POINTS


DENOTES BUFFER


DENOTES INVERTER

DENOTES AND GATE

A	B	C	Q
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

DENOTES NAND GATE

A	B	C	Q
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

DENOTES NOR GATE

A	B	C	Q
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

DENOTES EXCLUSIVE OR GATE

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

CONTROL BLOCK IS USED WHEN AN ARRAY OF RELATED LOGIC ELEMENTS SHARE COMMON CONTROL LINES

LOGIC ELEMENTS WITH COMMON CONTROL BLOCK

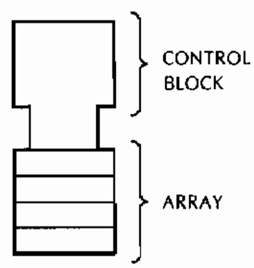


Table 8-2. Function Labels

▷	AMPLIFIER/BUFFER
1 ⎍	MONOSTABLE MULTIVIBRATOR (ONE-SHOT)
&	AND GATE
$\geqq$ 1	OR GATE
= 1	EXCLUSIVE OR GATE
X→Y	ENCODER, DECODER
XMAX→Y	PRIORITY ENCODER
CNTR	COUNTER
DEMUX	DEMULTIPLEXER
FF	FLIP FLOP
RAM	RANDOM-ACCESS MEMORY
REG	REGISTER
ROM	READ-ONLY MEMORY
SAR	SUCCESSIVE APPROXIMATION REGISTER
SEL	SELECTOR
SREG	SHIFT REGISTER
TX/RX	TRANSMITTER/RECEIVER

8-5 SAFETY CONSIDERATIONS

The HP 3577A is a Safety Class 1 instrument (provided with a protective earth terminal). The instrument and manuals should be reviewed for safety markings and instructions before operation. Refer to the Safety Symbol Table in the preface of this manual.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

WARNING

230 Vdc is present in the main power supply board (A21) even with the line switch in the off position and the power cord removed. Be extremely careful when working in the proximity of this area. This high voltage could cause serious personal injury if contacted. To remove this voltage, remove the mains power cord from the rear panel, remove the bottom cover and set the main power supply board (A21) jumpers W1 & W2 to the test position, using insulated pliers, to discharge the capacitors (A21C2 & A21C3) holding this voltage.

8-6 SCHEMATIC LIST

Table 8-3 shows the service groups by assembly numbers. Note that the service group number is the same as the assembly number for each of the circuit boards.

Table 8-3. Schematic List

Assembly Number	Description	Page
A1a	Input, Analog	8-27
A1b	Input, Digital	8-29
A4a	Local Oscillator	8-39
A4b	Local Oscillator	8-41
A5	250 kHz Offset	8-47
A6	Frequency Reference	8-55
A7a	Synthesizer, Analog	8-71
A7b	Synthesizer, Digital	8-73
A8a	Output	8-83
A8b	Output	8-85
A11a	Fast Processor	8-103
A11b	Fast Processor	8-105
A12	Trace Memory	8-109
A13a	Main Processor-Controller	8-131
A13b	Main Processor-Controller	8-133
A13c	Main Processor-Controller	8-135
A15	Keyboard	8-141
A16	HP-IB	8-147
A20	Motherboard	8-153
A21	Main Power Supply	8-173
A31	Oven	8-177

8-7 SERVICE GROUP A1, INPUT ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the circuit descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on.

Sweep Type . . . . CW
AMPTD . . . . -10 dBm
FREQuency . . . . 200 MHz

All Oscilloscope waveforms are taken using 10:1 probe and a HP 1980B Oscilloscope. All Spectrum Analyzer waveforms derived from SMB connectors are taken through the 03577-84401 Service Kit BNC to SMB cable. All Spectrum Analyzer waveforms taken off component leads are taken through a 10041A 10:1 probe. This probe has 215 Ω of series resistance.

All waveforms in this section were taken with the Receiver under test connected to the 3577A source using a cable from the HP 11851A Cable Kit.

Troubleshooting Hints

1. Before troubleshooting this circuit board, be sure that the fault is occuring on this circuit board by checking the following inputs using the settings in Table 2-7 and Table 8-5.
   a. A4J3,A4J4,A4J5 (depending on R,A, or B) L.O. Input
   b. A1R10 240 kHz Second L.O. input.
   c. A1TP10 8 kHz Third L.O. input.
   d. A1U28 pin 12 2 MHz Reference input.
   e. A1W4 2 kHz input.

2. Isolate the problem to either the digital or the analog circuitry by testing the signal at A1TP6 as decribed in step 6 of Table 8-5. If this test passes, then the analog circuitry is good, and the digital circuitry is bad. If the analog circuitry is bad, then half split the analog circuitry by testing the signal at A1TP4 as described in step 5 of Table 8-5. Then continue troubleshooting toward the bad signal. If the digital circuitry is indicated, follow the digital troubleshooting procedure following the troubleshooting hints.
3. SYMPTOM: Dynamic Linearity Performance Test fails.
   a. Use the other channels of the 3577A by setting the 3577A to continuous wave (CW) mode and setting the output frequency to the IF frequency where testing is taking place. Follow the Dynamic Accuracy test procedure in this section.
4. SYMPTOM: Crosstalk Performance Test fails.
   a. Board must be in cardnest and all receiver board screws in place.
   b. The A1L12 and A1L14 inductors could be coupling from receiver board to receiver board. These components should suspect.
5. SYMPTOM: Receiver Noise Performance Test fails.
   a. Check L.O. signals (all) for proper noise levels. DUT board must be in cardnest and all screws in place.
   b. Check the + or − 13 V power supplies for correct voltage and ripple.
6. SYMPTOM: Receiver Level Flatness cannot be adjusted into specification.
   a. Problem is in first mixer, L.O., input buffer, or impedance switching sub-blocks.
7. SYMPTOM: Receiver Phase Zero and Response out of specification.
   a. Check Frequency Reference board counter preset switch for proper position if 100 kHz phase zero bad. The proper position will put the phase zero between ± 15 degrees.
   b. Make sure L.O. ouput phase is good by observing a phase display when swapping the L.O. inputs to the A1 boards. If the display is constant then the L.O. is good. If the display changes, then L.O. is bad.
8. SYMPTOM: Receiver Sensitivity Performance Test fails.
   a. Jumper A1TP6 to ground. This is the Analog/Digital halfsplit. If the receiver passes, then the Analog section is bad. If the receiver fails, then the digital section is bad.
   b. If the analog circuit is suspect, jumper A1TP4 to ground. This should be used as an Input/10 kHz halfsplit.

Digital Filter Test

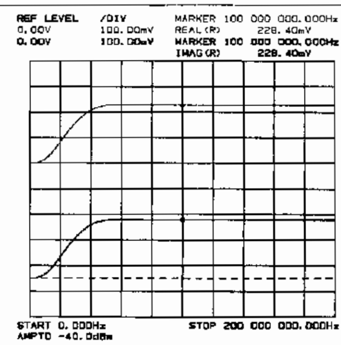
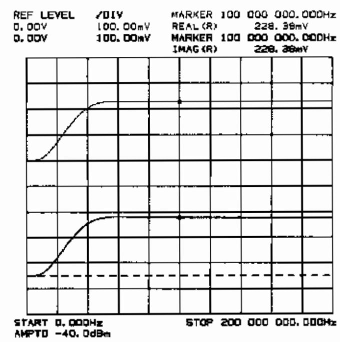
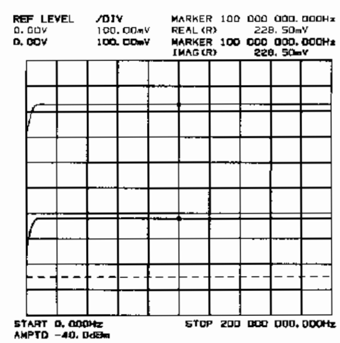
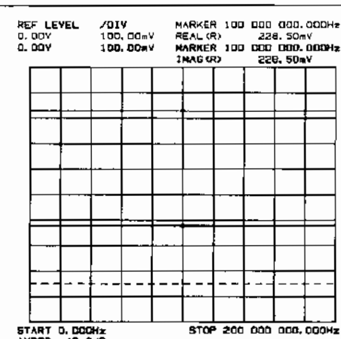
a. Disconnect the main power cord from the rear panel and remove the top cover. Place the suspect A1 receiver board on the 03577-66542 extender board.
b. Move the Digital Filter Test jumper W4 to the TEST position. Move the TEST jumper W2 to the TEST position.

c. Press the hardkeys listed below on the left and select the softkey, or enter the data listed on the right.

TRACE 1
INPUT . . . . Suspect Channel
DISP FCTN . . . . Real
SCALE
/ Div . . . . 100 mV
Ref Pos . . . . 60 %
Ref Level . . . . 0 V
TRACE 2
INPUT . . . . Suspect Channel
DISP FCTN . . . . Imag
SCALE
/ Div . . . . 100 mV
Ref Pos . . . . 15 %
Ref Level . . . . 0 V
SPCL FCTN
Service Diag . . . . Settling Off
AMPTD . . . . −40 dBm

d. Press the RES BW and SWP TIME hardkeys and select the values listed for each display shown in Table 8-4. The display is the digital filter step response. if any of these displays do not pass, then the digital filters or the algorithmic state machine are faulty. If both digital filters pass, then the Algorithmic State machine, I/O, and Look Up Tables are all good. If only one digital filter fails, then the failure is probably a bad filter. If both digital filters fail, then the problem is probably a state machine problem and the Signature Analysis tests should be run before replacing the digital filters.

Table 8-4. Digital Filter Test Waveform Table

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	As in step c. Sweep Time 5 sec RES BW 1 Hz	A1 board, W4 Digital Filter Test jumper in TEST position. A1W2 also in TEST position.	Step Response and final settled output value	
2	As in step c. Sweep Time.5 sec RES BW 10 Hz	A1 board, W4 Digital Filter Test jumper in TEST position. A1W2 also in TEST position.	Step Response and final settled output value.	
3	As in step c. Sweep Time.2 sec RES BW 100 Hz	A1 board, W4 Digital Filter Test jumper in TEST position. A1W2 also in TEST position.	Step Response and final settled output value	
4	As in step c. Sweep Time.2 sec RES BW 1 kHz	A1 board, W4 Digital Filter Test jumper in TEST position. A1W2 also TEST position.	Step Response and final settled output value	

A/D Test

a. Disconnect the main power cord from the rear panel and remove the top cover. Place the suspect receiver board on the 03577-66542 extender board.
b. Set the Test jumper W2 to the TEST position. Set the A/D Test jumper W3 to the TEST position. Set the 10 kHz in jumper W8 to the TEST position. All other jumpers should be in their NORMAL position.
c. Connect the External Power Supply to TP6.
d. Press the hardkeys listed on the left, and select the softkeys or enter the data listed on the right.

INSTR PRESET	
DISP FCTN	Real
SWEEP TYPE	CW
INPUT	
User Defined Input	K3*(K1*X-K2) X=Suspect Channel
DEF MATH	
K1 real	15.425 Units
K1 imag	0.0 Units
K2 real	7.5 Units
K2 imag	0.0 Units
K3 real	−1 Units
K3 imag	0.0 Units
SCALE	
/ Div	2 Units

e. This set up will measure positive input voltages at TP6. Monitor the External Power Supply with the Digital Voltmeter and compare the readings. All readings should agree to within 100 mV. At near 0 V, the reading may jump suddenly to ± 15V. This is normal and is due to the sign bit being toggled. The A/D does this because the trace math is different for the different polarities.
f. Test the negative half of the A/D by switching the polarity of the external power supply, and setting K2 real in step d to −7.5 Units.
g. If these tests fail, isolate the fault to the analog or digital sections of the receiver. Run the Digital Filter test in this section. If the digital filter test passes, then the fault is most likely in the A/D converter, sample and hold, or variable gain amplifier. If the digital filter test fails, then a algorithmic state machine, look up table or digital filter is faulty and must be repaired. Repair the components as indicated in the test.

Signature Analysis Tests

a. This Signature Analysis mode actually uses an Oscilloscope rather than a Signature Analyzer to check the digital sections of the A1 board.
b. Remove power from the 3577A and place the suspect receiver board on the 03577-66542 Extender board.
c. Set the following jumpers to their TEST position. All other jumpers must be the NORMAL position.

DIGITAL FILTER TEST	W4
A/D TEST	W3
BOARD TRI-STATE	W5 and W6
SIGNATURE ANALYSIS	W1

d. Externally trigger the Oscilloscope on the 4 kHz signal on A1TP8.
e. Check each of the signals as listed in Table 8-6. Expand the Time/Div control and adjust the delaying timebase to view each of the signals listed in the table. If a signal is bad, it will probably show up in the burst of pulses in the first 20 us. Check this time frame first, then expand out to view the second burst at approximately 120 us.
f. Replace each faulty component as shown from the signature data.

Dynamic Accuracy Troubleshooting

a. The Dynamic Accuracy Troubleshooting Procedure requires that two of the receivers in the 3577A are operating correctly. By programming the 3577A output frequency for the IF frequency under test, the good receiver is tuned to the IF, and linearity tests can be made. It is assumed the Input Variable Gain Amplifier dc Offset Adjustment was performed and the unit still failed the dynamic accuracy specifications. Also, perform the A/D converter and digital filter tests in this section to isolate the fault to the analog portion of the instrument.
b. Remove power from the 3577A and place the suspect receiver board on the 03577-66542 extender board. Connect the equipment as shown in Figure 8-3. Use the SMB to BNC cable to connect the suspect receiver board to the Power Splitter. The set up shown is for a faulty R channel board. Adapt the set up as necessary for an A or B circuit board fault.

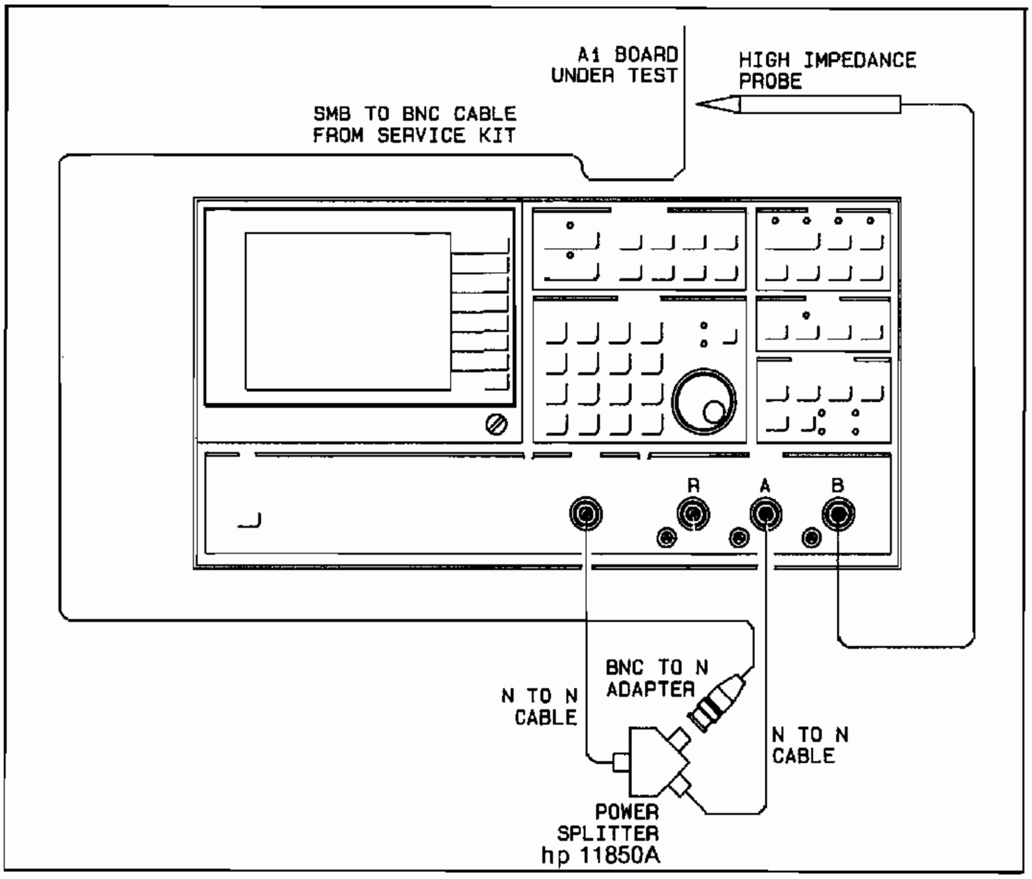


Figure 8-3. Dynamic Accuracy Troubleshooting Set Up

c. Set the 3577A controls by pressing the hardkey on the left and selecting the softkey, or entering the data listed on the right. The input settings below are for an R channel fault with the test set up seen in Figure 8-3. Adapt the control settings for your test set up as required by noting which channel is faulty, which is fed by the bridge and which has the 1:1 probe.

INPUT .... A/B
DISP FCTN .... Log Mag
SWEEP TYPE .... CW
RES BW .... 10 Hz
ATTEN
Receiver R .... 50 Ω, 20 dB
Receiver A .... 50 Ω, 20 dB
Receiver B .... 1 MΩ, 20 dB

d. If the failure occurs at only one frequency, then the fault is isolated to the first mixer and Local Oscillator buffer amplifier. Check this conversion section by by pressing the FREQ hardkey and entering a FREQUENCY of 250 kHz. Connect the 1:1 10007B Probe to A1R118.
e. Press the AMPTD hardkey and enter an amplitude of -10 dBm.
f. Press the MEASR CAL hardkey and select the NORMALIZE softkey.
g. Press the AMPTD hardkey and enter the amplitude where the suspect receiver fails the dynamic accuracy specifications. Vary the amplitude over the range of the input board. The marker readout should read 0 dB within the dynamic accuracy specifications. These specifications are listed in Table 1-1.
h. Dynamic accuracy failures will generally be limited to the A/D converter, non-linear amplifiers, and mixers. Test each of the mixers (U24 and U34) and the intermediate amplifiers at their outputs. Test these components from the first mixer back to the A/D. Replace all components that prove to be defective. After each mixer, the 3577A programmed frequency will change. Each of the IF frequencies are listed below.

First IF (mixer is U34) = 250 kHz
Second IF (mixer is U24) = 10 kHz

Variable Gain Amplifier Troubleshooting

a. These tests assume that the digital self tests have been run on the suspect receiver board. If these tests have not been run, then do the A/D test and the signature analysis test described in this section.
b. With the suspect receiver on the extender board, place jumpers A1W2, A1W13, and A1W3 into the test position. With the jumpers in this position, A1Q13 should be turned off, and the overall gain of the variable gain amplifier set to negative one. Note that the sample and hold has been disconnected by A1W13.
   1. Connect the External Power Supply positive terminal to A1TP14 and the negative terminal to chassis. Monitor the Power Supply voltage with the DC Voltmeter and set it to 5V ± 5 mV.
   2. Connect the DC Voltmeter to A1TP7 at the variable gain amplifier output. The voltage at A1TP7 should be -5.0 ± 0.1 V.
   3. If this test fails, then the variable gain amplifier or gain determining circuitry is faulty. Among the things to check for are shorted switch FETs, out of tolerance resistor ladder, faulty digital latches or buffer amplifiers. Replace all faulty components. Be sure the Variable Gain Amplifier

Offset adjustment has been properly performed before replacing components.

4. If this test passes, then the gain ladder can probably be assumed to be good. Continue with this procedure.

c. Test each of the Variable Gain Amplifier gain settings by following this procedure. A dc voltage is fed to the A/D converter which then determines the optimum gain value and turns on the appropriate gain selection FET.

1. Place jumper A1W13 into the test position and jumpers A1W2 and A1W3 into the normal position.
2. Set the External Power Supply to -6.8 V. Connect the positive terminal to A1TP14 and the negative terminal to chassis.
3. Connect the DC Voltmeter positive terminal to A1TP14 and the negative terminal to chassis.
4. Connect the Oscilloscope probe to A1TP7. The amplitude of the square wave at A1TP7 is the voltage at A1TP14 multiplied alternately by -1.1 and by the optimum gain value. If possible, the optimum gain value amplifies the voltage at A1TP7 to the range of +3.75 to +7.5 V or -3.75 to -7.5 V.
5. While monitoring the Oscilloscope, slowly increase the dc voltage at A1TP14. At approximately -3.4 V, a rapid change in the square wave occurs as Q20 turns on. Check all of the ranges in the following chart for a rapid change in the square wave each time the voltage at A1TP14 approaches the next range.

Approximate A1TP14 DC Voltage Range		Gain Selection FET
Lower	Upper	ON
-6.8	-3.4	Q21
-3.4	-1.7	Q20
-1.7	-0.85	Q19
-0.85	-0.43	Q18
-0.43	-0.21	Q17
-0.21	-0.11	Q16
-0.11	-0.05	Q15
-0.05	+0.05	Q14
+0.05	+0.11	Q15
+0.11	+0.21	Q16
+0.21	+0.43	Q17
+0.43	+0.85	Q18
+0.85	+1.7	Q19
+1.7	+3.4	Q20
+3.4	+6.8	Q21

6. If this test fails, check that the gain selection signals are getting through to the FETs and that the FETs are switching. If the signals are not getting through to the FETs, check for pulses to the driver chips (U18 and U17) and the buffer chip (U16). Note that pulses will be present rather than a steady state since the gain of the variable gain amplifier is first set to -1.1 and then to the optimum gain value.
7. If this test passes, run the signature analysis test to verify that the digital circuitry is operational. Also verify all clock signals entering the board.

Table 8-5. A1 Circuit Board, Troubleshooting Data

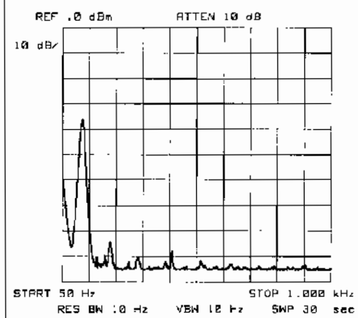
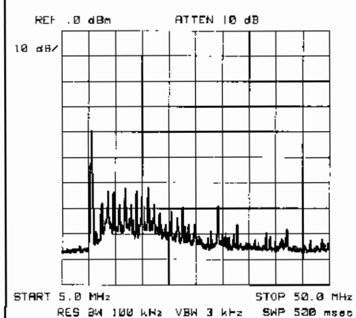
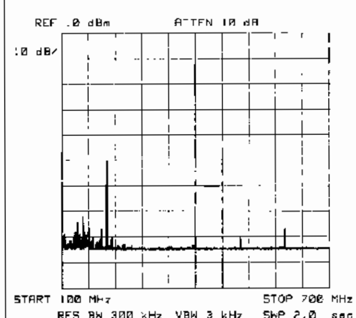
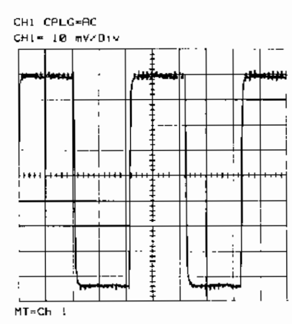
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Test at A1R106 Press INSTR PRESET AMPTD −20 dBm Sweep Type CW Freq 100 Hz Atten 1 MΩ 0 dB Connect source to receiver under test	Spectrum Analyzer Start 50 Hz Stop 1 kHz Res BW 10 Hz VBW 10 Hz Ref Level 0 dBm dB/Div 10 dB	100 Hz Carrier, noise.	
1 Cont	Test at A1R106 Press INSTR PRESET AMPTD −20 dBm Sweep Type CW Freq 10 MHz Atten 1 MΩ 0 dB Connect source to receiver under test	Spectrum Analyzer Start 5 MHz Stop 50 MHz Res BW 100 kHz VBW 3 kHz Ref Level 0 dBm dB/Div 10 dB	10 MHz Carrier, noise.	
1 Cont	Test at A1R106 Press INSTR PRESET AMPTD −20 dBm Sweep Type CW Freq 200 MHz Atten 1 MΩ 0 dB Connect source to receiver under test	Spectrum Analyzer Start 100 MHz Stop 700 MHz Res BW 300 kHz VBW 3 kHz Ref Level 0 dBm dB/Div 10 dB	200 MHz Carrier, noise.	
2	Test at A1R10 Press INSTR PRESET Freq start 5 Hz	Oscilloscope CH1 Coupling AC CH1 V/Div 10 mV Time/Div 1 us Trigger CH1	Waveshape period, noise.	

Table 8-5. A1 Circuit Board, Troubleshooting Data

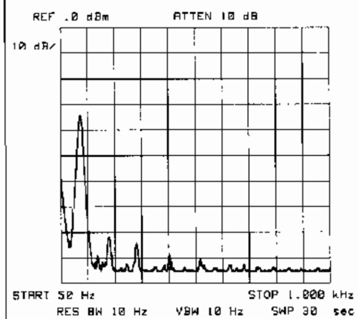
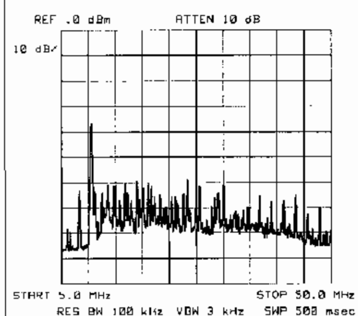
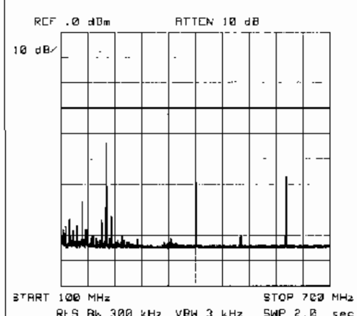
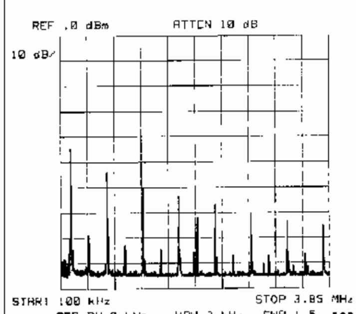
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
3	Test at A1R117 Press INSTR PRESET AMPTD −20 dBm Sweep Type CW Freq 100 Hz Atten 1 MΩ 0 dB Connect source to receiver under test	Spectrum Analyzer Start 50 Hz Stop 1 kHz Res BW 10 Hz VBW 10 Hz Ref Level 0 dBm dB/Div 10 dB	100 Hz Carrier, noise.	
3 Cont	Test at A1R117 Press INSTR PRESET AMPTD −20 dBm Sweep Type CW Freq 10 MHz Atten 1 MΩ 0 dB Connect source to receiver under test	Spectrum Analyzer Start 5 MHz Stop 50 MHz Res BW 100 kHz VBW 3 kHz Ref Level 0 dBm dB/Div 10 dB	10 MHz Carrier, noise.	
3 Cont	Test at A1R117 Press INSTR PRESET AMPTD −20 dBm Sweep Type CW Freq 200 MHz Atten 1 MΩ 0 dB Connect source to receiver under test	Spectrum Analyzer Start 100 MHz Stop 700 MHz Res BW 300 kHz VBW 3 kHz Ref Level 0 dBm dB/Div 10 dB	200 MHz Carrier, noise.	
4	Test at A1R118 Press INSTR PRESET AMPTD −4 dBm Sweep Type CW Freq 20 Hz Atten 50 Ω 20 dB Connect source to receiver under test	Spectrum Analyzer Start 100 kHz Stop 3.85 MHz Res BW 3 kHz VBW 3 kHz Ref Level 0 dBm dB/Div 10 dB	250 kHz first IF amplitude, distortion and noise.	

