Errata

Title & Document Type: 83592C RF Plug-In Operating and Service Manual

Manual Part Number: 83592-90076

Revision Date: July 1983

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.

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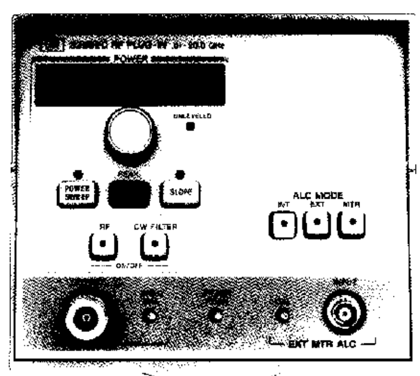
Agilent Technologies

OPERATING AND SERVICE MANUAL

HP 83592C
RF PLUG-IN
0.01 to 20.0 GHz



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PACKARD

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 lists the available exchange assemblies. Table 6-2 lists abbreviations used in the parts list and the names and addresses that correspond to the manufacturers' code numbers. Table 6-3 lists all replaceable parts in reference designator order.

6-3. EXCHANGE ASSEMBLIES

6-4. Table 6-1 lists assemblies within the instrument that may be replaced on an exchange basis, thus affording a considerable cost savings. Exchange, factory repaired and tested assemblies are available only on a trade-in basis; therefore the defective assemblies must be returned for credit. For this reason, assemblies required for spare parts stock must be ordered by the new assembly part number.

6-5. ABBREVIATIONS

6-6. Table 6-2 contains three major sections: Reference Designations expands the designators used in the parts list; Abbreviations defines all abbreviations used in the descriptions of replaceable parts; Manufacturers Code List references the name and address of a typical manufacturer with the code number provided in the parts list.

6-7. REPLACEABLE PARTS LIST

6-8. Table 6-3 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alpha-numerical order by reference designation.

b. Chassis-mounted parts in alpha-numerical order by reference designation.

c. Miscellaneous parts.

6-9. The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. Part number check digit (CD).

c. The total quantity (Qty) in the instrument.

d. The description of the part.

e. A typical manufacturer of the part in a five-digit code.

f. The manufacturer's number for the part.

6-10. The total quantity for each part is given only once — at the first appearance of the part number in the list.

NOTE

Total quantities for optional assemblies are totaled by assembly and not integrated into the standard list.

6-11. ILLUSTRATIONS

6-12. Figure 6-1, Mechanical Parts, provides the locations of all replaceable mechanical parts listed in Table 6-3. These parts are denoted with reference designation prefix "MP." Figure 6-2, Attaching Hardware, references the Hewlett-Packard part number for the hardware used, with at least one location within the instrument. Figure 6-3, RF Cables, shows the semi-rigid cables used in standard and option models.

6-13. ORDERING INFORMATION

6-14. To order a part listed in the Replaceable Parts List, quote the Hewlett-Packard part number with its check digit (CD), indicate the quantity, and address the order to the nearest Hewlett-Packard Office. The check digit will ensure accurate and timely processing of your order.

6-15. To order a part that is not listed in the Replaceable Parts List, include the instrument model number, instrument serial number, description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard Office.

6-16. SPARE PARTS KIT

6-17. Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard has a Spare Parts Kit available for this purpose. The kit consists of selected replaceable assemblies and components for this instrument. A list of the contents of the kit and the Recommended Spares list for this instrument may be obtained on request, and the Spare Parts Kit may be ordered through your nearest Hewlett-Packard Office.

Table 6-1. Exchange Parts

Reference Designation	New Part Number	Rebuilt-Exchange Part Number	Description
A12	5086-7340	5086-6340	YTM
A13	5086-7337	5086-6337	YO 2.3 to 7.0 GHz
A14	5086-7386	5086-6386	Power Amp. 2.3 to 7.0 GHz
A16	5086-7339	5086-6339	Modulator/Splitter
A17	5086-7217	5086-6217	Amplifier 0.01 to 2.4 GHz
A18	5086-7219	5086-6219	Modulator/Mixer
A20	5086-7404	5086-6404	Switched YTF

NOTE

For module exchange procedure, see Paragraph 8-30.

Table 6-2. Manufacturers Code List, Reference Designations, and Abbreviations (1 of 3)

MANUFACTURERS CODE LIST

Mfr. No.	Manufacturer Name	Address		Zip Code
S0545	NIPPON ELECTRIC CO.	TOKYO	JP	
00000	ANY SATISFACTORY SUPPLIER			
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
02114	FERROXCUBE CORP	SAUGERTIES	NY	12477
03888	K D I PYROFILM CORP	WHIPPANY	NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85008
06001	MEPCO ELECTA CORP	COLUMBIA	SC	29063
06665	PRECISION MONOLITHICS INC	SANTA CLARA	CA	95050
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW	CA	94042
11236	CTS OF BERNE INC	BERNE	IN	46711
13606	SPRAGUE ELECT CO SEMICONDUCTOR DIV	CONCORD	NH	03301
17856	SILICONIX INC	SANTA CLARA	CA	95054
18324	SIGNETICS CORP	SUNNYVALE	CA	94086
19701	MEPCO/ELECTRA CORP	MINERAL WELLS	TX	76067
24355	ANALOG DEVICES INC	NORWOOD	MA	02062
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
25088	SIEMENS CORP	ISELIN	NJ	08830
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
3L585	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	
30983	MEPCO/ELECTRA CORP	SAN DIEGO	CA	92121
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE	CA	92507
34371	HARRIS SEMICON DIV HARRIS-INTERTYPE	MELBOURNE	FL	32901
34649	INTEL CORP	MOUNTAIN VIEW	CA	95051
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
72136	ELECTRO MOTIVE CORP	FLORENCE	SC	06226
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON	CA	92634
9N171	UNITRODE COMPUTER PRODUCTS CORP	METHUEN	MA	
91506	AUGAT INC	ATTLEBORO	MA	02703

Table 6-2. Manufacturers Code List, Reference Designations, and Abbreviations (2 of 3)

REFERENCE DESIGNATIONS

A ..... Assembly
AT ..... Attenuator, Isolator, Limiter, Termination
C ..... Capacitor
CR ... Diode, Diode Thyristor, Step Recovery Diode (SCR), Varactor
DC ..... Directional Coupler
DS .... Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Audible or Visible)
E ..... Miscellaneous Electrical Part
F ..... Fuse
FL ..... Filter
H ..... Hardware
J ..... Electrical Connector (Stationary Portion), Jack
K ..... Relay
L ..... Coil, Inductor
MP ..... Miscellaneous Mechanical Part
P ..... Electrical Connector (Movable Portion), Plug
Q .... Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor
R ..... Resistor
S ..... Switch
T ..... Transformer
TP ..... Test Point
U ..... Integrated Circuit, Microcircuit
VR .... Breakdown Diode (Zener), Voltage Regulator
W ..... Cable, Transmission Path, Wire
X ..... Socket
Y ..... Crystal Unit (Piezoelectric, Quartz)
Z ... Tuned Cavity, Tuned Circuit

ABBREVIATIONS

A

A ..... Across Flats, Acrylic, Air (Dry Method), Ampere
ADJ ..... Adjust, Adjustment
ALC ..... Alcohol, Automatic Level Control
AMP ..... Amperage
AMPL ..... Amplifier
ANLG ..... Analog
ASSY ..... Assembly
ASTBL ..... Astable
ATTEN ..... Attenuation, Attenuator
AWG ..... American Wire Gage

B

BD ..... Board, Bundle
BE ..... Baume, Beryllium
BFR ..... Before, Buffer
BLK ..... Black, Blank, Block
BNC ..... Type of Connector
BSC ..... Basic
BVR ..... Reverse Breakdown Voltage

C

C ..... Capacitance, Capacitor, Center Tapped, Centistoke, Ceramic, Cermet, Circular Mil Foot, Closed Cup, Cold, Compression
CBL ..... Cable
CER ..... Ceramic
CH ..... Center Hole
CHAM ..... Chamfer
CHAN ..... Channel
COAX ..... Coaxial
COM ..... Commercial, Common
CONN ..... Connect, Connection, Connector
CONT ..... Contact, Continuous, Control, Controller
CONV ..... Converter
CP ..... Cadmium Plate, Candle Power, Centipoise, Conductive Plastic, Cone Point

D

D ..... Deep, Depletion, Depth, Diameter, Direct Current
D/A ..... Digital-to-Analog
DAP ..... Diallyl Phthalate
DB ..... Decibel, Double Break
DC ..... Direct Current, Double Contact
DBL ..... Double
DCDR ..... Decoder
DEG ..... Degree
DIA ..... Diameter
DIFF ..... Differential
DIP ..... Dual In-Line Package
DO ... Package Type Designation
DRVR ..... Driver

E

E ..... Enamel (Insulation, Enhancement, Extension)
E-MODE .... Enhancement Mode
EPROM ..... Erasable Programmable Read Only Memory
EXCL ..... Excluding, Exclusive
EXT ..... Extended, Extension, External, Extinguish

F

F ..... Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Flint, Fluorine, Frequency
FEM ..... Female
FF ..... Flange, Female Connection; Flip Flop
FM .... Flange, Male Connection; Foam, Frequency Modulation
FT ..... Current Gain Bandwidth Product (Transition Frequency); Feet, Foot
FXD ..... Fixed

G

GEN ..... General, Generator
GL ..... Glass
GP ..... General Purpose, Group

H

H ..... Henry, Hermaphrodite, High, Hole Diameter, Hot, Hub Inside Diameter, Hydrogen
HD ..... Hand, Hard, Head, Heavy Duty
HEX ..... Hexadecimal, Hexagon, Hexagonal

I

IC ..... Collector Current, Integrated Circuit
ID ..... Identification, Inside Diameter

Table 6-2. Manufacturers Code List, Reference Designations, and Abbreviations (3 of 3)

IF .... Forward Current, Intermediate Frequency
IMPD .... Impedance
IN .... Inch, Indium
INP .... Input
INT .... Integral, Intensity, Internal
INTL ...... Internal, International
INV .... Invert, Inverter

J

JFET .... Effect Transistor

K

Kilo, Potassium
KB .... Knob

L

LED .... Light Emitting Diode
LG .... Length, Long
LIN .... Linear, Linear Taper, Linearity
LK .... Link, Lock
LKG .... Leakage, Locking
LKWR .... Lockwasher
LS .... Loudspeaker, Low Power Schottky, Series Inductance
LUM .... Luminous

M

M .... Male, Maximum, Mega, Mil, Milli, Mode, Momentary, Mounting Hole Centers, Mounting Hole Diameter
MA .... Milliampere
MACH .... Machined
MAX .... Maximum
MCD .... Millicandela
MICPROC .... Microprocessor
MISC .... Miscellaneous
MLD .... Mold, Molded
MM .... Magnetized Material (Restricted Articles Code): Millimeter
MOD .... Model, Modified, Modular, Modulated, Modulator
MOSFET .... Metal Oxide Semiconductor Field Effect Transistor
MTG .... Mounting
MTR .... Meter
MULTIPLXR .... Multiplexer
MUW .... Music Wire
MW .... Milliwatt

N

N-CHAN .... N-Channel
N-CHAN .... N-Channel Metal Oxide Semiconductor
NO ..... Normally Open, Number
NPN .... Negative Positive Negative (Transistor)
NS .... Nanosecond, Non-Shorting, Nose

O

OCTL .... Octal
OD .... Olive Drab, Outside Diameter
OP .... Operational
OPT ... Optical, Option, Optional
OXD .... Oxide

P

PC .... Picocoulomb, Piece, Printed Circuit
PCB .... Printed Circuit Board
PD .... Pad, Palladium, Pitch Diameter, Power Dissipation
PKG .... Package
PL .... Phase Lock, Plain, Plate, Plug
PLSTC .... Plastic
PNP .... Positive Negative Positive (Transistor)
POLYE .... Polyester
POS .... Position, Positive
POZI .... Pozidriv Recess
PRCN .... Precision
PRP .... Purple, Purpose
PT .... Part, Pint, Platinum, Point, Pulse Time
PVC .... Polyvinyl Chloride
PW .... Power Wirewound, Pulse Width

Q

QUAD .... Set of Four

R

RES .... Research, Resistance, Resistor, Resolution
RET .... Retaining
RF .... Radio Frequency
RGLTR .... Regulator
RKR .... Rocker
RND .... Round
RPG ..... Rotary Pulse Generator
RR .... Rear
RVT .... Rivet, Riveted

S

SCR .... Screw, Scrub, Silicon Controlled Rectifier
SGL .... Single
SHFT .... Shaft
SI .... Silicon, Square Inch
SIG .... Signal, Significant
SIP .... Single In-Line Package
SKT .... Skirt, Socket
SLDR .... Solder
SM .... Samarium, Seam, Small, Square Meter, Sub Modular, Subminiature
SMB .... Subminiature, B Type (Snap-On Connector)
SQ .... Square
STL .... Steel
SZ .... Size

T

TA .... Ambient Temperature, Tantalum
TC .... Thermoplastic
THD .... Thread, Threaded
THK .... Thick
TO .... Package Type Designation, Troy Ounce
TPL .... Triple
TRIG .... Trigger, Triggerable, Triggering, Trigonometry
TRMR .... Trimmer
TRN .... Turn, Turns
TTL .... Tan Translucent, Transistor Transistor Logic

U

UNCT .... Undercut
UF .... Microfarad

V

V .... Vanadium, Variable, Violet, Volt, Voltage
VA .... Volt Ampere
VDC .... Volts, Direct Current
VID .... Video

W

W .... Watt, Wattage, White, Wide, Width, Wire
WB .... Wide Band
WD .... Width, Wood

X

XSTR .... Transistor

Y

YTM ...... YIG Tuned Multiplier

Z

ZNR .... Zener

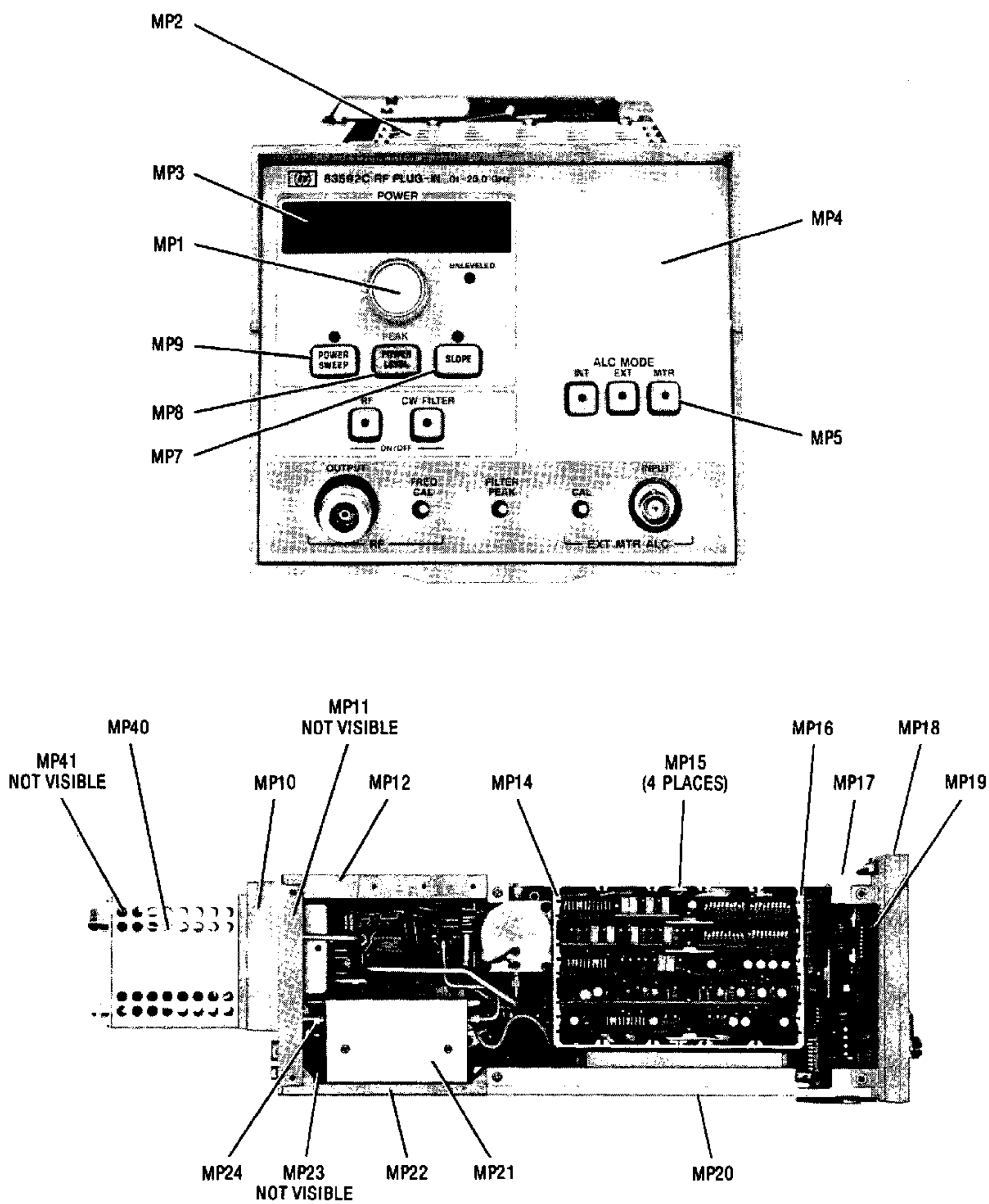

Figure 6-1. Mechanical Parts (1 of 3)

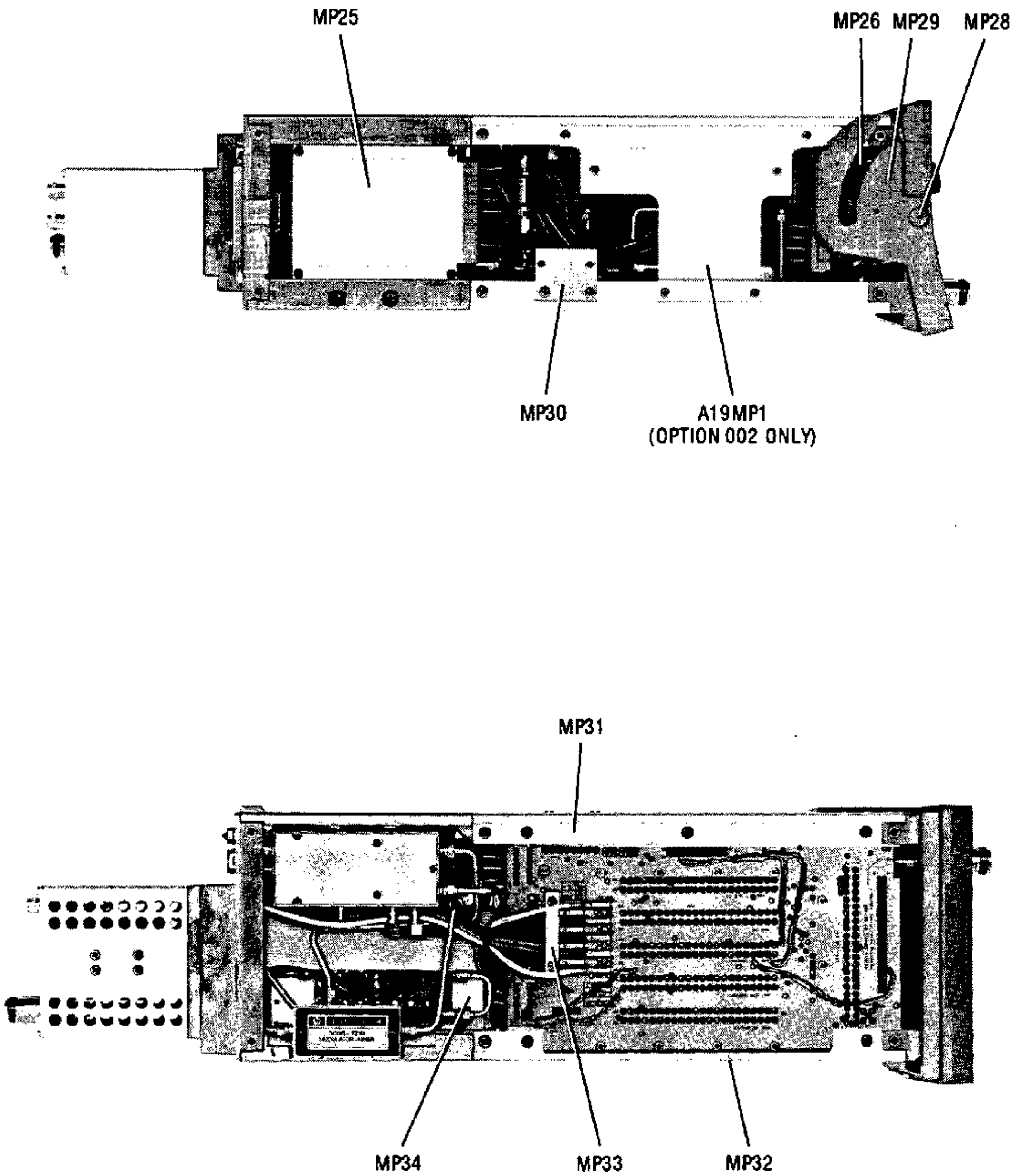

Figure 6-1. Mechanical Parts (2 of 3)

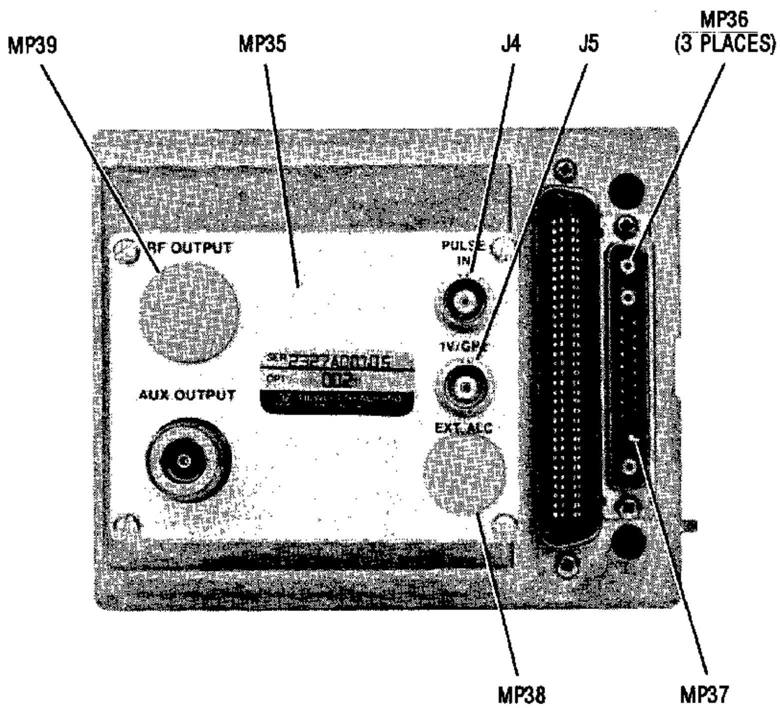

Figure 6-1. Mechanical Parts (3 of 3)

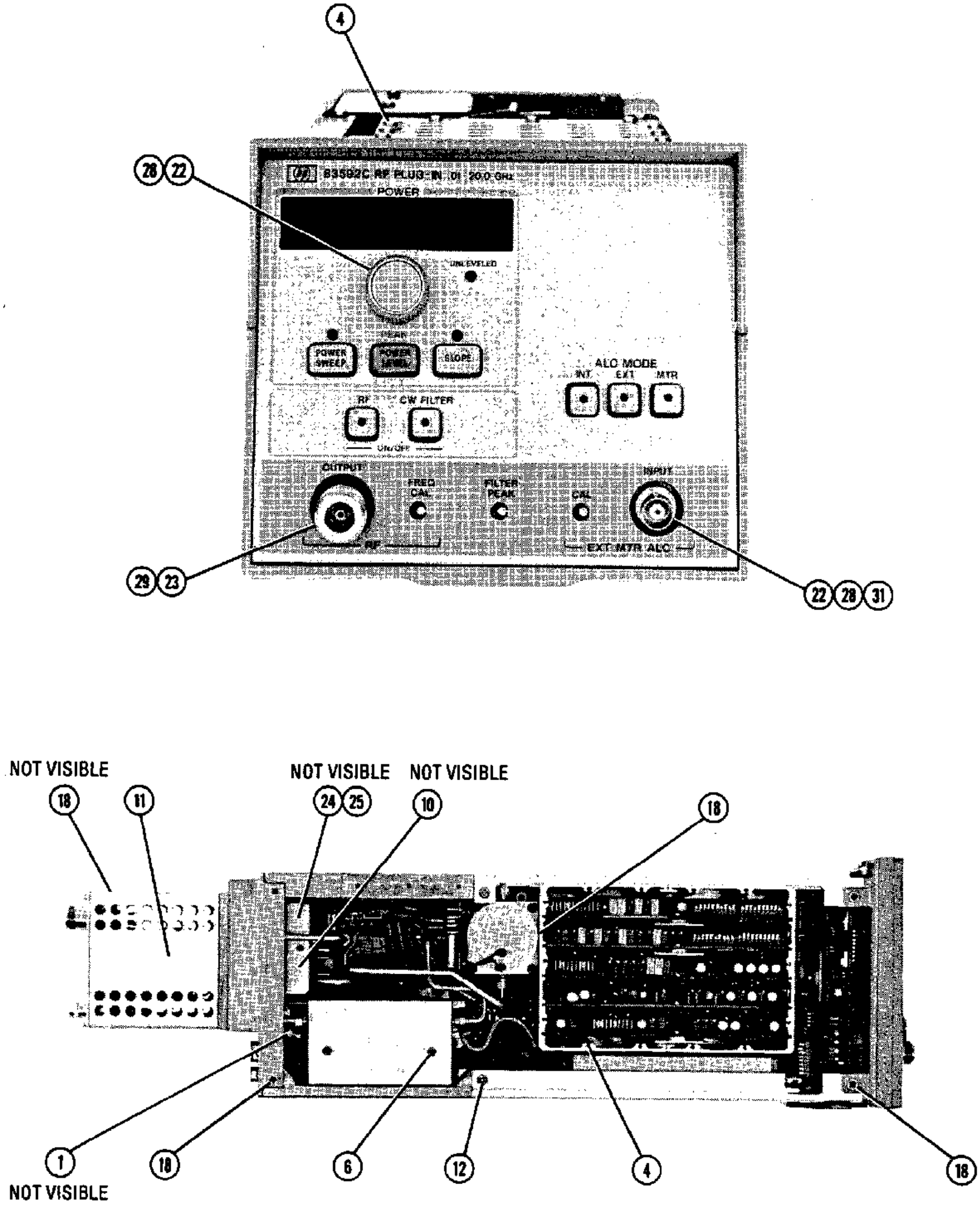

Figure 6-2. Attaching Hardware (1 of 3)

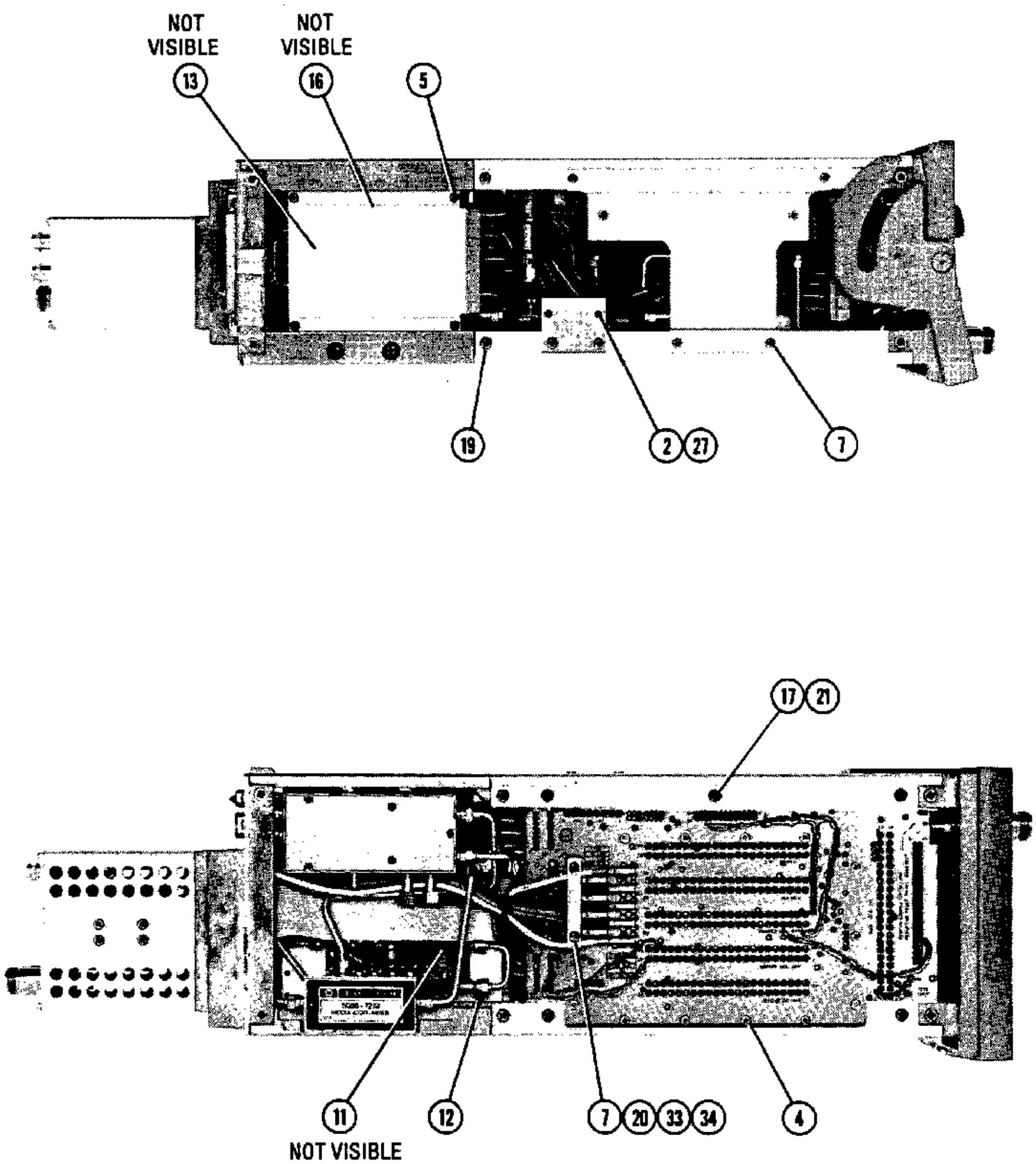

Figure 6-2. Attaching Hardware (2 of 3)

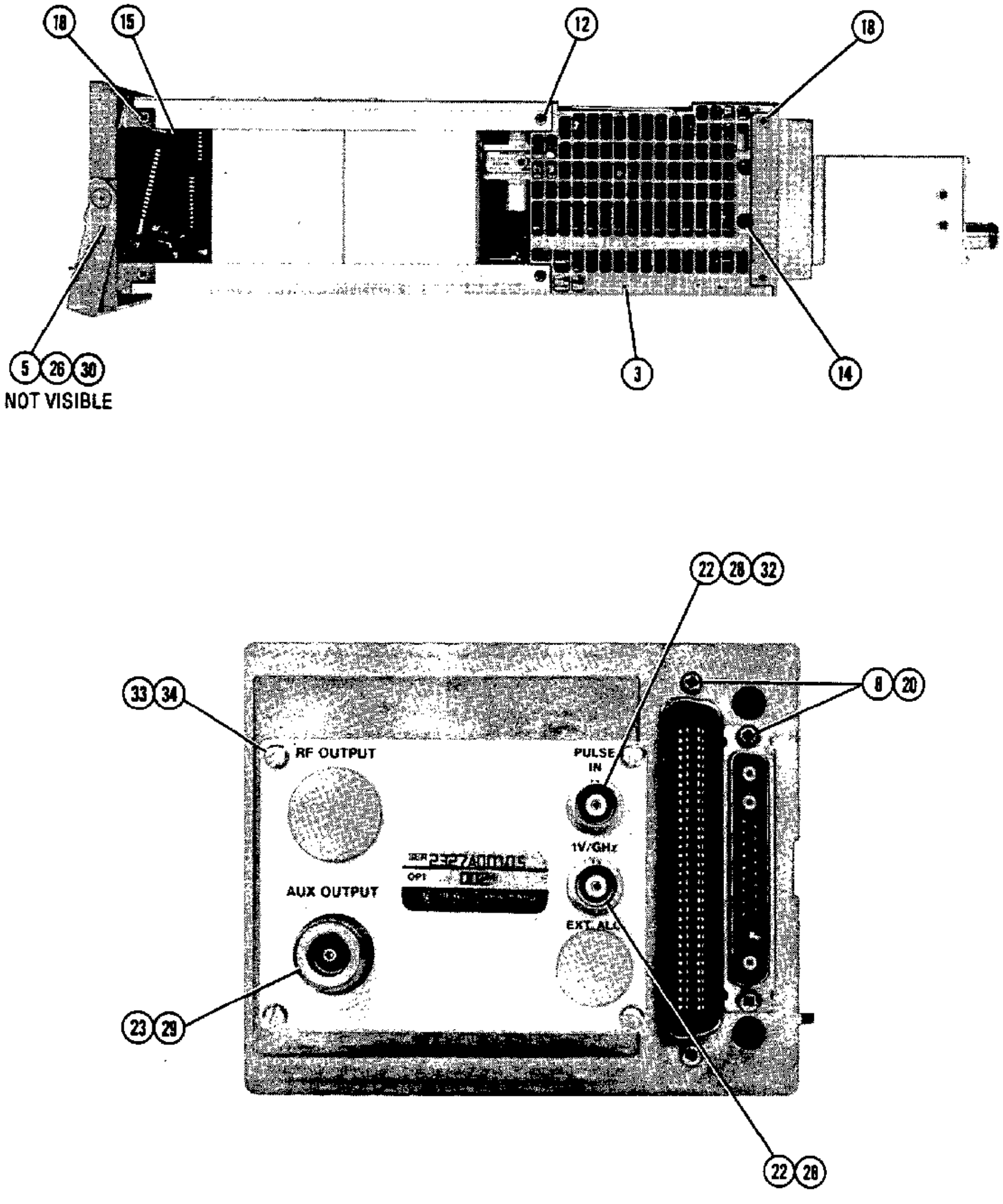

Figure 6-2. Attaching Hardware (3 of 3)

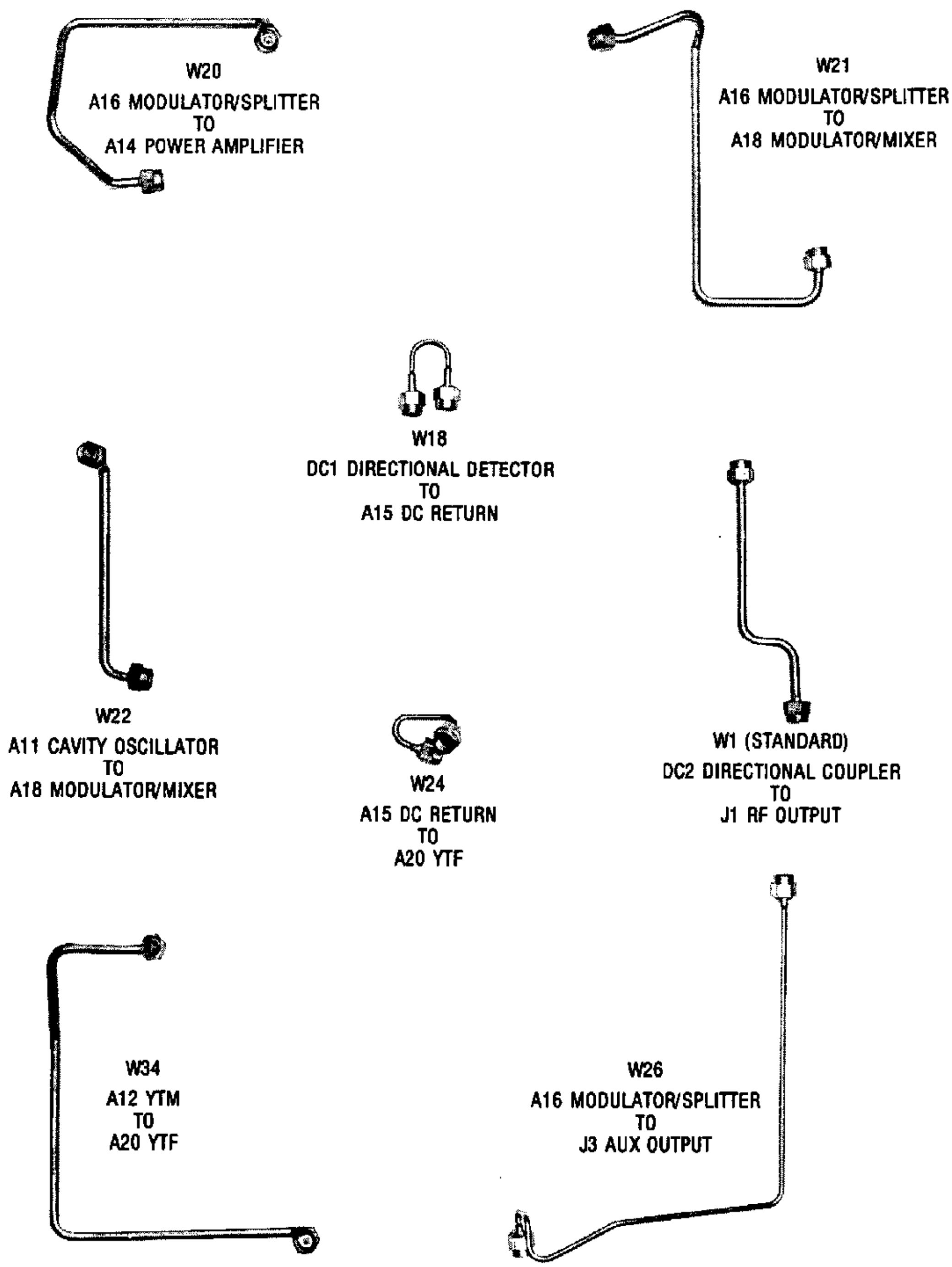

Figure 6-3. RF Cables (1 of 3)

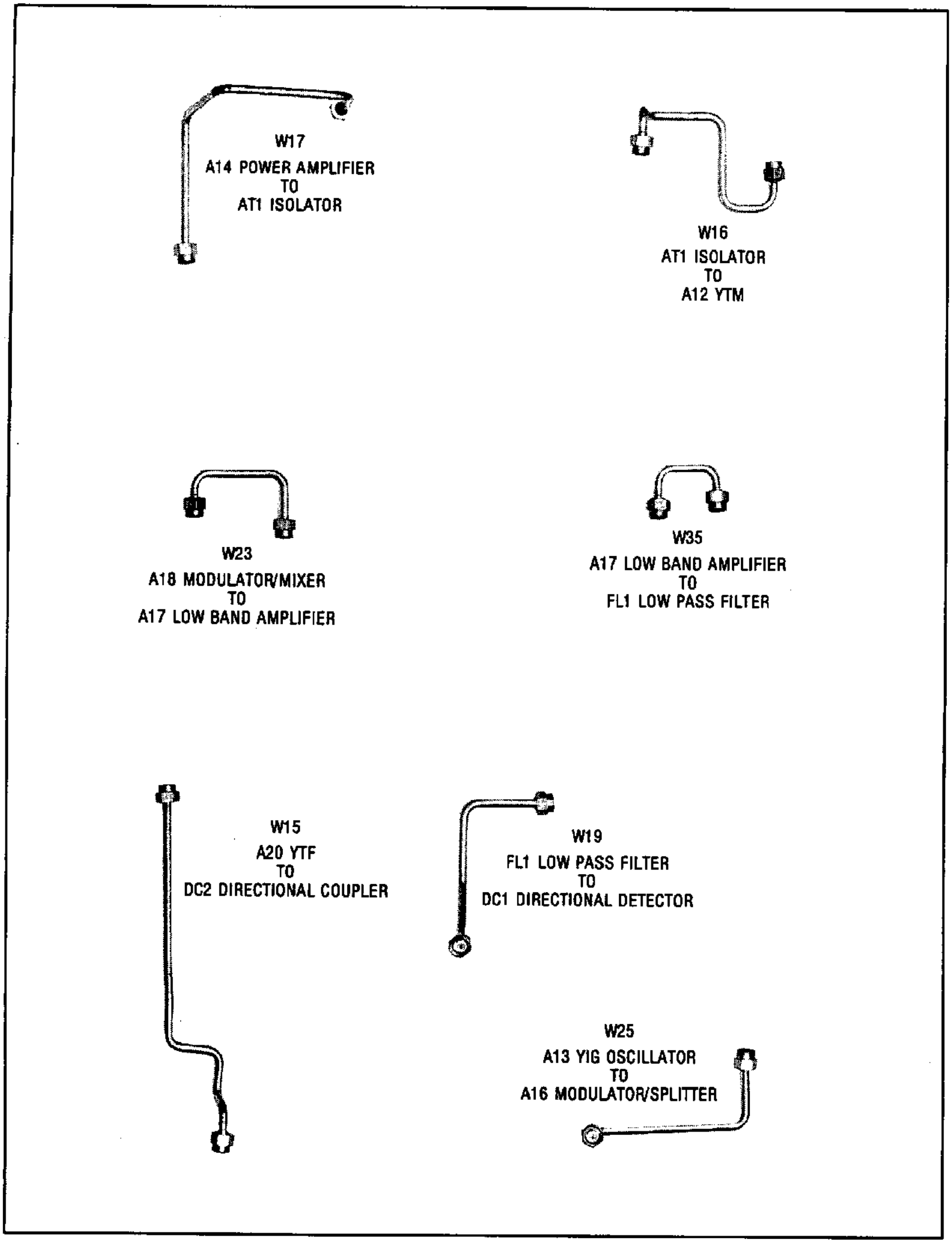

Figure 6-3. RF Cables (2 of 3)

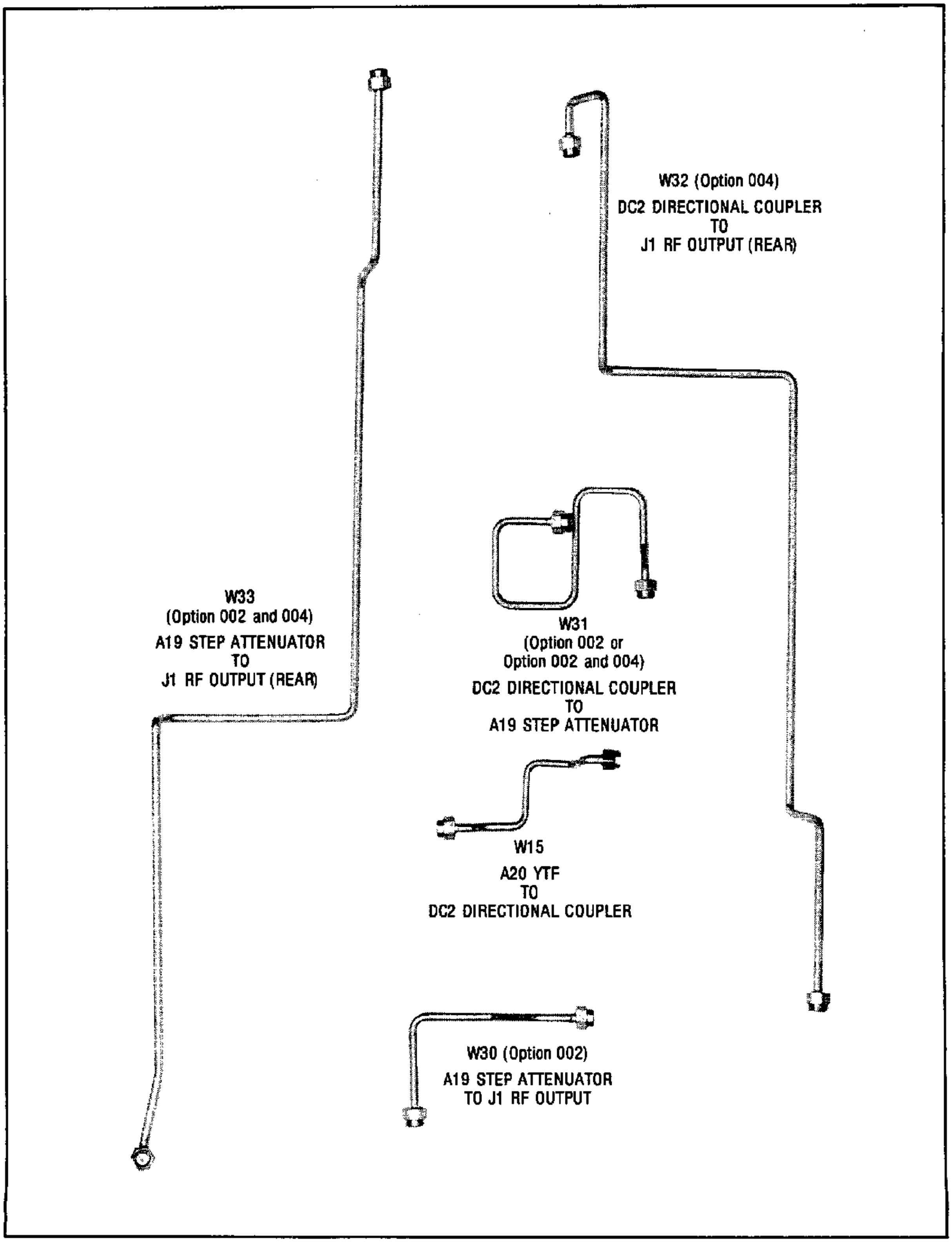

Figure 6-3. RF Cables (3 of 3)