Table 8-5. A1 Circuit Board, Troubleshooting Data

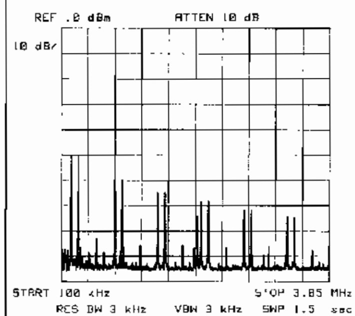
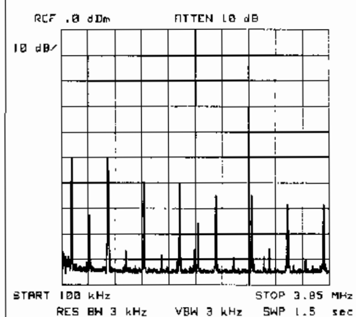
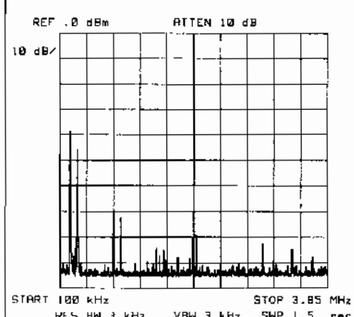
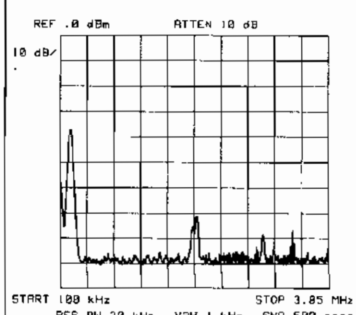
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
4 Cont	Test at A1R118 Press INSTR PRESET AMPTD −4 dBm Sweep Type CW Freq 50 kHz Connect source to receiver under test	Spectrum Analyzer Start 100 kHz Stop 3.85 MHz Res BW 3 kHz VBW 3 kHz Ref Level 0 dBm dB/Div 10 dB	250 kHz Carrier, amplitude, intermod-ulation, noise	
4 Cont	Test at A1R118 Press INSTR PRESET AMPTD −4 dBm Sweep Type CW Freq 250 kHz Connect source to receiver under test	Spectrum Analyzer Start 100 kHz Stop 3.85 MHz Res BW 3 kHz VBW 3 kHz Ref Level 0 dBm dB/Div 10 dB	250 kHz Carrier, amplitude, intermod-ulation, noise	
5	Test at A1TP4 Press INSTR PRESET AMPTD −4 dBm Sweep Type CW Freq 50 kHz Connect source to receiver under test	Spectrum Analyzer Start 100 kHz Stop 3.85 MHz Res BW 3 kHz VBW 3 kHz Ref Level 0 dBm dB/Div 10 dB	250 kHz Carrier, amplitude, intermod-ulation, noise	
5 Cont	Test at A1TP4 Press INSTR PRESET AMPTD −4 dBm Connect source to receiver under test	Spectrum Analyzer Start 100 kHz Stop 3.85 MHz Res BW 30 kHz VBW 1 kHz Ref Level 0 dBm dB/Div 10 dB	250 kHz Carrier, noise.	

Table 8-5. A1 Circuit Board, Troubleshooting Data

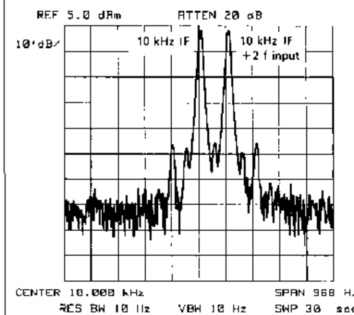
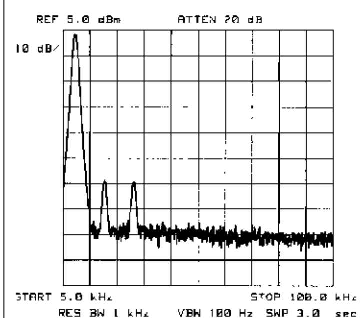
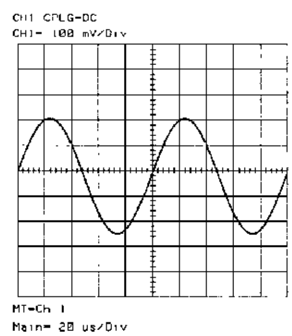
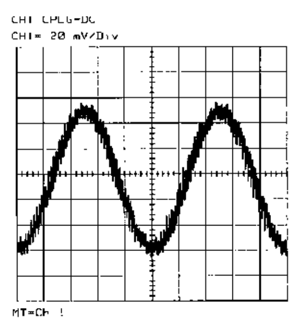
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
6	Test at A1TP6 Press INSTR PRESET Sweep Type CW Freq 50 Hz Amptd −10 dBm Connect source to receiver under test	Spectrum Analyzer Center 10 kHz Span 968 Hz Res BW 10 Hz VBW 10 Hz Ref Level 5 dBm dB/Div 10 dB	10 kHz IF, intermodulation, and noise	
6 Cont	Test at A1TP6 Press INSTR PRESET Sweep Type CW Freq 20 kHz Amptd −10 dBm Connect source to receiver under test	Spectrum Analyzer Start 5 kHz Stop 100 kHz Res BW 1 kHz VBW 100 Hz Ref Level 5 dBm dB/Div 10 dB	10 kHz IF, intermodulation, and noise	
6 Cont	Test at A1TP6 Press INSTR PRESET Sweep Type CW Freq 20 kHz AMPTD −10 dBm Connect source to receiver under test	Oscilloscope CH1 Coupling DC CH1 V/Div 100 mV Time/Div 20 us Trigger CH1	Period, noise	
7	Test at A1TP5 Press INSTR PRESET Sweep Type CW Freq 100 MHz Amptd −4 dBm Connect source to receiver under test	Oscilloscope CH1 Coupling DC CH1 V/Div 20 mV Time/Div 20 us Trigger CH1	Period, noise	

Table 8-5. A1 Circuit Board, Troubleshooting Data

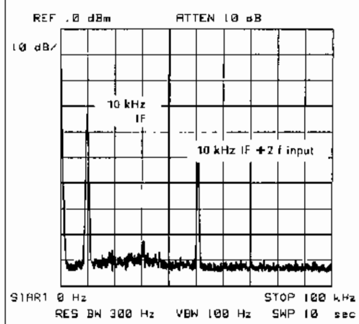
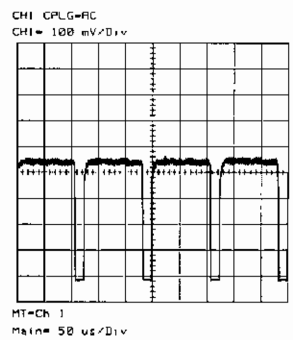
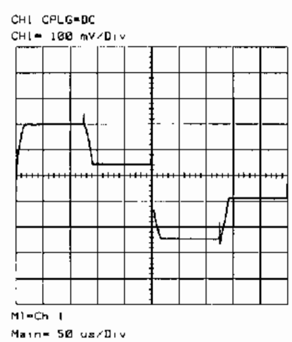
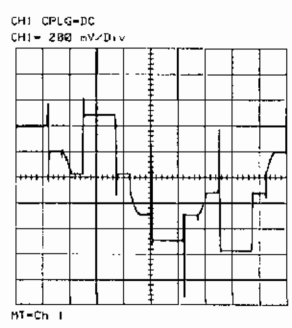
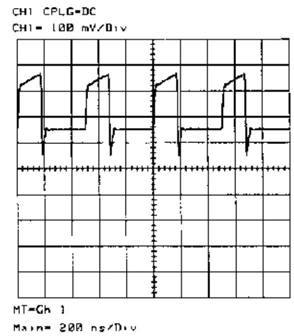
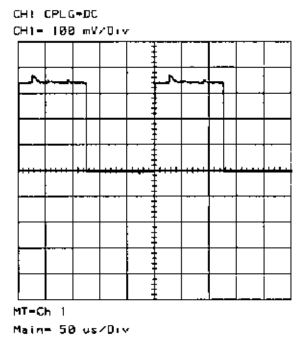
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
8	Test at A1R13 Press INSTR PRESET Sweep Type CW Freq 20 kHz AMPTD −4 dBm Connect source to receiver under test	Spectrum Analyzer Start 0 Hz Stop 100 kHz Res BW 300 Hz VBW 100 Hz Ref Level 0 dBm dB/Div 10 dB	10 kHz IF, intermodulation, and noise.	
9	Test at A1TP10 Press INSTR PRESET Connect source to receiver under test	Oscilloscope CH1 Coupling AC CH1 V/Div 100 mV Time/Div 50 uS Trigger CH1	Pulse Shape and noise	
10	Test at A1TP14 Press INSTR PRESET Sweep Type CW Freq 200 MHz Amptd −10 dBm Connect source to receiver under test	Oscilloscope CH1 Coupling DC CH1 V/Div 100 mV Time/Div 50 us Trigger CH1	Waveshape noise	
11	Test at TP7 Press INSTR PRESET Sweep Type CW Freq 200 MHz Amptd −10 dBm Connect source to receiver under test	Oscilloscope CH1 Coupling DC CH1 V/Div 200 mV Time/Div 50 us Trigger CH1	Waveshape, noise NOTE This will shift in time due to trigger level	

Table 8-5. A1 Circuit Board, Troubleshooting Data

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
12	Test at A1U28 Pin 12 Press INSTR PRESET Connect source to receiver under test	Oscilloscope CH1 Coupling DC CH1 V/Div 100 mV Time/Div 200 nS Trigger CH1	Waveshape, noise	
13	Test at TP11 Press INSTR PRESET Connect source to receiver under test	Oscilloscope CH1 Coupling DC CH1 V/Div 100 mV Time/Div 50 uS Trigger CH1	Waveshape, noise	

8-8 SERVICE GROUP A4, LOCAL OSCILLATOR ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on.

Sweep Type . . . . CW
AMPTD . . . . -49 dBm
FREQuency . . . . 200 MHz

All Oscilloscope waveforms are taken using 1:1 probe and a HP 1980B Oscilloscope. All Spectrum Analyzer waveforms connected to an SMB connector are taken through the 03577-84401 Service Kit BNC to SMB cable. All Spectrum Analyzer waveforms taken off component leads are taken through a 10007B 1:1 probe. This probe has 215 Ω of series resistance.

Troubleshooting Hints

1. Before troubleshooting this circuit board, be sure that the fault is occuring on this board by checking the following inputs using the settings in Table 2-7 in the Fault Isolation Section.

   a. A6J7 300 MHz reference output.
   b. A7J1 300.25 to 500.25 MHz output.

   If these signals check out as being good, then the problem is on the A4 Local Oscillator board.

2. SYMPTOM: Output Frequency is not correct.
   a. The problem is due to improper conversion in the first mixer, or improper frequency input signals.

3. SYMPTOM: Output Level or harmonic/spurious distortion.
   a. These problems could be anywhere on the circuit board. Begin troubleshooting at A4J11. Compare the Spectrum Analyzer reading with the information in Table 8-7 following this description. If the signal is good, then the fault is after J11, if it is bad, then the fault is before J11. Continue with this "half splitting" procedure until the faulty functional block is found. Compare all measured signals with the information given in Table 8-7.

Table 8-7. A4 Circuit Board, Troubleshooting Data

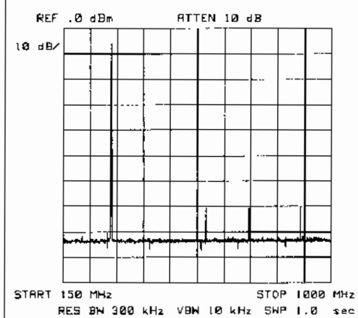
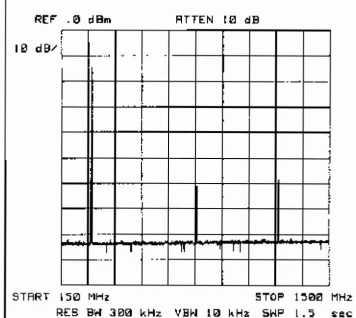
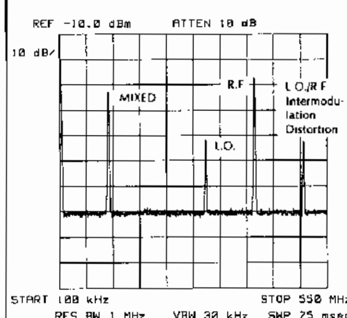
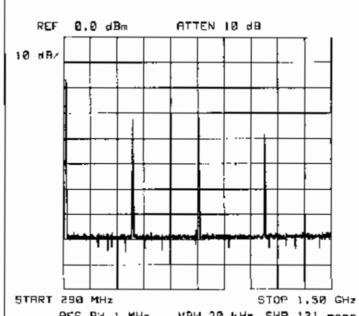
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Test at A4J6 Press INSTR PRESET	Spectrum Analyzer Start 150 MHz Stop 1000 MHz Res BW 300 kHz VBW 10 kHz Ref Level 0 dBm dB/Div 10 dB	300 MHz amplitude harmonics.	
2	Test at A4J7 Press INSTR PRESET	Spectrum Analyzer Start 150 MHz Stop 1500 MHz Res BW 300 kHz VBW 10 kHz Ref Level 0 dBm dB/Div 10 dB	300 MHz amplitude harmonics.	
3	Test at A4J9 Press INSTR PRESET Sweep Type CW Freq 100 MHz	Spectrum Analyzer Start 100 kHz Stop 550 MHz Res BW 1 MHz VBW 30 kHz Ref Level -10 dBm dB/Div 10 dB	100.25 MHz mixed, RF feedthrough, intermodulation.	
4	Test at A4C13 Press INSTR PRESET Sweep Type CW Freq 5 Hz	Spectrum Analyzer Start 290 MHz Stop 1500 MHz Res BW 1 MHz VBW 30 kHz Ref Level 0 dBm dB/Div 10 dB	300.25 MHz synthesizer output amplitude harmonics.	

Table 8-7. A4 Circuit Board, Troubleshooting Data

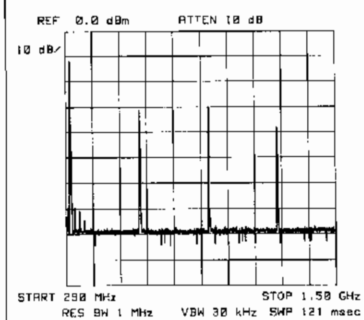
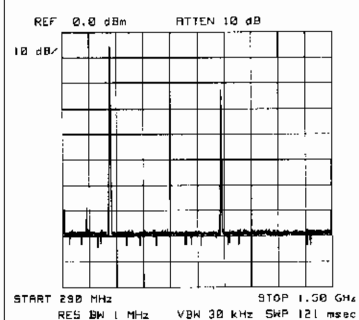
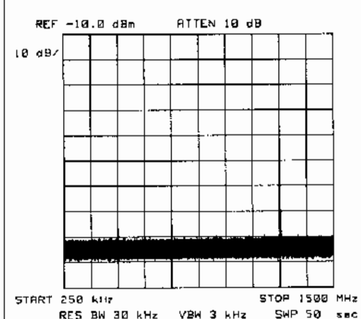
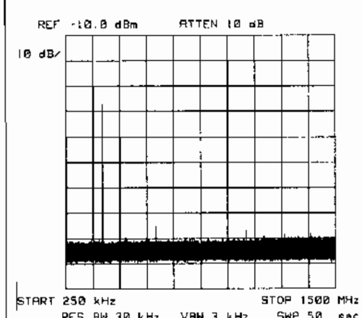
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
4 Cont	Test at A4C13 Press INSTR PRESET Sweep Type CW Freq 10 MHz	Spectrum Analyzer Start 290 MHz Stop 1500 MHz Res BW 1 MHz VBW 30 kHz Ref Level 0 dBm dB/Div 10 dB	310.25 MHz synthesizer output amplitude, harmonics.	
4 Cont	Test at A4C13 Press INSTR PRESET Sweep Type CW Freq 200 MHz	Spectrum Analyzer Start 290 MHz Stop 1500 MHz Res BW 1 MHz VBW 30 kHz Ref Level 0 dBm dB/Div 10 dB	500.25 MHz synthesizer output amplitude, harmonics.	
5	Test at A4J10 Press INSTR PRESET Sweep Type CW Freq 5 Hz	Spectrum Analyzer Start 250 kHz Stop 1500 MHz Res BW 30 kHz VBW 3 kHz Ref Level -10 dBm dB/Div 10 dB	250 kHz amplitude, harmonics, noise	
5 Cont	Test at A4J10 Press INSTR PRESET Sweep Type CW Freq 200 MHz	Spectrum Analyzer Start 250 kHz Stop 1500 MHz Res BW 30 kHz VBW 3 kHz Ref Level -10 dBm dB/Div 10 dB	200.25 MHz amplitude, harmonics, noise	

Table 8-7. A4 Circuit Board, Troubleshooting Data

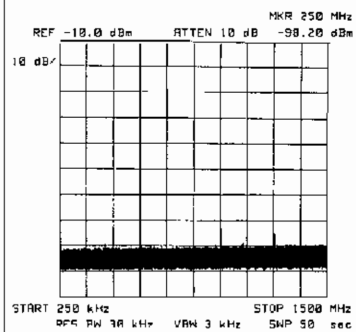
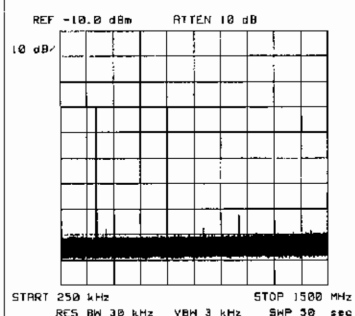
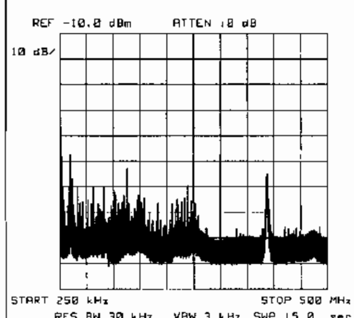
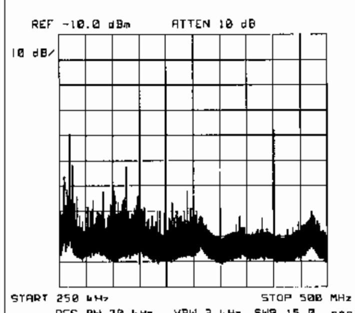
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
6	Test at A4J11 Press INSTR PRESET Sweep Type CW Freq 5 Hz	Spectrum Analyzer Start 250 kHz Stop 1500 MHz Res BW 30 kHz VBW 3 kHz Ref Level -10 dBm dB/Div 10 dB	250 kHz amplitude, harmonics, noise	
6 Cont	Test at A4J11 Press INSTR PRESET Sweep Type CW Freq 200 MHz	Spectrum Analyzer Start 250 kHz Stop 1500 MHz Res BW 30 kHz VBW 3 kHz Ref Level -10 dBm dB/Div 10 dB	200.25 MHz amplitude, harmonics, noise	
7	Test at A4U23 Pin 8 Press INSTR PRESETW Sweep Type CW Freq 5 Hz	Spectrum Analyzer Start 250 kHz Stop 500 MHz Res BW 30 kHz VBW 3 kHz Ref Level -10 dBm dB/Div 10 dB	250 kHz amplitude, harmonics, noise	
7 Cont	Test at A4J11 Pin 8 Press INSTR PRESET Sweep Type CW Freq 5 Hz	Spectrum Analyzer Start 250 kHz Stop 500 MHz Res BW 30 kHz VBW 3 kHz Ref Level -10 dBm dB/Div 10 dB	200.25 MHz amplitude, harmonics, noise	

Table 8-7. A4 Circuit Board, Troubleshooting Data

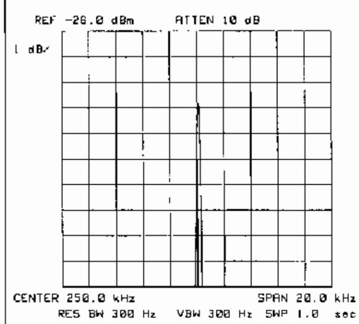
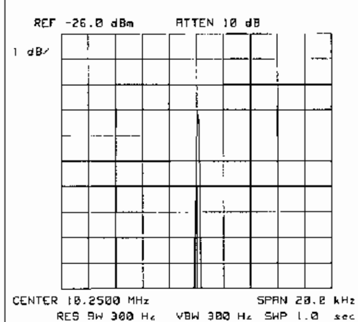
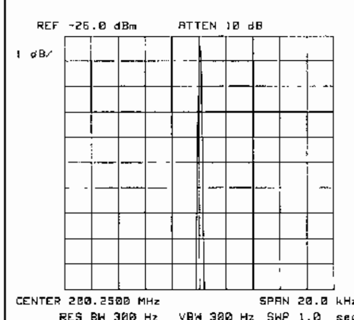
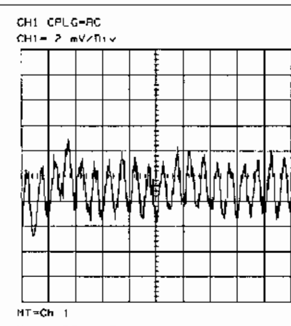
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
8	Test at A4R41 and R42 Junction Press INSTR PRESET Sweep Type CW Freq 5 Hz	Spectrum Analyzer Center 250 kHz Stop 20 kHz Res BW 300 Hz VBW 300 Hz Ref Level -26 dBm dB/Div 1 dB	Absolute Level	
8 Cont	Test at A4R41 and R42 Junction Press INSTR PRESET Sweep Type CW Freq 10 MHz	Spectrum Analyzer Center 10.25 MHz Stop 20 kHz Res BW 300 Hz VBW 300 Hz Ref Level -26 dBm dB/Div 1 dB	Absolute Level	
8 Cont	Test at A4R41 and R42 Junction Press INSTR PRESET Sweep Type CW Freq 200 MHz	Spectrum Analyzer Center 200.25 MHz Stop 20 kHz Res BW 300 Hz VBW 300 Hz Ref Level -26 dBm dB/Div 1 dB	Absolute Level	
9	Test at A4U25 Pin 2 Press INSTR PRESET Sweep Type CW Freq 100 MHz	Oscilloscope CH1 Coupling AC CH1 V/Div 2 mV Time/Div 20 ns Trigger CH1	100 MHz Feedthrough on leveling signal.	

Table 8-7. A4 Circuit Board, Troubleshooting Data

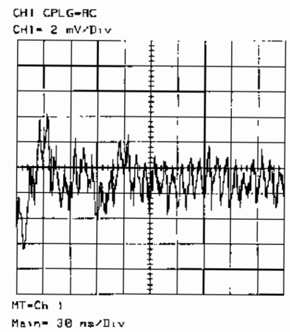
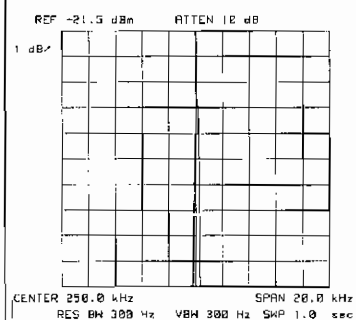
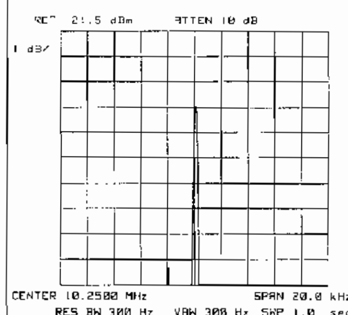
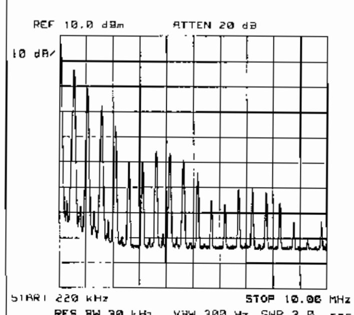
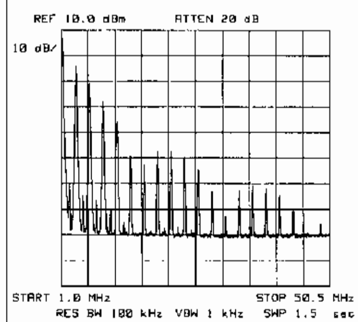
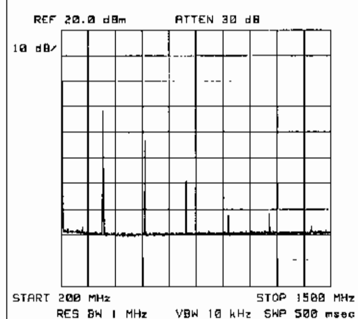
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
10	Test at A4U25 Pin 6 Press INSTR PRESET Sweep Type CW Freq 100 MHz	Oscilloscope CH1 Coupling AC CH1 V/Div 2 mV Time/Div 30 ns Trigger CH1	100 MHz Feedthrough on leveling signal.	
11	Test at A4R109 Press INSTR PRESET Sweep Type CW Freq 5 Hz	Spectrum Analyzer Center 250 kHz Span 20 kHz Res BW 300 Hz VBW 300 Hz Ref Level -21.5 dBm dB/Div 1 dB	Amplitude	
11 Cont	Test at A4R109 Press INSTR PRESET Sweep Type CW Freq 10 Hz	Spectrum Analyzer Center 10.25 MHz Span 20 kHz Res BW 300 Hz VBW 300 Hz Ref Level -21.5 dBm dB/Div 1 dB	Amplitude	
12	Test at A4J3 Press INSTR PRESET Sweep Type CW Freq 5 Hz	Spectrum Analyzer Start 220 kHz Stop 10 MHz Res BW 30 kHz VBW 300 Hz Ref Level 10 dBm dB/Div 10 dB	250 kHz amplitude, harmonics, noise	

Table 8-7. A4 Circuit Board, Troubleshooting Data

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
12 Cont	Test at A4J3 Press INSTR PRESET Sweep Type CW Freq 1 MHz	Spectrum Analyzer Start 1 MHz Stop 50.5 MHz Res BW 100 kHz VBW 1 kHz Ref Level 10 dBm dB/Div 10 dB	1 MHz amplitude, harmonics noise	
12 Cont	Test at A4J3 Press INSTR PRESET Sweep Type CW Freq 200 MHz	Spectrum Analyzer Start 200 MHz Stop 1500 MHz Res BW 1 MHz VBW 10 kHz Ref Level 20 dBm dB/Div 10 dB	200 MHz amplitude, harmonics, noise	

8-9 SERVICE GROUP A5, 250 kHz ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the circuit descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on.

Sweep Type .... CW
AMPTD .... −49 dBm
FREQuency .... 200 MHz

All Oscilloscope waveforms are taken using 1:1 probe and a HP 1980B Oscilloscope. All Spectrum Analyzer waveforms connected to an SMB connector are taken through the 03577-84401 Service Kit BNC to SMB cable. All Spectrum Analyzer waveforms taken off component leads are taken through a 10007B 1:1 probe. This probe has 215 Ω of series resistance.