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	83592-60088	5	1	**BOARD ASSEMBLY-FRONT PANEL (DOES NOT INCLUDE A1RPG1 ROTARY PULSE GENERATOR)**	28480	83592-60088
A1C1	0160-4084	8	29	CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A1C2	0180-2811	7	1	CAPACITOR-FXD 10UF+20% 35VDC TA	28480	0180-2811
A1C3	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A1C4	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A1C5	0180-0552	9	1	CAPACITOR-FXD 220UF+20% 10VDC TA	28480	0180-0552
A1DS1				NOT ASSIGNED		
A1DS2	1990-0487	7	2	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0487
A1DS3	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0487
A1DS4	1990-0670	0	5	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A1DS5	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A1DS6	1990-0486	6	1	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0486
A1DS7-A1DS13				NOT ASSIGNED		
A1DS14	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A1DS15	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A1DS16	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A1DS17	1990-0699	3	3	LED-LIGHT BAR MODULE LUM-INT=7MCD	28480	1990-0699
A1DS18	1990-0699	3		LED-LIGHT BAR MODULE LUM-INT=7MCD	28480	1990-0699
A1DS19	1990-0699	3		LED-LIGHT BAR MODULE LUM-INT=7MCD	28480	1990-0699
A1J1	1251-4827	1	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-4827
A1R1	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-TO-316R-F
A1R2	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-TO-316R-F
A1R3	2100-4022	0	3	RESISTOR-VAR CONTROL CP 10K 10% LIN	28480	2100-4022
A1R4	2100-4022	0		RESISTOR-VAR CONTROL CP 10K 10% LIN	28480	2100-4022
A1R5	2100-4022	0		RESISTOR-VAR CONTROL CP 10K 10% LIN	28480	2100-4022
A1R6	0698-8820	7	1	RESISTOR 4.64 1% .125W F TC=0+100	28480	0698-8820
A1R7	0757-0398	4	4	RESISTOR 75 1% .125W F TC=0+100	24546	C4-1/8-T0-75R0-F
A1R8	0757-0398	4		RESISTOR 75 1% .125W F TC=0+100	24546	C4-1/8-T0-75R0-F
A1R9	0757-0398	4		RESISTOR 75 1% .125W F TC=0+100	24546	C4-1/8-T0-75R0-F
A1R10	0698-3444	1	1	RESISTOR 316 1% .125W F TC=0+100	24546	C4-1/8-TO-316R-F
A1RPG1	5060-9444	7	1	ROTARY PULSE GENERATOR	28480	5060-9444
A1S1	5060-9436	7	8	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S6-A1S11				NOT ASSIGNED		
A1S12	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S13	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1S14	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A1U1	1810-0124	9	1	NETWORK-RES 16-DIP200.0 OHM X 8	28480	1810-0124
A1U2	1990-0738	1	1	DISPLAY-NUM-SEG 5-CHAR .152-H RED	28480	1990-0738
A1U3	1810-0403	7	1	NETWORK-RESISTOR R1-R15: 330 OHM+2%	01121	316A331
A1XDS17-A1XDS19				NOT ASSIGNED		
A1XU2	1251-5928	5	1	CONNECTOR 15-PIN M POST TYPE	28480	1251-5928
A1XU9	1200-0901	7	3	SOCKET-STRP 8-CONT SIP DIP-SLDR	28480	1200-0901
A1XU10	1200-0901	7		SOCKET-STRP 8-CONT SIP DIP-SLDR	28480	1200-0901
A1XU11	1200-0901	7		SOCKET-STRP 8-CONT SIP DIP-SLDR	28480	1200-0901
				A1 MISCELLANEOUS PARTS		
	2190-0067	4	2	WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0067
	2950-0006	3	2	NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	0380-1233	9	1	SPACER-SPECIALTY .450 IN LG; .175 IN OD	00000	ORDER BY DESCRIPTION
	2190-0067	4		WASHER-LK INTL T 1/4 IN .256-IN-ID	28480	2190-0067
	2950-0006	3		NUT-HEX-DBL-CHAM 1/4-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	7121-1153	1	1	LABEL-INFORMATION .14-IN-WD .4-IN-LG	28480	7121-1153
	0890-0052	9	1	TUBING-HS 1-D/.5-RCVD .035-WALL POLYO	28480	0890-0052
A2	83592-60095	4	1	**BOARD ASSEMBLY-SUB PANEL**	28480	83592-60095
A2C1	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A2C2	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A2C3	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A2C4				NOT ASSIGNED		
A2C5	0160-0174	9	4	CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A2C6	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A2C7	0160-3879	7	26	CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2C8	0160-3875	3	1	CAPACITOR-FXD 22PF +5% 200VDC CER 0+30	28480	0160-3875
A2CR1	1901-0033	2	23	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR4				NOT ASSIGNED		
A2CR5				NOT ASSIGNED		
A2CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR7	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2J1	1251-5926	3	3	CONNECTOR 50-PIN M POST TYPE	28480	1251-5926
A2J2				NOT ASSIGNED		
A2J3	1200-0508	0	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0508
A2K1	0490-0916	6	3	RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A2L1	9100-1618	1	2	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A2P1	1251-5491	7	1	CONNECTOR 25-PIN F POST TYPE	28480	1251-5491
A2Q1	1854-0474	4	2	TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A2Q2	1853-0316	1	1	TRANSISTOR-DUAL PNP PD=500MW	28480	1853-0316
A2Q3	1854-0474	4		TRANSISTOR NPN SI PD=310MW FT=100MHZ	04713	2N5551
A2Q4	1854-0477	7	5	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A2R1	2100-3056	8	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	02111	43P502
A2R2	0757-0289	2	3	RESISTOR 13.3K 1% .125W F TC=0+100	19701	MF4C1/8-T0-1332-F
A2R3	0757-0466	7	2	RESISTOR 110K 1% .125W F TC=0+100	24546	C4-1/8-T0-1103-F
A2R4	2100-3161	6	2	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A2R5	0757-0465	6	9	RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A2R6	2100-3054	6	2	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	02111	43P503
A2R7	0757-0440	7	3	RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A2R8	0698-3451	0	1	RESISTOR 133K 1% .125W F TC=0+100	24546	C4-1/8-T0-1333-F
A2R9	0757-0280	3	17	RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A2R10	0757-0442	9	33	RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A2R11	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+100	28480	0757-0123
A2R12	0698-3153	9	3	RESISTOR 3.83K 1% .125W F TC=0+100	24546	C4-1/8-T0-3831-F
A2R13	0698-3431	6	1	RESISTOR 23.7 1% .125W F TC=0+100	03888	PME55-1/8-T0-23R7-F
A2R14	0757-0438	3	6	RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A2R15	0698-3156	2	4	RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A2R16				NOT ASSIGNED		
A2R17	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A2R18	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+100	19701	MF4C1/8-T0-1332-F
A2R19				NOT ASSIGNED		
A2R20	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A2R21	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A2R22	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A2R23	2100-3054	6		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	02111	43P503
A2R24	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A2R25	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A2R26	0698-7229	8	1	RESISTOR 511 1% .05W F TC=0+100	24546	C3-1/8-TO-511R-F
A2R27	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A2R28	0698-7205	0	1	RESISTOR 51.1 1% .05W F TC=0+100	24546	C3-1/8-TO-51R1-F
A2TP1	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A2U1	1826-0092	3	3	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A2U2	1858-0047	5	2	TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A2U3	1858-0047	5		TRANSISTOR ARRAY 16-PIN PLSTC DIP	13606	ULN-2003A
A2U4	1820-1416	5	3	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A2U5	1820-1730	6	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A2U6	1820-2150	6	1	IC MICPROC-ACCESS NMOS	34649	D8279-5
A2U7	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A2U8	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A2U9	1826-0417	6	5	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A2U10	1858-0069	1	1	TRANSISTOR ARRAY 18-PIN PLSTC DIP	13606	ULN-2803A
A2U11				NOT ASSIGNED		
A2U12	1826-0205	0	1	IC TIMER TTL	18324	NE556A
A2U13	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A2VR1	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	1N751A	07263
A2W1				NOT ASSIGNED		
A2W2				NOT ASSIGNED		
A2W3	8159-0005	0	9	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
				A2 MISCELLANEOUS PARTS		
	0380-0773	0	4	SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
	0380-0773	0		SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
	0380-0773	0		SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	0380-0773	0		SPACER-RVT-ON .5-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A3	**83592-60078**	**3**	**1**	**BOARD ASSEMBLY-DIGITAL INT**	**28480**	**83592-60078**
A3C1	0160-0127	2	7	CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C2	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C3	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C4	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A3C5	0160-3537	4	1	CAPACITOR-FXD 680PF ±5% 100VDC MICA	28480	0160-3537
A3C6	0180-0500	7	1	CAPACITOR-FXD 47UF±20% 20VDC TA	28480	0180-0500
A3J1	1251-5926	3		CONNECTOR 50-PIN M POST TYPE	28480	1251-5926
A3R1	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0±100	24546	C4-1/8-T0-1621-F
A3R2	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0±100	24546	C4-1/8-T0-3831-F
A3R3	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0±100	24546	C4-1/8-T0-3831-F
A3R4	0698-7212	9	4	RESISTOR 100 1% .05W F TC=0±100	24546	C3-1/8-TO-100R-F
A3S1	3101-2243	6	1	SWITCH-RKR DIP-RKR-ASSY 8-1A .05A 30VDC	28480	3101-2243
A3U1	83592-80007	0	1	IC-NMOS 32K ERPOM PROGRAMMED	28480	83592-80007
A3U2	83592-80008	1	1	IC-NMOS 32K ERPOM PROGRAMMED	28480	83592-80008
A3U3	1826-0180	0	3	IC TIMER TTL MONO/ASTBL	01295	NE555P
A3U4	1820-2081	2	1	IC NMOS	04713	MC68A21P
A3U5	1820-2005	0	1	IC TIMER NMOS	S0545	UPD8253D
A3U6	1820-1202	7	2	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A3U7	1820-1197	9	3	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A3U8	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3U9	1820-1216	3	7	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A3U10	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3U11	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3U12	1810-0338	7	2	NETWORK-RES 16-DIP100.0 OHM X 8	11236	761-3-R100
A3U13	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A3U14	1820-1491	6	1	IC BFR TTL LS NON-INV HEX 1-INP	01295	SN74LS367AN
A3U15	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A3U16	1810-0338	7		NETWORK-RES 16-DIP100.0 OHM X 8	11236	761-3-R100
A3U17	1820-2075	4	2	IC MISC TTL LS	01295	SN74LS245N
A3U18	1820-2075	4		IC MISC TTL LS	01295	SN74LS245N
A3U19	1810-0338	7		NETWORK-RES 16-DIP100.0 OHM X 8	11236	761-3-R100
A3XU1				NOT ASSIGNED		
A3XU2				NOT ASSIGNED		
				A3 MISCELLANEOUS PARTS		
	5040-6852	3	1	EXTRACTOR, ORANGE	28480	5040-6852
	5000-9043	6	6	EXTRACTOR-PIN .031 BOARD	28480	5000-9043
A4	**83592-60061**	**7**	**1**	**BOARD ASSEMBLY-ALC**	**28480**	**83592-60061**
A4C1	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A4C2	0180-0374	3	4	CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A4C3	0180-0374	3		CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A4C4	0180-0374	3		CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A4C5	0180-0374	3		CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A4C6	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C7	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C8	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C9	0160-3821	9	1	CAPACITOR-FXD .33UF ±20% 50VDC CER	28480	0160-3821
A4C10	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C11	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A4C12	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C13	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C14	0160-3874	2	5	CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A4C15	0160-0127	2		CAPACITOR-FXD 1UF ±20% 25VDC CER	28480	0160-0127
A4C16	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C17	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C18	0160-0572	1	3	CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A4C19	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A4C20	0160-0574	3	6	CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A4C21	0160-0128	3	1	CAPACITOR-FXD 2.2UF ±20% 50VDC CER	28480	0160-0128
A4C22	0160-0945	2	2	CAPACITOR-FXD 910PF ±5% 100VDC MICA	28480	0160-0945
A4C23	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C24	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C25				NOT ASSIGNED		
A4C26				NOT ASSIGNED		
A4C27	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C28				NOT ASSIGNED		

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4C29	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A4C30-A4C34				NOT ASSIGNED		
A4C35	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A4C36	0160-3878	6	12	CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A4C37	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A4CR1				NOT ASSIGNED		
A4CR2	1901-1098	1	12	DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR3	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR4	1901-0535	9	12	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR5	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR6	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR7	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR8				NOT ASSIGNED		
A4CR9	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR10				NOT ASSIGNED		
A4CR11				NOT ASSIGNED		
A4CR12	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR13				NOT ASSIGNED		
A4CR14	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR15	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4CR16	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A4J1	1258-0124	7	2	PIN-PROGRAMING DUMPER .30 CONTACT	91506	8136-475G1
A4J2	1258-0124	7		PIN-PROGRAMING DUMPER .30 CONTACT	91506	8136-475G1
A4L1	9140-0210	1	2	INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4L2	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A4L3	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5% .166DX.385LG	28480	9140-0210
A4Q1	1855-0420	2	1	TRANSISTOR J-FET 2N4391 N-CHAN D-MODE	01295	2N4391
A4Q2	1854-0295	7	2	TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295
A4Q3	1855-0414	4	1	TRANSISTOR J-FET 2N4393 N-CHAN D-MODE	04713	2N4393
A4Q4				NOT ASSIGNED		
A4Q5				NOT ASSIGNED		
A4Q6	1854-0295	7		TRANSISTOR-DUAL NPN PD=400MW	28480	1854-0295
A4Q7	1855-0423	5	8	TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q8	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q9	1853-0451	5	2	TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A4Q10	1853-0451	5		TRANSISTOR PNP 2N3799 SI TO-18 PD=360MW	01295	2N3799
A4Q11				NOT ASSIGNED		
A4Q12				NOT ASSIGNED		
A4Q13	1854-0404	0	2	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A4Q14	1853-0007	7	1	TRANSISTOR PNP 2N3251 SI TO-18 PD=360MW	04713	2N3251
A4Q15	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q16	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4Q17	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A4R1	2100-2633	5	2	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A4R2	2100-2516	3	3	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A4R3	2100-2515	2	1	RESISTOR-TRMR 200K 10% C SIDE-ADJ 1-TRN	30983	ET50W204
A4R4	2100-2489	9	2	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	30983	ET50X502
A4R5	2100-3611	1	11	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A4R6	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A4R7	2100-0670	6	6	RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A4R8	2100-0670	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A4R9	2100-3749	6	4	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A4R10	0757-0416	7	5	RESISTOR 511 1% .125W F TC=0±100	24546	C4-1/8-T0-511R-F
A4R11	2100-2489	9		RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	30983	ET50X502
A4R12	0698-7257	2	3	RESISTOR 7.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-7501-F
A4R13	0698-7258	3	1	RESISTOR 8.25K 1% .05W F TC=0±100	24546	C3-1/8-T0-8251-F
A4R14				NOT ASSIGNED		
A4R15				NOT ASSIGNED		
A4R16				NOT ASSIGNED		
A4R17	0698-7253	8	3	RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3-1/8-T0-5111-F
A4R18	0698-7268	5	1	RESISTOR 21.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-2152-F
A4R19	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A4R20	0698-7263	0	2	RESISTOR 13.3K 1% .05W F TC=0±100	24546	C3-1/8-T0-1332-F
A4R21	0698-7274	3	1	RESISTOR 38.3K 1% .05W F TC=0±100	24546	C3-1/8-T0-3832-F
A4R22	0698-7261	8	1	RESISTOR 11K 1% .05W F TC=0±100	24546	C3-1/8-T0-1102-F
A4R23	0698-3162	0	5	RESISTOR 46.4K 1% .125W F TC=0±100	24546	C4-1/8-T0-4642-F
A4R24	0698-7262	9	2	RESISTOR 12.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-1212-F
A4R25				NOT ASSIGNED		
A4R26				NOT ASSIGNED		
A4R27	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A4R28	0698-7227	6	1	RESISTOR 422 1% .05W F TC=0±100	24546	C3-1/8-TO-422R-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R29	0698-6846	3	1	RESISTOR 5.42K .5% .125W F TC=0+50	24546	NC55-1/8-T2-5421-D
A4R30	0698-7252	7	1	RESISTOR 4.64K 1% .05W F TC=0+100	24546	C3-1/8-T0-4641-F
A4R31	0837-0119	7	1	THERMISTOR ROD 5K-OHM TC=+.7%/C-DEG	28480	0837-0119
A4R32	0698-7259	4	3	RESISTOR 9.09K 1% .05W F TC=0+100	24546	C3-1/8-T0-9091-F
A4R33*	0698-7272	1	3	RESISTOR 31.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-3162-F
A4R34	0698-7233	4	3	RESISTOR 750 1% .05W F TC=0+100	24546	C3-1/8-T0-750R-F
A4R35	0698-7243	6	7	RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A4R36	0698-7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3-1/8-T0-100R-F
A4R37	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A4R38	0698-7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3-1/8-T0-100R-F
A4R39	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A4R40	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A4R41	0698-7283	4	3	RESISTOR 90.9K 1% .05W F TC=0+100	24546	C3-1/8-T0-9092-F
A4R42	0698-7267	4	3	RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-1962-F
A4R43	0698-7272	1		RESISTOR 31.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-3162-F
A4R44	0698-7275	4	1	RESISTOR 42.2K 1% .05W F TC=0+100	24546	C3-1/8-T0-4222-F
A4R45				NOT ASSIGNED		
A4R46	0698-7197	9	1	RESISTOR 23.7 1% .05W F TC=0+100	24546	C3-1/8-T0-23R7-F
A4R47	2100-2030	6	4	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R48	0757-0421	4	3	RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A4R49*	0698-7277	6	6	RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A4R50	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A4R51	0698-7282	3	1	RESISTOR 82.5K 1% .05W F TC=0+100	24546	C3-1/8-T0-8252-F
A4R52	0698-7249	2		RESISTOR 3.48K 1% .05W F TC=0+100	24546	C3-1/8-T0-3481-F
A4R53	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R54	0698-7259	4		RESISTOR 9.09K 1% .05W F TC=0+100	24546	C3-1/8-T0-9091-F
A4R55	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R56	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R57	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R58	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R59	2100-1986	9	1	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	73138	82PR1K
A4R60				NOT ASSIGNED		
A4R61	0698-7259	4		RESISTOR 9.09K 1% .05W F TC=0+100	24546	C3-1/8-T0-9091-F
A4R62	0698-7270	9	1	RESISTOR 26.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-2612-F
A4R63	0757-0447	4	4	RESISTOR 16.2K 1% .125W F TC=0+100	24546	C4-1/8-T0-1622-F
A4R64	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R65	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R66	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A4R67	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A4R68	0698-7236	7	2	RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A4R69	0698-3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A4R70				NOT ASSIGNED		
A4R71*	0698-0085	0	2	RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A4R72	0757-0278	9	1	RESISTOR 1.78K 1% .125W F TC=0+100	24546	C4-1/8-T0-1781-F
A4R73	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A4R74	0698-7251	6	1	RESISTOR 4.22K 1% .05W F TC=0+100	24546	C3-1/8-T0-4221-F
A4R75	0698-3151	7	2	RESISTOR 2.87K 1% .125W F TC=0+100	24546	C4-1/8-T0-2871-F
A4R76	0757-0399	5	1	RESISTOR 82.5 1% .125W F TC=0+100	24546	C4-1/8-T0-82R5-F
A4R77	0757-0274	5	2	RESISTOR 1.21K 1% .125W F TC=0+100	24546	C4-1/8-T0-1211-F
A4R78	0698-7234	5	1	RESISTOR 825 1% .05W F TC=0+100	24546	C3-1/8-T0-825R-F
A4R79	0757-0394	0	4	RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A4R80*	0698-3440	7	4	RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A4R81-A4R85				NOT ASSIGNED		
A4R86	0698-3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A4R87	0698-7250	5	1	RESISTOR 3.83K 1% .05W F TC=0+100	24546	C3-1/8-T0-3831-F
A4R88	0698-7262	9		RESISTOR 12.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1212-F
A4R89	0698-7267	4		RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-1962-F
A4R90	0698-7257	2		RESISTOR 7.5K 1% .05W F TC=0+100	24546	C3-1/8-T0-7501-F
A4R91				NOT ASSIGNED		
A4R92				NOT ASSIGNED		
A4R93	0698-7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3-1/8-T0-100R-F
A4R94	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3-1/8-T0-5111-F
A4R95	0698-7222	1	1	RESISTOR 261 1% .05W F TC=0+100	24546	C3-1/8-T0-261R-F
A4R96	0698-3157	3	1	RESISTOR 19.6K 1% .125W F TC=0+100	24546	C4-1/8-T0-1962-F
A4R97				NOT ASSIGNED		
A4R98	0837-0085	6	1	THERMISTOR ROD 680-OHM TC=+.7%/C-DEG	28480	0837-0085
A4R99	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A4R100	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+100	24546	C4-1/8-T0-681R-F
A4R101*	0698-7260	7	16	RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A4R102	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1101-F
A4R103	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+100	24546	C4-1/8-T0-51R1-F
A4TP1-A4TP10	1251-4672	4	20	CONNECTOR 10-PIN M POST TYPE	28480	1251-4672

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP13				NOT ASSIGNED		
A4TP14	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP15	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4U1	1826-0261	8	4	IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A4U2	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A4U3	1826-0616	7	1	IC OP AMP PRCN QUAD 14-DIP-C PKG	06665	OP-11EY
A4U4	1826-0610	1	2	IC MULTIPLXR 4-CHAN-ANLG DUAL 16-DIP-C	06665	MUX24FQ
A4U5	1826-0319	7	2	IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	04713	LF356G
A4U6	1826-0610	1		IC MULTIPLXR 4-CHAN-ANLG DUAL 16-DIP-C	06665	MUX24FQ
A4U7	1826-0447	2	1	IC OP AMP WB TO-99 PKG	27014	LF257H
A4U8	1826-0021	8	1	IC OP AMP GP TO-99 PKG	27014	LM310H
A4U9	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A4U10	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A4U11	1826-0319	7		IC OP AMP LOW-BIAS-H-IMPD TO-99 PKG	04713	LF356G
A4U12	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A4U13	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A4U14	1826-0752	2	6	IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A4U15	1826-0026	3	3	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A4VR1	1902-0049	2	2	DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A4VR2	1902-0049	2		DIODE-ZNR 6.19V 5% DO-35 PD=.4W	28480	1902-0049
A4VR3	1902-0041	4	3	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A4VR4	1902-0111	9	3	DIODE-ZNR 1N753A 6.2V 5% DO-7 PD=.4W	28480	1902-0111
A4VR5	1902-3070	5		DIODE-ZNR 4.22V 5% DO-35 PD=.4W	28480	1902-3070
A4W1	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A4W2				NOT ASSIGNED		
A4W3				NOT ASSIGNED		
				A4 MISCELLANEOUS PARTS		
	5040-6848	7	1	EXTRACTOR YELLOW	28480	5040-6848
	5000-9043	6		5 PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	1251-4932	9	4	CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	91506	LSG-1AG14-1
	1251-4932	9		CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	91506	LSG-1AG14-1
	1251-4932	9		CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	91506	LSG-1AG14-1
	1251-4932	9		CONNECTOR-SGL CONT SKT .021-IN-BSC-SZ	91506	LSG-1AG14-1
A5	**83592-60005**	**6**	**1**	**BOARD ASSEMBLY-FM**	**28480**	**83592-60005**
A5C1	0160-0575	4	6	CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A5C2	0160-0572	1		CAPACITOR-FXD 2200PF ±20% 100VDC CER	28480	0160-0572
A5C3	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C4	0160-0945	2		CAPACITOR-FXD 910PF ±5% 100VDC MICA	28480	0160-0945
A5C5	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A5C6	0160-2247	1	1	CAPACITOR-FXD 3.9PF ±.25PF 500VDC CER	28480	0160-2247
A5C7	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C8	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C9	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C10	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C11	0140-0198	5	1	CAPACITOR-FXD 200PF ±5% 300VDC MICA	72136	DM15F201J0300WV1CR
A5C12	0160-2199	2	1	CAPACITOR-FXD 30PF ±5% 300VDC MICA	28480	0160-2199
A5C13				NOT ASSIGNED		
A5C14	0121-0446	6	1	CAPACITOR-V TRMR-CER 4.5-20PF 160V	28480	0121-0446
A5C15	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C16	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C17	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C18	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C19				NOT ASSIGNED		
A5C20	0160-2249	3	2	CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	28480	0160-2249
A5C21				NOT ASSIGNED		
A5C22				NOT ASSIGNED		
A5C23	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C24	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C25	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C26	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A5C27	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C28	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A5C29	0180-2617	1	6	CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A5C30	0180-2617	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A5C31	0180-2617	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A5C32	0180-2617	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	25088	D6R8GS1B35K
A5C33	0180-2207	5	1	CAPACITOR-FXD 100UF±10% 10VDC TA	56289	150D107X9010R2
A5C34	0180-0474	4	6	CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C35	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5C36	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C37	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C38	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C39	0180-0474	4		CAPACITOR-FXD 15UF±10% 20VDC TA	28480	0180-0474
A5C40	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A5C41	0160-2249	3		CAPACITOR-FXD 4.7PF ±.25PF 500VDC CER	28480	0160-2249
A5CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A5CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A5CR3	1901-0047	8	2	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A5CR4	1901-0047	8		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A5CR5	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A5CR6	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A5CR7	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A5CR8	1901-1098	1		DIODE-SWITCHING 1N4150 50V 200MA 4NS	9N171	1N4150
A5CR9	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A5K1	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A5K2	0490-1063	6	1	RELAY-REED 2A 500MA 50VDC 5VDC-COIL 10VA	28480	0490-1063
A5L1	9100-1625	0	1	INDUCTOR RF-CH-MLD 33UH 5% .166DX.385LG	28480	9100-1625
A5L2	9100-1619	2	4	INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5L3	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5L4	08503-80001	9	4	COIL TOROID	28480	08503-80001
A5L5	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5L6	9100-1619	2		INDUCTOR RF-CH-MLD 6.8UH 10%	28480	9100-1619
A5Q1	1854-0529	0	4	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0529
A5Q2	1854-0529	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0529
A5Q3	1854-0529	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0529
A5Q4	1854-0529	0		TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0529
A5Q5	1854-0475	5	1	TRANSISTOR-DUAL NPN PD=750MW	28480	1854-0475
A5R1	0698-0083	8	7	RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R2	0698-3154	0	6	RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R3	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R4	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R5	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A5R6	0757-0439	4	2	RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-T0-6811-F
A5R7	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0±100	24546	C4-1/8-T0-6811-F
A5R8	0698-3158	4	2	RESISTOR 23.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2372-F
A5R9	0698-6360	6		RESISTOR 10K .1% .125W F TC=0±25	28480	0698-6360
A5R10	0699-0124	0	1	RESISTOR 10.2K .1% .125W F TC=0±25	28480	0699-0124
A5R11	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0±100	24546	C4-1/8-T0-4641-F
A5R12	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R13	0698-3446	3	2	RESISTOR 383 1% .125W F TC=0±100	24546	C4-1/8-T0-383R-F
A5R14	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A5R15	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0±100	24546	C4-1/8-T0-51R1-F
A5R16				NOT ASSIGNED		
A5R17	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A5R19	2100-3749	6		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A5R20	0757-0458	7	3	RESISTOR 51.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-5112-F
A5R21	0698-3136	8	1	RESISTOR 17.8K 1% .125W F TC=0±100	24546	C4-1/8-T0-1782-F
A5R22	0698-6360	6		RESISTOR 10K .1% .125W F TC=0±25	28480	0698-6360
A5R23	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0±100	24546	C4-1/8-T0-2871-F
A5R24				NOT ASSIGNED		
A5R25				NOT ASSIGNED		
A5R26	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R27	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0±100	24546	C4-1/8-T0-1961-F
A5R28	0757-0382	6	2	RESISTOR 16.2 1% .125W F TC=0±100	19701	MF4C1/8-T0-16R2-F
A5R29	0757-0382	6		RESISTOR 16.2 1% .125W F TC=0±100	19701	MF4C1/8-T0-16R2-F
A5R30	0757-0398	4		RESISTOR 75 1% .125W F TC=0±100	24546	C4-1/8-T0-75R0-F
A5R31*	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0±100	24546	C4-1/8-T0-101-F
A5R32	0757-0403	2	3	RESISTOR 121 1% .125W F TC=0±100	24546	C4-1/8-T0-121R-F
A5R33	0698-7280	1	5	RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-F
A5R34	2100-2574	3	4	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A5R35	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-F
A5R36	2100-2574	3		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A5R37	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-F
A5R38	2100-2574	3		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A5R39	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-6812-F
A5R40	2100-2574	3		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A5R41	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A5R42	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5R43	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A5R44	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A5R45	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A5R46	0757-0420	3	3	RESISTOR 750 1% .125W F TC=0+100	24546	C4-1/8-T0-751-F
A5R47	0757-0420	3		RESISTOR 750 1% .125W F TC=0+100	24546	C4-1/8-T0-751-F
A5R48	2100-3759	8	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	28480	2100-3759
A5R49	0698-7280	1		RESISTOR 68.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-6812-F
A5R50	2100-3749	6		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A5R51	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A5R52	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A5R53	0757-0346	2	6	RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A5R54	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A5R55	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A5R56	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A5R57	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A5R58	0757-0346	2		RESISTOR 10 1% .125W F TC=0+100	24546	C4-1/8-T0-10R0-F
A5R59	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A5R60	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A5R61	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A5R62	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+25	28480	0698-6360
A5R63	0757-0467	8	1	RESISTOR 121K 1% .125W F TC=0+100	24546	C4-1/8-T0-1213-F
A5R64	0698-6363	9	2	RESISTOR 40K .1% .125W F TC=0+25	28480	0698-6363
A5R65	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+100	19701	MF4C1/8-T0-1332-F
A5R66	0698-6363	9		RESISTOR 40K .1% .125W F TC=0+25	28480	0698-6363
A5R67	0698-3447	4	7	RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A5R68	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A5R69	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A5R70	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A5R71	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A5R72	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A5R73	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A5R74	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A5R75	2100-2522	1	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	30983	ET50X103
A5R76	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A5R77	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A5R78	0698-3158	4		RESISTOR 23.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-2372-F
A5R79	0757-0403	2		RESISTOR 121 1% .125W F TC=0+100	24546	C4-1/8-T0-121R-F
A5R80	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+100	24546	C4-1/8-T0-4640-F
A5TP1	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP7	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP8	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP9	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP10	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5TP11	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A5U1	1810-0206	8	1	NETWORK-RES 8-SIP10.0K OHM X 7	01121	208A103
A5U2	1810-0208	0	1	NETWORK-RES 8-SIP68.0K OHM X 7	01121	208A683
A5U3	1826-0416	5	3	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A5U4	1810-0205	7	1	NETWORK-RES 8-SIP4.7K OHM X 7	01121	208A472
A5U5	1810-0321	8	1	NETWORK-RES 8-SIP220.0K OHM X 7	01121	208A224
A5U6	1820-1196	8	5	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A5U7	1826-0092	3		IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A5U8	1826-0349	3	1	IC V RGLTR TO-39	07263	UA78M06HL
A5U9	1826-0558	6	1	IC 337 V RGLTR TO-39	27014	LM337H
A5U10	1826-0546	2	1	IC WIDEBAND AMPL VID TO-100 PKG	18324	NE592H
A5U11	1826-0476	7	2	IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A5U12	1826-0416	5		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A5U13	1826-0416	5		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A5U14	1826-0557	5	1	IC OP AMP GP QUAD 14-DIP-C PKG	27014	LM348J
A5U15				NOT ASSIGNED		
A5U16	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A5U17	1826-0699	6	1	IC CONV 8-B-D/A 16-DIP-C PKG	24355	AD7524AD
A5U18	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A5U19	1826-0700	0	1	IC OP AMP WB 14-DIP-C PKG	34371	HA1-5195-5
A5U20	1810-0224	0	1	NETWORK-RES 8-SIP33.0K OHM X 4	01121	208B333
A5U21	1810-0366	1	1	NETWORK-RES 6-SIP220.0 OHM X 5	01121	206A221
A5VR1	1902-3002	3	3	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A5VR2	1902-3002	3		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5W1	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A5W2				NOT ASSIGNED		
A5W3				NOT ASSIGNED		
A5W4	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A5W5	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A5W6	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A5W7	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
				A5 MISCELLANEOUS PARTS		
	5040-6851	2	1	EXTRACTOR	28480	5040-6851
	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	4330-0145	9	6	INSULATOR-BEAD GLASS	28480	4330-0145
	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
	4330-0145	9		INSULATOR-BEAD GLASS	28480	4330-0145
A6	**83592-60054**	**9**	**1**	**BOARD ASSEMBLY-SWEEP CONTROL**	**28480**	**83592-60054**
A6C1-A6C4				NOT ASSIGNED		
A6C5	0180-0116	1	6	CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A6C6	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A6C7	0180-2815	1	3	CAPACITOR-FXD 100UF±20% 10VDC TA	28480	0180-2815
A6C8				NOT ASSIGNED		
A6C9	0180-0228	6	5	CAPACITOR-FXD 22UF±10% 15VDC TA	56289	150D226X9015B2
A6C10	0180-0228	6		CAPACITOR-FXD 22UF±10% 15VDC TA	56289	150D226X9015B2
A6C11				NOT ASSIGNED		
A6C12				NOT ASSIGNED		
A6C13				NOT ASSIGNED		
A6C14	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A6C15	0160-0573	2	1	CAPACITOR-FXD 4700PF ±20% 100VDC CER	28480	0160-0573
A6C16	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A6C17	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A6C18				NOT ASSIGNED		
A6C19	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A6C20	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A6C21	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A6C22	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A6C23	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A6C24	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A6C25	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A6C26	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A6C27	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A6C28	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A6CR1	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR2	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR3	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR4	1901-0050	3	7	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR8				NOT ASSIGNED		
A6CR9				NOT ASSIGNED		
A6CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR11	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR12	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR13	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A6L1	9140-0137	1	6	INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L2	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L3	08503-80001	9		COIL-TOROID	28480	08503-80001
A6Q1	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q2	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q3	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q4	1854-0019	3	1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q5	1853-0405	9	2	TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A6Q6	1853-0405	9		TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A6Q7	1855-0423	5		TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q8	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q10	1853-0281	9	3	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A6R1				NOT ASSIGNED		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R2				NOT ASSIGNED		
A6R3				NOT ASSIGNED		
A6R4	0757-0466	7		RESISTOR 110K 1% .125W F TC=0+100	24546	C4-1/8-T0-1103-F
A6R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A6R6	0757-1094	9	1	RESISTOR 1.47K 1% .125W F TC=0+100	24546	C4-1/8-T0-1471-F
A6R7	0698-3446	3		RESISTOR 383 1% .125W F TC=0+100	24546	C4-1/8-T0-383R-F
A6R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0+100	24546	C4-1/8-T0-101-F
A6R9	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A6R10	0698-7267	4		RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-1962-F
A6R11	0698-7283	4		RESISTOR 90.9K 1% .05W F TC=0+100	24546	C3-1/8-T0-9092-F
A6R12	2100-1738	9	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A6R13	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A6R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A6R15	0698-8469	0	8	RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R16	2100-3756	5	1	RESISTOR-TRMR 20 10% C SIDE-ADJ 17-TRN	28480	2100-3756
A6R17	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R18	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R19	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R20	0699-0642	7	1	RESISTOR 10K .1% .1W F TC=0+5	28480	0699-0642
A6R21	2100-3757	6	4	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A6R22	0699-0831	6	1	RESISTOR 9.95K .1% .1W F TC=0+5	28480	0699-0831
A6R23	0699-0830	5	2	RESISTOR 30.423K .1% .1W F TC=0+5	28480	0699-0830
A6R24	2100-3732	7	4	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R25	0699-0830	5		RESISTOR 30.423K .1% .1W F TC=0+5	28480	0699-0830
A6R26	2100-3732	7		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R27	0699-0829	2	1	RESISTOR 42.884K .1% .1W F TC=0+5	28480	0699-0829
A6R28	2100-0545	4	2	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-102
A6R29	0699-0828	1	1	RESISTOR 82.541 .1% .1W F TC=0+5	28480	0699-0828
A6R30	2100-3759	8		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	28480	2100-3759
A6R31	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R32	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R33	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R34	2100-3755	4	1	RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	28480	2100-3755
A6R35	0698-8469	0		RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R36	0698-8827	4	5	RESISTOR 1M 1% .125W F TC=0+100	28480	0698-8827
A6R37	2100-3750	9	3	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	28480	2100-3750
A6R38	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+100	28480	0698-8827
A6R39	0699-0154	6	1	RESISTOR 7.2K .1% .125W F TC=0+25	28480	0699-0154
A6R40	0698-6867	8	1	RESISTOR 7.35K .25% .125W F TC=0+50	28480	0698-6867
A6R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A6R42	0698-3260	9	3	RESISTOR 464K 1% .125W F TC=0+100	28480	0698-3260
A6R43	0698-3150	6	2	RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-T0-2371-F
A6R44	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A6R45	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+100	28480	0698-3260
A6R46	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+100	24546	C4-1/8-T0-2371-F
A6R47	0757-0421	4		RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A6R48	0757-0421	4		RESISTOR 825 1% .125W F TC=0+100	24546	C4-1/8-T0-825R-F
A6R49	0698-3447	4		RESISTOR 422 1% .125W F TC=0+100	24546	C4-1/8-T0-422R-F
A6R50	0698-3440	7		RESISTOR 196 1% .125W F TC=0+100	24546	C4-1/8-T0-196R-F
A6R51	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+100	24546	C4-1/8-T0-348R-F
A6R52	0698-0084	9	7	RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A6R53	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+100	03888	PME55-1/8-T0-19R6-F
A6R54	0698-3453	2	4	RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A6R55	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+100	28480	0698-8827
A6R56	0698-3159	5	4	RESISTOR 26.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-2612-F
A6R57	0698-3266	5	1	RESISTOR 237K 1% .125W F TC=0+100	24546	C4-1/8-T0-2373-F
A6R58	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A6R59	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1001-F
A6R60	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A6R61	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-5112-F
A6R62	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-5112-F
A6R63	2100-2030	6		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A6R64	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A6R65	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+100	24546	C4-1/8-T0-7501-F
A6R66	0698-7272	1		RESISTOR 31.6K 1% .05W F TC=0+100	24546	C3-1/8-T0-3162-F
A6R67	0698-7253	8		RESISTOR 5.11K 1% .05W F TC=0+100	24546	C3-1/8-T0-5111-F
A6R68	2100-2516	3		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R69	2100-2516	3		RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R70				NOT ASSIGNED		
A6R71	0698-7237	8	1	RESISTOR 1.1K 1% .05W F TC=0+100	24546	C3-1/8-T0-1101-F
A6R72	0698-7242	5	1	RESISTOR 1.78K 1% .05W F TC=0+100	24546	C3-1/8-T0-1781-F
A6R73	2100-2521	0	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A6R74	2100-2521	0		RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A6R75				NOT ASSIGNED		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R76	0698-7283	4		RESISTOR 90.9K 1% .05W F TC=0+100	24546	C3-1/8-T0-9092-F
A6R77	0698-7285	6	1	RESISTOR 110K 1% .05W F TC=0+100	24546	C3-1/8-T0-1103-F
A6R78	2100-2692	6	1	RESISTOR-TRMR 1M 20% C SIDE-ADJ 1-TRN	30983	ET50X105
A6R79	0689-7243	7	1	RESISTOR 1.96K 1% .05W F TC=0+100	28480	0689-7243
A6R80*	0698-7249	2	2	RESISTOR 3.48K 1% .05W F TC=0+100	24546	C3-1/8-T0-3481-F
A6R81	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3-1/8-T0-1002-F
A6R82	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3-1/8-T0-1961-F
A6R83	0698-7242	5		RESISTOR 1.78K 1% .05W F TC=0+100	24546	C3-1/8-TO-1781-F
A6R84	0698-7238	9		RESISTOR 1.21K 1% .05W F TC=0+100	24546	C3-1/8-TO-1211-F
A6TP1- A6TP10	1251-4672	4		CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6U1	1826-0720	4	5	IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A6U2	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A6U3	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A6U4	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A6U5	1826-0471	2	17	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U6	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U7				NOT ASSIGNED		
A6U8	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U9	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U10	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A6U11	1826-0417	6		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13333D
A6U12	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U13	1820-2024	3	5	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A6U14	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U15	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U16	1820-1246	9	1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS09N
A6U17	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A6U18	1826-0752	2		IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A6U19	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U20	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U21	1820-1202	7		IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A6U22	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A6U23	1826-0026	3		IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U24	1826-0092	3		IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A6U25				NOT ASSIGNED		
A6U26	1826-0185	5	1	IC OP AMP SPCL TO-99 PKG	3L585	CA3080
A6VR1	1902-3002	3		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A6W1	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W2				NOT ASSIGNED		
A6W3				NOT ASSIGNED		
A6W4	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
				A6 MISCELLANEOUS PARTS		
	5040-6849	8	1	EXTRACTOR, P.C. BOARD BLUE	28480	5040-6849
	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	0360-0124	3	1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A7	**83592-60076**	**4**	**1**	**BD ASSY-YTM DRIVER (DOES NOT INCLUDE 20 PIN HEADER P2 OR FACTORY SELECT RESISTORS R34* THRU R39* AND R66* THRU R71*)**	**28480**	**83592-60076**
A7C1	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A7C2	0160-3877	5	2	CAPACITOR-FXD 100PF +20% 200VDC CER	28480	0160-3877
A7C3	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A7C4	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A7C5	0160-3877	5		CAPACITOR-FXD 100PF +20% 200VDC CER	28480	0160-3877
A7C6	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A7C7	0180-2617	1		CAPACITOR-FXD 6.8UF+10% 35VDC TA	25088	D6R8GS1B35K
A7C8	0180-0116	1		CAPACITOR-FXD 6.8UF+10% 35VDC TA	56289	150D685X9035B2
A7C9	0180-2815	1		CAPACITOR-FXD 100UF+20% 10VDC TA	28480	0180-2815
A7C10	0180-2617	1		CAPACITOR-FXD 6.8UF+10% 35VDC TA	25088	D6R8GS1B35K
A7C11	0180-2814	0	1	CAPACITOR-FXD 22UF+20% 10VDC TA	28480	0180-2814
A7C12	0160-0574	3		CAPACITOR-FXD .022UF +20% 100VDC CER	28480	0160-0574
A7C13	0160-3879	7		CAPACITOR-FXD .01UF +20% 100VDC CER	28480	0160-3879
A7C14	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A7C15	0160-3878	6		CAPACITOR-FXD 1000PF +20% 100VDC CER	28480	0160-3878
A7C16	0160-0575	4		CAPACITOR-FXD .047UF +20% 50VDC CER	28480	0160-0575
A7C17	0180-2731	0	2	CAPACITOR-FXD 2.2UF+10% 20VDC TA	28480	0180-2731
A7C18	0160-3874	2		CAPACITOR-FXD 10PF +.5PF 200VDC CER	28480	0160-3874
A7C19	0160-4084	8		CAPACITOR-FXD .1UF +20% 50VDC CER	28480	0160-4084
A7C20	0180-0228	6		CAPACITOR-FXD 22UF+10% 15VDC TA	56289	150D226X9015B2

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7C21	0180-2794	5	1	CAPACITOR-FXD 3.3UF±20% 35VDC TA	28480	0180-2794
A7C22	0160-4535	4	2	CAPACITOR-FXD 1UF ±10% 50VDC CER	28480	0160-4535
A7C23	0160-4535	4		CAPACITOR-FXD 1UF ±10% 50VDC CER	28480	0160-4535
A7CR1	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A7CR2	1901-0539	3	2	DIODE-SM SIG SCHOTTKY	28480	1901-0539
A7CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7CR7	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A7CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7CR9	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A7CR10	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A7J1				NOT ASSIGNED		
A7L1	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A7L2	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A7L3	08503-80001	9		COIL TOROID	28480	08503-80001
A7P1				NOT ASSIGNED		
A7P2				NOT ASSIGNED		
A7Q1				NOT ASSIGNED		
A7Q2				NOT ASSIGNED		
A7R1	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0±100	24546	C4-1/8-T0-1102-F
A7R2	0698-7233	4		RESISTOR 750 1% .05W F TC=0±100	24546	C3-1/8-T0-750R-F
A7R3	0698-7277	6		RESISTOR 51.1K 1% .05W F TC=0±100	24546	C3-1/8-T0-5112-F
A7R4	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R5	0698-3449	6	1	RESISTOR 28.7K 1% .125W F TC=0±100	24546	C4-1/8-T0-2872-F
A7R6	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-F
A7R7	0698-7243	6		RESISTOR 1.96K 1% .05W F TC=0±100	24546	C3-1/8-T0-1961-F
A7R8	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A7R9	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A7R10	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R11	0757-0200	7	1	RESISTOR 5.62K 1% .125W F TC=0±100	24546	C4-1/8-T0-5621-F
A7R12	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R13	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0±100	24546	C4-1/8-T0-1622-F
A7R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A7R15	0698-3260	9		RESISTOR 464K 1% .125W F TC=0±100	28480	0698-3260
A7R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1001-F
A7R17	0698-3457	6	2	RESISTOR 316K 1% .125W F TC=0±100	28480	0698-3457
A7R18	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R19	2100-3732	7		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A7R20	0699-0796	2	2	RESISTOR 22.95K .1% .1W F TC=0±4	28480	0699-0796
A7R21	0683-6855	3	1	RESISTOR 6.8M 5% .25W FC TC=-900/+1100	01121	CB6855
A7R22				NOT ASSIGNED		
A7R23				NOT ASSIGNED		
A7R24	2100-3757	6		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A7R25	0699-1146	8	2	RESISTOR 9.064K .1% .1W F TC=0±4	28480	0699-1146
A7R26	0698-8960	6	2	RESISTOR 750K 1% .125W F TC=0±100	28480	0698-8960
A7R27	0699-1147	9	2	RESISTOR 9.53K .1% .1W F TC=0±4	28480	0699-1147
A7R28	0757-0444	1	2	RESISTOR 12.1K 1% .125W F TC=0±100	24546	C4-1/8-T0-1212-F
A7R29				NOT ASSIGNED		
A7R30				NOT ASSIGNED		
A7R31				NOT ASSIGNED		
A7R32				NOT ASSIGNED		
A7R33	0698-3453	2		RESISTOR 196K 1% .125W F TC=0±100	24546	C4-1/8-T0-1963-F
A7R34*						
A7R35*						
A7R36				NOT ASSIGNED		
A7R37				NOT ASSIGNED		
A7R38*						
A7R39*						
A7R40				NOT ASSIGNED		
A7R41				NOT ASSIGNED		
A7R42	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R43	2100-3750	9		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	28480	2100-3750
A7R44				NOT ASSIGNED		
A7R45	2100-3753	2	1	RESISTOR-TRMR 200K 10% C SIDE-ADJ 17-TRN	28480	2100-3753
A7R46	2100-3611	1		RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-503
A7R47	0698-7263	0		RESISTOR 13.3K 1% .05W F TC=0±100	24546	C3-1/8-T0-1332-F
A7R48	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0±100	24546	C4-1/8-T0-7501-F
A7R49	0698-6721	3	1	RESISTOR 19K 1% .125W F TC=0±25	28480	0698-6721
A7R50	0698-8827	4		RESISTOR 1M 1% .125W F TC=0±100	28480	0698-8827