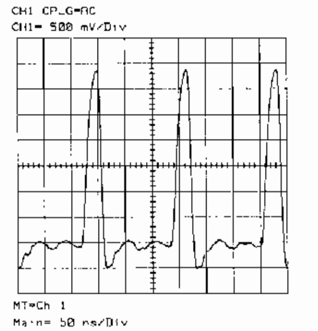
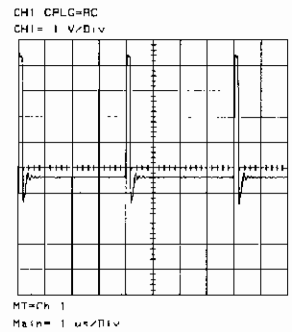
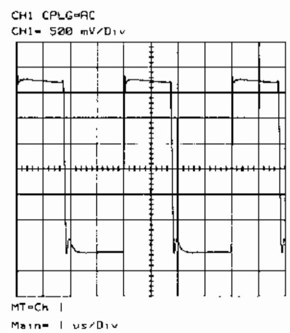
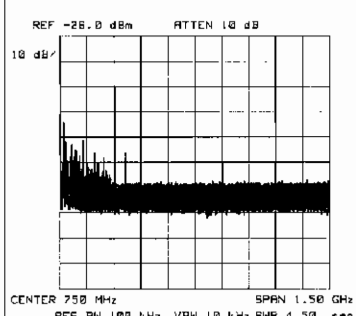
Troubleshooting Hints

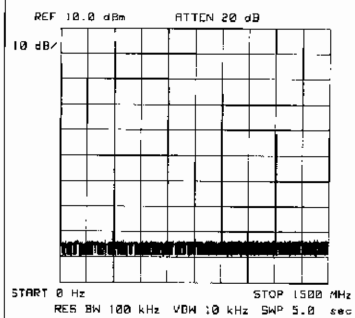
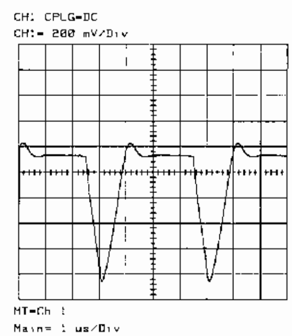
1. Before troubleshooting this circuit board, be sure that the fault is occuring on this board by checking the following inputs using the settings in Table 2-7 in the Fault Isolation Section.

   a. A6J4 300 MHz reference output

2. Test the signals listed in Table 8-7 to troubleshoot the circuit to the faulty functional sub-block. The phase locked loop can be can be opened by removing jumper W2. This allows troubleshooting of the phase detector and VCO.

Table 8-8. A5 Circuit Board, Troubleshooting Data

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Test at A5W3 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 500 mV Time/Div 50 ns Trigger CH1	Pulse shape and distortion	
2	Test at A5TP42 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 1 V Time/Div 1 us Trigger CH1	Pulse shape and distortion	
3	Test at A5TP31 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 500 mV Time/Div 1 us Trigger CH1	Pulse shape and distortion	
4	Test at A5U20 Pin 1 Press INSTR PRESET	Spectrum Analyzer Start 0 Hz Stop 1500 MHz Res BW 100 kHz VBW 10 kHz Ref Level -26 dBm dB/Div 10 dB	300 MHz amplitude, and harmonics.	

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
5	Test at A5J1 Press INSTR PRESET	Spectrum Analyzer Start 0 Hz Stop 1500 MHz Res BW 100 kHz VBW 10 kHz Ref Level 10 dBm dB/Div 10 dB	300.25 MHz amplitude and harmonics	
6	Test at A5U50 Pin 12 Press INSTR PRESET	Oscilloscope CH1 Coupling DC CH1 V/Div 200 MV Time/Div 1 us Trigger CH1	Pulse shape and distortion	
7	Test at A5Q1 collector Press INSTR PRESET Connect external power supply to W1 and GND	Counter	Correct Frequency	Frequency should be <300.25 MHz with 0 V input should be >300.25 MHz with 12 V in.

8-10 SERVICE GROUP A6, FREQUENCY REFERENCE ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on.

Sweep Type . . . . CW
AMPTD . . . . −49 dBm
FREQuency . . . . 200 MHz

All Oscilloscope waveforms are taken using 1:1 probe and a HP 1980B Oscilloscope. All Spectrum Analyzer waveforms connected to an SMB connector are taken through the 03577-84401 Service Kit BNC to SMB cable. All Spectrum Analyzer waveforms taken off component leads are taken through a 10007B 1:1 probe. This probe has 215 Ω of series resistance.

Troubleshooting Hints

1. Before starting to troubleshoot this circuit board, be sure the fault is on this board by checking the following input signals. The signal information is listed in Table 2-7 in the Fault Isolation Section.

   a. A31J1 Oven Reference Output

   NOTE

   The 3577A A6 Frequency Reference board will free run on its own 10 MHz VCXO if the A31 Oven signal is not present. The oven signal will not be present if the oven is not adequately warmed up.

2. Check the signal at A6J2 and A6J7 to determine in which third of the circuit the fault has occured. Refer to Table 8-9 for the proper signal levels at the various test points listed.

Table 8-9. A6 Circuit Board, Troubleshooting Data

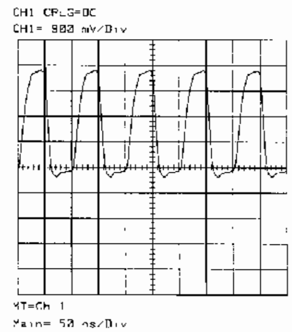
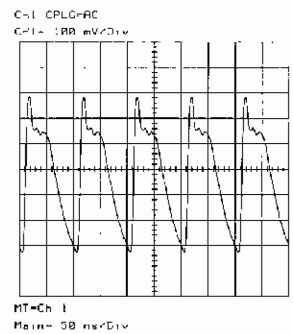
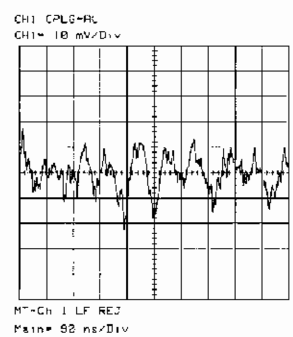
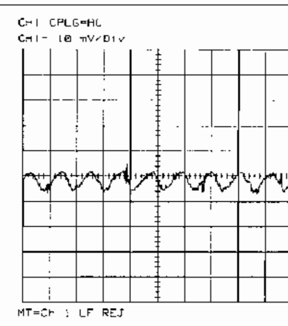
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Test at A6U22 Pin 1 Press INSTR PRESET	Oscilloscope CH1 Coupling DC CH1 V/Div 900 mV Time/Div 50 ns Trigger CH1	Pulse Shape, p-p amplitude.	
2	Test at A6TP1 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 100 mV Time/Div 50 ns Trigger CH1	Pulse Shape, p-p amplitude.	
3	Test at A6TP2 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 10 mV Time/Div 90 ns Trigger LF REJ, CH1	Noise on VCO control voltage	
4	Test at A6U2 Pin 14 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 10 mV Time/Div 90 ns Trigger LF REJ,CH1	Noise on VCO control voltage	

Table 8-9. A6 Circuit Board, Troubleshooting Data

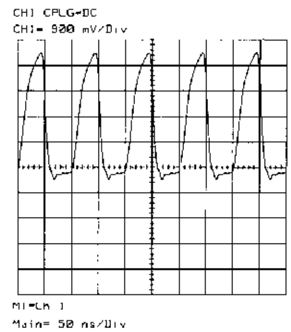
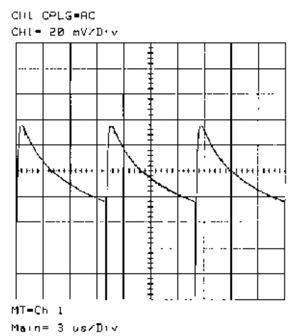
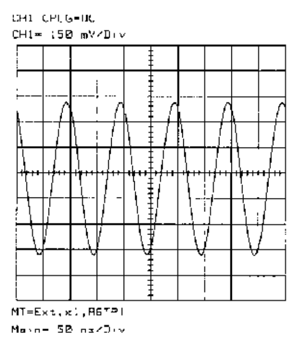
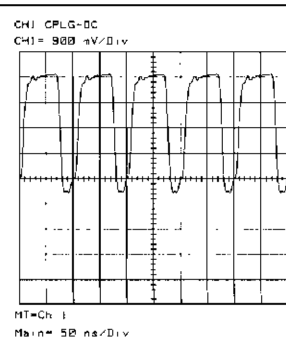
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
5	Test at A6TP3 Press INSTR PRESET	Oscilloscope CH1 Coupling DC CH1 V/Div 900 mV Time/Div 50 ns Trigger CH1	Pulse Shape, p-p amplitude.	
6	Test at A6J5 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 20 mV Time/Div 3 us Trigger CH1	Pulse Shape, p-p amplitude.	
7	Test at A6TP2 Press INSTR PRESET Trigger, × 1 on A6TP1	Oscilloscope CH1 Coupling DC CH1 V/Div 150 mV Time/Div 50 ns Trigger EXT × 1	Clean Sinewave	
8	Test at A6TP4 Press INSTR PRESET	Oscilloscope CH1 Coupling DC CH1 V/Div 900 mV Time/Div 50 ns Trigger CH1	Pulse p-p amplitude, period	

Table 8-9. A6 Circuit Board, Troubleshooting Data

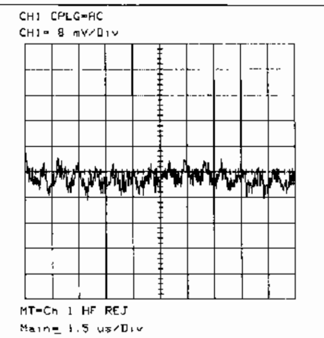
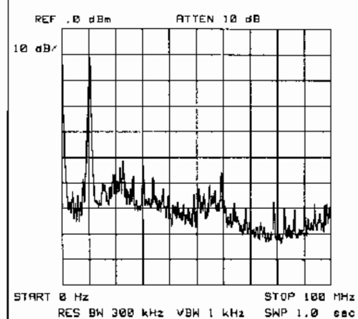
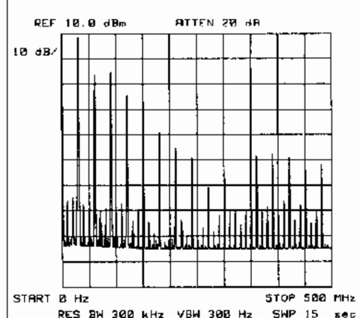
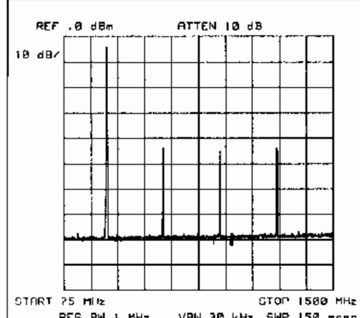
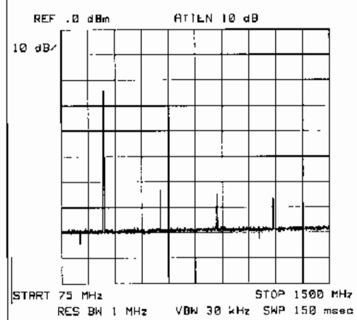
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
9	Test at A6R70 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 8 mV Time/Div 1.5 us Trigger HF REJ,CH1	Noise on VCO control voltage.	
10	Test at A6J2 Press INSTR PRESET	Spectrum Analyzer Start 0 Hz Stop 100 MHz Res BW 300 kHz VBW 1 kHz Ref Level 0 dBm dB/Div 10 dB	Harmonics and noise on 10 MHz output.	
11	Test at A6J7 Press INSTR PRESET	Spectrum Analyzer Start 0 Hz Stop 500 MHz Res BW 300 kHz VBW 300 Hz Ref Level +10 dBm dB/Div 10 dB	Harmonics and noise on 30 MHz output.	
12	Test at A6J3 Press INSTR PRESET	Spectrum Analyzer Start 75 MHz Stop 1500 MHz Res BW 1 MHz VBW 30 kHz Ref Level 0 dBm dB/Div 10 dB	Harmonics and noise on 300 MHz output	

Table 8-9. A6 Circuit Board, Troubleshooting Data

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
13	Test at A6J4 Press INSTR PRESET	Spectrum Analyzer Start 75 MHz Stop 1500 MHz Res BW 1 MHz VBW 30 kHz Ref Level 0 dBm dB/Div 10 dB	Harmonics and noise on 300 MHz output.	
14	Test at A6R22	Oscilloscope CH1 Coupling DC CH1 V/Div 1 V Time/Div any Trigger AUTO	See TTL Toggle	Oscilloscope should show U2b toggle when an External Reference is connected and disconnected.

A7
SYNTHESIZER

8-11 SERVICE GROUP A7, SYNTHESIZER ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on:

Sweep Type . . . . CW
AMPTD . . . . -49 dBm
FREQuency . . . . 200 MHz

All Oscilloscope waveforms are taken using 1:1 probe and an HP 1980B Oscilloscope. All Spectrum Analyzer waveforms connected to an SMB connector are taken through the 03577-84401 Service Kit BNC to SMB cable. All Spectrum Analyzer waveforms taken off component leads are taken through a 10007B 1:1 probe. This probe has 215 Ω of series resistance.

All troubleshooting in this section takes place with the synthesizer diagnostics turned on. To turn on this diagnostic, press the SPCL FCTN hardkey and toggle the SYN DIAG to the ON mode. This causes the 3577A to display directly in synthesizer frequency rather than output frequency.

Troubleshooting Hints

1. Before starting to troubleshoot this circuit board, be sure the fault is on this board by checking the following input signals. The signal information is listed in Table 2-7 in the Fault Isolation Section.

   a. A6J5 100 kHz reference signal.

   b. Run Service Diagnostics section in the Fault Isolation Section to verify that the digital circuits are operational.

   c. This circuit board regulates the main power supplies input to it. When the fault has been isolated to a functional sub-block, first check the supplies associated with that circuit.

2. SYMPTOM: Synthesizer output frequency is bad or noisy.

   a. Isolate whether the analog or digital circuitry is faulty by checking the signal at A7J1 with the Spectrum Analyzer. Power the instrument up with the Reset button pushed on the A13 Main Processor-Controller board. This keeps the main processor from programming the synthesizer, and makes the output VCO free run at the top of its frequency range. By releasing the main processor reset switch and disconnecting the 100 kHz reference signal at A7J3, the VCO will free run at the bottom of its frequency range.

   b. If the VCO oscillates at both the top and bottom of its range, the VCO is probably operating correctly. The important aspects of these signals are the frequency range and amplitude at both frequency extremes. There must be adequate signal level for the VCO to drive the associated circuitry. If the signals are good, begin troubleshooting the digital section of this board.

   c. If the VCO does not oscillate at all, repair the VCO circuit before continuing.

   d. If the VCO frequency range is not wide enough, then troubleshoot the oscillator transistor and the associated bias circuits.

Analog Troubleshooting

1. Connect the Spectrum Analyzer to A7J1 and then A7J2. Set A7W1 to the right and left positions. The output signals for both connectors should be −1 dBm ± 1.5 dB for both frequency extremes.

   a. If the signal is at A7J1 only, then the buffer circuits in the 300.25 MHz to 500.25 MHz VCO are faulty.

   b. If 200 MHz of tuning range is available, but not centered correctly, then the adjustment of this tuning range is required. See the appropriate adjustment in Section IV.

   c. If 200 MHz of tuning range is not available, then check all components in the schematic and physical vicinity of the oscillator transistor, A7Q161. Placement and mounting of these components is critical.

2. If the counter circuit is operational as described in the digital troubleshooting section, and the VCO is still not tuning correctly, then test for the correct signal at A7TP10. Sample waveforms for this test point are shown in step 3 of Table 8-10.

   a. If the waveform is slightly distorted or rounded, then check for proper operation of the sample and hold. Be sure the sampling FETS are not leaky. Start troubleshooting at the sample pulse input at A7TP20.

b. If the waveform is good, then check the following circuits in the order given to isolate the faulty functional sub-block.

1. The phase detector output at A7TP9 should look like the waveforms in step 2 of Table 8-10.

2. The voltage at A7R45 should be approximately -13.5 V.

3. The voltage at the junction of A7R40 and A7R46 should be between -7 and -8 V.

4. The outputs generating the Bias and API signals should be toggling for a swept synthesizer output. If they are not present, make sure the Fractional-N IC is generating them and that the latch clock is present. There should be 14 latch clock cycles for each reference cycle.

3. If the above circuitry checks as good, then the fault lies in the API and Bias sub-blocks. Care should be taken when troubleshooting this circuitry as all the signals are small currents which are difficult to detect. Note that if the VCO locks correctly, but there are large spurious signals present on the output, then check the diodes A7CR3,4,8,9 for opens, shorts, or excessive leakage.

Digital Troubleshooting

1. Always check to be sure the main processor is talking to the synthesizer properly. Connect the Oscilloscope to A7TP12. Press the SWEEP TYPE hardkey and select the CW softkey. Press the FREQ hardkey and enter a FREQUENCY of 1 MHz. Note on the Oscilloscope display that three pulses are sent to the Fractional-N IC after the MHz softkey is pressed. Repeat sending new frequencies to the A7 board until you are sure the data is present or not.

   a. If the data is latching through from the main processor-controller and motherboard to the A7 board, then the fault is on the A7 board. Continue the digital troubleshooting.

   b. If the data is not latching through, the input instruction decoding latches are faulty, or the main processor-controller signals are bad or missing.

2. Disconnect the jumper A7W1 and connect the External Power Supply to the A7W1 pins. Set the power supply for approximately 2 V. Monitor the VCO output frequency with the spectrum analyzer and adjust the power supply for a 400 MHz output signal. Press the SWEEP TYPE hardkey and select the CW softkey. With the Synthesizer Diagnostics on, press the FREQ hardkey and enter a FREQUENCY of 400 MHz. Monitor A7TP13 with the Oscilloscope while the VCO is manually tuned. If the frequency at TP13 approaches 100 kHz (10 μS) as the output frequency approaches 400 MHz, then the entire counter digital section is working correctly. Note that this frequency will approach 100 kHz for every N number programmed into the 3577A and tuned for at the VCO output.

a. If this test passes, and the faults appear to be digitally related, check to make sure the API current sources are getting the correct signals and are not leaky.

b. If this test fails, troubleshoot the counter subblocks and repair as necessary. Refer to the counter troubleshooting procedure.

API Troubleshooting

Overall API Troubleshooting

This procedure checks the entire API current source programming section. This can be used when the API circuit in general is suspect and will determine if the digital programming or the analog current sources are faulty.

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Place the A7 board on an extender board and connect A7J3 to A6J5. Connect the instrument to the power line, and turn the POWER switch ON.

b. Set the HP 3577A as follows:
Sweep Type . . . . CW
SPCL FCTN
SERVICE DIAG . . . . toggle SYN DIAG to ON
FREQ . . . . 450.000001 MHz

NOTE

SYN DIAG mode ON cannot be saved in the instrument state register.

c. In this mode, the Fractional-N counter is running to correct the phase detector error for the 1 Hz offset. In this mode, the programming pattern for the API's repeats at the following rate.

API NUMBER	LOCATION	RATE
1	U5 PIN 9	10 s
2	U4 PIN 15	1 s
3	U4 PIN 12	100 ms
4	U4 PIN 10	10 ms
5	U4 PIN 7	1 ms

d. Using an oscilloscope, check for the programming pattern at the outputs of A7U4 and A7U5. If these pulses are present, then the digital section is probably operational.

Individual API Troubleshooting

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Place the A7 board on an extender board and connect A7J3 to A6J5. Connect the instrument to the power line, and turn the POWER switch ON.

b. Connect the HP 8568B Spectrum Analyzer 10 MHz REF OUT to the HP 3577A EXT REF IN using a BNC cable. The EXT REF LED on the HP 3577A front panel should be lit.

c. Connect the spectrum analyzer to A7J1.

d. Set the HP 3577A as follows:
Sweep Type . . . . CW
SPCL FCTN
SERV DIAG . . . . toggle SYN DIAG to ON
FREQ . . . . 400.1 MHz

NOTE

SYN DIAG mode ON cannot be saved in the instrument state register.

e. Set the spectrum analyzer as follows:
INSTR PRESET

Center Frequency	400.1 MHz
Frequency Span	1 kHz
Ref Level	+5 dBm
Resolution Bandwidth	10 Hz
Sweep Time	20 sec
dB/Div	10 dB
CF Step Size	10 kHz

f. Wait one complete sweep, then press PEAK SEARCH on the spectrum analyzer. Turn the Δ function ON and step the center frequency up to 400.11 MHz using the ↑ key. Wait one complete sweep, then press PEAK SEARCH.

g. The Δ amplitude reading on the spectrum analyzer should be <-50 dB. If it is not, then troubleshoot API 1.

h. Set the frequency on the HP 3577A to 400.01 MHz.

i. Set the center frequency on the spectrum analyzer to 400.01 MHz. Wait one complete sweep, then press PEAK SEARCH on the spectrum analyzer. Toggle the Δ function until the marker Δ reading is 0 Hz, 0 dB. Step the center frequency up to 400.02 MHz using the ↑ key. Wait one complete sweep, then press PEAK SEARCH.

j. The Δ amplitude reading on the spectrum analyzer should be < -50 dB. If it is not, then troubleshoot API 2.

k. Set the frequency on the HP 3577A to 400.001 MHz.

l. Set the center frequency on the spectrum analyzer to 400.001 MHz. Wait one complete sweep, then press PEAK SEARCH. Toggle the Δ function until the marker Δ reading is 0 Hz, 0 dB. Step the center frequency up to 400.011 MHz using the ↑ key. Wait one complete sweep, then press PEAK SEARCH.

m. The Δ amplitude reading on the spectrum analyzer should be < -50 dB. If it is not, then troubleshoot API 3.

n. Set the frequency on the HP 3577A to 400.0001 MHz.

o. Set the center frequency on the spectrum analyzer to 400.0001 MHz. Wait one complete sweep, then press PEAK SEARCH. Toggle the Δ function until the marker Δ reading is 0 Hz, 0 dB. Step the center frequency to 400.0101 MHz using the ↑ key. Wait one complete sweep, then press PEAK SEARCH.

p. The Δ amplitude reading on the spectrum analyzer should be < -50 dB. if it is not, then troubleshoot API 4.

Counter Troubleshooting

a. Set the 3577A for a CW frequency at 300 MHz (the synthesizer diagnostics must be turned on). This sets the synthesizer for an integer counter divide value. Test for the proper frequencies on the nodes labeled both on the schematic and in step 9 of Table 8-10. Replace all faulty components as indicated.

Table 8-10. A7 Circuit Board, Troubleshooting Data

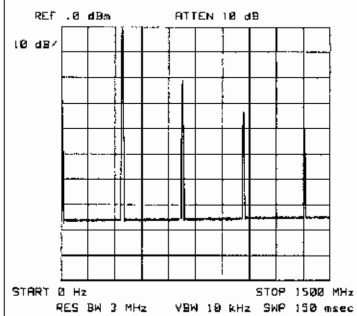
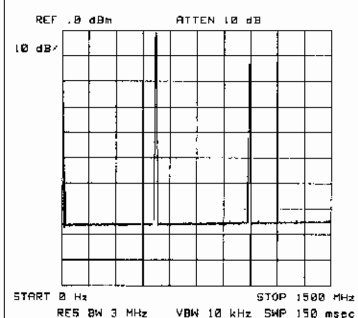
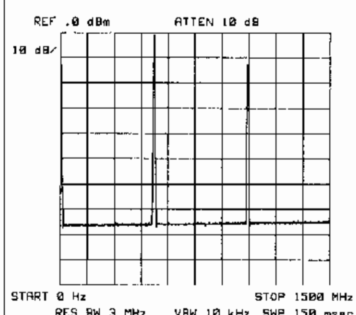
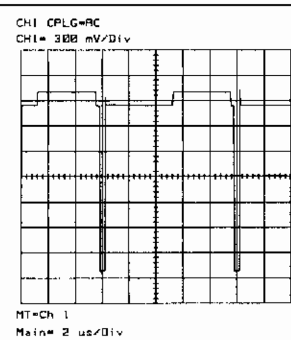
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Test at A7J1 Press INSTR PRESET Set A7W1 to +5V	Spectrum Analyzer Start 0 Hz Stop 1500 MHz Res BW 3 MHz VBW 10 kHz Ref Level 0 dBm dB/Div 10 dB	Frequency, Amplitude, Harmonics	
1 Cont	Test at A7J1 Press INSTR PRESET Set A7W1 to GND	Spectrum Analyzer Start 0 Hz Stop 1500 MHz Res BW 3 MHz VBW 10 kHz Ref Level 0 dBm dB/Div 10 dB	Frequency, Amplitude, Harmonics	
1 Cont	Test at A7J1 Press INSTR PRESET Set A7W1 open	Spectrum Analyzer Start 0 Hz Stop 1500 MHz Res BW 3 MHz VBW 10 kHz Ref Level 0 dBm dB/Div 10 dB	Frequency, Amplitude, Harmonics	
2	Test at A7TP9 Press INSTR PRESET Sweep Type CW Freq 5 Hz Press SPCL FCTN toggle STN DIAG to OFF mode	Oscilloscope CH1 Coupling AC CH1Volts/Div 300mV Time/Div 2 us Trigger CH1	Top pulse width and reset.	

Table 8-10. A7 Circuit Board, Troubleshooting Data

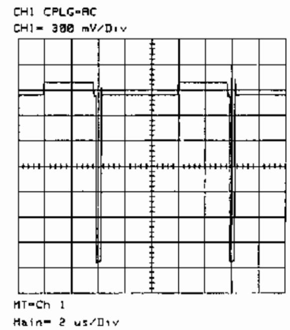
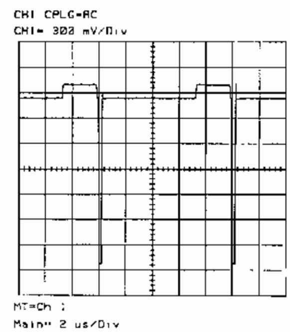
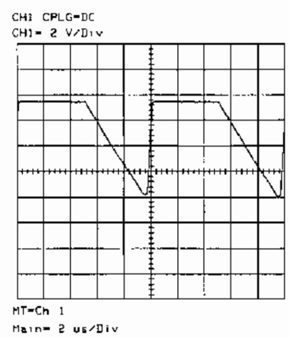
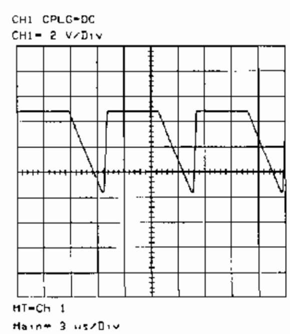
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
2 Cont	Test at A7TP9 Press INSTR PRESET Sweep Type CW Freq 50 MHz Press SPCL FCTN Toggle SYN DIAG to OFF mode	Oscilloscope CH1 Coupling AC CH1 Volts/Div 300mV Time/Div 2 us Trigger CH1	Top pulse width and reset.	
2 Cont	Test at A7TP9 Press INSTR PRESET Sweep Type CW Freq 200 MHz Press SPCL FCTN Toggle SYN DIAG TO OFF mode	Oscilloscope CH1 Coupling AC CH1 Volts/Div 300mV Time/Div 2 us Trigger CH1	Top pulse width and reset.	
3	Test at A7TP10 Press INSTR PRESET Sweep Type CW Freq 0 Hz Press SPCL FCTN Toggle SYN DIAG to OFF mode	Oscilloscope CH1 Coupling DC CH1 Volts/Div 2 V Time/Div 2 us Trigger CH1	Pulse height and reset.	
3 Cont	Test at A7TP10 Press INSTR PRESET Sweep Type CW Freq 50 MHz Press SPCL FCTN Toggle SYN DIAG to OFF mode.	Oscilloscope CH1 Coupling DC CH1 Volts/Div 2 V Time/Div 3 us Trigger CH1	Pulse height and reset.	