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7R51	2100-0670	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A7R52	0698-8827	4		RESISTOR 1M 1% .125W F TC=0+100	28480	0698-8827
A7R53	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-2612-F
A7R54	0698-8958	2	2	RESISTOR 511K 1% .125W F TC=0+100	28480	0698-8958
A7R55	2100-2031	7	1	RESISTOR-TRMR 50K 10% C TOP-ADJ 1-TRN	73138	82PR50K
A7R56	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A7R57	0757-0290	5	2	RESISTOR 6.19K 1% .125W F TC=0+100	19701	MF4C1/8-T0-6191-F
A7R58	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A7R59				NOT ASSIGNED		
A7R60	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A7R61	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A7R62				NOT ASSIGNED		
A7R63	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1212-F
A7R64	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A7R65	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A7R66				NOT ASSIGNED		
A7R67				NOT ASSIGNED		
A7R68				NOT ASSIGNED		
A7R69*						
A7R70*						
A7R71				NOT ASSIGNED		
A7R72	0698-8959	3	1	RESISTOR 619K 1% .125W F TC=0+100	28480	0698-8959
A7R73				NOT ASSIGNED		
A7R74	0757-0418	9	2	RESISTOR 619 1% .125W F TC=0+100	24546	C4-1/8-T0-619R-F
A7R75	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A7R76	2100-0670	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A7R77	0699-1148	0	1	RESISTOR 215K .1% .1W F TC=0+4	28480	0699-1148
A7R78	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-2612-F
A7R79				NOT ASSIGNED		
A7R80	0698-8960	6		RESISTOR 750K 1% .125W F TC=0+100	28480	0698-8960
A7R81	0757-0418	9		RESISTOR 619 1% .125W F TC=0+100	24546	C4-1/8-T0-619R-F
A7R82	0699-0796	2		RESISTOR 22.95K .1% .1W F TC=0+4	28480	0699-0796
A7R83	2100-3732	7		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A7R84	0699-1146	8		RESISTOR 9.064K .1% .1W F TC=0+4	28480	0699-1146
A7R85	2100-3757	6		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A7R86				NOT ASSIGNED		
A7R87	0699-1147	9		RESISTOR 9.53K .1% .1W F TC=0+4	28480	0699-1147
A7R88*						
A7R89*						
A7R90*						
A7R91*						
A7R92*						
A7R93*						
A7R94				NOT ASSIGNED		
A7R95				NOT ASSIGNED		
A7R96				NOT ASSIGNED		
A7R97				NOT ASSIGNED		
A7R98				NOT ASSIGNED		
A7R99				NOT ASSIGNED		
A7R100	0698-3453	2		RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A7R101				NOT ASSIGNED		
A7R102	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+100	24546	C4-1/8-T0-4642-F
A7R103	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+100	24546	C4-1/8-T0-4642-F
A7R104				NOT ASSIGNED		
A7R105	2100-3752	1	2	RESISTOR-TRMR 500K 10% C SIDE-ADJ 17-TRN	28480	2100-3752
A7R106-				NOT ASSIGNED		
A7R199				NOT ASSIGNED		
A7R200*						
A7R201*						
A7R202	2100-3749	6		RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TRN	28480	2100-3749
A7R203	0698-3455	4	3	RESISTOR 261K 1% .125W F TC=0+100	24546	C4-1/8-T0-2613-F
A7R204	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+100	24546	C4-1/8-T0-2611-F
A7R205	0698-3455	4		RESISTOR 261K 1% .125W F TC=0+100	24546	C4-1/8-T0-2613-F
A7R206	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A7R207	2100-0670	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A7S1	3101-0471	8	4	SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A7S2	3101-0471	8		SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A7TP1-	0360-0535	0	25	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP2	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP3	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP4	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP5	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7TP6	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7TP7-A7TP12	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A7U1	1810-0277	3	4	NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A7U2	1810-0277	3		NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A7U3	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A7U4	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A7U5	1826-0180	0		IC TIMER TTL MONO/ASTBL	01295	NE555P
A7U6				NOT ASSIGNED		
A7U7	1820-1568	8	2	IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A7U8	1820-1144	6	2	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A7U9	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A7U10	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A7U11	1826-0753	3	2	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-C	04713	MC34004BL
A7U12	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A7U13	1826-0752	2		IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A7U14	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7U15				NOT ASSIGNED		
A7U16	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A7U17	1826-0752	2		IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A7U18	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7U19	1826-0261	8		IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A7U20	1826-0758	8	2	IC MULTIPLIER ANLG TO-100 PKG	28480	1826-0758
A7U21	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7U22	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7U23	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7U24	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A7VR1	1902-0197	1	4	DIODE-ZNR 82V 5% PD=1W IR=5UA	28480	1902-0197
A7VR2	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A7VR3	1902-0197	1		DIODE-ZNR 82V 5% PD=1W IR=5UA	28480	1902-0197
A7VR4	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A7XA1	1200-0626	3	1	SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0626
				A7 MISCELLANEOUS PARTS		
	5040-6844	3	1	EXTRACTOR-BOARD	28480	5040-6844
	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	1251-7204	4	1	CONNECTOR 20-PIN M DUAL INLINE	28480	1251-7204
A8	**83592-60002**	3	1	**BOARD ASSEMBLY-YO DRIVER**	**28480**	**83592-60002**
A8C1	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C2	0160-4389	6	2	CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A8C3	0160-0161	4	1	CAPACITOR-FXD .01UF ±10% 200VDC POLYE	28480	0160-0161
A8C4	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A8C5	0160-4389	6		CAPACITOR-FXD 100PF ±5PF 200VDC CER	28480	0160-4389
A8C6	0160-0575	4		CAPACITOR-FXD .047UF ±20% 50VDC CER	28480	0160-0575
A8C7	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A8C8	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A8C9	0180-2815	1		CAPACITOR-FXD 100UF±20% 10VDC TA	28480	0180-2815
A8C10	0180-0116	1		CAPACITOR-FXD 6.8UF±10% 35VDC TA	56289	150D685X9035B2
A8C11	0180-0228	6		CAPACITOR-FXD 22UF±10% 15VDC TA	56289	150D226X9015B2
A8C12	0160-0574	3		CAPACITOR-FXD .022UF ±20% 100VDC CER	28480	0160-0574
A8C13	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C14	0160-3874	2		CAPACITOR-FXD 10PF ±.5PF 200VDC CER	28480	0160-3874
A8C15	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C16	0180-3020	2	1	CAPACITOR-FXD 120UF±10% 50VDC TA	28480	0180-3020
A8C17	0180-0228	6		CAPACITOR-FXD 22UF±10% 15VDC TA	56289	150D226X9015B2
A8C18	0160-4084	8		CAPACITOR-FXD .1UF ±20% 50VDC CER	28480	0160-4084
A8C19	0160-3878	6		CAPACITOR-FXD 1000PF ±20% 100VDC CER	28480	0160-3878
A8C20	0180-2731	0		CAPACITOR-FXD 2.2UF±10% 20VDC TA	28480	0180-2731
A8C21	0180-2186	9	1	CAPACITOR-FXD 300UF±20% 30VDC TA	06001	69F455G7
A8CR1	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A8CR2	1901-0539	3		DIODE-SM SIG SCHOTTKY	28480	1901-0539
A8CR3				NOT ASSIGNED		
A8CR4	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR5	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR6	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8CR7	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A8CR8	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A8J1				NOT ASSIGNED		
A8K1	0490-0916	6		RELAY-REED 1A 500MA 100VDC 5VDC-COIL	28480	0490-0916
A8L1	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8L2	9140-0137	1		INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A8L3	08503-80001	9		COIL TOROID	28480	08503-80001
A8P2				NOT ASSIGNED		
A8Q1	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A8Q2	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A8Q3	1853-0044	2	2	TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A8Q4	1853-0044	2		TRANSISTOR PNP SI TO-39 PD=1W FT=200MHZ	28480	1853-0044
A8R1	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A8R2	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-T0-1961-F
A8R3	0757-0458	7		RESISTOR 51.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-5112-F
A8R4	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A8R5	0757-0462	3	1	RESISTOR 75K 1% .125W F TC=0+100	24546	C4-1/8-T0-7502-F
A8R6	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-T0-1961-F
A8R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+100	24546	C4-1/8-T0-1961-F
A8R8	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A8R9	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A8R10	2100-0670	6		RESISTOR-TRMR 10K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-103
A8R11	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+100	24546	C4-1/8-T0-4641-F
A8R12	2100-3752	1		RESISTOR-TRMR 500K 10% C SIDE-ADJ 17-TRN	28480	2100-3752
A8R13	0757-0460	1	1	RESISTOR 61.9K 1% .125W F TC=0+100	24546	C4-1/8-T0-6192-F
A8R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A8R15	0698-3452	1	1	RESISTOR 147K 1% .125W F TC=0+100	24546	C4-1/8-T0-1473-F
A8R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A8R17	0698-3456	5	1	RESISTOR 287K 1% .125W F TC=0+100	24546	C4-1/8-T0-2873-F
A8R18	2100-3750	9		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	28480	2100-3750
A8R19	2100-3757	6		RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A8R20	0699-0797	3	1	RESISTOR 7.65K .1% .1W F TC=0+4	28480	0699-0797
A8R21	0698-6406	1	2	RESISTOR 8.54K .1% .1W F TC=0+4	28480	0698-6406
A8R22	2100-0545	4		RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-102
A8R23	0699-0799	5	1	RESISTOR 21.1K .1% .1W F TC=0+4	28480	0699-0799
A8R24	2100-3758	7	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	28480	2100-3758
A8R25	0699-0798	4	1	RESISTOR 11.475K .1% .1W F TC=0+4	28480	0699-0798
A8R26	0757-0470	3	2	RESISTOR 162K 1% .125W F TC=0+100	24546	C4-1/8-T0-1623-F
A8R27	0698-8489	4	2	RESISTOR 15K .1% .1W F TC=0+4	28480	0698-8489
A8R28	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A8R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A8R30	0757-0470	3		RESISTOR 162K 1% .125W F TC=0+100	24546	C4-1/8-T0-1623-F
A8R31	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A8R32	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+100	24546	C4-1/8-T0-1211-F
A8R33	0698-3453	2		RESISTOR 196K 1% .125W F TC=0+100	24546	C4-1/8-T0-1963-F
A8R34				NOT ASSIGNED		
A8R35				NOT ASSIGNED		
A8R36*						
A8R37*						
A8R38*						
A8R39*						
A8R40	0698-8489	4		RESISTOR 15K .1% .1W F TC=0+4	28480	0698-8489
A8R41	0698-6406	1		RESISTOR 8.54K .1% .1W F TC=0+4	28480	0698-6406
A8R42	0698-8472	5	1	RESISTOR 2.653K .1% .1W F TC=0+5	28480	0698-8472
A8R43	0698-6409	4	1	RESISTOR 19.68K .1% .1W F TC=0+4	28480	0698-6409
A8R44	2100-3161	6		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	02111	43P203
A8R45	0699-0518	6	1	RESISTOR 11.489K .1% .1W F TC=0+4	28480	0699-0518
A8R46	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A8R47	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A8R48	0757-0416	7		RESISTOR 511 1% .125W F TC=0+100	24546	C4-1/8-T0-511R-F
A8R49	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A8R50	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A8R51	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A8R52	0757-0180	2	1	RESISTOR 31.6 1% .125W F TC=0+100	28480	0757-0180
A8R53	0698-3159	5		RESISTOR 26.1K 1% .125W F TC=0+100	24546	C4-1/8-T0-2612-F
A8R54	0698-8958	2		RESISTOR 511K 1% .125W F TC=0+100	28480	0698-8958
A8R55	2100-2517	4	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 1-TRN	30983	ET50X503
A8R56	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+100	24546	C4-1/8-T0-5111-F
A8R57	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A8R58	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+100	28480	0698-3457
A8R59	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A8R60	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A8R61	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+100	24546	C4-1/8-T0-2151-F
A8R62	0698-3455	4		RESISTOR 261K 1% .125W F TC=0+100	24546	C4-1/8-T0-2613-F
A8R63	0698-3152	8	1	RESISTOR 3.48K 1% .125W F TC=0+100	24546	C4-1/8-T0-3481-F
A8R64	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A8R65	0698-3156	2		RESISTOR 14.7K 1% .125W F TC=0+100	24546	C4-1/8-T0-1472-F
A8R66	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8R67	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+100	19701	MF4C1/8-T0-6191-F
A8R68				NOT ASSIGNED		
A8R69				NOT ASSIGNED		
A8S1	3101-0471	8		SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A8S2	3101-0471	8		SWITCH-RKR DIP-RKR-ASSY 10-1A .05A 30VDC	28480	3101-0471
A8TP1	1251-5925	2	12	CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP2	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP3	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP4	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP5	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP6	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP7	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP8	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP9	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP10	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP11	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8TP12	1251-5925	2		CONNECTOR 12-PIN M POST TYPE	28480	1251-5925
A8U1	1810-0277	3		NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A8U2	1810-0277	3		NETWORK-RES 10-SIP2.2K OHM X 9	01121	210A222
A8U3	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A8U4	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A8U5	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U6	1826-0476	7		IC SWITCH ANLG 8-DIP-P PKG	01295	TL601CP
A8U7	1820-1568	8		IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A8U8	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A8U9	1826-0180	0		IC TIMER TTL MONO/ASTBL	01295	NE555P
A8U10	1826-0753	3		IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-C	04713	MC34004BL
A8U11	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U12	1826-0758	8		IC MULTIPLIER ANLG TO-100 PKG	28480	1826-0758
A8U13	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A8U14	1826-0752	2		IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A8U15	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U16	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A8U17	1826-0752	2		IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A8U18	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U19	1826-0720	4		IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A8U20	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8U21	1826-0471	2		IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A8VR1	1902-0197	1		DIODE-ZNR 82V 5% PD=1W IR=5UA	28480	1902-0197
A8VR2	1902-0625	0	3	DIODE-ZNR 1N829 6.2V 5% DO-7 PD=.25W	04713	1N829
A8VR3	1902-0625	0		DIODE-ZNR 1N829 6.2V 5% DO-7 PD=.25W	04713	1N829
A8VR4	1902-0625	0		DIODE-ZNR 1N829 6.2V 5% DO-7 PD=.25W	04713	1N829
A8VR5	1902-3070	5		DIODE-ZNR 4.22V 5% DO-35 PD=.4W	28480	1902-3070
A8XA1	1200-0455	6	1	SOCKET-IC 8-CONT DIP-SLDR	28480	1200-0455
				A8 MISCELLANEOUS PARTS		
	5040-6846	5	1	P.C. BOARD EXTRACTOR	28480	5040-6846
	5000-9043	6		PIN P.C. BOARD EXTRACTOR	28480	5000-9043
	1200-0173	5	5	INSULATOR-XSTR DAP-GL	28480	1200-0173
	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
A9	**83592-60087**	**4**	**1**	**BOARD ASSEMBLY-DRIVERS INCLUDES PC BOARD C1, C2, VR1 AND VR2**	**28480**	**83592-60087**
A9C1	0180-0291	3	3	CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A9C2	0180-1735	2	1	CAPACITOR-FXD .22UF+10% 35VDC TA	56289	150D224X9035A2
A9Q1	1854-0080	8	1	TRANSISTOR NPN SI TO-3 PD=100W FT=3MHZ	28480	1854-0080
A9Q2	1855-0527	0	2	TRANSISTOR MOSFET P-CHAN E-MODE TO-3 SI	04713	MTM2P45
A9Q3	1855-0527	0		TRANSISTOR MOSFET P-CHAN E-MODE TO-3 SI	04713	MTM2P45
A9Q4	1820-0430	1	1	IC 309 V RGLTR TO-3	07263	LM309K
A9VR1	1902-0554	4	2	DIODE-ZNR 10V 5% PD=1W IR=10UA	28480	1902-0554
A9VR2	1902-0554	4		DIODE-ZNR 10V 5% PD=1W IR=10UA	28480	1902-0554
A9Z1	0380-0322	5	9	SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A9Z2	0380-0745	6	1	STANDOFF-RVT-ON .187-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
A9Z3	1251-2313	6	1	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2313
A9Z4	0811-3650	3	1		28480	0811-3650
A9Z5	9170-0847	3	1	CORE-SHIELDING BEAD	02114	56-590-65/3B PARYLENE COATE
A9Z6	1200-0043	8	1	INSULATOR-XSTR ALUMINUM	28480	1200-0043
A9Z7	0340-0171	8	1	INSULATOR-BSHG DELRIN	28480	0340-0171
A9Z8	1251-8551	6	2	CONN RTNR CLIP	28480	1251-8551
A9Z9	83592-20082	5	1	EXTRUSION-TRANSISTOR MOUNT	28480	83592-20082
A9Z10	83592-20081	4	1	BOX EXTRUSION	28480	83592-20081

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9Z11	1251-8743	8	1	CONN HDR 24 M2R	28480	1251-8743
A10	**83592-60075**	0	1	**BOARD ASSEMBLY-MOTHER**	**28480**	**83592-60075**
A10C1	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C2	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C3	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C4	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C5	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C6	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10C7	0160-3879	7		CAPACITOR-FXD .01UF ±20% 100VDC CER	28480	0160-3879
A10CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A10J1	1251-5926	3		CONNECTOR 50-PIN M POST TYPE	28480	1251-5926
A10J2	1251-6952	7	1	CONNECTOR 26-PIN M POST TYPE	28480	1251-6952
A10J3	1251-3196	5	1	CONNECTOR 8-PIN M POST TYPE	28480	1251-3196
A10J4	1200-0507	9	7	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A10J5	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A10J6	1250-0257	1	2	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A10J7	1251-8553	8	1	CONN HDR 24 M2R	28480	1251-8553
A10R1	0698-8812	7	1	RESISTOR 1 1% .125W F TC=0±100	28480	0698-8812
A10W1	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A10XA1				NOT ASSIGNED		
A10XA2				NOT ASSIGNED		
A10XA3	1251-1365	6	6	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA4	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA5	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA6	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA7	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA8	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A10XA9				NOT ASSIGNED		
A10XA10	1251-8551	6		CONN RTNR CLIP	28480	1251-8551
				A10 MISCELLANEOUS PARTS		
	1251-1115	4	5	POLARIZING KEY-PC EDGE CONN	28480	1251-1115
A11	**86222-60007**	7	1	**CAVITY OSCILLATOR**	**28480**	**86222-60007**
A11C1	0180-2216	6	1	CAPACITOR-FXD 350UF+75-10% 16VDC AL	56289	30D357G016DH2
A11C2	0180-2144	9	1	CAPACITOR-FXD 200UF+75-10% 25VDC AL	56289	30D207G025DH9
A12	**5086-7406**	1	1	**YIG TUNED MULTIPLIER**	**28480**	**5086-7406**
A12	5086-6406	9	1	EXCHANGE 5086-7406 YTM	28480	5086-6406
A12A1				BOARD ASSEMBLY-YTM HEATER P/O A12 AND NOT SEPARATELY REPLACEABLE		
A12A1C1	0160-2055	9	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12A1C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A12A1C3	0180-0049	9	2	CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A12A1CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A12A1J1	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A12A1J2-A12A1J5	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A12A1Q1	1853-0038	4	2	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A12A1R1	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A12A1R2	0757-0465	6		RESISTOR 100K 1% .125W F TC=0±100	24546	C4-1/8-T0-1003-F
A12A1R3	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A12A1R4	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0±100	24546	C4-1/8-T0-4642-F
A12A1R5	0683-1555	0	2	RESISTOR 1.5M 5% .25W FC TC=-900/+1100	01121	CB1555
A12A1R6	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0±100	24546	C4-1/8-T0-1622-F
A12A1R7	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0±100	24546	C4-1/8-T0-4221-F
A12A1R8	0757-0280	3		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A12A1TP1	1251-0600	0	14	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A12A1U1	1826-0261	8		IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A12A1VR1	1902-0176	6	2	DIODE-ZNR 47V 5% PD=1W IR=5UA	28480	1902-0176
				A12A1 MISCELLANEOUS PARTS		
	1205-0011	0	2	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
	1200-0173	5		INSULATOR-XSTR DAP-GL	28480	1200-0173
	1251-3172	7	25	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A13	**5086-7337**	7	1	**OSCILLATOR 2.3-7.0GHZ**	**28480**	**5086-7337**
A13	5086-6337	5	1	EXCHANGE 5086-7337 OSCILLATOR	28480	5086-6337
A13E1	5001-1559	5	1	INSULATOR	28480	5001-1559
A13A1				BD ASSY-OSCILLATOR BIAS P/O A13 AND NOT SEPARATELY REPLACEABLE		
A13A1C1	0160-0127	2		CAPACITOR-FXD 1UF +20% 25VDC CER	28480	0160-0127
A13A1CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A13A1J1	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A13A1J2	1250-0257	1		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A13A1R1*						
A13A1R2*						
A13A1R3	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+100	24546	C4-1/8-T0-3161-F
A13A1R4	2100-2633	5		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A13A1VR1	1902-0579	3	2	DIODE-ZNR 5.1V 5% PD=1W IR=10UA	28480	1902-0579
A13A1VR2	1902-0579	3		DIODE-ZNR 5.1V 5% PD=1W IR=10UA	28480	1902-0579
A13A1VR3	1902-0197	1		DIODE-ZNR 82V 5% PD=1W IR=5UA	28480	1902-0197
A14	**5086-7405**	0	1	**POWER AMPLIFIER (2.3-20.0 GHZ)**	**28480**	**5086-7405**
A14	5086-6405	8	1	EXCHANGE 5086-7405 AMPLIFIER	28480	5086-6405
A14A1				BD ASSY-AMP BIAS PART OF A14 AND NOT SEPARATELY REPLACEABLE		
A14A1C1	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A14A1C2	0180-1704	5	4	CAPACITOR-FXD 47UF+10% 6VDC TA	56289	150D476X9006B2
A14A1C3	0180-1704	5		CAPACITOR-FXD 47UF+10% 6VDC TA	56289	150D476X9006B2
A14A1C4	0180-0291	3		CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A14A1C5	0180-0291	3		CAPACITOR-FXD 1UF+10% 35VDC TA	56289	150D105X9035A2
A14A1C6	0180-1704	5		CAPACITOR-FXD 47UF+10% 6VDC TA	56289	150D476X9006B2
A14A1C7	0180-1704	5		CAPACITOR-FXD 47UF+10% 6VDC TA	56289	150D476X9006B2
A14A1C8	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A14A1E1	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E2	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E3	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E4	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E5	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E6	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E7	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E8	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E9	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E10	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E11	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1E12	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A14A1J1	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A14A1Q1	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A14A1Q2	1853-0213	7	1	TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A14A1R1	0698-3443	0	1	RESISTOR 287 1% .125W F TC=0+100	24546	C4-1/8-T0-287R-F
A14A1R2	0757-0420	3		RESISTOR 750 1% .125W F TC=0+100	24546	C4-1/8-T0-751-F
A14A1R3	0698-3441	8	3	RESISTOR 215 1% .125W F TC=0+100	24546	C4-1/8-T0-215R-F
A14A1R4	0698-3441	8		RESISTOR 215 1% .125W F TC=0+100	24546	C4-1/8-T0-215R-F
A14A1R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+100	24546	C4-1/8-T0-1001-F
A14A1R6	0757-0198	2	1	RESISTOR 100 1% .5W F TC=0+100	28480	0757-0198
A14A1R7	0757-0417	8	2	RESISTOR 562 1% .125W F TC=0+100	24546	C4-1/8-T0-562R-F
A14A1R8	0757-0400	9	2	RESISTOR 90.9 1% .125W F TC=0+100	24546	C4-1/8-T0-90R9-F
A14A1R9	0757-0400	9		RESISTOR 90.9 1% .125W F TC=0+100	24546	C4-1/8-T0-90R9-F
A14A1R10	0698-3441	8		RESISTOR 215 1% .125W F TC=0+100	24546	C4-1/8-T0-215R-F
A14A1R11				FACTORY ADJUSTED; NOT REPLACEABLE		
A14A1R12				NOT ASSIGNED		
A14A1R13				FACTORY ADJUSTED; NOT REPLACEABLE		
A14A1R14				FACTORY ADJUSTED; NOT REPLACEABLE		
A14A1R15				FACTORY ADJUSTED; NOT REPLACEABLE		
A14A1R16				FACTORY ADJUSTED; NOT REPLACEABLE		