Table 8-10. A7 Circuit Board, Troubleshooting Data

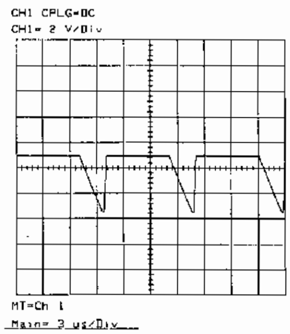
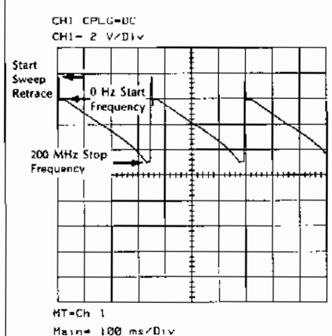
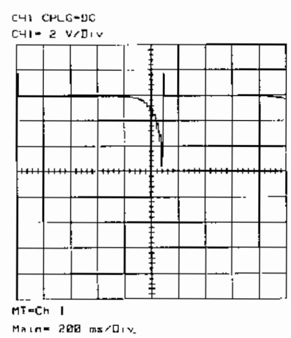
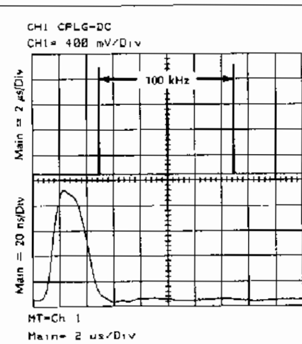
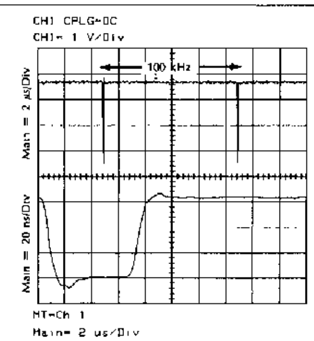
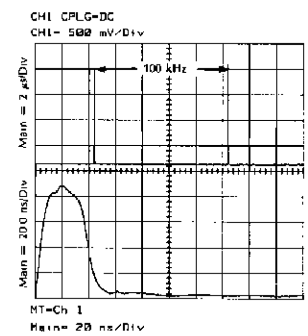
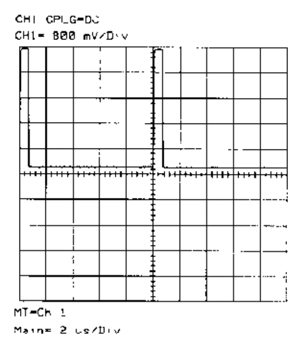
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
3 Cont	Test at A7TP10 Press INSTR PRESET Sweep Type CW Freq 200 MHz Press SPCL FCTN Toggle SYN DIAG to OFF mode	Oscilloscope CH1 Coupling DC CH1 Volts/Div 2 V Time/Div 3 us Trigger CH1	Pulse height and reset.	
4	Test at A7W11 Press INSTR PRESET Press SPCL FCTN Toggle SYN DIAG TO OFF mode	Oscilloscope CH1 Coupling DC CH1 Volts/Div 2 V Time/Div 100 ms Trigger CH1	Pulse height and linear ramp	
4 Cont	Test at A7W11 Press INSTR PRESET Sweep Type Log Press SPCL FCTN Toggle SYN DIAG to OFF mode	Oscilloscope CH1 Coupling DC CH1 Volts/Div 2 V Time/Div 200 ms Trigger CH1	Pulse height and logarithmic ramp	
5	Test at A7TP13 Press INSTR PRESET Sweep Type DC Freq 300 MHz Press SPCL FCTN Toggle SYN DIAG to ON mode.	Oscilloscope CH1 Coupling DC CH1 Volts/Div 400mV Trigger CH1 Time/Div Top 2 us Bottom 20 ns	Frequency, Pulse height and width.	

Table 8-10. A7 Circuit Board, Troubleshooting Data

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
6	Test at A7TP4 Press INSTR PRESET Sweep Type CW Freq 300 MHz Press SPCL FCTN Toggle SYN DIAG to ON mode	Oscilloscope CH1 Coupling DC CH1 Volts/Div 1 V Trigger CH1 Time/Div Top 2 us Bottom 20 ns	Frequency, pulse height and width.	
7	Test at A7TP16 Press INSTR PRESET Press SPCL FCTN Toggle SYN DIAG TO ON mode	Oscilloscope CH1 Coupling DC CH1 Volts/Div 500mV Trigger CH 1 Time/Div Top 2 us Bottom 20 ns	Frequency, Pulse height and width.	
8	Test at A7TP20 Press INSTR PRESET Sweep Type CW Freq 300 MHz Press SPCL FCTN Toggle SYN DIAG to ON mode	Oscilloscope CH1 Coupling DC CH1 Volts/Div 800mV Time/Div 2 us Trigger CH1	Frequency, pulse height and width.	
9	Digital Section Tests Press INSTR PRESET Sweep Type CW Freq 300 MHz Press SPCL FCTN Toggle SYN DIAG to ON mode.	Counter	Frequency at each test location	U11 (1,9,10,15)=100 kHz U14 (3,4,6)=100 kHz U14 (1,9)=200 kHz U15 (3)=100 kHz U15 (5,7,10,15)=100 kHz U18(5)=6 MHz

8-12 SERVICE GROUP A8, OUTPUT ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

All measurements are ± 10 percent unless otherwise specified.

Troubleshooting Hints

1. Before troubleshooting this circuit board, be sure that the fault is occurring on this board by checking the following signals using the parameters in Table 2-7.

A7J2	Swept Synthesizer Output
A5J1	300.25 MHz Offset Signal Amplifier

Troubleshooting Procedure

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Place the A8 Source board on an extender board. Connect the instrument to the power line, and turn the POWER switch ON.
b. Set the HP 3325A Synthesizer to a frequency of 100 kHz and an amplitude of -40 dBm.
c. Move A8W5 to the top right position and connect the synthesizer to A8J8.
d. Set the HP 3577A as follows:

Sweep Type . . . . CW
AMPTD . . . . +15 dBm

e. Measure the level at A8J3 with an HP 8568B Spectrum Analyzer. The level should be approximately +14.3 dBm. If it is not, use Table 8-11 to determine the faulty amplifier. These levels may be measured with an HP 8568B Spectrum Analyzer and an HP 10020A 20:1 resistive divider probe, or an oscilloscope and a 1:1 probe.

Table 8-11 A8 Circuit Board, Troubleshooting Data

Junction of Q5 and Q6	0.07 V peak-to-peak	-45 dBm
Junction of Q25 and Q26	0.64 V peak-to-peak	-27 dBm
Junction of Q45 and Q46	6.6 V peak-to-peak	-6 dBm
Output side of R72*	3.4 V peak-to-peak	-12 dBm

* Connect a 50 Ω load from J3 to ground.

f. The drop across R72 should be exactly 6 dB. If it is not, then troubleshoot the relays in the 60 dB Step Attenuator.
g. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

Low Frequency Gain Error Correction Troubleshooting Procedure

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.
b. Lift one side of R194. Place the A8 Source board on an extender board. Connect the instrument to the power line, and turn the POWER switch ON.
c. Set the HP 3325A Synthesizer to a frequency of 100 kHz and an amplitude of -40 dBm.
d. Move A8W5 to the top right position and connect the synthesizer to A8J8.
e. Set the HP 3577A as follows:
   SWEEP TYPE . . . . CW
   AMPTD . . . . +15 dBm

f. Connect an oscilloscope to A8J3 and set its input impedance to 50 ohms.
g. Adjust the DC offset on the synthesizer until the sine wave viewed on the oscilloscope is centered around 0 volts.
h. If the source trips before the synthesizer can be adjusted, lift one side of R115 to disable the overload sense circuit.
i. The synthesizer DC offset should not be greater than ± 25 mV and the output at J3 should be a 3 V peak-to-peak sine wave (non-clipped). If it is not, then the problem is in one of the amplifier stages and the bias levels at each stage should be checked.
j. Re-install R194 and R115.
k. Return the synthesizer DC offset to zero.
l. Lift one side of R193 and the side of R331 connected to U4 pin 6.
m. Set an external DC power supply to zero volts. Using the hole left by R331, connect the power supply through a 10 k Ω resistor to U4 pin 6.
n. Monitor the junction of R181 and R182 with a DC voltmeter.
o. Adjust the power supply output until the DC voltmeter reads 0 ± 0.1 V. If unable to obtain the correct voltmeter reading, check the outputs of U4 and U190 for voltages that vary with the power supply.
p. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

Peak Detetector (CR161 and CR160) Troubleshooting Procedure

a Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Place the A8 Source board on an extender board. Connect the instrument to the power line, and turn the POWER switch ON.

b. Set the HP 3325A Synthesizer to a frequency of 100 kHz and an amplitude of -40 dBm.

c. Move A8W5 to the top right position and connect the synthesizer to A8J8.

d. Set the HP 3577A as follows:

Sweep Type .... CW
AMPTD .... +15 dBm

e. Measure the output at A8J3 with an HP 8568B Spectrum Analyzer. Adjust the synthesizer for an output reading of +15 dBm ± 0.1 dB.

f. With an oscilloscope and a 10:1 probe, check the DC level at the junction of R149 and R150. It should be +3.5 V.

g. Decrease the amplitude of the synthesizer by 4 dB.

h. The DC level on the oscilloscope should be +2.5 V.

i. If this test failed, suspect CR160 or CR161.

j. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

Amplitude Leveling Troubleshooting Procedure

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover. Place the A8 Source board on an extender board. Connect A7J2 to A8J1 and A5J1 to A8J2 using extender cables. Connect the instrument to the power line, and turn the POWER switch ON.

b. Set the HP 3577A as follows:

SWEEP TYPE .... CW
FREQ .... 100.001 kHz
STEP SIZE .... 2 Hz
AMPTD .... +11 dBm
STEP SIZE .... 4 dB

c. Adjust Level Cal 1 (R144) for approximately 1.93 V at U20 pin 2.

d. Increase the HP 3577A amplitude to +15 dBm by pressing AMPTD ↑.

e. Adjust Step Cal 1 (R142) for approximately 3.12 V at U20 pin 2.

f. Ground one side of L125 and turn R156 and R157 fully clockwise.

g. Decrease the HP 3577A frequency to 99.999 kHz by pressing FREQ ↓ and decrease the amplitude to +11 dBm by pressing AMPTD ↓.

h. The DC voltage at U21 pin 3 should be approximately -0.275 V.

i. Increase the HP 3577A amplitude to +15 dBm by pressing AMPTD ↑.

j. The DC voltage at U21 pin 3 should be approximately -0.437 V.

k. Remove the ground from L125.

l. If this test passed, then the amplitude leveling loop works. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state. Perform adjustment 4-19, Source Amplitude and Step Adjustments.

m. Decrease the HP 3577A amplitude to +11 dBm by pressing AMPTD ↓ (the frequency should be 99.999 kHz).

n. Check each of the following op amp stages:
   The voltage at U20 pin 3 should be the same as the reference voltage on U21 pin 12.
   The output of U20 pin 3 should be constant.
   The output of U20 pin 4 should be approximately -2 V.
   The output of U21 pin 10 should be 0 V.
   The Anode of CR171 should be 0.5 V.
   The output of U21 pin 4 should be +0.24 V.

o. Ground one side of L125. The output of U21 pin 3 should now be -0.24 V providing the output of U21 pin 4 was +0.24 V.

p. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state. Perform adjustment 4-19 Source Amplitude and Step Adjustments.

Limiting Mixer (U13) Troubleshooting Procedure

a. Turn OFF the instrument's power switch, remove the power cord, and remove the top cover.

b. Lift the side of L125 connected to CR164. Using the hole left by L125, connect the DC supply through a 10 k Ω resistor to CR164.

c. Place the A8 Source board on an extender board. Connect A5J1 to A8J2 using extender cables. Connect the instrument to the power line, and turn the POWER switch ON.

d. Move A8W1 to the top left position and connect the HP 8568B Spectrum Analyzer to A8J4.

e. Adjust the DC supply to -4 V.

f. The 300.25 MHz signal on the spectrum analyzer should be approximately -33.7 dBm.

g. Change the DC supply voltage to -7 V.

h. The 300.25 MHz signal on the spectrum analyzer should be approximately -29 dBm.

i. If this test failed, replace the U13 mixer.

j. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

8-13 SERVICE GROUP A11, FAST PROCESSOR ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on:

INSTR PRESET

All Oscilloscope waveforms are taken using a 1:1 probe and a HP 1980B Oscilloscope. All signatures are taken using a HP 5006A Signature Analyzer.

NOTE

When running all signature analysis routines, keep the signature analyzer and the HP 3577A physically far from each other to prevent digital signal coupling.

Troubleshooting Hints

a. Self Tests and Diagnostics

Use the power on self tests and the service diagnostics described in Section II to isolate all problems. First verify that the problem encountered is on the A11 Fast Processor circuit board and not the A13 Main Processor-Controller board by running the power on self tests. Note which tests fail and troubleshoot the indicated circuit using the SA1 routine described below. The service diagnostics will test the Fast Processor and Main Processor-Controller communication, and will make the Fast Processor run a self test. Again, note the indicated circuit and test it using the SA1 routine.

All signatures for the A11 Fast Processor assembly are taken with the Main Processor-Controller (A13) and Trace Memory (A12) boards removed and all three Receiver (A1) boards disconnected from the fast bus by placing A1W5 and A1W6 into the Tri-State position. These jumpers are available from the top of the instrument without removing the Receiver boards.

b. SA1 Signature Analysis Routine

The SA1 signature Analysis routine is the general purpose signature analysis routine. Use SA1 to isolate the fault as narrowly as possible. After the 3577A is placed into SA1 mode (set W1 to the SA1 position) and power is applied, the fast processor must be reset by momentarily shorting INIT (A11TP6) to ground.

SA1 consists of ten different subtests. Due to the Fast Processor clock frequencies involved, different test configurations are required for stable, repeatable signatures. The test configuration for the first subtest is described below. At the beginning of each test, first set the signature analyzer as described below, then make any changes indicated by the subtest.

Signature Analysis SA1 Routine Test Set Up

Clock	A11J3 pin3
Qualify	No Connection
Start	A11J3 pin5
Stop	A11J3 pin4

Signature Analyzer Set Up

Clock	_/‾
Qualify	N/A
Start	_/‾
Stop	_/‾

+5 V signature = 7A70
GND signature = 0000

c. SA2 Signature Analysis Routine

The SA2 Signature Analysis routine is to be used only after SA1 has been used to narrow down faults to the components covered in SA2. Move W1 to the SA2 position and set the Signature Analyzer as described below.

Signature Analysis SA2 Routine Test Set Up

Clock	A11J3 pin3
Qualify	No Connection
Start	A11J3 pin5
Stop	A11J3 pin4

Signature Analyzer Set Up

Clock	_/‾
Qualify	N/A
Start	_/‾
Stop	_/‾

+5 V signature = 9515
GND signature = 0000

The SA2 mode is software driven, so the fast processor must be reset after moving the jumper to SA2 mode. To reset the fast processor, momentarily short INIT (A11TP6) to ground. Verify a good reset by watching for a toggle on the Signature Analyzer gate LED.

Table 8-12. A11 Circuit Board, Troubleshooting Data

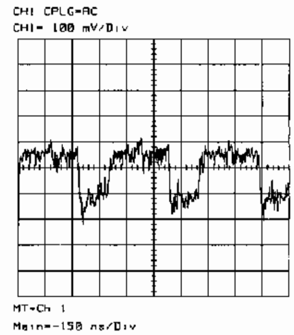
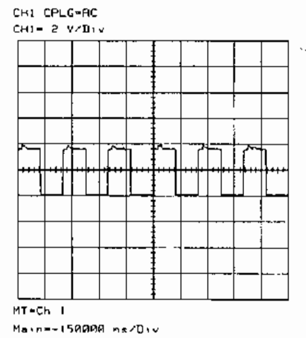
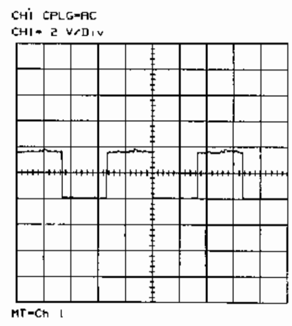
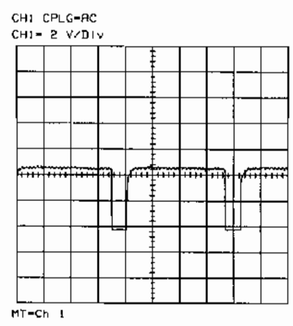
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Test at A11P1B30 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 100 mV Time/Div 150 ns Trigger CH1	Risetime, Period, noise.	
2	Test at A11P1B3 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 2 V Time/Div 150 us Trigger CH1	Risetime, Period, noise.	
3	Test at A11P1A7 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 2 V Time/Div 150 us Trigger CH1	Risetime, Period, noise.	
4	Test at A11TP4 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 2 V Time/Div 30 us Trigger CH1	Risetime, Period, noise.	

Table 8-12. A11 Circuit Board, Troubleshooting Data

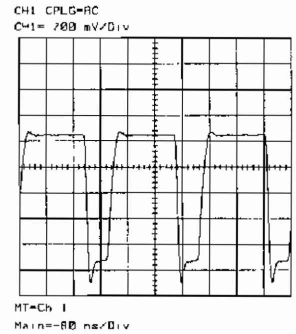
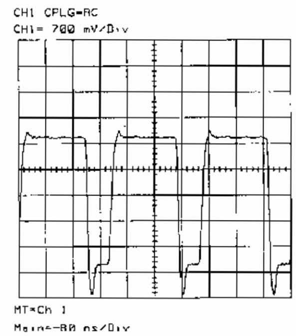
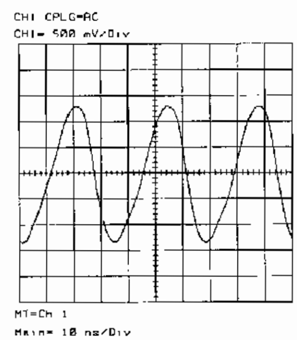
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
5	Test at A11P1B5 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 700 mV Time/Div 80 ns Trigger CH1	Risetime, Period, noise.	
6	Test at A11TP1 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 700 mV Time/Div 80 ns Trigger CH1	Risetime, Period, noise.	
7	Test at A11TP1 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 500 mV Time/Div 10 ns Trigger CH1	Clean signal for TTL level transition	
8	Digital Tests Press INSTR PRESET Set A11W1 to SA1 A11W2 to mid A11W3 to mid	Oscilloscope CH1 Coupling AC CH1 V/Div 1 V Time/Div 100 us Trigger CH1	Squarewave frequency.	A11U60 pin 5 12 kHz pin 9 12 kHz A11U35 pin 14 12 kHz pin 13 6 kHz 12 kHz = 83.3 us 6 kHz = 166.7 us

Table 8-13a. A11 Circuit Board, Signature Analysis Data (SA1)

Component	Pin	Signature	Component	Pin	Signature
U1 to U6	1	0772	U6	9	48CU
	2	4U2A		10	FH4C
	3	4442		11	26HU
	4	P030		13	HF26
	5	H0AA		14	C9P0
	6	HA07		15	9P5H
	7	C21A		16	8UF5
	8	H62A		17	384A
	18	7A70	U7	2	40F2
	21	U424		5	40PF
	22	1734		6	A884
	23	9635		9	5667
U1	9	8185		11	0000
	10	81H9		12	8U70
	11	P1A4		15	9482
	13	9070		16	U706
	14	A795		19	U0H2
	15	AFFU	U8	2	479P
	16	HU98		5	F950
	17	PP0F		6	U8C2
U2	9	8U3H		9	7954
	10	92A0		11	0000
	11	8A94		12	F6AP
	13	8H5H		15	77HA
	14	PUC4		16	7U48
	15	U2A9	U9	2	C886
	16	U164		5	5C55
	17	UP91		6	F7A0
U3	9	710F		9	74HA
	10	C6AC		11	0000
	11	62C0		12	12AA
	13	2554		15	98P5
	14	31FC		16	642F
	15	P9C5		19	3158
	16	8U40	U10	2	7CPC
	17	46F8		5	1929
U4	9	U7H7		6	H1UA
	10	3252		9	P4HU
	11	61A6		11	0000
	13	8HP6		12	81CC
	14	10C7		15	885C
	15	F9CP		16	UF1H
	16	2H79	U11	2	973F
	17	76AA		5	4P0A
U5	9	2P78		6	2F26
	10	9F15		9	8589
	11	CHFH		11	0000
	13	08P9		12	0474
	15	0C12		15	PF1C
	16	584H		16	F43C
	17	8877			

Table 8-13a. A11 Circuit Board, Signature Analysis Data (SA1) Cont.

Component	Pin	Signature	Component	Pin	Signature
U12	2	245U	U25	15	0000
	5	P6A5		29	H32H
	6	80AA		36	C9PH
	9	8866		37	3663
	11	0000		38	2CU4
	12	A95C		39	H1A5
	15	5FU0		15	0000
	16	9F25		25	U15U
U13	7	7A70		29	2H4C
	14	7A70		36	HFCU
U14	7	7A70		37	14F6
	14	7A70		38	548H
U15	14	4FUU		39	09HF
	31	0000	U27	15	0000
U16	3	3HPP		23	U00C
	12	479P		29	C2F3
	13	0C61		36	20C3
U17	1	784U		37	CF8C
	2	4HU1		38	9690
	3	C00P		39	56U3
	15	7066	U28	4	9H9F
U18	15	6U69		5	9539
U21	1	7449		10	2P6U
	2	1602	U29	1	642F
	3	2374		2	642F
	4	AA37		3	1P5F
	9	53F5		8	2P6U
	11	H32H		9	5C55
	12	2H4C		10	C886
	13	C2F3		11	4C28
	14	P658		12	3158
	15	4417		13	3158
U23	3	HPH3			
	18	4HU1	U30	5	PU50
	19	26U8		10	FP6H
U24	15	0000		12	3F7C
	22	UHUU		15	0000
	23	207U	U31	2	P91U
	29	53F5		3	7A70
	31	784U		4	936U
	33	4HU1		6	936U
	36	370C		9	C41H
	37	8C91		10	FP6H
	38	7066		11	7A70
	39	784U	U35	2	4U2A
				13	7UAP
				14	4858
			U36	1	0496
				5	HPH3
			U43	7	05HP
				9	4858

Table 8-13a. A11 Circuit Board, Signature Analysis Data (SA1) Cont.

Component	Pin	Signature	Component	Pin	Signature
U44	1	0000	U48	3	0000
	2	0000		5	245U
	3	0000		6	5P2U
	4	0000		8	9FH9
	5	7A70		9	P6A5
U45	5	C2F3	U49	8	F2UA
U46	15	207U	U50	3	40H0
	17	UHUU		8	C88A
U47	3	U15U	U56	6	7A70
	5	U00C	U57	6	7PP6
			U59	9	U424
			U60	3	7A70
				5	UAUU
				9	4858

Table 8-13b. A11 Circuit Board, Signature Analysis Data (SA1)

Move Signature Analyzer QUAL lead to A11U33 pin 11. Set QUAL mode to LOW.

+5 V Signature = 001U
Momentarily ground TP6

Component	Pin	Signature
U33	1	0009
	4	001U
	5	0000
	9	0009
	10	0009
	11	0000
	13	001U
	14	001U
	15	0009
U34	1	0009
	4	001U
	9	0009
	10	0009
	13	001U
	15	0009
U41	1	0009
	4	001U
	9	0009
	10	0009
	13	001U
	15	0009
U42	1	0009
	9	0009
	10	0009
	15	0019

Table 8-13c. A11 Circuit Board, Signature Analysis Data (SA1)

Move Signature Analyzer QUAL lead to A11U12 pin 19.
Set QUAL mode to LOW.

+5 Signature = CH38

Component	Pin	Signature
U37	4	0000
	5	0000
	7	AAPC
U38	1	6C05
	2	U282
	3	75AC
	5	3U80
	12	017A
	13	3159
	14	7095
	15	8C8P
U39	4	0000
	6	3A68
	7	H540
	9	6A83
	11	7CF9
U40	1	3U80
	3	82C8
	5	CH38
	6	CH38
	8	75A5
	11	CH38
	12	0000

Table 8-13d. A11 Circuit Board, Signature Analysis Data (SA1)

Move the Signature Analyzer QUAL lead to A11U12 pin 6.
Set QUAL mode to LOW.

+5 Signature = F4AU

Component	Pin	Signature	
U51	1	0000	NOTE: These signatures are valid for both sides of A13RP3 and A13RP4.
	2	91H9	
	3	C024	
	4	C014	
	5	9388	
	6	91A5	
	7	C3HP	
	8	C014	
	9	918H	
	11	A97A	
	12	9321	
	13	C3PP	
	14	C3HP	
	15	93A0	
	16	91A5	
	17	C3HP	
	18	C3HP	
	19	93A0	
U52	1	0000	
	2	H3U8	
	3	C014	
	4	C3HP	
	5	H351	
	6	92HP	
	7	C014	
	8	C3HP	
	9	F986	
	11	A97A	
	12	HF2P	
	13	C0H5	
	14	2A7U	
	15	F056	
	16	PACP	
	17	C7H8	
	18	C3HP	
	19	UA05	

Table 8-13e. A11 Circuit Board, Signature Analysis Data (SA1)

Move Signature Analyzer CLOCK lead to A11U19 pin 1. Set QUAL mode to LOW.

+5 Signature = 8132

Component	Pin	Signature	
U19	3	53A1	NOTE: All buffer output signatures are the same as input signatures.
	5	4898	
	7	UF13	
	9	34P0	
	12	PPA7	
	14	H90C	
	16	9051	
	18	2UH0	
U20	3	A1UH	
	5	9C81	
	7	PAU6	
	9	C8PU	
	12	5178	
	14	467C	
	16	3A9F	
	18	09P4	

Table 8-13f. A11 Circuit Board
Signature Analysis Data (SA1)

Move the Signature Analyzer CLOCK lead to A11U22 pin 1.
Set QUAL mode to LOW.

+5 Signature = 6PF5

Component	Pin	Signature
U22	3	6516
	4	6516
	5	6516
	6	6516
	7	PCPC
	9	U050
	11	6516
	12	958P
	13	HU2H

Table 8-13g. A11 Circuit Board Signature Analysis Data (SA1)

Move the Signature Analyzer QUAL lead to A11U24 pin 6. Set QUAL mode to HIGH.

+5 Signature = 6692

Component	Pin	Signature
U24	8	F4PP
	9	3U1C
U25	8	3U1C
	9	UC73
U26	8	UC73
	9	UA54
U27	8	UA54
	9	HA91

Table 8-13h. A11 Circuit Board Signature Analysis Data (SA1)

Move the Signature Analyzer QUAL lead to A11U32 pin 1. Set QUAL mode to LOW.

+5 Signature = CH38

Component	Pin	Signature
U32	3	0000
	5	0000
	7	75A5

Table 8-13i. A11 Circuit Board Signature Analysis Data (SA1)

Move the Signature Analyzer QUAL lead to A11U53 pin 1. Set QUAL mode to HIGH.

+5 Signature = 6PF5

Component	Pin	Signature
U53	2	U084
	3	6PF5
	7	C0C6
	9	H786
	14	PCPC

Table 8-13J. A11 Circuit Board Signature Analysis Data (SA1)

Move the Signature Analyzer QUAL lead to A11U54 pin 1. Set QUAL mode to LOW.