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A14A1R17				NOT ASSIGNED		
A14A1R18				FACTORY ADJUSTED; NOT REPLACEABLE		
A14A1R19	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R20				NOT ASSIGNED		
A14A1R20	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R24	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R25				NOT ASSIGNED		
A14A1R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0±100	24546	C4-1/8-T0-1002-F
A14A1R27	0757-0417	8		RESISTOR 562 1% .125W F TC=0±100	24546	C4-1/8-T0-562R-F
A14A1R28	0757-0403	2		RESISTOR 121 1% .125W F TC=0±100	24546	C4-1/8-T0-121R-F
A14A1R29				NOT ASSIGNED		
A14A1R30	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A14A1R31	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0±100	24546	C4-1/8-T0-2151-F
A14A1VR1	1902-0551	1	2	DIODE-ZNR 6.2V 5% PD=1W IR=10UA	28480	1902-0551
A14A1VR2	1902-0029	8	1	DIODE-ZNR 12V 5% PD=1W IR=50A	28480	1902-0029
				A14A1 MISCELLANEOUS PARTS		
	1200-0173	5	1	INSULATOR-XSTR DAP GL	28480	1200-0173
	0380-0322	5	8	SPACER-RVT-ON .062-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A15	**5086-7238**	**7**	**1**	**DC RETURN**	**28480**	**5086-7238**
A16	**5086-7339**	**9**	**1**	**MODULATOR/SPLITTER**	**28480**	**5086-7339**
A16	5086-6339	7	1	EXCHANGE 5086-7339 MOD/SPLITTER	28480	5086-6339
A16	5086-7339	9	1	MODULATOR/SPLITTER	28480	5086-7339
A16A1				BOARD ASSEMBLY-MOD/SPLITTER PART OF A16 AND NOT SEPARATELY REPLACEABLE		
A16A1C1	0160-0174	9		CAPACITOR-FXD .47UF +80-20% 25VDC CER	28480	0160-0174
A16A1C2	0180-2602	4	2	CAPACITOR-FXD 47UF±20% 8VDC TA	28480	0180-2602
A16A1C3	0180-2602	4		CAPACITOR-FXD 47UF±20% 8VDC TA	28480	0180-2602
A16A1J1	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A16A1J2	1251-4572	3	1	CONNECTOR 10-PIN M POST TYPE	28480	1251-4572
A16A1Q1	1854-0456	2	1	TRANSISTOR NPN SI PD=65W FT=3MHZ	01295	TIP41A
A16A1Q2	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A16A1R1	0698-7231	2	1	RESISTOR 619 1% .05W F TC=0±100	24546	C3-1/8-TO-619R-F
A16A1R2	0698-7220	9	1	RESISTOR 215 1% .05W F TC=0±100	24546	C3-1/8-TO-215R-F
A16A1R3	0698-7223	2	1	RESISTOR 287 1% .05W F TC=0±100	24546	C3-1/8-TO-287R-F
A16A1R4	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A16A1R5	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A16A1R6	2100-1738	9		RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A16A1R7	0698-7260	7		RESISTOR 10K 1% .05W F TC=0±100	24546	C3-1/8-T0-1002-F
A16A1R8	0698-7244	7	1	RESISTOR 2.15K 1% .05W F TC=0±100	24546	C3-1/8-T0-2151-F
A16A1R9	0698-7273	2	1	RESISTOR 34.8K 1% .05W F TC=0±100	24546	C3-1/8-T0-3482-F
A16A1R10	0698-7257	2		RESISTOR 7.5K 1% .05W F TC=0±100	24546	C3-1/8-T0-7501-F
A16A1R11	0698-7233	4		RESISTOR 750 1% .05W F TC=0±100	24546	C3-1/8-T0-750R-F
A16A1VR1	1902-0551	1		DIODE-ZNR 6.2V 5% PD=1W IR=10UA	28480	1902-0551
A16A1VR2	1902-3171	7	1	DIODE-ZNR 11V 5% DO-35 PD=.4W TC=+.062%	28480	1902-3171
				A16A1 MISCELLANEOUS PARTS		
	0380-0321	4	7	SPACER-RVT-ON .125-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
	1251-3172	7	5	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
	0570-0034	9	1	SCREW-MACH 4-40 .25-IN-LG RD-HD-SLT	00000	ORDER BY DESCRIPTION
	0510-0160	6	1	NUT-HEX-DBL-CHAM 4-40-THD .122-IN-THK	00000	ORDER BY DESCRIPTION
A17	**5086-7217**	**2**	**1**	**AMPLIFIER .01-2.4 GHZ**	**28480**	**5086-7217**
A17	5086-6217	0	1	EXCHANGE 5086-7217 AMPLIFIER	28480	5086-6217
A18	**5086-6219**	**2**	**1**	**EXCHANGE 5086-7219 MOD-MIXER**	**28480**	**5086-6219**
A18	5086-7219	4	1	MODULATOR-MIXER	28480	5086-7219
A20	**5086-7404**	**9**	**1**	**YIG TUNED FILTER**	**28480**	**5086-7404**
A20	5086-6404	7	1	EXCHANGE 5086-7404	28480	5086-6404
A20A1				BD ASSY-YTF HEATER P/O A20 AND NOT SEPARATELY REPLACEABLE		
A20A1C1	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A20A1C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A20A1C3	0180-0049	9		CAPACITOR-FXD 20UF+75-10% 50VDC AL	56289	30D206G050CC2
A20A1CR1	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A20A1J1	1200-0507	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0507
A20A1J2-A20A1J5	1251-3172	7		CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
A20A1Q1	1853-0038	4		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A20A1R1	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A20A1R2	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+100	24546	C4-1/8-T0-1003-F
A20A1R3	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+100	24546	C4-1/8-T0-1002-F
A20A1R4	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+100	24546	C4-1/8-T0-4642-F
A20A1R5	0683-1555	0		RESISTOR 1.5M 5% .25W FC TC=-900/+1100	01121	CB1555
A20A1R6	0757-0447	4		RESISTOR 16.2K 1% .125W F TC=0+100	24546	C4-1/8-T0-1622-F
A20A1R7	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+100	24546	C4-1/8-T0-4221-F
A20A1TP1	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20A1TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20A1TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20A1TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A20A1U1	1826-0261	8		IC OP AMP LOW-NOISE TO-99 PKG	28480	1826-0261
A20A1VR1	1902-0176	6		DIODE-ZNR 47V 5% PD=1W IR=5UA	28480	1902-0176
				A20A1 MISCELLANEOUS PARTS		
	1251-3172	7	4	CONNECTOR-SGL CONT SKT .03-IN-BSC-SZ RND	28480	1251-3172
	1205-0011	0	1	HEAT SINK TO-5/TO-39-CS	28480	1205-0011
	1200-0173	5	1	INSULATOR-XSTR DAP-GL	28480	1200-0173
AT1	**0960-0638**	**6**	**1**	**ISOLATOR-TWO PORT FREQ RANGE:2.0 TO 7.0**	**28480**	**0960-0638**
CR1	86290-60045	5	1	LBBCD DETECTOR	28480	86290-60045
CR2	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
CR3	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
DC1	5086-7220	7	1	DIRECTIONAL DETECTOR	28480	5086-7220
DC2	0955-0148	2	1	DIRECTIONAL COUPLER .01-20.0 GHZ	28480	0955-0148
MP1	0370-3023	8	1	KNOB3/4 JGK .25-IN-ID	28480	0370-3023
MP2	83592-00019	9	1	COVER-PC	28480	83592-00019
MP3	4040-1695	1	1	WINDOW-DISPLAY	28480	4040-1695
MP4	83592-00018	5	1	FRONT PANEL-DRESS	28480	83592-00018
MP5	5041-0285	6	1	KEY CAP-LITE	28480	5041-0285
MP6				NOT ASSIGNED		
MP7	5041-1926	4	1	KEY CAP-SLOPE	28480	5041-1926
MP8	5041-1924	2	1	KEY CAP-POWER LEVEL	28480	5041-1924
MP9	5041-1925	3	1	KEY CAP-POWER SWEEP	28480	5041-1925
MP10	0050-2032	9	1	CASTING-AL FRAME (RR)	28480	0050-2032
MP11	0050-2032	9	1	CASTING-AL FRAME(RR)	28480	0050-2032
MP12	0050-2069	2	1	CASTING-AL HEAT SINK RF	28480	0050-2069
MP13				NOT ASSIGNED		
MP14	83592-20086	9	4	SHIELD-REAR	28480	83592-20086
MP15	1400-1095	6	4	CLIP-FASTENER .400 X .300 X .090 HI; BE	28480	1400-1095
MP16	83525-20037	9	1	SHIELD-FRONT	28480	83525-20037
MP17	83592-20016	5	1	SIDERAIL UPPER RIGHT	28480	83592-20016
MP18	83592-20090	1	1	CASTING-FRONT	28480	83592-20090
MP19	0510-1148	2	1	RETAINER-PUSH ON KB-TO-SHFT EXT	28480	0510-1148
MP20	83592-20017	6	1	SIDERAIL UPPER LEFT	28480	83592-20017
MP21	83592-00008	3	1	SHIELD-ISOLATOR	28480	83592-00008
MP22	0050-2066	9	1	CASTING-AL HEAT SINK, RF	28480	0050-2066
MP23	83592-00006	1	1	BRACKET-ISOLATOR	28480	83592-00006
MP24	83592-00013	0	1	BRACKET-DET/DC RET	28480	83592-00013
MP25	83525-00010	6	1	GUARD	28480	83525-00010
MP26	1460-1851	8	1	WIREFORM MUW BLK OXD	28480	1460-1851
MP27				NOT ASSIGNED		
MP28	83525-20033	5	1	LATCH-SCREW	28480	83525-20033
MP28	3030-0007	5	1	SCREW-SET 4-40 .125-IN-LG SMALL CUP-PT	00000	ORDER BY DESCRIPTION
MP29	83525-20040	4	1	LATCH	28480	83525-20040
MP30	83592-00009	4	1	BRACKET-COUPLER	28480	83592-00009
MP31	83592-20018	7	1	SIDERAIL-LOWER LEFT	28480	83592-20018
MP32	83592-20015	4	1	SIDERAIL-LOWER RIGHT	28480	83592-20015
MP33	83592-00022	1	1	WIRE HOLDER	28480	83592-00022
MP34	83592-00004	9	1	BRACKET-AMPLIFIER	28480	83592-00004
MP35	83592-00021	0	1	PANEL-REAR	28480	83592-00021

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
MP36	5021-0906	6	1	BUSHING-PLASTIC	28480	5021-0906
MP37	11869-20020	4	1	ALIGNMENT PIN	28480	11869-20020
MP38	6960-0002	4	1	PLUG-HOLE DOME-HD FOR .5-D-HOLE STL	28480	6960-0002
MP39	6960-0003	5	1	PLUG-HOLE DOME-HD FOR .75-D-HOLE STL	28480	6960-0003
MP40	83592-20081	4	1	BOX-EXTRUSION	28480	83592-20081
MP41	83592-00020	9	1	CONNECTOR MOUNT ASSEMBLY TYPE-N	28480	83592-00020
R1	0811-3650	9	2	RESISTOR-MATCHED SET WIREWOUND CHASSIS	28480	0811-3650
R2	0811-3650	9		RESISTOR-MATCHED SET WIREWOUND CHASSIS	28480	0811-3650
W1	83592-20045	0	1	CBL-RF COUPLER/OUTPUT	28480	83592-20045
W2	83592-60021	6	1	CABLE COAX EXT/MTR ALC	28480	83592-60021
W3	83592-60025	0	1	CABLE ASSY RIBBON FRONT PANEL	28480	83592-60025
W4 60083	83592-60082	0	1	CABLE ASSY RIBBON RF SECTION	28480	83592-60082
W5	83592-60090	9	1	CABLE COAX PULSE IN	28480	83592-60090
W6	83592-60013	6	1	CABLE COAX PULSE MOD	28480	83592-60013
W7	83525-60029	3	1	CABLE COAX VTUNE	28480	83525-60029
W8	83592-60012	5	1	CABLE COAX GRAY DETECTOR	28480	83592-60012
W9	83592-60015	8	1	CABLE COAX BLUE FM	28480	83592-60015
W10	83592-60016	9	1	CABLE COAX, PURPLE, INT DET 0	28480	83592-60016
W11	83592-60020	5	1	CABLE COAX, GREEN, FM IN	28480	83592-60020
W12	83592-60011	4	1	CABLE COAX, BROWN, AM IN	28480	83592-60011
W13	83592-60014	7	1	CABLE COAX, YELLOW, MOD 1	28480	83592-60014
W14	83592-60084	1	1	CABLE COAX RIBBON, RF SECTION	28480	83592-60084
W15	83592-20047	2	1	CABLE-RF DC2/YTM	28480	83592-20047
W16	83592-20083	6	1	CABLE-RF AT1/YTM	28480	83592-20083
W17	83592-20038	1	1	CABLE-RF PWR AMPL/AT1	28480	83592-20038
W18	83592-20034	7	1	CABLE-RF DC1/DC RETURN	28480	83592-20034
W19	83592-20097	2	1	CABLE-RF A17/DC1RETURN	28480	83592-20097
W20	83592-20085	8	1	CABLE-RF A16/A14	28480	83592-20085
W21	83592-20041	6	1	CABLE-RF A16/A18	28480	83592-20041
W22	83592-20030	3	1	CABLE-RF A11/A18	28480	83592-20030
W23	83592-20031	4	1	CABLE-RF A18/A17	28480	83592-20031
W24	83592-20035	8	1	CABLE-RF A15/A12	28480	83592-20035
W25	83592-20036	9	1	CABLE-RF A13/A16	28480	83592-20036
W26	83592-20092	7	1	CABLE-RF A16/J3 AUX OUTPUT	28480	83592-20092
W27	83592-60010	3	1	WIRING HARNESS, RF SECTION	28480	83592-60010
W28	83525-60024	8	1	CABLE ASSEMBLY POWER SUPPLY	28480	83525-60024
W29	83525-60085	1	1	CABLE ASSEMBLY RIBBON-REAR CONN	28480	83525-60085
W34	83592-20084	7	1	CABLE-RF YTM/SYTF	28480	83592-20084
W35	83592-20098	3	1	CABLE-RF A17/FL1	28480	83592-20098
W36 60082	83592-60083	0	1	CABLE ASSEMBLY RIBBON-A10/A9	28480	83592-60083
				MISCELLANEOUS PARTS		
	5040-0345	7	3	INSULATOR: CONNECTOR	28480	5040-0345
	5061-1100	8	1		28480	5061-1100
	1250-0118	3	5	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50 OHM	28480	1250-0118
	86290-60005	7	1	CONNECTOR ASSEMBLY TYPE-N	28480	86290-60005
				OPTION 002		
A19	83595-60019	5	1	ATTENUATOR-55 DB (OPT. 002 ONLY)	28480	83595-60019
A19MP1	83592-00010	7	2	BRACKET-ATTENUATOR	28480	83592-00010
W15	83592-20048	3	3	CABLE-RF DC2/YTM (DELETE STD W15)	28480	83592-20048
W30	83592-20050	7	2	CABLE-RF A19/RF OUTPUT	28480	83592-20050
W31	83592-20029	0	2	CABLE-RF DC2/A19	28480	83592-20029
				OPTION 004		
	83592-20062	1	1	PLUG-HOLE FRONT (DELETE MP38)	28480	83592-20062
	83592-20063	2	1	PLUG-HOLE FRONT (DELETE MP39)	28480	83592-20063
W2	83592-60086	3	1	CABLE-COAX EXT/MTR ALC (DELETE STD W2) OPT. 004	28480	83592-60086
W15	83592-20048	3		CABLE-RF DC2/YTM (DELETE STD W15)	28480	83592-20048
W32	83592-20094	9	2	CABLE-RF DC2/REAR PANEL RF OUTPUT	28480	83592-20094
				OPTION 002 AND 004		
A19	83592-60019	2	1	ATTENUATOR-55DB	28480	83592-60019
A19MP1	83592-00010	7		BRACKET-ATTENUATOR	28480	83592-00010
	83592-20062	9		PLUG-HOLE FRONT (DELETE MP38)	28480	83592-20062
	83592-20063	0		PLUG-HOLE FRONT (DELETE MP39)	28480	83592-20063
W15	83592-20048	3		CABLE-RF DC2/YTM (DELETE STD W15)	28480	83592-20048
W30	83592-20050	7		CABLE-RF A19/RF OUTPUT	28480	83592-20050

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W31	83592-20029	0		CABLE-RF DC2/A19	28480	83592-20029
W32	83592-20094	9		CABLE-RF DC2/REAR PANEL RF OUTPUT	28480	83592-20094
W33	83592-20093	8	1	CABLE-RF A19/REAR PANEL RF OUTPUT	28480	83592-20093
				HARDWARE LOCATIONS		
1	0520-0126	5	6	SCREW-MACH 2-56 .125-IN-LG 100 DEG	28480	0520-0126
2	0520-0127	6	6	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
3	0520-0166	3	2	SCREW-MACH 2-56 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
4	0624-0281	3	28	SCREW-TPG 4-20 .5-IN-LG PAN-HD-POZI STL	28480	0624-0281
5	2200-0101	0	5	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
6	2200-0103	2	10	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	28480	2200-0103
7	2200-0107	6	6	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
8	2200-0107	6	6	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
9	2200-0113	4	8	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
10	2200-0164	5	2	SCREW-MACH 4-40 .188-IN-LG UNCT 82 DEG	00000	ORDER BY DESCRIPTION
11	2200-0166	7	2	SCREW-MACH 4-40 .312-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
12	2360-0115	4	23	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
13	2360-0117	6	3	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value

VII Manual Backdating

SECTION VII
MANUAL BACKDATING CHANGES

7-1. INTRODUCTION

7-2. This manual has been written for and applies directly to instruments with serial numbers prefixed as indicated on the title page. Earlier versions of the instrument (serial number prefixes lower than the one indicated on the title page) may be slightly different in design or appearance. The purpose of this section of the manual is to document these differences. With the information provided in this section, this manual can be corrected so that it applies to any earlier version or configuration of the instrument. Later versions of the instrument (serial number prefixes higher than the one indicated on the title page) are documented in a yellow Manual Changes Supplement.

7-3. Since there are no earlier versions of the HP Model 83592C RF Plug-In, there is no change information provided here. This manual applies directly to instruments with serial numbers prefixed as indicated on the title page. If your instrument serial number is different than the one on the title page, it will be documented in a yellow Manual Changes Supplement. Complimentary copies of this supplement can be obtained from your nearest Hewlett-Packard Office. Refer to INSTRUMENTS COVERED BY MANUAL in Section I for more information about serial number coverage.

VIII Service

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for troubleshooting and repairing the Model 83592C Plug-In. Information includes circuit descriptions, troubleshooting procedures, block diagrams, schematics, and component location maps for each PC board assembly.

WARNING

Adjustments or repairs inside the Model 8350A/B-83592C with the top or bottom cover removed and the AC power connected should be avoided whenever possible. Any procedure requiring a cover to be removed from the instrument and AC power connected to the mainframe SHOULD BE PERFORMED ONLY BY QUALIFIED SERVICE PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED. With the AC power cable connected to the instrument, the AC line voltage is present on the terminals of the line power module on the rear panel, and at the LINE power switch, whether the switch is ON or OFF. The AC line voltage on these terminals can, if contacted, produce fatal electrical shock. You must also be aware that capacitors inside the instrument may remain charged even though the instrument has been disconnected from its AC power source.

After you have completed a repair, check the instrument carefully to make sure all safety features are intact and functioning, and that all protective grounds are solidly connected.

8-3. SERVICE SHEETS

8-4. Each service sheet pertains to a specific assembly. They are arranged in assembly number order. Table 8-1 provides a Service Sheet Index.

8-5. Service sheets fold out and up to facilitate access to reference material. Block diagrams appear on the fold-down apron. Component location maps, PC board pin-edge connections, and pertinent circuit information (e.g., waveforms) are found on the fold-up apron of the service sheet, with the schematic directly below. Circuit descriptions and assembly level troubleshooting are located on pages immediately preceding the service sheets.

8-6. SCHEMATIC DIAGRAM NOTES

8-7. Figure 8-1, Schematic Diagram Notes, provides definitions of schematic symbols.

8-8. MNEMONICS

8-9. The Motherboard Wiring List (Service Sheet A10) lists alphabetically and defines all Model 83592C signal mnemonics; references the point-to-point distribution of each signal to and from the PC board sockets and the cable connectors on the A10 Motherboard assembly; and identifies the signal source. This table is located on the A10 Service Sheet.

8-10. SERVICE AIDS

8-11. A small length of semi-rigid cable (83525-20013) is included to monitor the output of the YTM. Two Extender Cable assemblies, HP Part Number 08350-60034 (64 pin) and 08350-60035 (17 pin), are designed to power the Plug-In when it is removed from the Model 8350A/B sweep oscillator for troubleshooting. These service aids are recommended for convenience in servicing the Model 83592C.

Table 8-1. Index of Service Sheets

Assembly	Fig. No.	Assembly	Fig. No.
OVERALL		**A6 SWEEP CONTROL**	
Circuit Description/Troubleshooting		Circuit Description/Troubleshooting	
Simplified Overall Block	8-7	Block Diagram	8-43
Overall Block Diagram	8-8	Component Locations	8-44
		Schematic	8-49
A1/A2 FRONT PANEL		**A7/A9 YTM/YTF DRIVER/ REFERENCE RESISTOR**	
Circuit Description/Troubleshooting		Circuit Description/Troubleshooting	
Block Diagram	8-10	Block Diagram	8-51
A1 Front Panel Component Locations	8-11	A7 YTM/YTF Driver Component Locations	8-52
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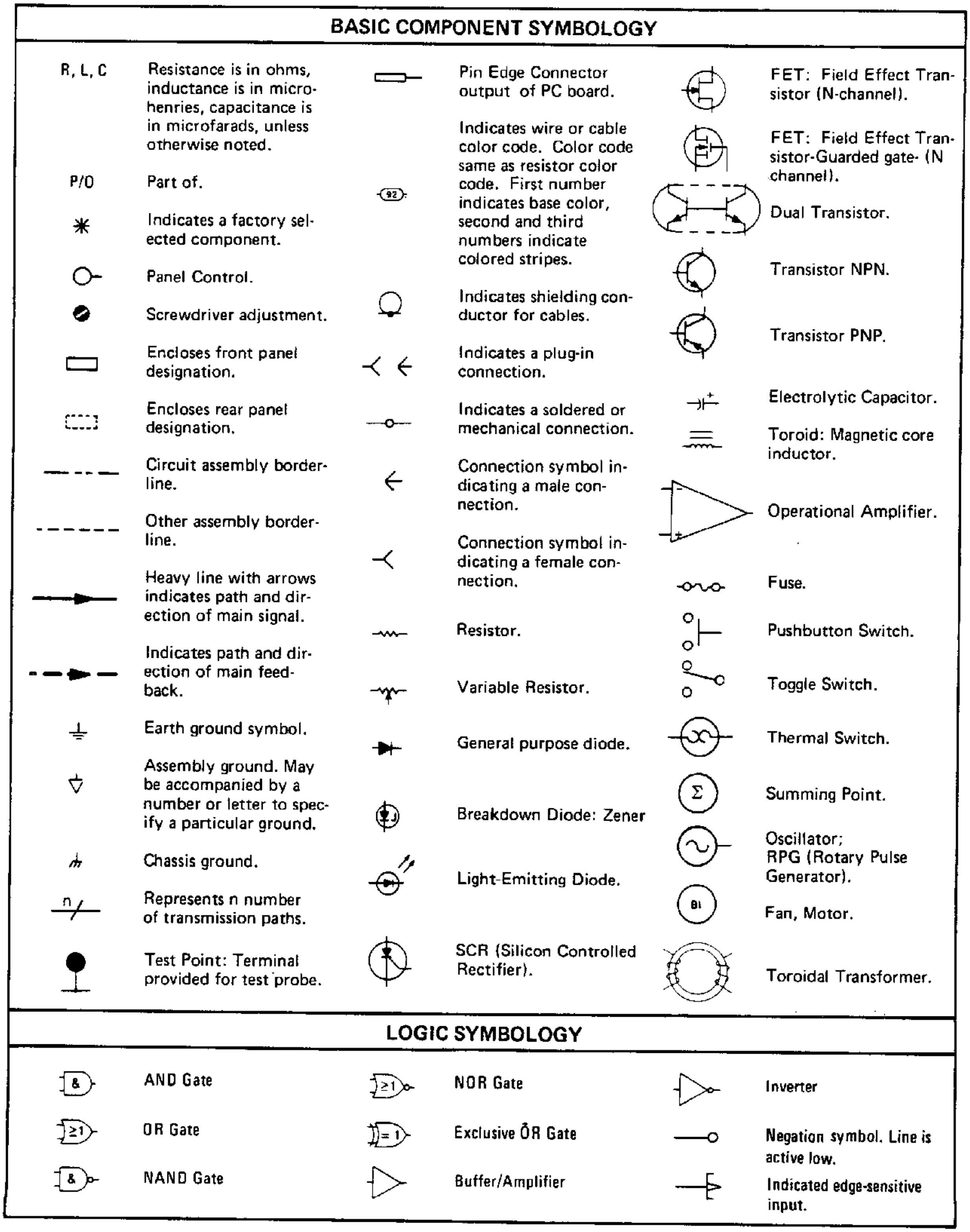
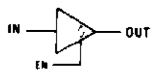


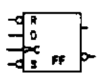
Figure 8-1. Schematic Diagram Notes (1 of 3)

INTEGRATED CIRCUIT SYMBOLOGY

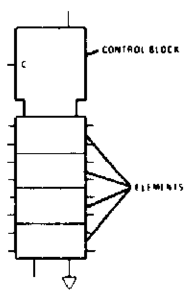
Schmitt Trigger: The gate of the Schmitt Trigger switches at different points for positive - and negative-going signals. The difference between the positive and negative thresholds is defined as hysteresis voltage.



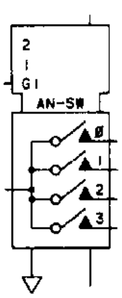
3-State Buffer: Three States:
Enable (EN) Input low: High impedence output.
Enable input high: Output = 0 or Output = 1



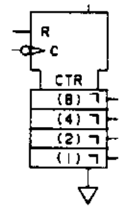
Data Flip-Flop: Set (S) and Reset (R) are asynchronous controls. Active S sets the noninverting output high and the inverting output (O—) low; active R resets both outputs. When S and R are both inactive, the outputs remain latched in the last state. An active clock (-▷) enables the D input, at which time the noninverting output = D, and the inverting output = $\bar{D}$.



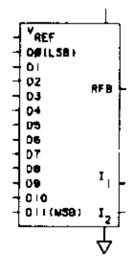
Control Block: All controlling inputs (gates, clocks, inhibits, etc.) connect to the control block.
Elements: Can be one or more of any logic function (flip-flop, counter, gate, RAM, etc.). Data inputs are on the left side of element, data outputs on the right.



Analog Switch: Control lines 1 and 2 decode to select one of four inputs. G1, high=enable.



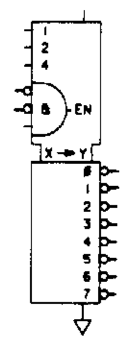
Counter: Binary-weighted registers count on the falling edge of each clock pulse. Active (high) R clears all registers.



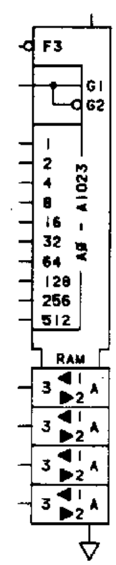
Digital to Analog Converter (DAC): Provides a scaled current output (I_1), the product of V_{REF} and the fractional binary input:

$$D_{11}2^{-1} + D_{10}2^{-2} + D_9 2^{-3} + \ldots D_0 2^{-12}$$

The product of V_{REF} and complement of the binary input appears at I_2.



Decoder: The logic states of the three select lines A, B, and C, and the three enable inputs (EN), determine which one of the eight outputs will be decoded. The selected output will be low, while all others are high.



Random-Access Memory (RAM):
Binary addresses (A0 to A9) access one of 1024 registers in RAM. When G1 is high, bits appearing at D0 to D3 will be written to the addressed location (A0 to A9). When G2 is low, bits appearing at D0 to D3 have been accessed from the addressed location.

Figure 8-1. Schematic Diagram Notes (2 of 3)

FUNCTION LABEL ABBREVIATIONS

Σ	Adder	◊	Open Collector	LED	Light-Emitting Diode
▷	Amplifier/Buffer	1⎍	Monostable Multivibrator	MUX	Multiplexer
⎎	Schmitt Trigger	BCD	Binary Coded Decimal	RAM	Random-Access Memory
&	AND	CTR	Counter	REG	Register
≥1	OR	DAC	Digital-to-Analog Converter	ROM	Read Only Memory
=1	Exclusive OR	FF	Flip-Flop	RPG	Rotary Pulse Generator
X→Y	Encoder, Decoder	I/O	Input/Output		

LINE LABEL ABBREVIATIONS

CK, C	Clock Input	MSB	Most Significant Bit	T	Trigger Input (Monostable)
D	Data or Delay Input (Flip-Flop)	Q	Output	WR	Write
EN	Enable	$\overline{Q}$	Not Q Complement of Q	+1	Count Up
F	3-State Enable Input	R	Reset or Clear Input	−1	Count Down
G	Gating Input	RD	Read	3-ST	3-State (placed by function)
LSB	Least Significant Bit	S	Set Input		

Figure 8-1. Schematic Diagram Notes (3 of 3)

8-12. A 44-pin extender board (HP Part No. 08350-60031) is available to allow access to printed circuit board assembly components while maintaining electrical contact with the Plug-In. This and other service aids are referenced in Section I, Table 1-3, of this manual.

8-13. TROUBLESHOOTING

CAUTION

Improper methods of discharging the −40 Volt supply may result in damage to the instrument. Refer to the Model 8350A/B sweep oscillator operating and service manual for these procedures.

8-14. Troubleshooting is generally divided into two maintenance levels in this manual. The first level isolates the problem to a circuit or assembly. SELF-TEST (described in paragraph 8-16) together with the Overall Block Diagram and Troubleshooting hints, helps to isolate the problem source to a particular assembly.

8-15. The second maintenance level isolates the trouble to the component. Operator-initiated tests, schematic diagrams, and circuit descriptions for each assembly aid in troubleshooting to the component level.

8-16. SELF-TEST

8-17. Model 8350A/B software provides microprocessor and operator-initiated checks. These checks verify the proper functioning of the majority of the Model 8350A/B and Model 83592C digital circuitry and some of the analog devices.

8-18. Whenever the Model 8350A/B is powered ON, or the front panel **[INSTR PRESET]** pushbutton is pressed, instrument SELF-TEST is initiated. Instrument SELF-TEST checks a number of circuits in both the Model 8350A/B and the Model 83592C. If a failure in the Model 83592C is detected during SELF-TEST, error code E001 will be displayed. Table 8-2 lists other error codes associated with the Model 83592C Plug-In.

8-19. If the front panel displays an error code, refer to the Overall Block Diagram and Troubleshooting section. This section will help the operator to define the troubled area.

8-20. OPERATOR-INITIATED TESTS

8-21. The Model 8350A/B microprocessor services several operator-initiated tests of the Model 83592C to check functions which are not exercised during SELF-TEST. The tests may be initiated by making the appropriate key entry indexed in Table 8-3.

Table 8-2. Error Codes Associated with 83592C

Error Code	Circuit Tested
E001	Addresses Model 83592C ROM and reads Checksum back to Model 8350A/B.
E050	Erroneous Front Panel Pushbutton Flag.
E051	Erroneous Front Panel Pushbutton Code received by Model 8350A/B Microprocessor.
E052	Checks for Timer Failure in A3.
E053	Checks PIA circuits in A3.

NOTE

Error Codes E050 through E099 are reserved for the RF Plug-Ins. However, not all are used.

Table 8-3. Operator Initiated Self Test Routines Available

Data Entry	Test	Assembly*	Test Point
SHIFT 50	Power Level DAC	A4	A4TP2
SHIFT 51	Power Sweep DAC	A5	A5TP8
SHIFT 52	Scale/Offset DACs	A7, A8	A7TP1, A7TP9, A8TP2, A8TP3
SHIFT 53	Address Decoder, check major address decoder lines.	A7, A8	A3U6, A3U7, A3U9, A3U13
SHIFT 53	Address Decoder, checks individual board address decoders.	A4 thru A8	Address Decoders
SHIFT 55	Interrupt Control	A3	A3U4 pin 38
SHIFT 56	Bandswitch DAC	A6	A6TP1

*Refer to troubleshooting procedure of the appropriate assembly for waveforms and detailed procedures.

8-22. Access to most of the Model 83592C digital circuitry can be achieved through local programming with the following key entry commands:

Function	Key Entry
Hex Address Entry	**[SHIFT] [0] [0] [M1]*** (enter hex address)
Hex Data WRITE	**[M2]** (enter data: two hex digits)
Hex Data READ	**[M3]**
Hex Data Rotation Write	**[M4]**
Hex Addressed Fast Read	**[M5]**

*To address a different location, press M1 and enter the new address, or use the increment keys [⇧ ⇩] to step to the new address.

By entering the hex address location of a specific device, that device can be exercised. (Addresses are supplied next to the mnemonic on each schematic. Also, circuit descriptions usually include Address Decoder Tables to define the addresses used on that particular assembly.) Hex address entry must be made prior to any of the following:

NOTE

Before addressing a Model 83592C component, determine whether or not the Model 8350A/B microprocessor can READ or WRITE to that particular device. The majority of Model 83592C digital chips do NOT have both READ and WRITE capabilities.

- HEX DATA WRITE, **[M2]**, allows the operator to write any combination of hex data bytes to the addressed device. The outputs can then be checked to see if the device is functioning properly.
- HEX DATA READ, **[M3]**, allows the operator to read the outputs of an addressed device.
- HEX DATA ROTATION WRITE, **[M4]**, strobes a '1' (high state) through a column of zeros (low states) to the addressed device. In effect, Hex Data Rotation Write is a rapid WRITE mode, exercising the addressed device in real time. The microprocessor inputs the data continuously, without servicing interrupts from the rest of the instrument. Latch enable lines, inputs, and outputs can be checked in this mode. Figure 8-2 illustrates the appropriate waveforms.
- HEX ADDRESSED FAST READ, **[M5]**, provides an operator-initiated check for verification of the data bus, in which the addressed device is clocked in real time. Latch outputs can be traced from the onboard location back through the data bus to the microprocessor. At each buffer, verify TTL level response to the enable pulse. Enable line waveforms are shown in Figure 8-3.

8-23. HEXADECIMAL

8-24. Hexadecimal is the number system used to locally address the Model 8350A/B and

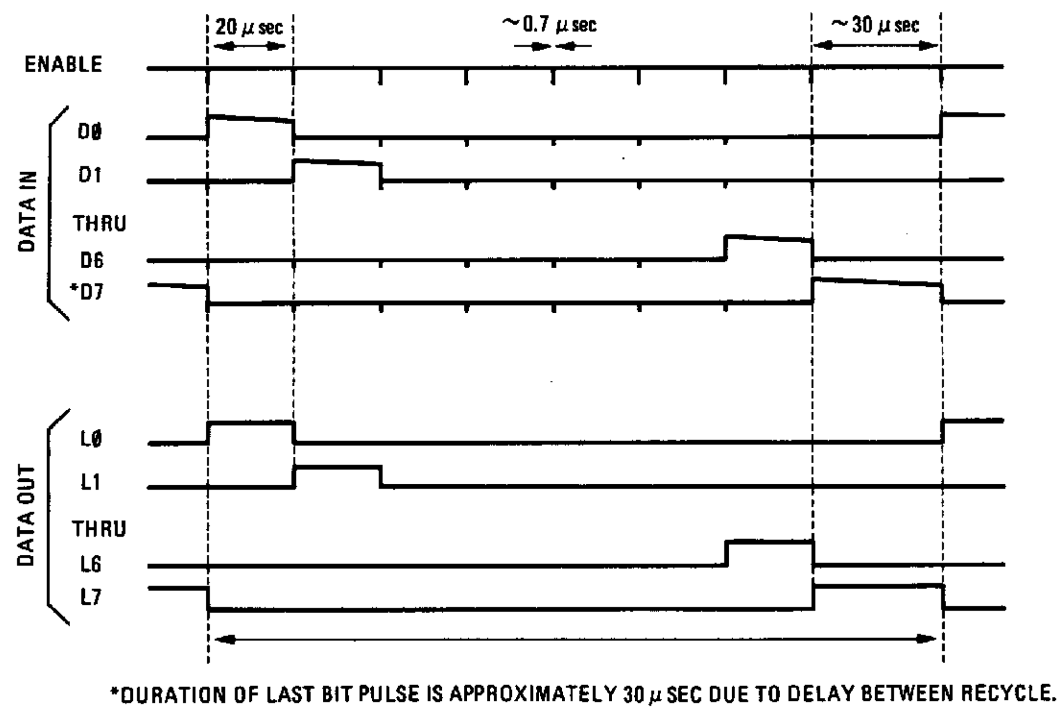


Figure 8-2. Hex Data Rotation Write — Bit Pattern

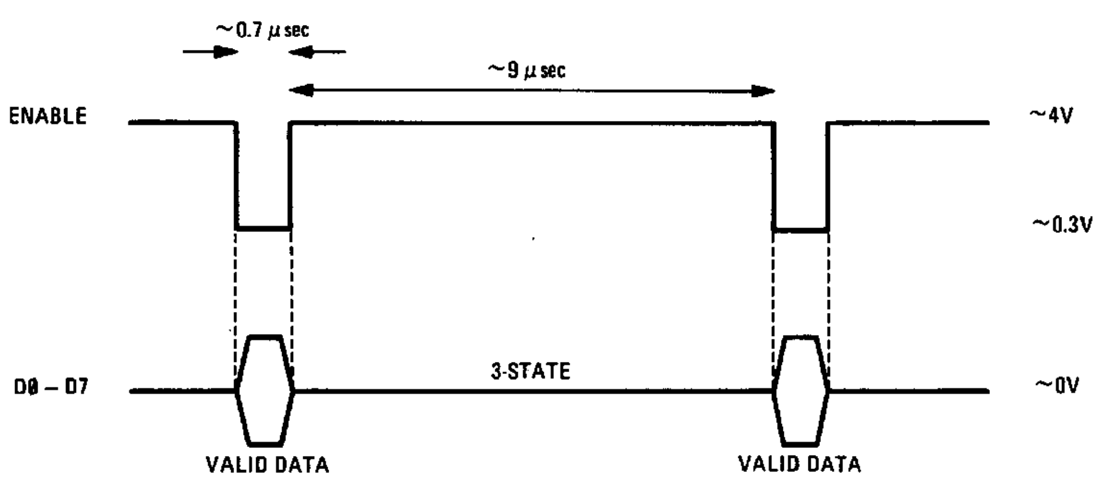


Figure 8-3. Hex Addressed Fast Read — Timing Diagram

Table 8-4. Hexadecimal Equivalents

Hexidecimal	Binary	Decimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
A	1010	10
b	1011	11
C	1100	12
d	1101	13
E	1110	14
F	1111	15

Model 83592C logic components. Available operator initiated self test routines are indexed in Table 8-3.

8-25. The hexadecimal system uses 16 digits: 0 through 9 and A through F. Since 16 is the fourth power of two, four-bit binary numbers can be expressed with one hexadecimal digit, making local programming easier. Table 8-4 provides hexadecimal conversions to binary and decimal equivalents.

8-26. When the Model 8350A/B is in the Hex Data WRITE mode (refer to paragraph 8-22), several front panel keyboard pushbuttons convert to hexadecimal digit entries. The hex numbers assigned to the DATA ENTRY keys are shown in Figure 8-4.

8-27. RECOMMENDED TEST EQUIPMENT

8-28. Test equipment required to maintain the Model 83592C is listed in Section I. If the equipment listed is not available, equipment that meets the minimum specifications shown may be substituted.

8-29. REPAIR

8-30. Module Exchange Program

8-31. This instrument may be quickly repaired by replacing a defective module with a restored-exchange module. To support the module repair concept, Hewlett-Packard has set up a module exchange program.

8-32. The procedure for using the module exchange program is given in Figure 8-5. When you locate the defective module, order a replacement module through the nearest Hewlett-Packard sales office. The restored-exchange module will be sent immediately directly from a customer service replacement parts center. When you receive the exchange module, return the defective module in the same special carton in which the exchange module was received. DO NOT return a defective module to Hewlett-Packard until you receive the exchange module.

8-33. If you are not going to return the defective module to Hewlett-Packard, or if you are ordering a module for spare parts stock, etc., order a new module using the new module part number listed in Table 6-3.

8-34. The Hewlett-Packard module exchange program allows you to obtain a fully tested and guaranteed restored-exchange module at a reduced price. (The reduced price is contingent upon return of the defective module to Hewlett-Packard.) Assemblies available for module exchange are listed in Table 6-1.

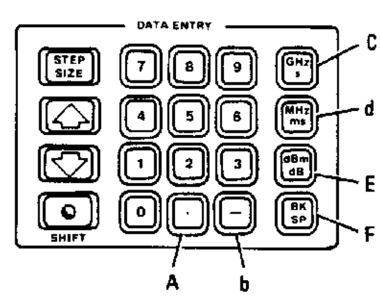


Figure 8-4. Hex Entry Keys

Use this fast, efficient, economical method to keep your Hewlett-Packard instrument in service.

Locate defective assembly using troubleshooting procedures and service sheets in this manual.

Is a replacement assembly on hand?

YES

Install the replacement assembly. Keep the defective assembly for return to HP.

Order rebuilt-exchange assembly from HP. Refer to the replaceable parts section for part numbers.

Put rebuilt-exchange assembly in spares stock.

Return defective assembly to HP.

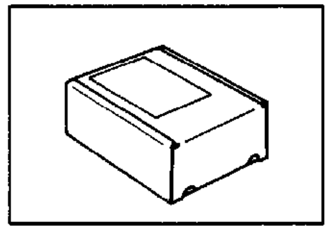
NO

Order rebuilt exchange assembly from HP. Refer to the replaceable parts section for part numbers.

Swap replacement assembly and defective assembly.

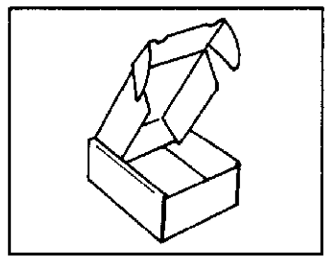
Return defective assembly to HP.

A.



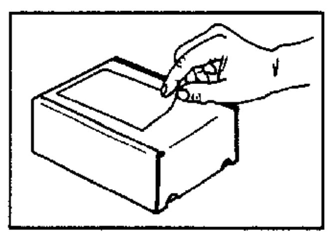
Rebuilt-exchange assemblies are shipped individually in boxes like this. In addition to the circuit assembly, the box contains:
Exchange assembly failure report
Return address label

B.



Open box carefully - it will be used to return defective assembly to HP. Complete failure report. Place it and defective assembly in box. Be sure to remove enclosed return address label.

C.



Seal box with tape. Inside U.S.A.*, stick preprinted return address label over label already on box, and return box to HP. Outside U.S.A., do not use address label; instead address box to the nearest HP office.

*HP pays postage on boxes mailed in U.S.A.

Figure 8-5. Module Exchange Program

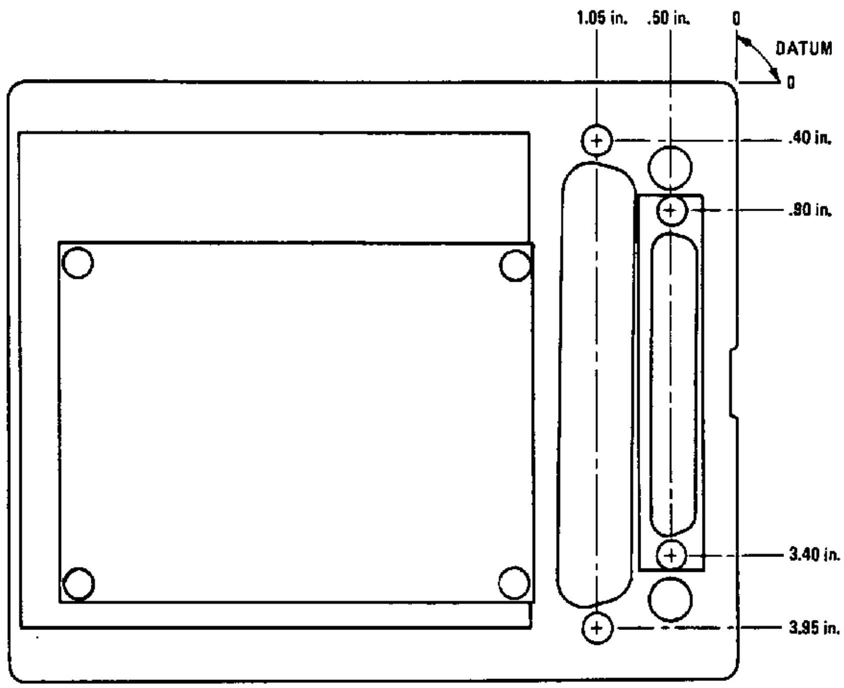


Figure 8-6. Rear Panel Connector Alignment

8-35. Replacing YO A13, YTM A12, YTF A20, YO Driver A8, or YTM/YTF Driver A7

8-36. Each YIG Oscillator (YO), YIG Tuned Multiplier (YTM), or YIG Tuned Filter (YTF) requires a unique set of resistors to be installed on its respective driver board (A7 or A8) for proper YIG coil drive. The values of these resistors are documented on labels attached to the side of the Model 83592C near the RF Section. If the driver assembly (A7 or A8) is replaced, the resistor header containing these resistors must be installed on the new board. Also, if the YO, YTM or YTF is replaced, the resistor header shipped with the YO, YTM, or YTF must be installed on the driver board in place of the old resistors. (In some cases, some or all of the resistors may be deleted, depending on the drive requirements of the individual YO, YTM, or YTF.)

8-37. Rear Panel Connector Replacement

8-38. When replacing rear panel connector P1, connector P2 also must be partially removed to remove P1 from the rear panel casting.

8-39. When rear panel connectors P1 and P2 are reassembled into the casting, alignment is very critical to ensure proper interface with the mating Model 8350A/B connectors. Align the center of the attaching bolts with a steel rule and tighten in place in accordance with the placement drawing in Figure 8-6.

8-40. AFTER-SERVICE PRODUCT SAFETY CHECKS

8-41. Visually inspect the interior of the instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy the cause of any such condition.

Model 83592C RF PLUG-IN OVERALL BLOCK DIAGRAM DESCRIPTION

The operating principles of the Model 83592C Plug-In are described in two levels. The Functional Block Diagram Description describes major functional areas of the instrument. The Overall Block Diagram Description discusses the theory in greater depth, and outlines the breakdown of functions among the various instrument assemblies.

FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

The Model 83592C Plug-In, used with the Model 8350A/B sweep oscillator, covers the 0.01 to 20 GHz frequency range in five bands with +10 dBm of leveled RF power from .01 to 2.4 GHz, +6 dBm from 2.4 to 18.6 GHz, and +4 dBm from 18.6 to 20.0 GHz. In addition to internal leveling, external detectors or power meters can be used to level the RF power. Furthermore, the Model 83592C can sweep power proportional to either frequency or sweep.

The Model 83592C can be broken down into four functional sections:

- Digital Control and Front Panel
- Frequency Control
- Power Control (ALC)
- RF Section

The functional description for each of these four functions is described briefly below.

Digital Control/Front Panel

The entire Model 83592C is digitally controlled by the Model 8350A/B microprocessor. It must be emphasized that nearly all functions are commanded by the Model 8350A/B: very few activities take place without microprocessor intervention.

The Digital Control section of the Model 83592C is the focal point of all communication between Plug-In and mainframe. It receives commands ordered by the microprocessor through the Model 8350A/B's instrument bus. Once in the Model 83592C, these commands are decoded and routed to the appropriate part of the Plug-In to control virtually every capability. The Digital Control section also contains a block of Read Only Memory (ROM), which provides the microprocessor with the constants and program software tailored to the Plug-In. The Digital Control section, then, is the control center for the entire Plug-In.