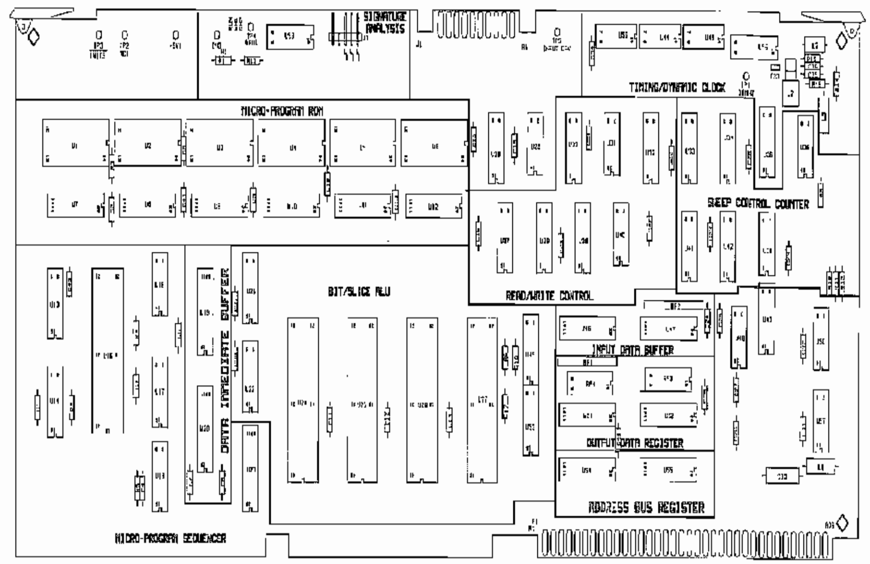
+5 Signature = CH38

Component	Pin	Signature
U54	2	97HC
	3	8CF9
	4	024H
	5	92H2
	6	97F0
	7	2FP4
	8	H8FP
	9	1958
	11	82C8
	12	17H3
	13	P90C
	14	6HH8
	15	97F0
U55	2	H565
	3	01AH
	4	76AC
	5	75AC
	6	6C05
	7	2261
	8	U7U9
	9	U282
	11	82C8
	12	5A15
	13	U655
	14	7631
	15	6958
	16	5HH3
	17	8918
	18	43A3
	19	32F7

Table 8-14. A11 Circuit Board Signature Analysis Data (SA2)

+5 Signature = 9515

Component	Pin	Signature	Component	Pin	Signature
U19	3	AC37	U25	15	0000
	5	56CA		36	876F
	7	56CA		37	122F
	9	AC37		38	8264
	12	5HUF		39	10F8
	14	AP3U	U26	15	0000
	16	AP3U		36	876F
	18	5HUF		37	122F
U20	3	AP3U		38	8264
	5	5HUF		39	10F8
	7	AP3U	U27	15	0000
	9	AC37		36	876F
	12	56CA		37	122F
	14	5HUF		38	8264
	16	56CA		39	10F8
	18	AC37	U45	2	5HHF
U21	1	2PAF		3	9515
	2	2U1A		5	0020
	3	2PAF		10	0000
	4	2U1A		11	0020
	9	CCC9	U59	9	AF44
	11	CCC9			
	12	CCC9			
	13	0020			
	14	2PAF			
	15	2U1A			
U24	1	A352			
	2	967C			
	3	FU97			
	4	50C8			
	5	H5C0			
	6	0000			
	7	U5P2			
	11	01C6			
	12	U76H			
	13	7FU0			
	14	CF95			
	15	0000			
	17	A170			
	18	9U2U			
	19	2FU6			
	20	46A5			
	26	CA76			
	27	3U4A			
	28	F9AP			
	31	10F8			
	36	876F			
	37	122F			
	38	8264			
	39	10F8			



A11 Component Locator
8-101/8-102

8-14 SERVICE GROUP A12, TRACE MEMORY ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on:

INSTR PRESET

All Oscilloscope waveforms are taken using a 1:1 probe and a HP 1980B Oscilloscope.

Troubleshooting Hints

a. The A12 Trace Memory board can be fully tested from the front panel without removal of the instrument covers. Press the SPCL FCTN hardkey and select the SERVICE DIAG softkey. Press the TRC MEM TEST softkey to test the A12 circuit board. Replace all components as indicated in the selftest.

NOTE

The A11 Fast Processor must be operational for the trace memory self test to operate. To verify that the Fast Processor is operating correctly, run the FASTPROC TEST and the FAST BUS INT TEST. If both of these tests pass, then the Fast Processor is not causing false Trace Memory failures.

b. If the battery back-up is suspect of being bad, connect the Oscilloscope to A12TP1. With power applied to the HP 3577A, the voltage should be approximately 5 V. With the 3577A power turned off, the voltage should read approximately 3 V. Repeat the above for A21U19 pin 6. With power applied, the voltage should be approximately 0 V. With the power removed the voltage should be approximately 3 V.

8-15 SERVICE GROUP A13, MAIN PROCESSOR-CONTROLLER ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on:

INSTR PRESET

All Oscilloscope waveforms are taken using a 1:1 probe and a HP 1980B Oscilloscope. All signatures are taken using a HP 5006A Signature Analyzer.

NOTE

When running all signature analysis routines, keep the signature analyzer and the HP 3577A physically far from each other to prevent digital signal coupling.

Troubleshooting Hints

a. This procedure assumes the initial Fault Isolation procedure listed in Section II has been followed and has indicated running these procedures. If the Fault Isolation Procedures have not been run, perform them now to make sure that the fault is resident on the Main Processor-Controller circuit board.

b. Clock signal waveforms are shown in Table 8-15. Check these waveforms as described in Table 8-15.

c. The following procedure is to be used as a general troubleshooting procedure when a fault exists on the A13 Main Processor-Controller board. Refer to the Digital Block Diagram in Section II when performing these tests as it shows the interaction of all the bus in the instrument.

1. Disconnect the mains power cord from the rear panel and remove the top cover. Reconnect the mains power cord and turn the instrument on.

2. Allow about 2 minutes for the display to warm up.

3. If the display does not operate, be sure that the display is not causing the problem by running the Fault Isolation procedures in Section II.

4. With the instrument properly warmed up, press the RESET pushbutton (A13S1) through the shield over the A13 board. Watch the ROM and RAM test LEDs.

5. If the ROM test LED extinguishes after approximately 5 seconds, then the ROM test has passed. This test verifies the ROM checksums and the first buffer on the main processor address and data bus.

6. If the RAM test LED extinguishes after approximately 10 seconds, then the RAM test has passed. This test verifies the RAM with a marching ones test, and the second buffer on the main processor address and data bus. Note that all periferal devices (fast processor, display, HP-IB, etc) are tied to this bus, so if any of these buffers are loading the bus, the RAM will not pass the self test. This self test verifies all RAM except that which have non-volatile requirements. The non-volatile memory stores the saved instrument states. If the instrument does not operate correctly when a saved state is recalled, then perform the total RAM test as described in the Power On Self Tests in Section II.

7. Run the Service Diagnostics for the periferal devices. To run these diagnostics, press the SPCL FCTN hardkey and select the SERVICE DIAG softkey. All service diagnostics to be run, and any special instructions for running them, are listed below

   a. TEST PATTERN: This test requires no external interaction with the user. The display test pattern as documented in the HP 1345A manual supplied with this instrument. This will verify the display buffer and the display operation. To exit from this test mode, press the INSTR PRESET hardkey.

   b. TRC MEM TEST: This test performs a marching ones test on the A12 Trace Memory board. This test requires no external interaction with the user and is fully documented in Section II of this manual. Please note that the main processor talks to the trace memory through the fast processor bus. If the fast processor does not operate correctly, it may cause the trace memory test to fail, even though the trace memory is good.

c. FASTPROC TEST: This test has the main processor command the fast processor to perform a self test, and send the results back to the main processor. This verifies the main processor, fast processor buffers and the fast processor logic.

d. FAST BUS INT TEST: This test has the main processor write to one of the main processor, fast processor buffers, then read the data from the other. The test is then repeated write to the other buffer and reading from the first. The fast processor decoding logic must be operational for this test to pass.

e. DISP MEM TEST: This test verifies the memory board in the HP 1345A display. The display buffer is also verified in this test. This is fully documented in Section II of this manual.

f. DISP HP-IB: This test makes the HP-IB circuit read the HP-IB control and data lines at the rear panel. Note that HP-IB protocol will not be followed in this test. To run this test, the operator should ground each of the HP-IB control and data lines to the connector shield. As the lines are grounded, a dot should appear in the slot for it drawn on the display. To exit from this test mode, press the INSTR PRESET hardkey.

8. Run the confidence test for each of the inputs. The confidence test is run by presssing the SPCL FCTN hardkey and the CONF TEST softkey. The test requires a cable to connect the source to the channel under test. This test will verify that the instrument control bus is working properly, along with any hard analog failures.

d. Due to the interaction of the circuits on this board, it is impossible to have a troubleshooting tree which would catch all cases of error. If the procedure in step c does not lead you to the fault, then perform each of the signature analysis routines listed below. Run the SA1 routine first, as it is the most general test. SA2 is to be used when ambiguity remains after running SA1.

SYMPTOM: Unit fails ROM self test.

a. Check the +5V supply on the A13 board at A13TP2. The reading should be 5 V ± 0.2V. If the voltage is bad, replace the faulty components.

b. Check for the clock signal at TP3 with the oscilloscope. The signal should look like the one in step 3 of Table 8-15. With the signal on the oscilloscope, press the Line pushbutton, off then on. With the power on, the 8 MHz phase locked loop will free run. The frequency of the free run should be between 6 and 8 MHz. If the frequency is outside these limits, the microprocessor may not reset correctly, and will hang up. When the $\overline{\text{POP}}$ line goes high, then the signal should phase lock to the 1 MHz input signal from the A6 reference board. If either of these tests fail, then replace the faulty components.

c. Run the SA1a signature analysis routine. If the SA1a tests pass, then run the SA1b signature analysis routine. This tests the ROM as a total unit. If this test fails, run SA1c to test the individual ROM components.

SYMPTOM: Unit fails RAM self test.

a. If only one RAM shows up as bad, then it is most likely a RAM chip failure. If half or all of RAM fails, then it is most likely a bus or an address decoder, A13U9 or U10, failure. Replace all faulty components.

b. Look at each data bus line with the oscilloscope while the RAM test is in progress. Each data line should toggle. If any data line does not toggle, then one of the buffers tied to this bus is most likely loading it down. Replace all faulty components.

c. Run the SA2b signature analysis routine on the data bus buffers. If +5V signature is bad, then look in the Address Decoding functional sub-block for failures. If the +5V signature is good, then check all the buffers tied to the RAM bus.

SA1 Signature Analysis Routine
This routine is the general signature analysis routine for the Main Processor-Controller board. Run this test first when led to the Main Processor-Controller from the Fault Isolation procedures. Remove the Fast Processor (A11) and the Trace Memory (A12) boards. Disconnect all three Receiver (A1) boards from the fast bus by placing A1W5 and A1W6 into the TriState position. The SA1 test set is described below.

Signature Analysis SA1 Routine Test Set Up

Clock A13J2
Start A13J2
Stop A13J2
Qualify .... No Connection

Signature Analyzer Set Up

Clock .... _/‾
Start .... _/‾
Stop .... _/‾
Qualify .... N/A

+5 V signature = UP73
GND signature = 0000

Set the signature analysis jumper A13W1 to the TEST position and connect the Signature Analyzer to the SA test connectors. Press the reset switch A13S1 to start the SA mode.

10. SA2 Signature Analysis Routine
This routine is used primarily to test the "kernal" and isolating functional sub-blocks from each other. This is done in the SA mode by setting all the tri-state buffers to read mode only. Run this after completing the Main Processor-Controller SA1 Signature Analysis Test and a functional sub-block is suspect. Remove the Fast Processor (A11) and the Trace Memory (A12) boards. Disconnect all three Receiver (A1) boards from the fast bus by placing A1W5 and A1W6 into the Tri-State position. The SA2 test set up is described below.

Signature Analysis SA2 Routine Test Set Up

Clock A13J2
Start A13TP4
Stop A13TP4
Qualify .... No Connection

Signature Analyzer Set Up

Clock .... _/‾
Start .... _/‾
Stop .... _/‾
Qualify .... N/A

+5 V signature = AU47
GND signature = 0000

Set the signature analysis jumper A13W2 to the TEST position and connect the Signature Analyzer to the SA test connectors. Press the reset switch A13S1 to start the SA mode.

Table 8-15. A13 Circuit Board, Troubleshooting Data

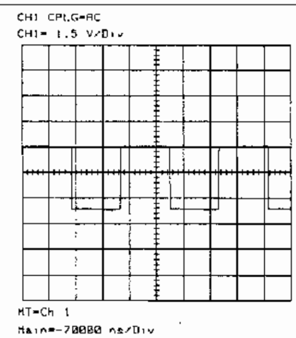
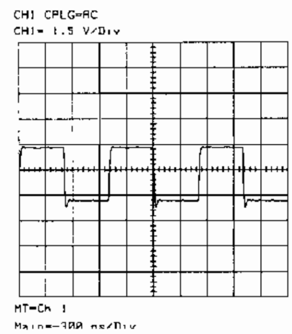
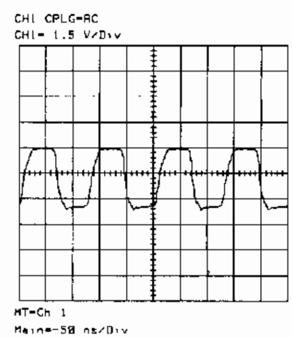
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Test at A13U77 Pin 8 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 1.5 V Time/Div 70 us Trigger CH1	Risetime, Period	
2	Test at A13P2A30 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 1.5 V Time/Div 300 ns Trigger CH1	Risetime, Period	
3	Test at A13TP3 Press INSTR PRESET	Oscilloscope CH1 Coupling AC CH1 V/Div 1.5V Time/Div 50 ns Trigger CH1	Risetime, Period	

Table 8-16a. A13 Circuit Board, Signature Analysis Data (SA1a)

This signature analysis test is used to test the microprocessor and all functional sub-blocks. This test should be run first, after fault isolation to the A13 board is performed.

+5V Signature = UP73

Component	Pin	Signature	Component	Pin	Signature
U1	9	UP73	U6	2	F3U8
	10	0000		3	FA75
	12	UP73		4	FAF6
	13	UP73		5	85U4
	17	UP73		6	55H1
	18	UP73		7	334U
	21	UP73		8	0U16
	22	UP73		9	00UP
	26	UP73		11	00UP
	27	UP73		12	0U16
	28	0000		13	334U
	29	55H1		14	55H1
	30	334U		15	85U4
	31	0U16		16	FAF6
	32	00UP		17	FA75
	33	UUUU		18	F3U8
	34	34P0	U7	3	0000
	35	0U52		5	UP73
	36	48C6		6	UP8H
	37	HAP7		7	0U16
	38	85U4		8	334U
	39	FAF6		9	55H1
	40	3HPH		11	55H1
	41	U1U8		12	334U
	42	FA75		13	OU16
	43	C5F0		14	UP8H
	44	F3U8		15	UP73
	45	55H1		16	0000
	46	33U4		18	0000
	47	0U16	U9	1	3HPH
U2	8	H06U		2	U1U8
	12	H06U		3	FA75
U5	2	C5F0		4	UP8H
	3	U1U8		5	0000
	4	3HPH		6	0U16
	5	48C6		7	F402
	6	HAP7		9	6C58
	7	0U52		12	CHU3
	8	34P0		13	F120
	9	UUUU		14	05PA
	11	UUUU		15	0766
	12	34P0			
	13	0U52			
	14	HAP7			
	15	48C6			
	16	3HPH			
	17	U1U8			
	18	C5F0			

Table 8-16a. A13 Circuit Board, Signature Analysis Data (SA1a)

Component	Pin	Signature	Component	Pin	Signature
U10	1	3HPH	U51	1	UP73
	2	U1U8		2	UP73
	3	FA75		3	UP73
	4	UP8H		4	UP73
	5	0000		6	9U6A
	6	0U16		9	UP73
	12	CHU3		10	9U6A
	13	F120		12	9U6A
	14	05PA	U52	1	UP73
	15	0766		6	0000
U12	1	F3U8		7	0000
	2	55H1		8	0000
	3	334U		9	UP82
	4	UP8H		10	4U05
	5	0U16		11	H06U
	6	UP73		12	UP73
	7	AC80		13	9U6A
	9	AC90		14	9U6A
	10	5595	U56	11	47H7
	11	55C5		12	47H7
	12	A9CU		13	UP73
	13	A9UU	U57	1	UP73
	14	51PC		2	231A
	15	516A		3	231A
U13	1	U67C		8	231A
	2	8H9U		9	0P26
	3	8A66		10	H34U
	4	H34U	U58	1	6C58
	5	0P26		2	HAP7
	6	13UU		3	59PP
	7	H06U		11	UP73
	8	2P54		12	UP82
	9	47H7		13	UP73
	10	4U05			
	11	4518	U59	3	UP73
	18	F402		4	UP73
	19	0000		5	0000
	20	HAP7		6	UP73
	21	48C6		8	0UU1
	22	0U52		9	8A66
	23	34P0		10	8H9U
U31	12	231A		11	U67C
	19	231A	U64	1	UP82
	24	UP73		2	00U1
U32	12	231A		3	UP73
	19	231A		4	0000
	24	UP73		8	U182
U37	1	0P26		9	0UU1
	13	H34U	U66	3	UP73
U44	1	13UU	U67	5	UP73
	19	13UU		6	0000
U45	1	13UU			
	19	13UU			
U47	1	2P54			
	19	0000			

Table 8-16a. A13 Circuit Board, Signature Analysis Data (SA1a)

Component	Pin	Signature	Component	Pin	Signature
U68	1	UP73	U69	4	0000
	2	UP82		5	0000
	3	UP73		6	UP73
	4	UP73		11	UP82
	5	00U1		12	UP73
	6	UP73		13	00U1
	8	UP73	U79	13	47H7
	9	UP73	U85	5	UP73
	10	0000		6	UP73
	11	UP82	U86	1	0000
	12	0U16		2	UP8H
	13	UP8H		3	UP8H

Table 8-16b. A13 Circuit Board, Signature Analysis Data (SA1b)

Move Signature Analyzer Stop lead to A13TP7, Set Start trigger to . Press A13S1 Reset.

This signature analysis test is used to isolate the ROM functional sub-block. This tests the ROM as a total unit. SA1c tests the individual ROM components

+5 V Signature = 000U

Component	Pin	Signature
U83	2	HA2C
	4	C06H
	6	2412
	8	002F
	11	5755
	13	6U8H
	15	654U
	17	FUUH
U84	2	237C
	4	IFCC
	6	0APC
	8	6269
	11	U717
	13	HF81
	15	88FS
	17	7U35

Table 8-16c. A13 Circuit Board, Signature Analysis Data (SA1c)

Move Signature Analyzer Start and Stop lead to Uxx Pin20, Set Start trigger to ‾_ . Press A13S1 Reset.

This signature analysis test checks the individual ROM components in the ROM functional sub-block, and should be run after SA1b. Each ROM is isolated from the others by the Start and Stop SA pins to the ROM under test.

+ 5V signature = 755U

Component	Pin	Signature
U19	11	9FC0 Start and Stop to U19 pin20
	12	F2P1
	13	90H3
	15	8245
	16	7F81
	17	P2A8
	18	60P3
	19	C977
U20	11	294A Start and Stop to U20 pin20
	12	4526
	13	IF7F
	15	6A30
	16	896C
	17	OFHC
	18	C4UA
	19	09P8
U21	11	2P12 Start and Stop to U21 pin20
	12	ACCU
	13	CFF4
	15	F120
	16	FA8F
	17	7F4F
	18	8A74
	19	HHSC
U22	11	IH52 Start and Stop to U22 pin20
	12	HHFS
	13	P774
	15	41HP
	16	93F8
	17	4113
	18	2651
	19	600H
U23	11	OFC6 Start and Stop to U23 pin20
	12	5249
	13	55AU
	15	AF35
	16	C718
	17	CP59
	18	F4P4
	19	05H3

Table 8-16c. A13 Circuit Board, Signature Analysis Data (SA1c) Cont.

Component	Pin	Signature
U24	11	9AC2 Start and Stop to U24 pin20
	12	01CA
	13	HU5U
	15	13H7
	16	6905
	17	P897
	18	993C
	19	1827
U25	11	9A4A Start and Stop to U25 pin20
	12	44AH
	13	FF45
	15	46AH
	16	F273
	17	3U39
	18	8300
	19	H4UP
U26	11	PHF4 Start and Stop to U26 pin20
	12	FA8C
	13	859A
	15	UUF9
	16	A8PU
	17	UPPF
	18	8413
	19	U14U

Table 8-16d. A13 Circuit Board, Signature Analysis Data (SA1d)

Move Signature Analyzer Start and Stop leads to A13TP6. Press A13S1 Reset switch.

This signature analysis test checks the Bus Error Detection circuitry for faults.

+5 V Signature = 6PCP

Component	Pin	Signature
U1	50	91FC
	51	3CPF
	52	F9C2
U55	1	9P5H
	2	3CPF
	3	F9C2
U58	1	06AU
	2	FP47
	3	9336
	4	6PCP
	5	9P5H
	6	6PCP
	11	6PCP
	12	2P3F
	13	6PCP
U66	8	9P5H
	9	6PCP
	10	U0P3
	11	U0P3
	12	6PCP
	13	9P5H

Table 8-17a. A13 Circuit Board, Signature Analysis Data (SA2a)

This signature analysis test is primarily used to test the "kernal" and to isolate functional sub-blocks from each other. This test should be run after completing the A13 SA1 test.

+5 V Signature = AU47

Component	Pin	Signature	Component	Pin	Signature
U2	8	C471	U35	1	0000
	9	P1H5		2	467A
	11	P1H5		3	5626
	12	C471		4	6755
U7	5	P1H5		5	HFA2
	15	P1H5		6	08U5
U13	1	247A		7	8570
	2	4096		8	3438
	3	3775		9	8A70
	4	2852		11	8A70
	5	3580		12	3438
	6	AUF6		13	8570
	7	C471		14	08U5
	8	AU47		15	HFA2
	9	U459		16	6755
	10	9299		17	5626
	11	67HA		18	467A
	18	5F0H		19	0000
	19	0000	U36	1	0000
	20	9U01		2	9U01
	21	5626		4	UP15
	22	HFA2		6	UP15
	23	8570		7	H519
U14	1	5CP0		8	U34A
	2	8HP7		9	H519
	3	P5H1		11	H519
	4	1363		12	U34A
	5	16F4		13	H519
	6	9917		14	UP15
	9	13C9		16	UP15
	10	9F7P		18	9U01
	11	AU47		19	0000
	13	10P0	U38	4	0894
	14	6668		9	8U38
	15	0894		11	67HA
	16	8CC0	U47	7	97P2
	17	5F19		9	C1P6
	18	8914		11	C1P6
	19	P1H5		13	97P2
	20	9U01	U50	1	AU47
	21	5626		3	5F19
	22	HFA2		4	AU47
	23	8570		5	C1P6
U31	12	C295		9	97P2
	19	C295		10	AU47
	24	10P0		11	8CC0
U32	24	10P0		13	AU47

Table 8-17a. A13 Circuit Board, Signature Analysis Data (SA2a)Cont.

Component	Pin	Signature
U51	1	AU47
	2	AU47
	3	AU47
	4	AU47
	6	26P8
	9	AU47
	10	26P8
	12	26P8
	13	26P8
U52	1	AU47
	6	0000
	7	0000
	9	U6UP
	10	9299
	11	C471
	12	AU47
	13	26P8
	14	26P8
U53	1	AU47
	3	6668
	4	AU47
	5	U807
	9	F4U8
	10	AU47
	11	6668
	13	AU47
U55	5	U807
	8	0000
	9	F4U8
	10	6CCU
	11	6CCU
U56	8	9F7P
	9	AU47
	10	9F7P
U57	1	AU47
	2	C295
	3	C295
	8	C295
	9	3580
	10	2852
U58	1	8914
	2	9U01
	3	0021
	4	0000
	8	P1H5
	9	0000
	10	P1H5

Component	Pin	Signature
U59	1	23P7
	2	AU47
	3	AU47
	4	57P2
	5	U8A5
	6	AU47
	8	UFHP
	9	3775
	10	4096
	11	247A
	12	8FA0
	13	AU47
U61	1	8U38
	2	9299
	3	9299
	4	P1H5
	5	AU47
	6	AU47
	8	98UU
	9	4P92
	10	9299
	11	98UU
	12	98UU
	13	0000
U62	1	0000
	2	P1H5
	3	P1H5
	4	467A
	5	0000
	6	6755
	7	388C
	8	08U5
	12	08U5
	13	388C
	14	6755
	15	0000
	16	467A
	17	P1H5
	18	P1H5
	19	0000
U64	1	U6UP
	2	59C9
	3	AU47
	4	0000
	5	AU47
	6	0000
	8	5399
	9	UFHP
	12	4P92
	13	P1H5

Table 8-17a. A13 Circuit Board, Signature Analysis Data (SA2a) Cont.

Component	Pin	Signature	Component	Pin	Signature
U66	2	AU47	U79	1	9F7P
	3	AU47		2	0000
	4	AU47		3	0000
	5	A7AF		4	13C9
	6	08PC		5	0171
U68	1	0000	U80	1	26P8
	2	U6UP		2	9299
	3	U6UP		3	AU47
	4	0000		4	P1H5
	5	59C9		5	26P8
	6	59C9		6	199C
	8	0000		8	26P8
	9	0000		9	0000
	10	0000		10	26P8
	11	UPU6		11	P1H5
	12	H519		12	0000
	13	23P7		13	P1H5
U69	4	388C	U85	5	U838
	5	0000		6	U838
	6	AU47	U86	1	0000
	8	AP36		2	23P7
	9	0171		3	23P7
	10	AU47			
	11	U6UP			
	12	P1H5			
	13	59C9			
U70	1	AU47			
	2	A840			
	3	08PC			
	4	AU47			
	6	3223			
	8	3223			
	10	AU47			
	11	08PC			
	12	1663			
	13	AU47			

Table 8-17b. A13 Circuit Board, Signature Analysis Data (SA2b)

Set Qualify to ⌐_ and connect Signature Analyzer lead to component pin as specified below.

This signature analysis test check the buffers which connect the microprocessor to the rest of the digital portions of the instrument. Use this routine to troubleshoot the appropriate buffers.

+5 V Signature = 9515

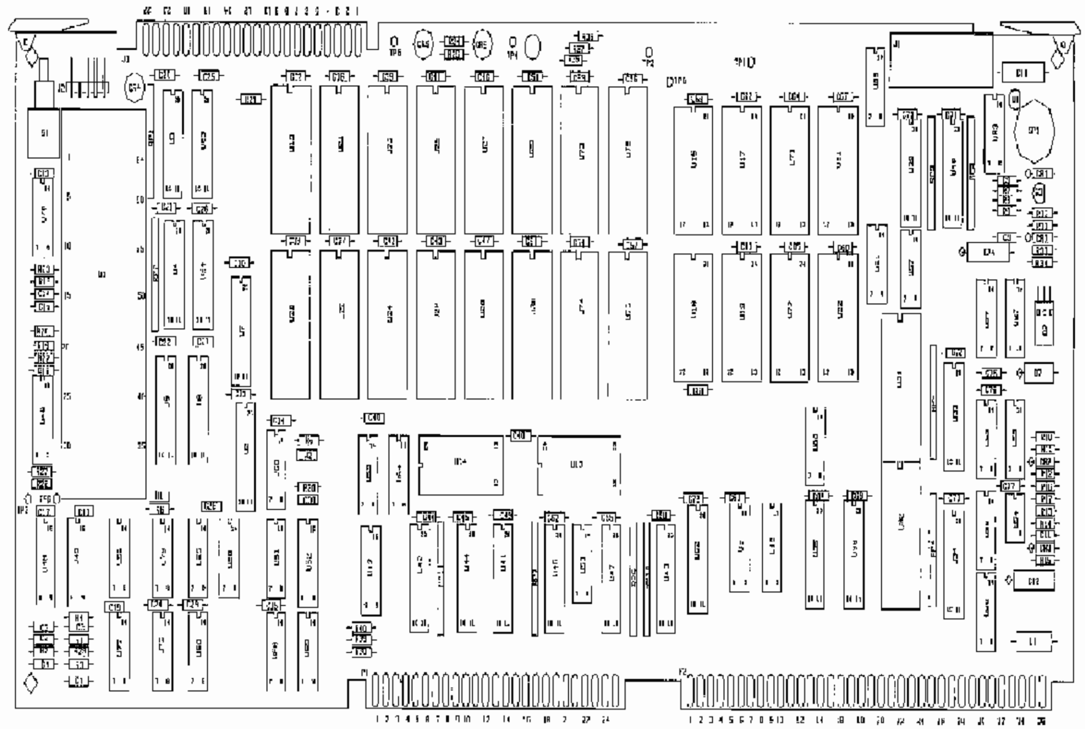
Component	Pin	Signature	
U33	1	5U9U	Qualify to U33 pin 19
	2	F5AF	
	3	6CU9	
	4	3752	
	5	8P05	
	6	UFAC	
	7	19U7	
	8	H34P	
	9	463F	
	11	463F	
	12	H34P	
	13	19U7	
	14	UFAC	
	15	8P05	
	16	3752	
	17	6CU9	
	18	F5AF	
U34	1	5U9U	
	2	AF05	
	3	C8AC	
	4	91U7	
	5	F34P	
	6	663F	
	7	2FH9	
	8	C913	
	9	9286	
	11	9286	
	12	C913	
	13	2FH9	
	14	663F	
	15	F34P	
	16	91U7	
	17	C8AC	
	18	AF05	

Table8-17b. A13 Circuit Board, Signature Analysis Data (SA2b) Cont.

Component	Pin	Signature	
U39	1	5U9U	Qualify to U39 pin19
	2	9286	+5 V Signature = 9515
	3	AF05	
	4	C8AC	
	5	C913	
	6	2FH9	
	7	663F	
	8	F34P	
	9	91U7	
	11	91U7	
	12	F34P	
	13	663F	
	14	2FH9	
	15	C913	
	16	C8AC	
	17	AF05	
	18	9286	
U40	1	5U9U	
	2	F5AF	
	3	463F	
	4	6CU9	
	5	H34P	
	6	3752	
	7	19U7	
	8	8P05	
	9	UFAC	
	11	UFAC	
	12	8P05	
	13	19U7	
	14	3752	
	15	H34P	
	16	6CU9	
	17	463F	
	18	F5AF	
U41	1	0000	Qualify to U41 pin19
	2	5FP9	+5 V signature = PCU5
	3	AP74	
	4	H73A	
	5	6C9H	
	6	C5FP	
	7	5AP7	
	8	2H73	
	9	96C9	
	11	96C9	
	12	2H73	
	13	5AP7	
	14	C5FP	
	15	6C9H	
	16	H73A	
	17	AP74	
	18	5FP9	

Table 8-17b. A13 Circuit Board, Signature Analysis Data (SA2b) Cont.

Component	Pin	Signature	
U42	1	PH5U	Qualify to U42 pin19
	2	F28U	+5 V signature = 4C63
	3	UAC7	
	4	66AC	
	5	A8A5	
	6	4UA2	
	7	3F21	
	8	05P0	
	9	9900	
	11	9900	
	12	05P0	
	13	3F21	
	14	4UA2	
	15	A8A5	
	16	66AC	
	17	UAC7	
	18	F28U	
U43	1	14AA	Qualify to U43 pin19
	2	PF9A	+5 V signature = P733
	3	P8C2	
	4	PAA6	
	5	6CAF	
	6	2C29	
	7	0C6C	
	8	1C4A	
	9	135A	
	11	135A	
	12	1C4A	
	13	0C6C	
	14	2C29	
	15	6CAF	
	16	PAA6	
	17	P8C2	
	18	PF9A	
U45	1	0000	Qualify to U45 pin19
	3	0001	+5 V signature = 0001
	5	0001	
	7	0000	
	9	0001	
	12	0001	
	14	0000	
	16	0001	
	18	0001	
U85	2	0001	
	3	0001	
	4	0000	
	5	0000	
	6	0000	
	8	0001	
	9	0001	
	10	0000	
	11	0001	
	12	0001	
	13	0000	



A13 Component Locator
8-129/8-130

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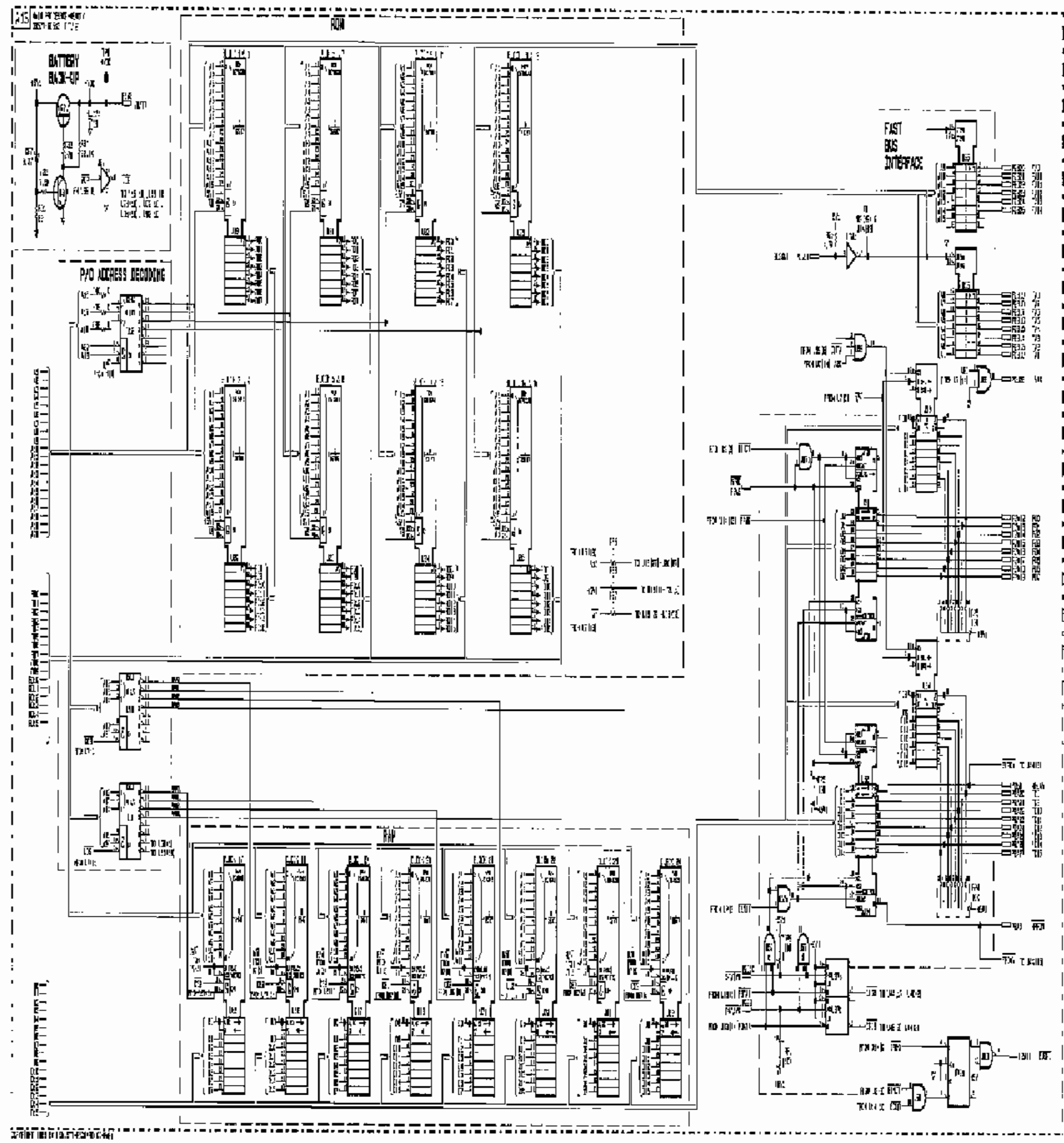
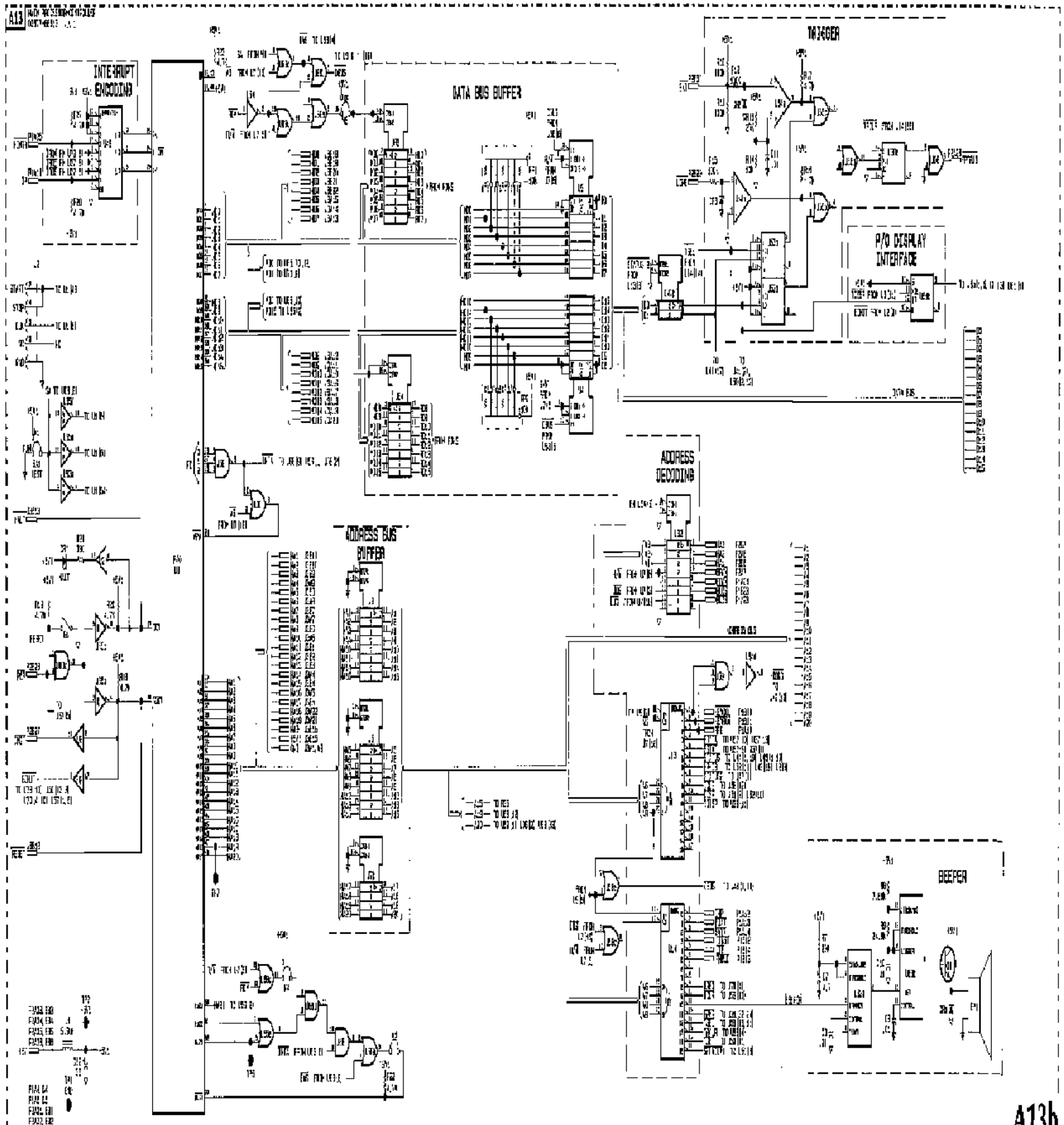


A13a

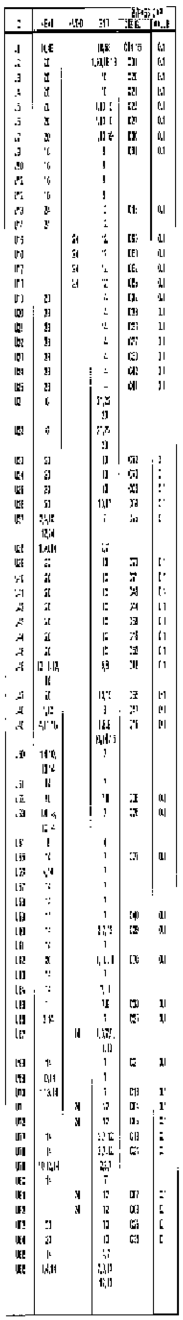
Figure [illegible] A13 Main Processor-Controller Board, ROM/RAM Schematic

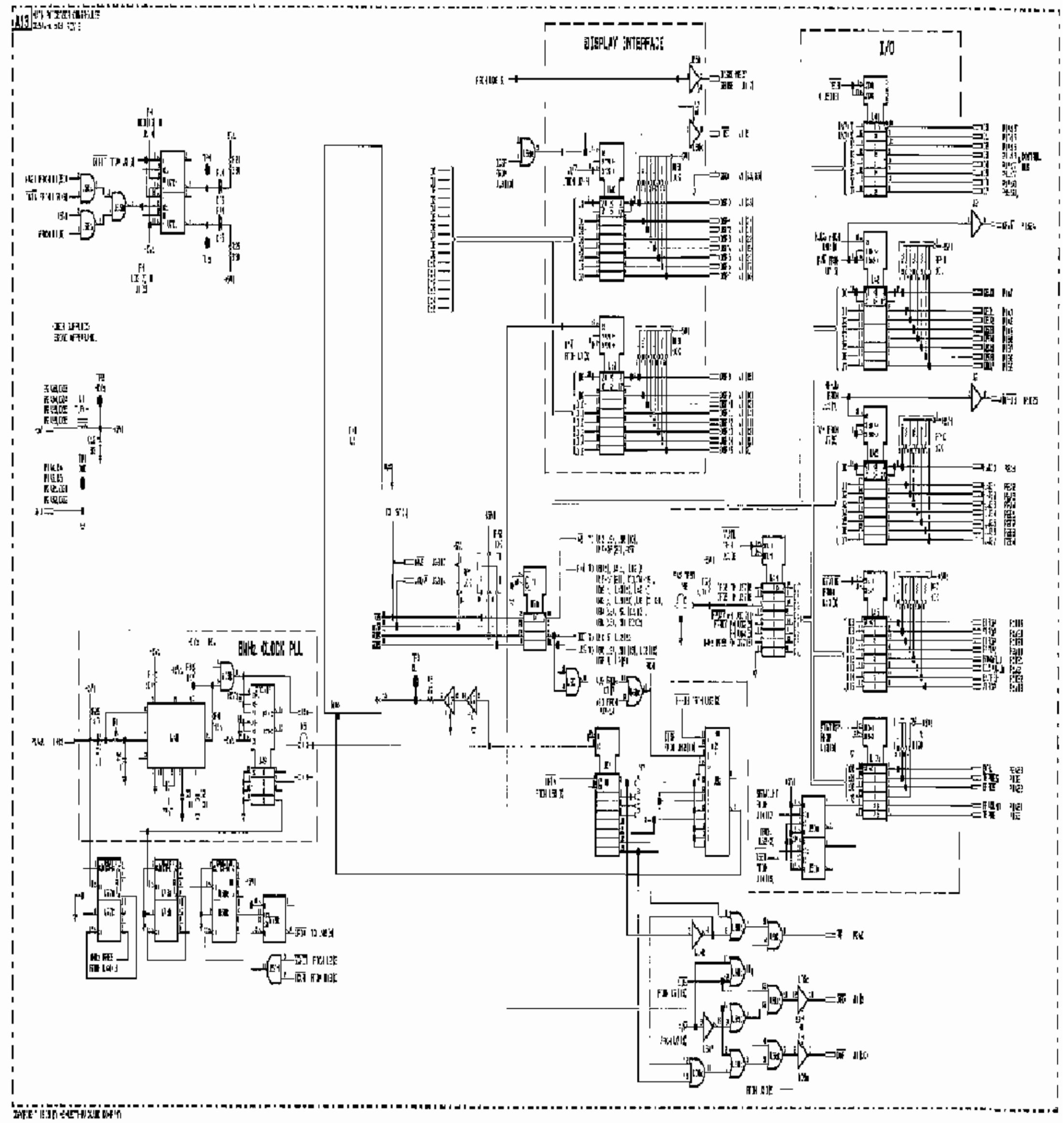
[illegible]



A13b

Figure 8-19. A13 Main Processor-Controller Board, Processor Schematic





A13c

Figure 8-20. A13 Main Processor-Controller Board, Interface Schematic

0-13558-136

8-16 SERVICE GROUP A15, KEYBOARD ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

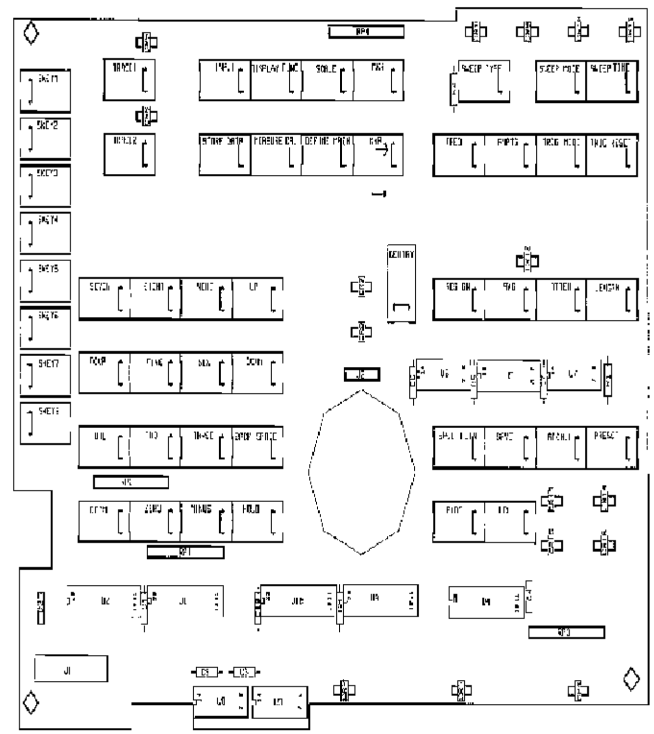
Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on:

Press INSTR PRESET

All Oscilloscope waveforms are taken using a 1:1 probe and an HP 1980B Oscilloscope.

Troubleshooting Hints

1. Troubleshoot at each side of the latches separating the suspect key, LED, or the RPG from the keyboard connector J1. Key closure is indicated by TTL ground.

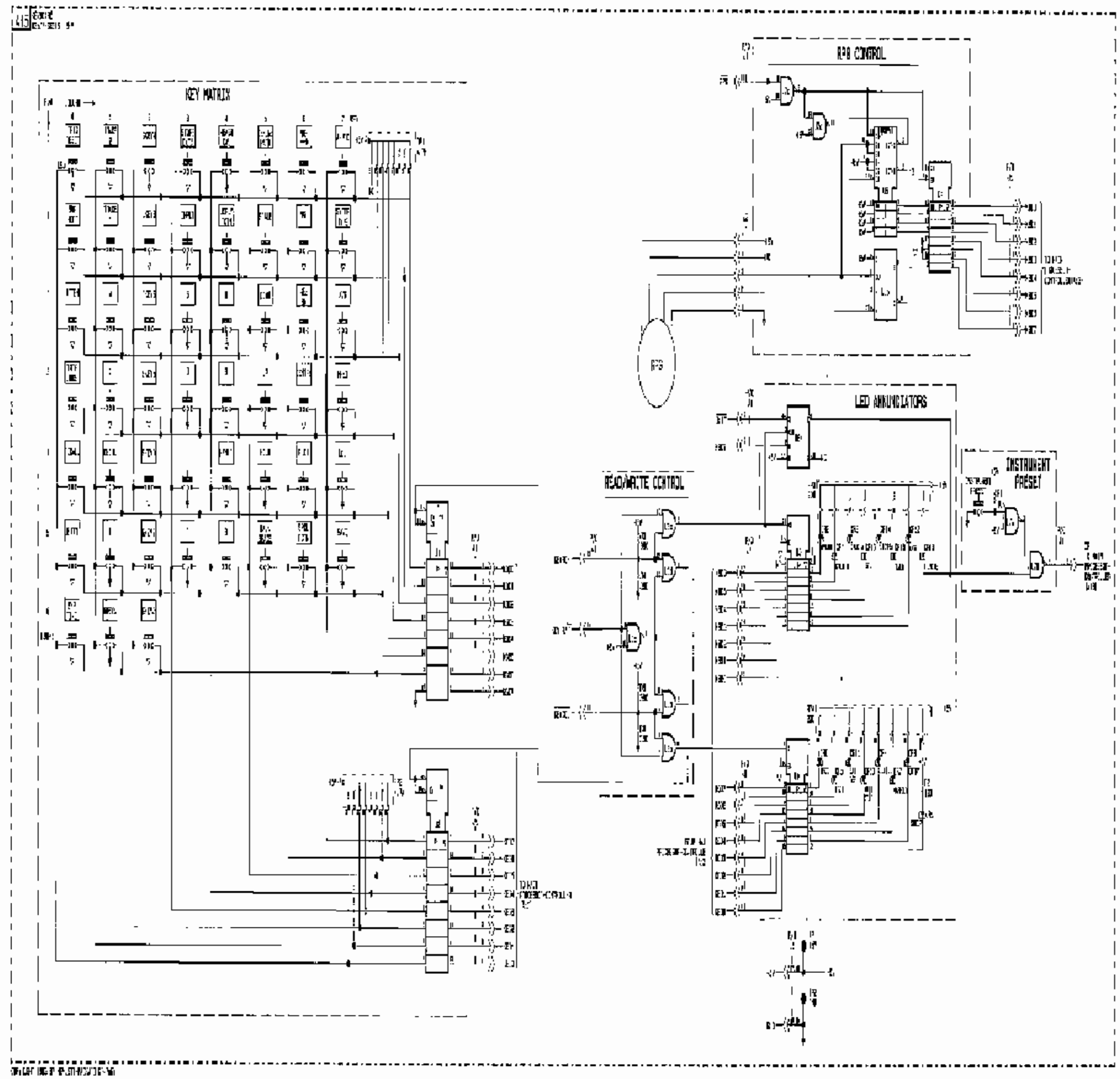


A15 Component Locator
0-13970-140

IC	+5V	GND	BYPASS CAP DESIG.	BYPASS CAP VALUE
U1	20	[illegible]	C1	0.1
U2	20	10	C2	0.1
U3	14	7	C3	0.1
U4	20	[illegible]	C4	0.1
U5	[illegible]	8	C5	0.1
U6	[illegible]	8	C6	0.1
U7	[illegible]	7	C7	0.1
U8	[illegible]	[illegible]	C8	0.1
U9	20	[illegible]	C9	0.1
U10	20	[illegible]	C10	0.1

LEDs

DIODE	DESCRIPTION
CR1	SWEEP
CR2	[illegible]
CR3	[illegible]
CR4	[illegible]
CR5	[illegible]
CR6	[illegible]
CR7	[illegible]
CR8	[illegible]
CR9	[illegible]
CR10	[illegible]
CR11	[illegible]
CR12	[illegible]
CR13	REMOTE
CR14	LISTEN
CR15	TALK
CR16	SRQ



A15

Figure 8-21. A15 Keyboard, Schematic

8-17 SERVICE GROUP A16, HP-IB ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on:

Press INSTR PRESET

All Oscilloscope waveforms are taken using a 1:1 probe and a HP 1980B Oscilloscope. All signatures were taken using a HP 5006A Signature Analyzer.

NOTE

When running all signature analysis routines, keep the signature analyzer and the HP 3577A physically far from each other to prevent digital signal coupling.

Troubleshooting Hints

NOTE

The HP-IB signature analysis routine is run from the Main Processor-Controller. Faulty +5VI and GNDI signatures would indicate Main Processor-Controller and HP-IB communication fault.

1. Run the DISP HP-IB test routine under the SPCL FCTN hardkey and SERVICE DIAG softkey. Using a small jumper, short each of the control pins to HP-IB connector ground. When each pin is grounded, the appropriate pin shown should have a dot in it.

   If this test passes, and there is still an HP-IB fault, then the fault would either be in either the HP-IB chip or in Main Processor-Controller servicing of the HP-IB circuit. All signal paths and buffers are checked using the above procedure.

   If this test fails, then all components are still suspect. Run the HP-IB Signature Analysis routine under the SPCL FCTN hardkey and SERVICE DIAG softkey. If the Signatures are correct and there is still an HP-IB fault, then there is probably a firmware fault, and the Main Processor-Controller ROMs should be checked as described in the Power-On Selftest section of Section II.

2. To run the HP-IB signature analysis routine, press the SPCL FCTN hardkey and select the HP-IB SA softkey. Connect the Signature Analyzer to the HP 3577A as described below.

   Clock A16J3 pin3
   Qualify .... No Connection
   Start A16J3 pin5
   Stop A16J3 pin4

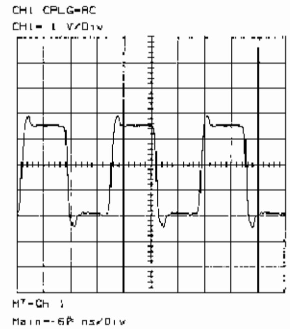
   Signature Analyzer set-up.

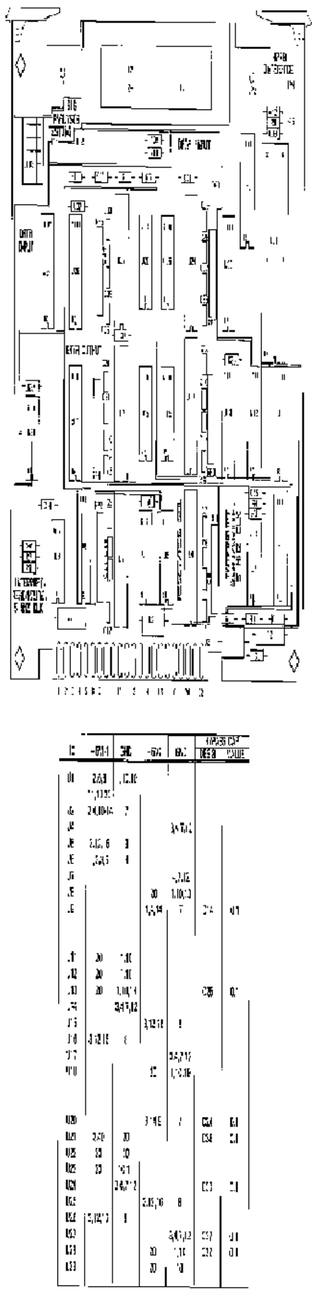
   Clock ....
   Qualify .... N/A
   Start ....
   Stop ....

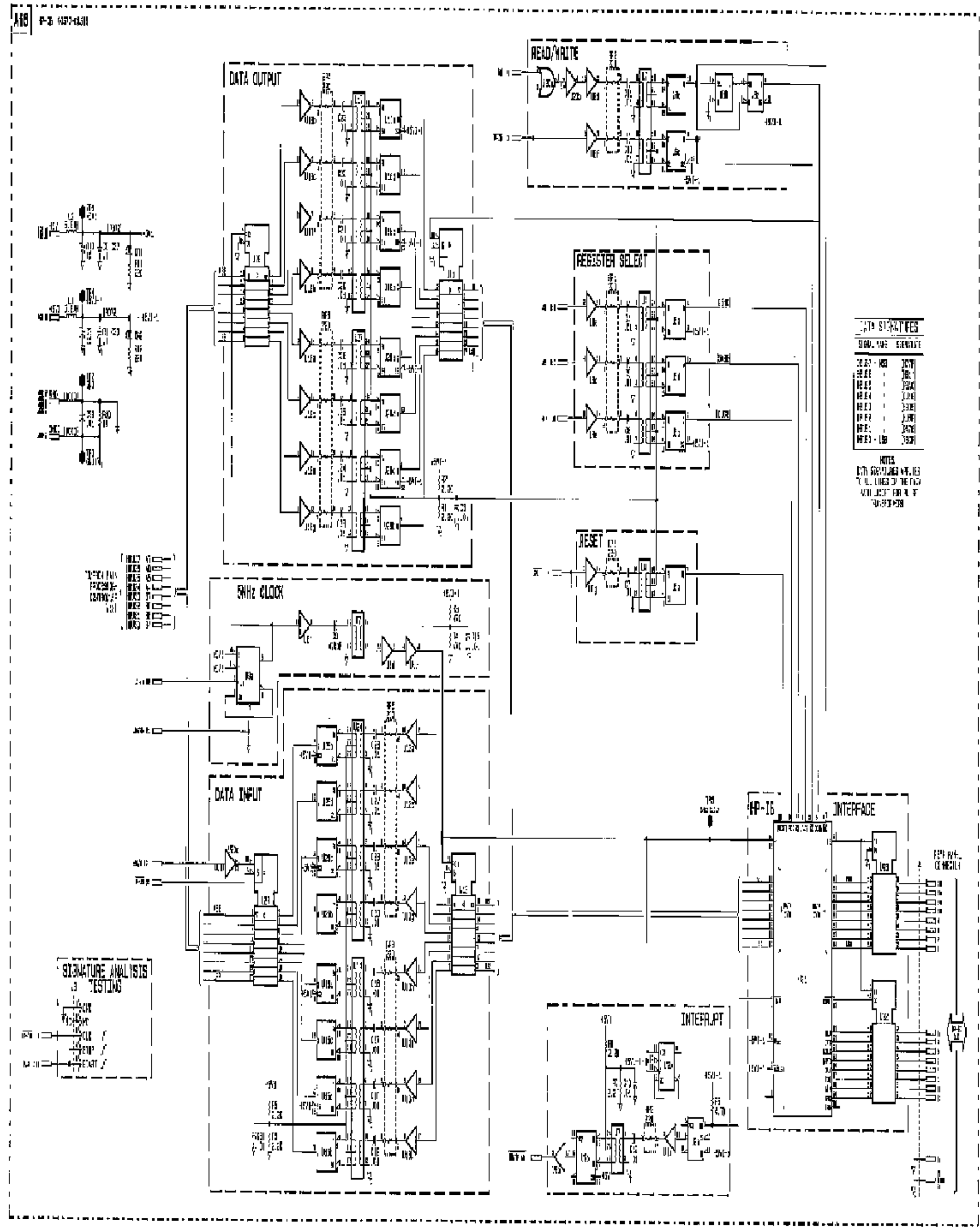
   +5VI signature = P672
   GNDI signature = 0000

   Test for correct signatures as noted on Figure 8-22, HP-IB Schematic. All data path signatures are identical.

Table 8-18. A16 Circuit Board, Troubleshooting Data

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Test at A16TP5 (Clock signal)	Oscilloscope CH1 Coupling DC CH1 V/Div 1V Time/Div 60 ns Trigger CH1	Risetime, Period	





A16

Figure 8-22. A16 HP-IB Board, Schematic

8-18 SERVICE GROUP A20, MOTHERBOARD ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

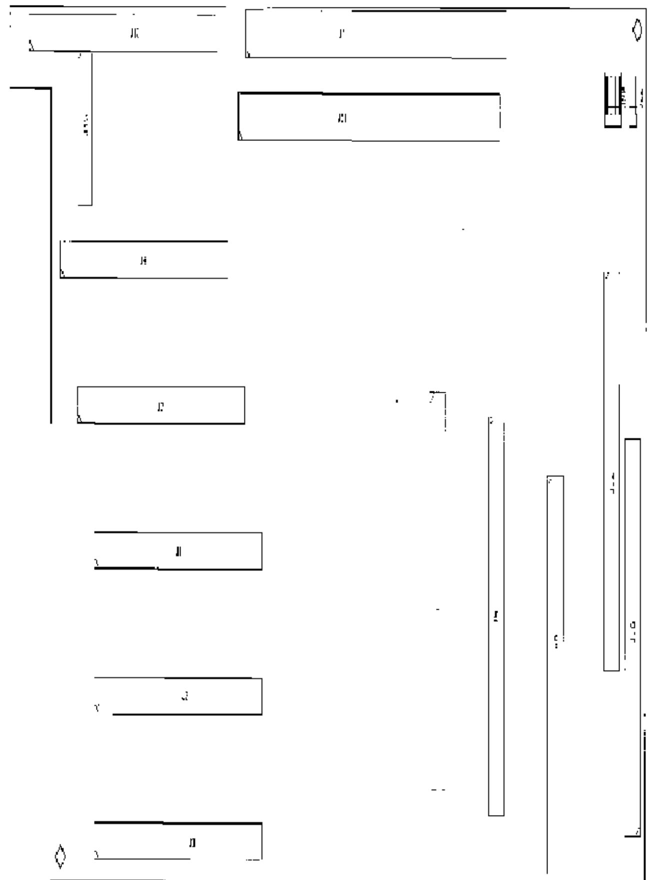
Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

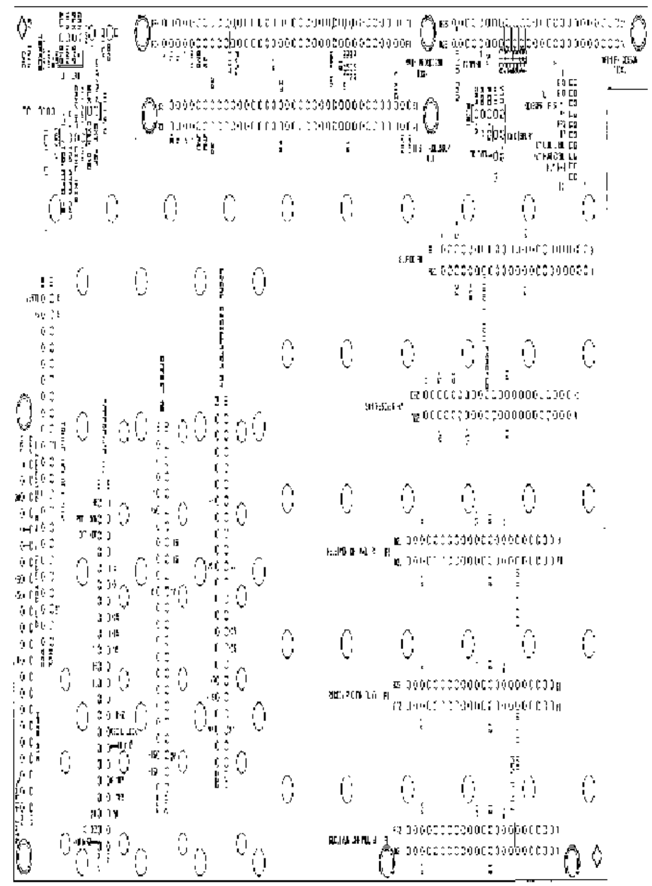
NOTE

This circuit board contains no active or signal conditioning components. All signal paths shown in Table 8-19 can be checked for continuity using an ohmmeter.

How to Use Table 8-19

All signal names are listed vertically with each of the circuit boards listed horizontally. When a signal is connected to a circuit board, the edge connector pin number is entered in the table at the intersection point of the signal name and the circuit board in the matrix. All circuit board connections for a specific signal can be seen by looking left to right in the signal name row. All signals connected to a circuit board can be seen by looking up and down in the circuit board column.





A20 Component Locator
8-151/8-152

[illegible]

Table D-19. A20 Motherboard Signal Interconnect Table

D-153/D-154

8-19 SERVICE GROUP A21, MAIN POWER SUPPLY ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

WARNING

230 Vdc is present in the Main Power Supply board (A21) even with the line switch in the OFF position and the power cord removed. Be extremely careful when working in the proximity of this area. This high voltage could cause serious personal injury if contacted. To remove this voltage, remove the main power cord from the rear panel and remove the bottom cover. Using insulated pliers, set the Main Power Supply board (A21) jumpers W1 and W2 into the TEST position. The capacitors (A21C2 and A21C3) holding this voltage will discharge to a relatively safe level after approximately two minutes.

NOTE

All power supplies in the HP 3577A are driven by the FET DRIVE circuit and transformer T1. The +5 volt supply is the reference for the PULSEWIDTH MODULATOR, and must be operating correctly for the other supplies to be in regulation.

Initial Conditions

The following conditions apply to all procedures in this section:

Turn OFF the instrument's power switch, and remove the power cord before removing the bottom cover.

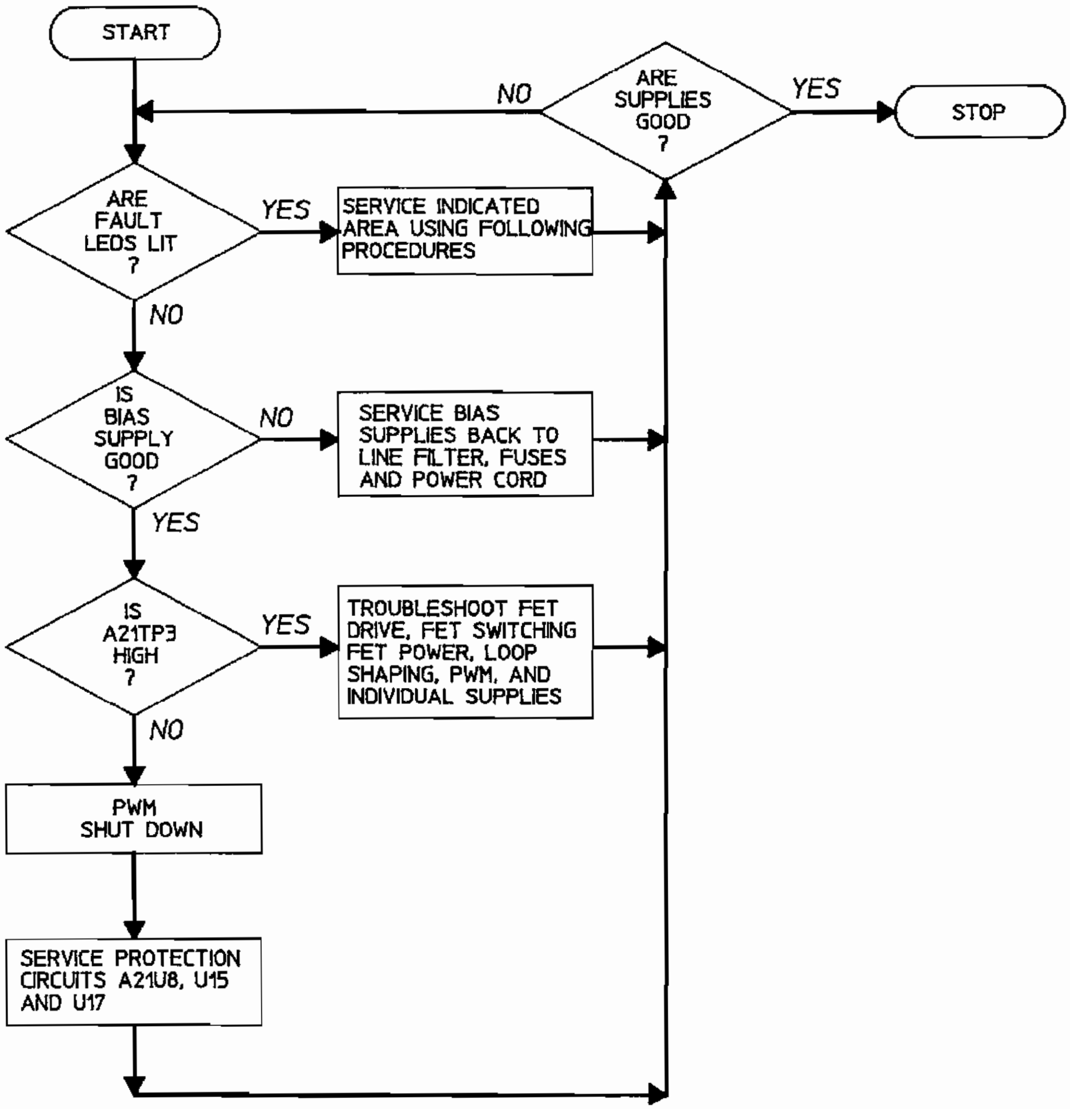
The +5 V supply must be loaded by at least the A11 Fast Processor and the A13 Main Processor boards. The voltage levels and circuit conditions in these procedures may not be correct if these boards are not inserted.

The +15V and -15 V supplies must have no load. Disconnect J1, J2, J3, J4, and J5.

Unless otherwise noted, all jumpers, test pins, and components referred to in these procedures are located on the A21 Main Power Supply board.

Troubleshooting Hints

Symptom: The HP 3577A does not power up when the line switch is turned on.



Symptom: The +5 V supply cannot be adjusted to the correct value.

If the voltage is too high, troubleshoot the listed circuits in the following order:

FET Drive
Loop Shaping/Pulsewidth Modulator
5 V Control Loop

If the voltage is too low, troubleshoot the listed circuits in the following order:

FET Drive
FET Power
Loop Shaping/Pulsewidth Modulator
5 V Control Loop

Symptom: A supply other than the +5 V is bad.

If the +5 V supply is properly loaded and adjusted to +5.10 ± 0.02 V, troubleshoot from the secondary of T1 to the output. Remember that the output of T1 is a 40 kHz square wave (the reason for the large LC filters on the rectifier output).

Protection Circuits

The A21 Main Power Supply protection mechanisms (except fuses) are as follows:

Primary protection circuits
- Turn On/Pop Circuits
- Primary Current Limit

Secondary protection circuits
- +5 V Current Limit
- +15 V Current Limit
- -15 V Current Limit
- +5 V Overvoltage
- +15 V Overvoltage
- -15 V Overvoltage
- Hi Temp

If TP3 is a TTL low, the pulsewidth modulator is shut down. The only protection circuit without a warning LED is the Turn On/Pop circuit. Check this circuit first if TP3 is a TTL low and there are no warning LEDs lit.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level after approximately two minutes, provided the jumpers are installed in the TEST position.

To distinguish between a real overvoltage or overcurrent situation and a protection circuit problem, turn OFF the instrument's power switch, and remove the power cord. Place W1 and W2 into the TEST position using insulated pliers. Connect the instrument to the power line and turn the POWER switch ON. If the fault indication persists, the problem is most likely in the protection circuit itself.

Turn On/Pop Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury.

b. Connect the oscilloscope's channel A to TP25.
c. Connect the instrument to the power line, and turn the POWER switch ON.
d. The signal on the oscilloscope should stay low for approximately 2.4 seconds and then go high.
e. If this test failed, continue this procedure.
f. Connect the voltmeter positive terminal to TP24 and negative terminal to chassis ground. The voltage should read $+27 \pm 3$ V.
g. If this test failed, troubleshoot from the diode bridge (CR110) back to the line filter.
h. If this test passed, troubleshoot the TURN ON/POP circuits.

Primary Current Limit Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level after approximately two minutes, provided the jumpers are installed in the TEST position.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the TEST position. Short TP16 to TP15.
c. Connect the instrument to the power line, and turn the POWER switch ON. The yellow primary current limit LED (CR22) should not be lit.
d. Turn the POWER switch OFF. Remove the short between TP16 and TP15, and short TP16 to TP14.
e. Turn the POWER switch ON. The yellow primary current limit LED (CR22) should be lit.
f. If this test failed, troubleshoot the primary current limit circuit.

g. If this test passed, continue this procedure.
h. Turn OFF the instrument's power switch, and remove the power cord.
i. Move W1 and W2 into the NORMAL position using insulated needlenose pliers. Turn the +15 V, -15 V, and +5 V adjustment pots fully counter clockwise. Verify that J1, J2, J3, J4, and J5 are not connected.
j. Connect the instrument to the power line, and turn the POWER switch ON. The yellow primary current LED (CR22) should not be lit.
k. If this test failed, the fault is most likely between T1 and the secondary current limit sense resistors.

NOTE

Intermittent connections in the +5 V output area(L1, C71, and the+5 V connector) can cause a primary current limit.

l. If the fault cannot be located with an ohmmeter, begin isolating portions of the secondary by lifting the diodes leading to the secondary outputs. DO NOT REMOVE CR40. DAMAGE TO THE FETs MAY RESULT.

NOTE

The primary current limit circuit is much faster than the secondary current limit circuits. Therefore it is possible for a secondary load following the current sense resistor to cause a primary current limit.

m. If the primary current limit LED is not lit after lifting a diode, troubleshoot the components in the associated area.
n. If the cause of the primary current limit does not appear to be in the secondary circuitry, first verify that the FET drive waveform is correct and then troubleshoot the primary circuits.

NOTE

Quite often, when one or both FETs are shorted, several other parts are damaged; notably those in the gate circuit. Occasionally, T1 itself has been known to cause a primary current limit. Also, the problem may be related to the primary current limit transformer T2 and diodes CR23 and CR24 which are not tested in steps a through e.

o. If the above procedure fails to uncover the cause of the primary current limit, perform the +5 V Control Loop Troubleshooting Procedure.

NOTE

If the supply can be brought up slowly without causing a primary current limit, the problem may be associated with the soft start circuit (C59). The +5 V Control Loop Troubleshooting Procedure can be performed with or without a supply load. If the supply is loaded, a faulty soft start circuit may cause a primary current limit because of surge currents. The soft start circuit insures that the pulsewidth modulator starts out with a low duty cycle and then increases gradually (0.5 second) to the proper value.

+5 V Current Limit Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level after approximately two minutes, provided the jumpers are installed in the TEST position.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the TEST position. Short TP33 to TP2 (+5 V REF).
c. Connect the instrument to the power line, and turn the POWER switch ON. The yellow +5 current limit LED (CR14) should not be lit.
d. Turn the POWER switch OFF. Remove the short connecting TP33 to TP2, and short TP32 to TP2.
e. Turn the POWER switch ON. The yellow +5 current limit LED (CR14) should be lit.
f. If this test failed, troubleshoot the +5 V current limit circuit.
g. If this test passed, then the fault is most likely in the +5 V output, +5 V loading, or current sensing circuits.

+15 V Current Limit Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level after approximately two minutes, provided the jumpers are installed in the TEST position.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the NORMAL position. Verify that J1, J3, J4, and J5 are not connected and that the +5 V supply is properly loaded.
c. Connect the instrument to the power line, and turn the POWER switch ON. The yellow +15 V current limit LED (CR84) should not be lit.
d. If this test failed, the fault is most likely the +15 V current limit, +15 V output, or the current sensing circuits.
e. If this test passed, continue this procedure.
f. Turn the POWER switch OFF. Short TP35 to TP36.
g. Turn the POWER switch ON. The yellow +15 V current limit LED (CR84) should not be lit.
h. Turn the POWER switch OFF. Remove the short connecting TP35 to TP36, and short TP34 to TP36.
i. Turn the POWER switch ON. The yellow +15 V current limit LED (CR84) should be lit.
j. If this test failed, troubleshoot the +15 V current limit circuit.
k. If this test passed, then the fault is most likely in the +15 V output, +15 V loading, or current sensing circuits.

-15 V Current Limit Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level after approximately two minutes, provided the jumpers are installed in the TEST position.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the NORMAL position. Verify that J1, J3, J4, and J5 are not connected and that the +5 V supply is properly loaded.
c. Connect the instrument to the power line, and turn the POWER switch ON. The yellow -15 V current limit LED (CR92) should not be lit.
d. If this test failed, the fault is most likely the -15 V current limit, -15 V output, or the current sensing circuits.
e. If this test passed, continue this procedure.
f. Turn the POWER switch OFF. Short TP39 to TP37.
g. Turn the POWER switch ON. The yellow +15 V current limit LED (CR84) should not be lit.
h. Turn the POWER switch OFF. Remove the short connecting TP39 to TP37, and short TP37 to TP38.
i. Turn the POWER switch ON. The yellow -15 V current limit LED (CR92) should be lit.
j. If this test failed, troubleshoot the -15 V current limit circuit.
k. If this test passed, then the fault is most likely in the -15 V output, -15 V loading, or current sensing circuit.

+5 V Overvoltage Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the NORMAL position. Disconnect the +5 V load (J8). Turn the +5 V adjust (R22) fully counter clockwise.
c. Connect the voltmeter positive terminal to TP26 and negative terminal to chassis ground.
d. Connect the instrument to the power line, and turn the POWER switch ON.
e. Adjust R22 slowly until the +5 V overvoltage circuit trips and the red overvoltage LED (CR100) lights. The overvoltage trip point should be approximately 5.4 V.
f. If this test passed, then the fault is most likely in the +5 V output, loop shaping, or pulsewidth modulator circuits.

g. If this test failed, continue this procedure.

NOTE

A power supply that can drive 5.5 V into 10 ohms is needed for this procedure. The recommended power supply is an HP 6235A.

h. Turn OFF the instrument's power switch, and remove the power cord. Move jumpers W1 and W2 into the TEST position using insulated needlenose pliers.
i. Connect the voltmeter positive terminal to TP26 and negative terminal to chassis ground.
j. Connect the variable DC power supply positive terminal to TP26 and negative terminal to chassis ground.
k. Connect the instrument to the power line, and turn the POWER switch ON.
l. Adjust the DC power supply voltage slowly until the +5 V overvoltage circuit trips and the red overvoltage LED (CR100) lights. The overvoltage trip point is approximately 5.4 V.
m. If this test failed, troubleshoot the +5 V overvoltage circuit.
n. If this test passed, then the fault is most likely in the +5 V output, loop shaping, or pulsewidth modulator circuits.

+15 V Overvoltage Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the NORMAL position. Disconnect the +5 V load (J8). Turn the +5 V adjust (R22) fully counter clockwise.
c. Connect the instrument to the power line, and turn the POWER switch ON.
d. Adjust R122 (+15 V adj) for +15.00 (+0.05, -0.00) V.
e. Turn the POWER switch OFF. Short TP6 to TP8.
f. Turn the POWER switch ON. The red +15 V overvoltage LED (CR95) should not be lit.
g. Turn the POWER switch OFF. Remove the short connecting TP6 to TP8, and short TP7 to TP8.
h. Turn the POWER switch ON. The red +15 V overvoltage LED (CR95) should be lit.
i. If this test failed, troubleshoot the +15 V overvoltage circuit.
j. If this test passed, then the fault is most likely in the +15 V output, +15 V loading, or the voltage sensing circuits.

-15 V Overvoltage Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the NORMAL position. Verify that J1, J3, J4, and J5 are not connected and that the +5 V supply is properly loaded. Turn the -15 V adjust (R124) fully counter clockwise.
c. Connect the instrument to the power line, and turn the POWER switch ON.
d. Adjust R124 (-15 V adj) for -15.00 ± 0.05 V.
e. Turn the POWER switch OFF. Short TP4 to chassis ground.
f. Turn the POWER switch ON. The red -15 V overvoltage LED (CR103) should not be lit.
g. Turn the POWER switch OFF. Remove the short connecting TP4 to chassis ground, and short TP5 to chassis ground.
h. Turn the POWER switch ON. The red -15 V overvoltage LED (CR103) should be lit.
i. If this test failed, troubleshoot the -15 V overvoltage circuit.
j. If this test passed, then the fault is most likely in the -15 V output, -15 V loading, or voltage sensing circuits.

HI Temp Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord. After removing the bottom cover, allow about 20 minutes for all components to cool off.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level after approximately two minutes, provided the jumpers are installed in the TEST position.

b. Using insulated needlenose pliers, set jumpers W1 and W2 into the TEST position. Apply cool spray to S4 (mounted on CR40).
c. Connect the instrument to the power line, and turn the POWER switch ON.
d. The red HI Temp LED (CR106) should not be lit.
e. If this test failed, troubleshoot the HI Temp circuit. (Check for loose hardware holding the temperature switch to the diodes.)

f. If this test passed, then the fault is most likely in the +5 V current limit or +5 V output circuit. The high temp switch monitors CR40's case temperature, which increases with diode current. The high temperature trip point is approximately 105 ° C.

NOTE

A dirty fan screen or improper fan operation may cause a HI Temp condition.

Bias Supply Troubleshooting Procedure

a. Connect the instrument to the power line, and turn the POWER switch ON.
b. Connect the voltmeter negative terminal to chassis ground and positive terminal to TP23. The DC voltage should be +15 ± 1 V.
c. Move the voltmeter positive terminal to TP22. The DC voltage should be -15 ± 1 V.
d. If this test failed, troubleshoot the bias supplies back to the line filter.

FET Drive Troubleshooting

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level after approximately two minutes, provided the jumpers are installed in the TEST position.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the TEST position.
c. Set the oscilloscope to A-B mode and the trigger to external. Connect the external trigger to TP1 using a 1:1 probe. Connect channel A to TP17 and channel B to TP18 with properly compensated 10:1 probes. Connect the probe ground leads to the chassis.
d. Connect the instrument to the power line, and turn the POWER switch ON.
e. The waveform should appear as shown in Table 8-20 step 1.
f. If this test failed, then the fault is most likely the loop shaping circuit, pulsewidth modulator circuit, or shorted FETs. Check the voltage at TP29 with a DC voltmeter. It should be at approximately +6.0 to +6.6 V. If the voltage is near zero, the loop shaping circuit is probably shutting down the pulsewidth modulator (U5).

NOTE

With W1 and W2 in the TEST position, the loop shaping circuit drives the FETs with a maximum duty cycle in an attempt to raise the output from zero to +5 V. This drives TP29 to about +6 V. The FETs are not damaged since FET power is removed.

WARNING

After replacing shorted FETs and BEFORE turning the HP 3577A on with the jumpers in the NORMAL position, perform the FET Switching Troubleshooting Procedure.

FET Switching Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

CAUTION

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level after approximately two minutes, provided the jumpers are installed in the TEST position.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the TEST position.
c. Set an external DC power supply to approximately 20 V with the current limited to approximately 200 mA.
d. Connect the power supply positive terminal to the junction of R9 and W1 and negative terminal to the junction of R10 and W2.
e. Connect the instrument to the power line, and turn the POWER switch ON.
f. The current meter on the external power supply should indicate < 50 mA.
g. A current significantly in excess of 50 mA indicates a shorted FET or improper FET drive. To determine if one or both sides of the FET drive circuit is shorted, repeat the remainder of this procedure for both sides of the FET drive (use the locations in parentheses for the other side of the FET drive).
h. Set the oscilloscope to A-B mode. Connect channel A to TP18 (TP20) and channel B to the junction of W1 and R9 (W2 and R10). A square wave with an approximate 50% duty cycle should be seen.
i. If this test passed, return to step h and check the other side of the FET drive circuit using the locations in the parenthesis.
j. If this test failed, continue this procedure to check the gate drive.

NOTE

A Leaky/shorted CR7 or leaky/open C2 or C3 can cause the power FETs to be turned on at an improper time, thus causing the FETs to conduct current simultaneously and draw excessive, if not destructive, currents.

k. Move channel B to TP17 (TP19) and leave channel A connected to TP18 (TP20). The oscilloscope should display a square wave with an approximate 50% duty cycle.
l. If this test passed, the fault is probably a shorted FET.
m. If this test failed, continue this procedure to determine if the input to the FET drive from the pulsewidth modulator is working properly.
n. Set the oscilloscope to A-B mode and the trigger to "CHOP". Connect channel A to U3 pin 3 and channel B to U3 pin 12. The oscilloscope should display negative pulses 180 degrees out of phase.
o. If this test passed, troubleshoot the FET drive.
p. If this test failed, troubleshoot the pulsewidth modulator circuit.

FET Power Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

CAUTION

Perform the FET Switching Troubleshooting Procedure before doing this procedure.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the NORMAL position.
c. Connect the instrument to the power line, and turn the POWER switch ON.
d. Connect the voltmeter negative terminal to TP21 and positive terminal to the positive side of C2(+). The DC voltmeter should read +150 ± 15V.
e. Move the voltmeter positive terminal to the negative side of C3(-). The DC voltmeter should read -150 ± 15 V.
f. If this test failed, troubleshoot the FET power circuit back to the line filter.
g. If this test passed, continue this procedure.
h. Set the oscilloscope to A-B mode. Connect channel A to the positive side of C10 and channel B to TP21 using properly compensated 10:1 probes. Connect the probe ground leads to chassis ground. The waveform should appear as shown in Table 8-20 step 2.
i. If this test failed, the fault is most likely in the FET drive (including the FETs), pulsewidth modulator, +5 V output, or loop shaping circuits.

+5 V Control Loop Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

NOTE

Use this procedure if FET drive output is good with W1 and W2 in the test position, but the +5 V output cannot be adjusted to +5.10 ± 0.02 V.

CAUTION

When manually controlling the FET drive pulse width, it is very easy to damage (by overdriving) the power MOSFETs. This is especially true if any of the protection circuits have been disabled for troubleshooting purposes. Perform the +5 V Overvoltage Troubleshooting Procedure before continuing.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury.

b. Using insulated needlenose pliers, place W1 and W2 into the NORMAL position.
c. Set a positive referenced variable DC supply to 0 V output. Connect the positive terminal to TP28 and negative terminal to chassis ground. Turn the supply on.
d. Place a short across R32.
e. Connect the oscilloscope's channel A to the lead of C23 that is physically closest (and electrically connected) to L1 using a properly compensated 10:1 probe.
f. Connect the DC voltmeter positive terminal to TP29 and negative terminal to chassis ground.

CAUTION

DO NOT apply power to the HP 3577A unless the external supply is connected, turned on, and set to zero volts output, otherwise damage to the circuit may occur.

g. Connect the instrument to the power line, and turn the POWER switch ON. Nothing should happen on the secondary side of T1 because the pulsewidth modulator is shut down. The DC voltmeter should read approximately 0 V.
h. SLOWLY increase the output of the variable DC supply watching the voltmeter and oscilloscope. As the voltage at (TP29) reaches about 0.8 V, narrow pulses should appear on the oscilloscope (C23). See Table 8-20 Step 4.

i. Move the voltmeter positive terminal to TP26 (+5 V Output).
j. Continue increasing the output of the variable DC supply, watching the pulse width and the +5 V output (TP26) increase. When the +5 V output (TP26) is approximately +3.1 V, the pulses on the oscilloscope (C23) should look like the waveform in Table 8-20 Step 5.
k. If this test failed, troubleshoot back to the pulsewidth modulator or loop shaping circuits.
l. Reduce the DC supply to 0 volts output. Turn OFF the instrument's power switch, remove the power cord, and return the HP 3577A to its original state.

Loop Shaping/Pulse Width Modulator Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level after approximately two minutes, provided the jumpers are installed in the TEST position.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the TEST position.
c. Set an external variable DC power supply to 0 V output. Connect the negative terminal to chassis ground and positive terminal to TP28. Adjust the supply output to between 1 and 2 V.
d. Short TP27 to chassis ground.
e. Connect the voltmeter positive terminal to TP29 and negative terminal to chassis ground.
f. Connect the oscilloscope's channel A to the cathode of CR30 and channel B to the cathode of CR31 using properly compensated 10:1 probes. Connect the external trigger to TP1 using a 1:1 probe. Connect the probe ground leads to chassis ground.
g. Setup oscilloscope and verify that the waveform is as shown in Table 8-20 Step 3. The two waveforms should be exactly 180 degrees out of phase. This insures that only one of the power MOSFETs is ON at a time.
h. Slowly decrease the output of the variable supply. When the voltage measured at TP29 reaches about 3 V, the pulse width should start to narrow. When the voltage measured at TP29 reaches about 0.3 V or close to 0 V, the pulsewidth modulator should completely shut down. The external supply should have complete control over the duty cycle up to a maximum of near 50%.
i. If this test passed, return to Troubleshooting Hints section.
j. If this test failed, continue this procedure.
k. Monitor TP29 with the voltmeter. It should vary from 0 to the +15 V supply rail as the voltage on TP28 varies from 0 to 2 V.
l. Check TP29 with a oscilloscope for a clean waveform and a smooth response to the variable DC supply on TP28.

m. If this test failed, troubleshoot the loop shaping circuit.
n. If this test passed and the pulsewidth modulator is still shut down, continue this procedure.
o. Drive TP29 to about 6 V by adjusting the variable DC supply. This produces a 50% duty cycle in the pulsewidth modulator. Check for 6 V on U5 pin 1.
p. Measure the voltage at U5 pin 5. A logic low here represents a pulsewidth modulator shutdown. Troubleshoot the protection circuits. If the logic level at U5 pin 5 is high, verify the +5 V Ref (TP2) and +15 V Bias (U5 pin 17).

NOTE

While troubleshooting the pulsewidth modulator, remember that Q35 and Q36 are capable of shutting down the pulsewidth modulator output if either one is turned on or shorted. R86 and C56 externally set the pulsewidth modulator frequency to 40 ± 4 kHz.

+15 V and -15 V Output Regulator Troubleshooting Procedure

a. Turn OFF the instrument's power switch, and remove the power cord.

WARNING

Even with the power removed, there can be sufficient stored energy in some circuits to cause personal injury.

b. Using insulated needlenose pliers, move jumpers W1 and W2 into the NORMAL position. Verify that J1, J3, J4, and J5 are disconnected and that the +5 V supply is properly loaded.
c. Connect the instrument to the power line, and turn the POWER switch ON.
d. Connect the voltmeter positive terminal to TP26 and negative terminal to chassis ground. The DC voltmeter reading should be +5.10 ± 0.02 V.
e. If this test failed, return to the Troubleshooting Hints section.
f. If this test passed and a 15 V supply cannot be adjusted to the correct value, troubleshoot the 15 V regulator circuits. Trace the proper voltages back through the circuit to the main power transformer T1.

NOTE

The three pin voltage regulators usually require a 3 V to 5 V potential difference between the input and output for proper regulation.

Final Power Supply Adjustments

a. Perform the adjustment in section 4-5, Power Supply Adjustments.

Table 8-20 A21 Circuit Board, Troubleshooting Data

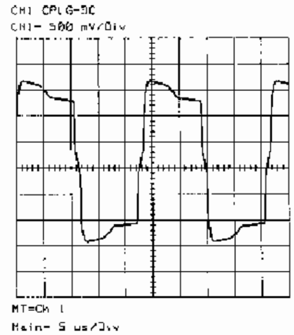
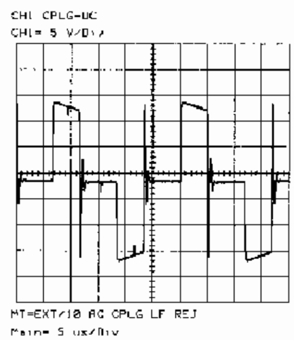
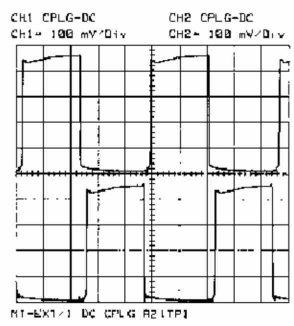
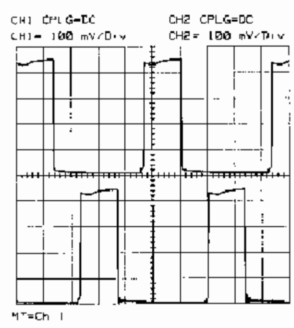
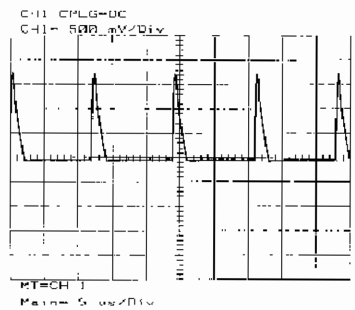
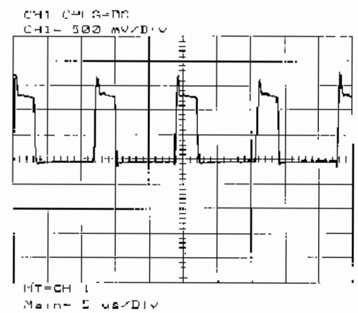
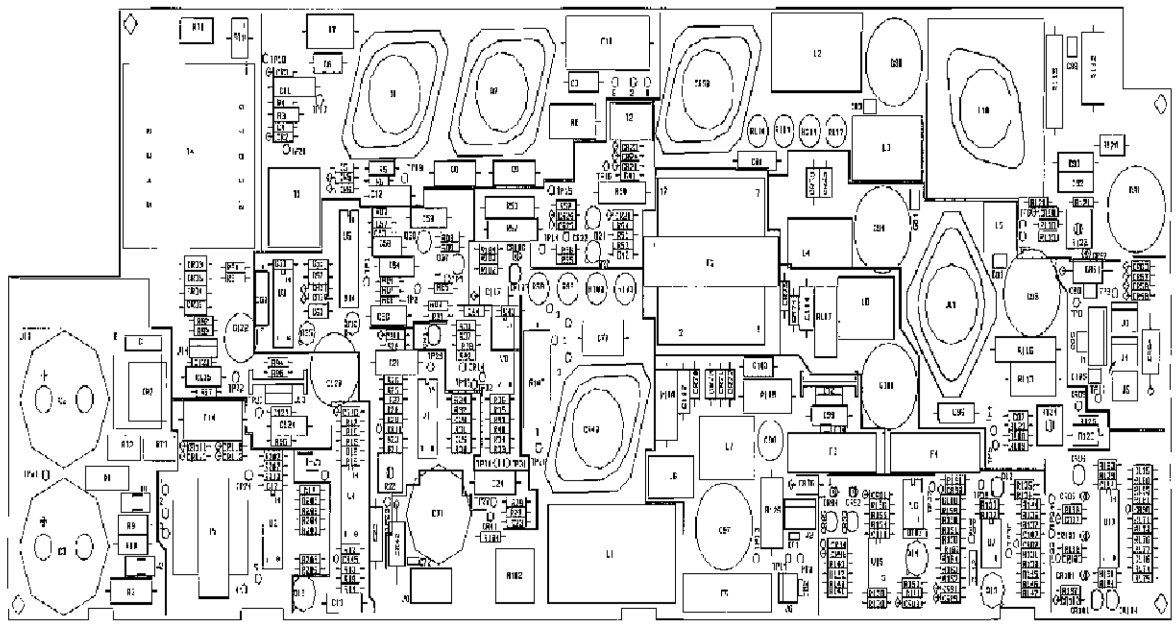
Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Connect CH A to A21TP17 Connect CH B to A21TP18 Externally trigger on A21TP1 Set A21W1 and W2 to TEST	Oscilloscope Mode A-B CH A V/Div 500 mV CH B V/Div 500 mV Time/Div 5 μs Trigger EXT CH A Coupling DC CH B Coupling DC	Pulse shape and duty cycle.	
2	Connect CH A to A21C10 Connect CH B to A21TP21 Set A21W1 and W2 to NORMAL	Oscilloscope Mode A-B CH A V/Div 5 V CH B V/Div 5 V Time/Div 5 μs Trigger INT CH A Coupling DC CH B Coupling DC	Pulse shape and duty cycle	
3	Connect CH A to A21CR30 Connect CH B to A21CR31 Externally trigger on A21TP1 Jumper TP27 to GND Set A21W1 and W2 to TEST Drive TP28 with external power supply to 1 V	Oscilloscope CH A V/Div 2 V CH B V/Div 2 V Time/Div 5 μs Trigger EXT CH A Coupling DC CH B Coupling DC	Pulse shape, only one signal on at a time (no overlap)	
3 cont	Connect CH A to A21CR30 Connect CH B to A21CR31 Externally trigger on A21TP1 Jumper TP27 to GND Set A21W1 and W2 to TEST Drive TP28 with external power supply to 0.5 V	Oscilloscope CH A V/Div 100 mV CH B V/Div 100 mV Time/Div 5 μs Trigger EXT CH A Coupling DC CH B Coupling DC	Pulse shape, only one signal on at a time (no overlap)	

Table 8-20. A21 Circuit Board, Troubleshooting Data

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
4	Connect CH A to A21C23 Set A21W1 and W2 to NORMAL Drive TP28 with external power supply to 0.8 V on TP29 Place a short across A21R32	Oscilloscope CH A V/Div 500 mV Time/Div 5 μs Trigger INT CH A Coupling DC	Peak-to-peak voltage	
5	Connect CH A to A21C23 Set A21W1 and W2 to NORMAL Drive TP28 with external power supply to 3.1 V on TP26 Place a short across A21R32	Oscilloscope CH A V/Div 500 mV Time/Div 5 μs Trigger INT CH A Coupling DC	Peak-to-peak voltage, pulse shape, duty cycle, DC level	



A21 Component Locator
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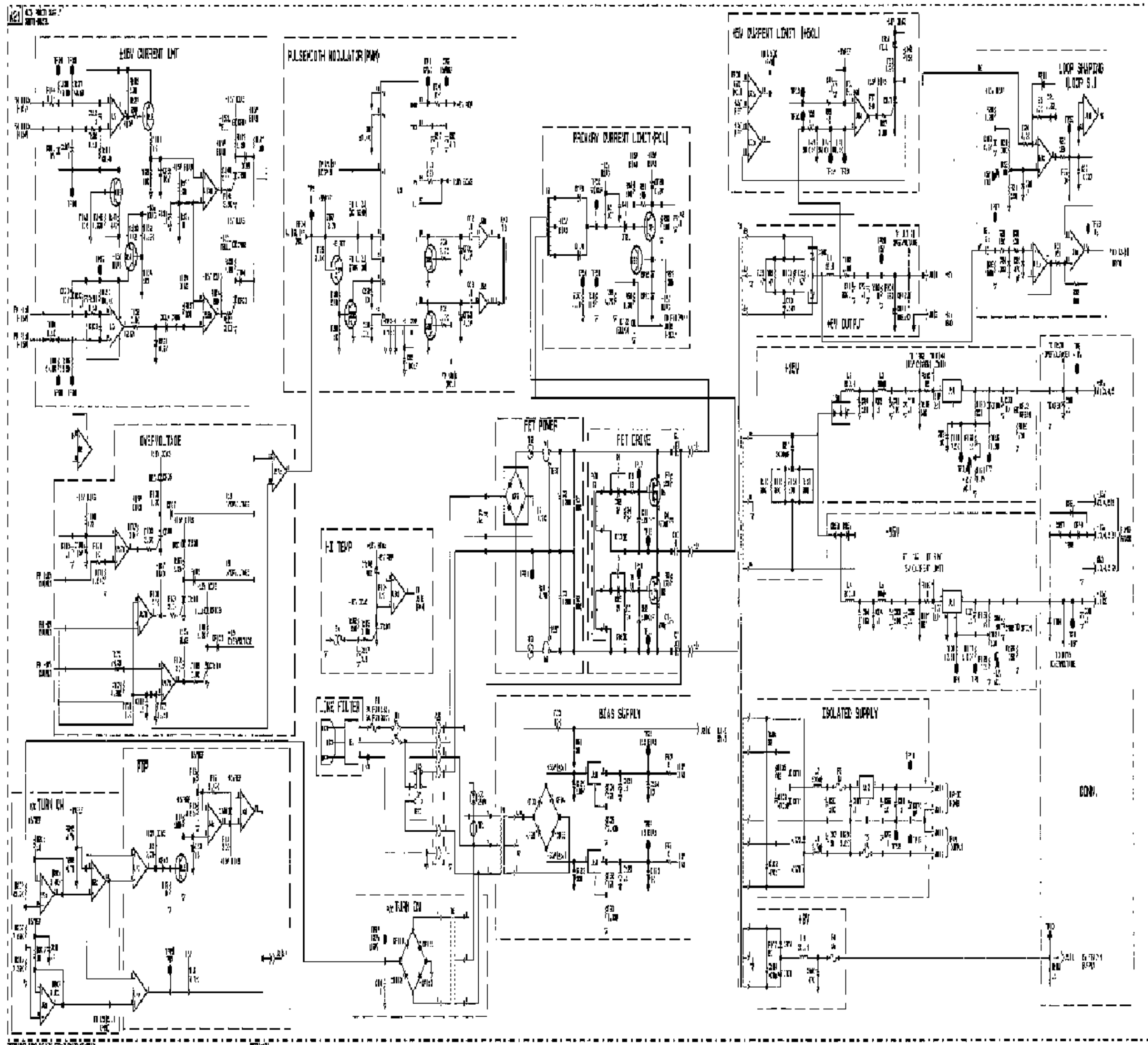


A21

Figure 8-23. A21 Main Power Supply Board, Schematic

IC	BUS VOLTAGE PIN	GND	BYPASS CAP DESIG.	VALUE
U1	+15V,4		[illegible]	[illegible]
U1	-15V,11		[illegible]	[illegible]
U2	+15V,8	[illegible]	[illegible]	[illegible]
U3	+15V,1	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]
U4	+15V,8	[illegible]	[illegible]	[illegible]
U6	+15V,7	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]
U8	+15V,8	[illegible]	[illegible]	[illegible]
U10				
U11				
U12		[illegible]		
U14				
U15	+15V,8	4	[illegible]	[illegible]
U17	+15V,8	[illegible]	[illegible]	[illegible]

8-20 SERVICE GROUP A31, OVEN ASSEMBLY

The information in this section should be used to isolate faulty functional sub-blocks when servicing the HP 3577A. All procedures assume the Fault Isolation procedures of Section II have been used to determine which functional block has failed, and the Circuit Descriptions of Section VII are understood.

WARNING

Service procedures described in this section are performed with the protective covers removed and power applied. Energy available at many points can, if contacted, result in personal injury.

CAUTION

Do not insert or remove any circuit board in the HP 3577A with the line power turned on. Power transients caused by insertion or removal may damage the circuit boards.

Initial Conditions

Unless otherwise stated in the troubleshooting sections of the signal table, set the 3577A as described below, after power on:

Press INSRT PRESET
Disconnect the EXT REF if connected

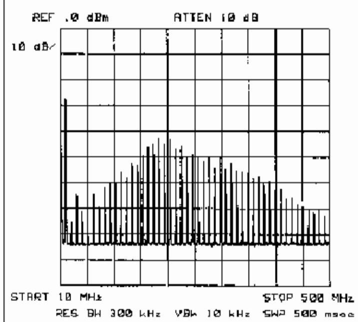
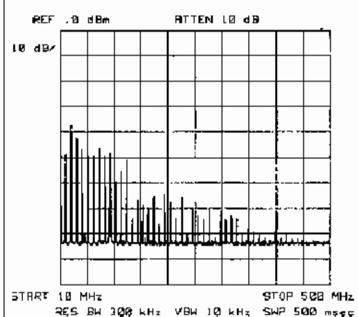
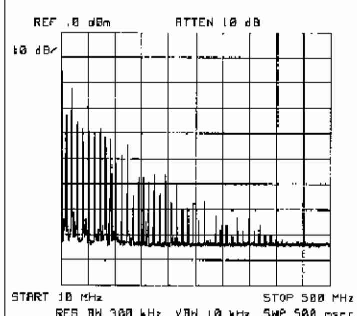
All Oscilloscope waveforms are taken using a 1:1 probe and a HP 1980B Oscilloscope. All Spectrum Analyzer waveforms connected to an SMB connector are taken through the 03577-84401 Service Kit BNC to SMB cable. All Spectrum Analyzer waveforms taken off component leads are taken through a 10007B 1:1 probe. This probe has 215 Ω of series resistance.

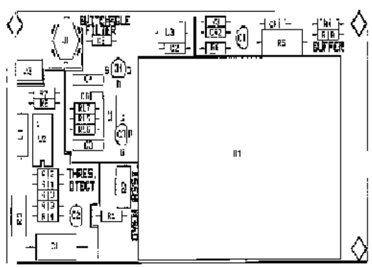
Troubleshooting Hints

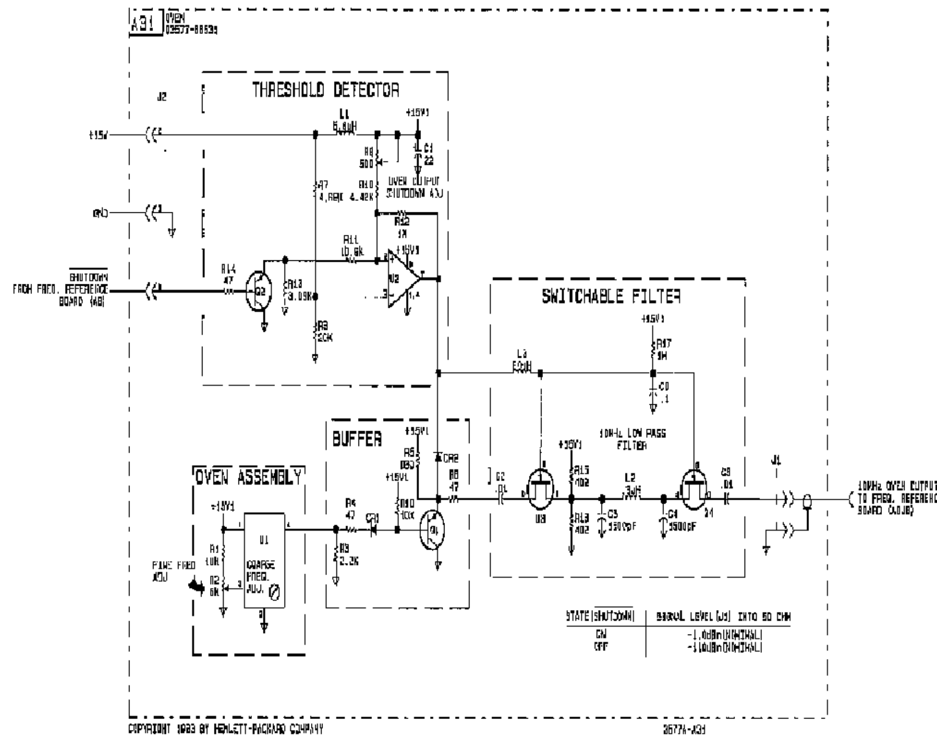
1. Jumper A31U2 pin 7 to ground. A31Q3 and A31Q4 should turn on and the oven signal should be on at A31J1 at approximately -1 dBm. If the signal is not present, suspect both A31Q3 and A31Q4 as being faulty.

2. Connect a jumper across A31R17 shorting it. A31Q3 and A31Q4 should turn off and the oven signal should be < -100 dBm at A31J1. If the signal is higher, suspect both A31Q3 and A31Q4 as being leaky.

Table 8-22. A31 Circuit Board, Troubleshooting Data

Step	HP 3577A Set up	Measurement Set up	Important Parameters	Waveform
1	Test at A31J1 Press INSTR PRESET	Spectrum Analyzer Start 10 MHz Stop 500 MHz Res BW 300 kHz VBW 10 kHz Ref Level 0 dBm dB/Div 10 dB	10 MHz Amplitude, Harmonics.	
2	Test at A31U1 pin 4 Press INSTR PRESET	Spectrum Analyzer Start 10 MHz Stop 500 MHz Res BW 300 kHz VBW 10 kHz Ref Level 0 dBm dB/Div 10 dB	10 MHz Amplitude, Harmonics	
3	Test at A31Q1 emmitter Press INSTR PRESET	Spectrum Analyzer Start 10 MHz Stop 500 MHz Res BW 300 kHz VBW 10 kHz Ref Level 0 dBm dB/Div 10 dB	10 MHz Amplitude Harmonics.	
4	Test at A31U2 pin 7	Oscilloscope Volts/Div 1 V Time/Div any Autotrigger	TTL State	Should TTL toggle when EXT REF is connected and disconnected.





A31

Figure 8-24. A31 Oven Board Schematic

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8-21 HP 1345A DISPLAY REMOVAL

The HP 1345A Digital Display is a stand alone digital display which is serviced separately using the HP 1345A service manual included with the instrument. To remove the display for servicing, the only screws requiring removal are those called out in Figure 8-25. With the HP 3577A placed on its side, the internal cables used to connect to the display can be connected to the removed display. Perform the following steps to remove the display.

a. Disconnect the mains power cord from the rear panel and remove the top cover.

b. Remove both internal shields from over the display unit and A31 Reference circuit board.

c. Remove the side handle from the left side of the HP 3577A by removing the two screws at the end of each side of the handle.

d. Remove the side cover by removing the screw which connects the side panel to the rear frame.

e. Remove the trim strip from top of the front frame.

f. Remove the front frame and side panel screws as shown in Figure 8-25.

g. Remove the screw which attaches the display to the instrument bottom deck as shown in Figure 8-25.

h. The display will pull out of the unit from the front. Disconnect the display power cable and the dislay interface cable.

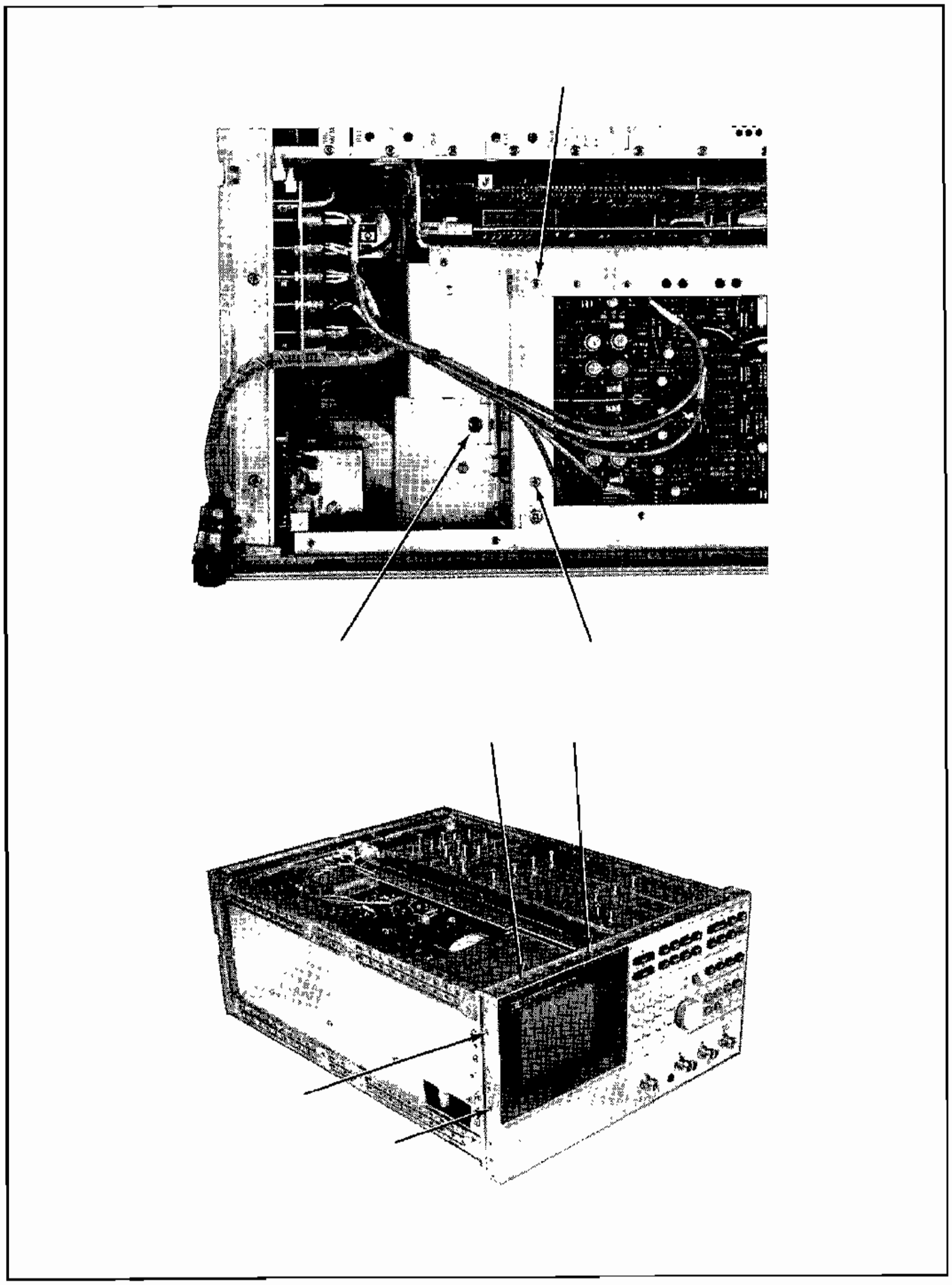

Figure 8-25. HP 1345A Removal