The Front Panel Interface is the communication link between the front panel displays or controls and the rest of the Plug-In. It receives and stores information to be presented by the numerical display or annunciators through the Digital Control block, and continuously refreshes the display. It also receives the user's commands through the front panel pushbuttons and Rotary Pulse Generator (RPG), and sends them back through the Digital Control block to the Model 8350A/B microprocessor. Certain analog signals, such as FREQ CAL, pass through the Front Panel Interface directly to the appropriate part of the Model 83592C.

Frequency Control

The Frequency Control block is responsible for converting the tuning ramp (VTUNE) from the Model 8350A/B sweep oscillator into drive currents for controlling the YIG Oscillator (YO), YIG Tuned Multiplier (YTM), and YIG Tuned Filter (YTF). The tuning voltage is offset, scaled, and buffered to provide a buffered tuning voltage for the YO, YTM and YTF drivers. The three drivers each digitally scale and offset the buffered tuning voltage (BVTUNE) to yield tuning voltages that enable both the YTM (which is basically a harmonic generator followed by a tunable bandpass filter) and the YTF (a tunable bandpass filter) to track the YO fundamental frequency or one of its harmonics (Bands 2 and 3 use the second and third harmonics of the YO). Each driver develops a delay compensation signal that is summed with the scaled tuning voltage on each driver to compensate for delay in the YO, YTM, or YTF. Lastly, low-frequency components of external frequency modulation (FM) are filtered and also summed in to produce total YO, YTM, and YTF control voltages. However, the YO, YTM, and YTF are current-controlled devices, so Current Drivers convert the control voltages to drive currents for the YO, YTM, and YTF.

The high-frequency FM components cannot be summed in with the drive currents due to the limited dynamic response of the YO, YTM and YTF. The YO contains a separate coil that allows smaller yet faster frequency modulation. The amount of deviation is limited and is within the bandpass characteristics of the YTM and YTF, so the YTM and YTF do not require any frequency control for high-frequency modulation.

The Sweep Interrupt block monitors the tuning voltage (VTUNE) when the Model 83592C is performing a sweep requiring more than one band. When a tuning voltage corresponding to the end of a band is sensed, these circuits temporarily stop the sweep ramp and interrupt the Model 8350A/B microprocessor. The microprocessor then prepares the Plug-In for the new band, including new scaling and offset values, and continues the sweep.

Power Leveling (ALC)

The Power Control circuits determine the RF output power level, and ensure that the power is constant across the sweep. A feedback loop detects the RF power level, compares it with a reference voltage, and adjusts modulators in the RF path to correct for amplitude errors.

The power level is digitally programmed from the Model 8350A/B sweep oscillator. A scaled sweep ramp to provide the power slope or power sweep function is added, yielding a reference power level.

RF detectors provide a voltage proportional to the actual RF power level. This is compared to the desired reference power level voltage to produce an error voltage. The error is then amplified to drive RF modulators and correct the output power level.

RF Section

The RF Section includes the high-frequency microcircuits and their bias components which produce and amplify the RF output.

The 0.01 to 20 GHz frequency range is covered in four bands. The YIG Oscillator (YO) is the tunable source for all bands. The upper bands (Bands 1 through 3) are obtained by amplifying the direct YO output and then generating harmonics in the YTM. The YTM contains a tunable bandpass filter that is tuned to the desired RF output frequency. As a result, the YTM passes the desired RF output frequency and rejects unwanted harmonics. The YTF selects the output from one of two different paths. It provides additional filtering after the YTM for bands 1 to 3 to reduce harmonic output considerably.

Band 0 uses a fixed 3.8 GHz oscillator to mix down the YO output, covering the 0.01 to 2.4 GHz frequency range. The low pass filter FL1 reduces harmonic output of the A17 amplifier. When Band 0 is selected, the YTF provides a through path for the 0.01 to 2.4 GHz RF.

Two directional couplers with detectors sense the RF power level and send a voltage to the ALC circuits for power leveling.

In Option 002 instruments, a programmable step attenuator is included to provide up to −55 dB of additional output power control range.

OVERALL BLOCK DIAGRAM DESCRIPTION

DIGITAL CONTROL/FRONT PANEL

A3 Digital Interface

The A3 Digital Interface assembly acts as the Model 83592C's distribution center, receiving digital commands from the Model 8350A/B sweep oscillator and routing them to the appropriate assembly within the Plug-In.

The Buffer receives the digital control (including timing), data, and address signals from the Model 8350A/B sweep oscillator's Instrument Bus. The control and address lines are uni-directional and pass only to the Plug-In, whereas the data lines are bi-directional and carry information both to and from the Plug-In. A single buffer returns the Plug-In flag (L PIFLG) to the Model 8350A/B, indicating that a Plug-In front panel key was pushed.

The Address Decoder provides the major control lines which eventually direct data to the correct part of the Plug-In. Address and control lines are decoded to produce enable lines: two for ROM, three for the Configuration Switches/Interrupt Control, five for the Front Panel, and two for the remainder of the Plug-In assemblies.

The ROM (Read Only Memory) stores program software and constants used by the Model 8350A/B microprocessor while executing routines dedicated to the Plug-In. Two address decoding lines, plus address lines, select the byte of data to be sent back the the Model 8350A/B.

The Configuration Switch/Interrupt Control circuits serve a dual purpose. The Configuration Switch encodes information about the plug-in options used, and certain user-defined parameters. During INSTR PRESET and power-on, the switch positions are read by the Model 8350A/B microprocessor, then used to configure the Model 83592C according to the parameters selected. As Interrupt Control, the circuits monitor the L SIRQ line, and send an interrupt (L PIIRQ) to the Model 8350A/B to begin each bandswitch. During a bandswitch, the Interrupt Control is programmed to count down time intervals specified by the microprocessor. At the end of these intervals, the L PIIRQ line is again activated to notify the Model 8350A/B that the time interval has elapsed.

The RF Plug-In Interface buffers the data and address lines for use thoughout the rest of the RF Plug-In. The data bus is bi-directional, so that the Model 8350A/B can read information from the A2 Front Panel Interface, A6 Sweep Control, A7 YTM/YTF Driver, and A8 YO Driver assemblies. The control lines, which complete the internal bus, come directly from the Address Decoder. This internal bus sends control messages and data for DACs to digital interface circuits on each assembly. These digital interface circuits are essentially buffers between the digital and analog circuits.

A2 Front Panel Interface, A1 Front Panel

NOTE

Due to their strong functional interrelation, the A2 Front Panel Interface and A1 Front Panel assemblies are discussed together.

The A2 Front Panel Interface and A1 Front Panel assemblies are primarily responsible for displaying the status and power level of the Plug-In, and transmitting pushbutton and RPG commands back to the Model 8350A/B sweep oscillator for processing. Front panel analog adjustments, and the analog 1V/GHz rear panel output, are also processed on these assemblies.

The Keyboard/Display Interface performs two functions. As a Keyboard Interface, it strobes the columns of the Pushbutton Switch Matrix, while sensing the row lines. When a key is pushed, the row line tracks the strobed column line corresponding to that key. The Keyboard Interface detects this, sets the FLAG line to alert the microprocessor, and transmits the encoded data back to the Model 8350A/B for processing. As a Display Interface, the same column strobes are buffered and used to drive the digits of the Power Display. While a digit is enabled, the appropriate seven-segment data stored inside the Display Interface is buffered to drive the segments. The scanning is done at a fast rate to avoid flickering.

The Annunciator Interface stores data to drive the LED Annunciators that display the status of various functions. However, the Unleveled annunciator is not digitally controlled, but is driven from a separate Unleveled circuit which monitors the ALC assembly.

The Power Control Interface digitally controls several functional areas. Three of the lines are buffered by the Attenuator Control, which operates the A19 Step Attenuator in instruments equipped with Option 002. The RF On circuits control the biasing for the A13 YIG Oscillator and the A17 Amplifier. When the RF is turned off, the bias to these assemblies is removed, shutting off the oscillator and amplifier for minimum RF output.

The Frequency Tracking Amplifier and 1V/GHz blocks are the only active analog circuits on the A2 and A1 assemblies. The Frequency Tracking Amplifier monitors the YTF DRIVE V, a voltage proportional to the RF output frequency. Its output tracks the RF output frequency, and is used to compensate for frequency-dependent non-linearities in the ALC loop. The 1V/GHz circuit further processes this signal to produce a rear-panel output supplying 1 Vdc per GHz (to 18 GHz) of output frequency for use with external equipment.

Miscellaneous front panel controls must pass through the A1 and A2 assemblies. The RPG produces pulses when rotated, and sends them directly back to the Model 8350A/B sweep oscillator to be decoded and processed to adjust the power or fine-tune the YTM and YTF bandpass frequencies. The FREQ CAL adjustment is used to fine-tune the Band 0 output frequency to correct for drift or error in the A11 Cavity Oscillator frequency. The EXT/MTR ALC CAL adjusts the absolute power level when external detector or power meter leveling is used. The FILTER PEAK adjustment fine tunes the YTF tracking.

FREQUENCY CONTROL

The Frequency Control section of the Plug-In is responsible for determining the actual RF output frequency. Based on the tuning voltage VTUNE and digital data, the correct drive currents are developed for tuning the A13 YIG Oscillator, A12 YIG Tuned Multiplier, and A20 YIG Tuned Filter. Frequency Modulation (FM) is also processed in these circuits.

A6 Sweep Control

The A6 Sweep Control assembly scales and offsets the tuning voltage from the Model 8350A/B sweep oscillator to provide a series of 0 to −10V ramps (one ramp for each band) during a multiband sweep. For single band sweeps, the A6 Sweep Control assembly just buffers and inverts the 0 to 10V VTUNE ramp from the Model 8350A/B.

The Bandswitch Comparator and Sweep Control/Interrupt Logic sections monitor the buffered tuning voltage. When the sweep ramp requires a change of band, this circuit issues "stop sweep" and blanking pulse requests. At the same time, an interrupt is sent to the mainframe through the A3 assembly, requesting service for the bandswitch. After this point, the microprocessor completes the bandswitch sequence through the Sweep Control circuits.

SRD Bias circuits control Step Recovery Diode (SRD) biasing. The PIN SW output controls a PIN diode switch in the YTF to select either a through path for Band 0 or YTM/YTF operation for Bands 1 through 3. The SRD BIAS output optimizes the SRD biasing for the frequency band of operation.

A8 YO Driver, A9 Reference Resistor Assembly

The A8 YO Driver assembly scales and offsets the buffered tuning voltage from the A6 Sweep Control assembly and converts it to a current for controlling the A13 YIG Oscillator (YO) frequency.

The buffered tuning voltage BVTUNE is scaled, offset, and summed with various correction signals to produce the tuning current for the A13 YIG Oscillator. The scaling and offsetting are used to change the frequency range of the YIG Oscillator depending on the band of operation. For each band, the 0 to 10V ramp must tune the YIG Oscillator over a different frequency range as shown in Table 8-5.

Table 8-5. YO Frequency Bands

Band	YO Frequency Range (GHz)
Band 0	3.81 to 6.2 GHz
Band 1	2.3 to 7.0 GHz
Band 2	3.5 to 6.75 GHz
Band 3	4.5 to 6.67 GHz

The Scaling and Offset DACs are also used to compensate for differences in oscillator sensitivities. The amount of scaling and offset is set by the Frequency Cal switches. At initial power on or Instrument Preset, the status of the Cal switches is read by the Model 8350A/B and stored in RAM. This information is then used along with frequency range (band) information to program the DACs. The −10V Reference generates a stable voltage source used as a reference on the A6 Sweep Control, A7 YTM/YTF Driver, and A8 YO Driver assemblies.

The Delay Compensation circuit produces signals to compensate for time delay in the YIG Oscsillator response. The coils in the YO are used to set up a strong controlled magnetic field to control the RF frequency. Due to inductive reactance of the electromagnets, there is a delay between the applied voltage and resultant current flow through the coils. The Delay Compensation circuit monitors the scaled tuning voltage, and from its amplitude and slope produces a signal added to the YO DRIVE V to compensate for swept frequency errors that would occur because of the response delays.

The +20V Tracking circuit monitors the +20V supply, producing an output which follows this voltage. Since the current through theYO is referenced to this supply, this prevents power supply drift or noise from creating frequency errors.

The summing junction adds together the scaled tuning voltage, offset, delay compensation, +20V tracking voltage, and offset compensation, plus the front-panel FREQ CAL in Band 0. The YO LO FM from the A5 FM Driver (described below) is also added. The product is the YO DRIVE V, a signal proportional to the YO frequency.

The remainder of the A8 circuits and the A9 components convert the YO DRIVE V to a current to control the YO frequency. The final current drive transistor is controlled by the A8 assembly. The current through this transistor, and hence the YO, generates a proportional voltage across the chassis-mounted reference resistor, which is monitored and compared to the YO DRIVE V. Any errors between the two are corrected in a closed loop, producing a current proportional to the YO DRIVE V. Compensation elements (Comp) correct for nonlinearities in the YO. If the YO is replaced, this section of circuitry requires changing also.

In CW mode, a relay connects a large capacitor across the YO's coil. The capacitor resists changes in the YO current to reduce residual FM noise.

The Frequency Cal switches set the frequency end-point accuracy. These switches are set when the Plug-In is calibrated, and are read by the Model 8350A/B during Instrument Preset or initial power on. This information is used to program the Scale and Offset DACs.

A7 YTM/YTF Driver, A9 Reference Resistor Assembly

The A7 YTM/YTF Driver assembly scales and offsets the buffered tuning voltage from the A6 Sweep Control assembly and converts it to a current for controlling the A12 YIG Tuned Multiplier (YTM) and A20 YIG Tuned Filter (YTF) frequencies for Bands 1 through 3.

The buffered tuning voltage BVTUNE is scaled, offset, and summed with various correction signals to produce the tuning currents for the A12 YTM and A20 YTF. The scaling and offsetting are used to change the frequency range of the YTM and YTF depending on the band of operation. For each band, the 0 to 10V ramp must tune the YTM and YTF over a different frequency range as shown in Table 8-6.

Table 8-6. YTM/YTF Frequency Bands

Band	YTM/YTF Frequency Range (GHz)
Band 0	Not Used
Band 1	2.4 to 7.0 GHz
Band 2	7.0 to 13.5 GHz
Band 3	13.5 to 20.0 GHz

The Scaling and Offset DACs are also used to compensate for differences in YTM and YTF sensitivities. The amount of scaling and offset is set by the Frequency Cal switches. At initial power on or Instrument Preset, the status of the Cal switches is read by the Model 8350A/B and stored in RAM. This information is then used along with frequency range (band) information to program the DACs. The −10V Reference from the A8 YO Driver is a stable voltage source used as a reference for the Offset DAC.

The Delay Compensation circuit produces signals to compensate for time delay in the YTM and YTF responses. The coils in the YTM and YTF are used to set up a strong controlled magnetic field to control the RF bandpass frequency. Due to inductive reactance of the electromagnets, there is a delay between the applied voltage and resultant current flow through the coils. The Delay Compensation circuit monitors the scaled tuning voltage, and from its amplitude and slope produces a signal added to both the YTM DRIVE V and YTF DRIVE V to compensate for swept bandpass frequency errors that would occur because of the response delays.

The YTM and YTF summing junctions add together the scaled tuning voltage, offset, delay compensation, and offset compensation. The YTM LO FM from the A5 FM Driver (described below) is also added. The products are the YTM DRIVE V, and YTF DRIVE V; signals proportional to the RF output frequency.

The remainder of the A7 circuits and the A9 components convert the YTM DRIVE V and YTF DRIVE V to a current to control the YTM and YTF bandpass frequencies. The final current drive FET is controlled by the A7 assembly. The currents through these FETs, and hence the YTM and YTF, generate proportional voltages across the reference resistors, which are monitored and compared to the YTM DRIVE V and YTF DRIVE V. Any errors between the two are corrected in a closed loop, producing a current proportional to the DRIVE V. Compensation elements (Comp) correct for nonlinearities in the YTM and YTF. If the YTM or YTF is replaced, this section of circuitry requires changing.

The Frequency Cal switches set the YTM and YTF frequency end-points accuracy for tracking the YO frequency. These switches are set when the Plug-In is calibrated, and are read by the Model 8350A/B during Instrument Preset or initial power on. This information is used to program the Scale and Offset DACs.

P/O A5 FM Driver

The A5 FM Driver assembly splits the external FM signal, passed through the mainframe, into two frequency ranges (Low Frequency and High Frequency). The low frequency modulation is added to the main coil tuning voltages for the YO, YTM, and YTF; the high frequency modulation is routed to a separate coil inside the YO dedicated to high-frequency FM.

The external FM Input is routed to the A5 FM Driver assembly, where it splits into two paths. One path is lowpass filtered, removing high frequency components; the other path is highpass filtered, removing low frequency components. The filters are matched in stop-band response, such that one picks up where the other leaves off. Two Sensitivity Select circuits determine the FM sensitivity (RF Output deviation of −20 or −6 MHz/volt) and select either crossover or direct coupling.

The low frequency path is further divided into two paths, one for driving the YIG Oscillator and the other for the YTM and YTF. Since, for Bands 2, and 3, the RF output is actually a harmonic of the YO frequency, the FM sensitivity of the YO (in relation to changes in the RF output frequency) varies between bands. Also, if the rear panel Aux Output (YO fundamental frequency) is used for phaselocking, the FM sensitivities for the YTM and YTF vary between bands. Thus, variable gain amplifiers (controlled by band-select logic) scale the FM driver outputs according to the band of operation and phaselock source (as selected by the A3S1 Configuration Switch).

The YO LO FM is eventually added to the YO DRIVE V, and modulates the YO output frequency through its main coils. The YTM/YTF LO FM is added to the YTM DRIVE V and YTF DRIVE V, and modulates both the YTM and YTF bandpass frequencies through their main coils. Thus, for low frequency modulation, the YO, YTM, and YTF track each other in frequency.

The YO, YTM, and YTF main coils cannot respond to fast deviations due to inductive and magnetic delays. Therefore, the YO contains a separate, small, but fast-acting "FM coil". The HI FREQ FM is sent to this coil, allowing limited high-frequency modulation. Since this modulation is limited, and does not extend beyond the bandwidth of the YTM and YTF, no high-frequency modulation is required for the YTM or YTF.

ALC/POWER CONTROL

The A4 ALC assembly, and parts of the A5 FM Driver assembly, are responsible for power level control. Power leveling is accomplished by detecting the RF output power level, comparing it to a fixed reference voltage, and adjusting RF modulators to correct for power errors. This results in a constant RF power level across the entire sweep. The absolute RF power is digitally controlled, and can be set between +10 and −5 dBm. (Instruments with Option 002 use an RF step attenuator to achieve power control down to −60 dBm. However, this is not part of the leveling loop.) The power sweep and power slope functions are obtained by adding a scaled voltage ramp offset to the reference power level.

A4 ALC Assembly

The A4 ALC assembly receives its inputs from the various detectors, and selects one of them for leveling. The sources include Directional Detector DC1 (Band 0), Detector CR1 (Bands 1−3), the External input (external negative detector), and a fourth position which inverts the polarity of the external input (power meter detection). The selected detector voltage is proportional to the peak RF amplitude. The Input Sample & Hold stores the detected level during pulse modulation. This prevents subsequent circuits from saturating when the RF power drops out during blanking or pulse modulation. The Logger amplifier produces a voltage proportional to the log of peak RF amplitude, and essentially represents the RF power level in dB. When power meter leveling, two log amplifiers are used to improve the stability of the loop with various power meters.

The reference, or desired, power level is established digitally by a 12-bit DAC, scaling the −10V REF from the A8 assembly. This establishes a voltage proportional to the desired output level in dBm. The External AM signal from the Model 8350A/B sweep oscillator, and the PWR/SWP COMP signal from the A5 FM Driver assembly (described below), are summed in to produce PWR REF, a voltage proportional to the desired RF output power.

The second summing junction adds the External Cal input from the front panel. This offset voltage is used to calibrate absolute power when external leveling is used. The final product of the power reference chain is a reference voltage representing the desired RF output amplitude.

The ultimate goal of the leveling loop is to make the actual RF power equal to the desired RF power. A third summing junction compares the voltages representing these two quantities, and yields a signal representing the error between actual and desired power. This error voltage is sampled and held during pulse modulation to prevent subsequent circuits from saturating. The held error signal is amplified, and the RF blanking signal added to switch off the RF power during bandswitch, retrace, and internal squarewave modulation (from the Model 8350A/B), without saturating any other components in the path. An additional circuit monitors the input to the modulator drivers, and lights a front panel Unleveled LED if this voltage exceeds the normal range for leveled power.

P/O A5 FM Driver

The A5 FM Driver assembly includes circuits to produce the PWR/SWP COMP signal added to yield the PWR REF. The Power Sweep function is achieved by scaling the VSW sweep voltage with a DAC. By programming the appropriate scale factor, a voltage representing dB/GHz or dB/Sweep is produced.

The ALC Compensation is a four-breakpoint, adjustable slope network, which compensates for fixed frequency-dependent nonlinearities in the RF path, typically caused by the couplers and detectors. Its input is FREQ TRK V, a voltage proportional to frequency. This signal drives an array of four pairs of transistors, whose outputs are summed together to yield the ALC compensation signal. The gain of each transistor, and the voltage at which they conduct, is adjustable. A ninth adjustment adds the FREQ TRK V directly. In this way, a complicated compensation function, approximated by five straight lines, is produced. (An additional adjustment on the A4 assembly adds another compensation signal proportional to frequency for Band 0 only.)

The Power Sweep DAC adds a ramp voltage to the power reference signal when the Power Sweep or Power Slope functions are activated. Its input, VSW, is a sweep ramp that essentially tracks the tuning voltage, but always runs from 0 to 10 Vdc. A digitally programmable multiplying DAC scales this voltage according to the dB/SWP or dB/GHz value selected. (If these functions are disabled, the DAC is set to its minimum value.) This ramp is added to the ALC Compensation signal described above, and added to the Power Reference signal on the A4 assembly.

RF SECTION

The RF Section includes the microcircuits and their bias boards that produce the actual RF output power. These components include A11 through A20, AT1, DC1, DC2, CR1, and FL1.

The A13 YIG (Yttrium-Iron-Garnet) Oscillator (YO) is the fundamental frequency-controllable microwave source for the Model 83592C RF Plug-In, ranging from 2.3 to 7.0 GHz. The YO's frequency is determined by the current flowing through large electromagnetic coils inside, supplied by the A8 and A9 assemblies. Due to the response time limitations of the main coils, a smaller coil with a much faster response but limited range is used to modulate the output frequency when faster rates are needed.

The A16 Modulator/Splitter splits the YO output into two paths (one for Band 0 and the other for Bands 1 through 3); provides pulse modulation for all bands; provides amplitude control for leveling in Bands 1 through 3; and couples part of the YO output to the rear panel AUX OUTPUT connector.

For Bands 1 through 3, the fundamental YO output is amplified by the A14 Power Amplifier. The AT1 Isolator provides 20 dB of isolation between the Power Amplifier and the A12 YTM. The fundamental YO frequency from the Isolator is applied to a Step Recovery Diode (SRD) in the YTM. The SRD not only passes the fundamental frequency, but also generates an output that is rich in harmonics. The YIG Tuned Filter is a bandpass filter that is tuned to the desired RF output frequency by the A7 YTM/YTF Driver. Thus, the YTM uses the YO fundamental frequency to generate an RF output corresponding to either the YO fundamental frequency (Band 1) or one of its harmonics (Bands 2, and 3). Following the YTM is a separate Yig Tuned Filter (YTF) which further reduces harmonic output. On the output of the YTF is a PIN switch which selects either the YTM-YTF path (Bands 1-3), or the Band 0 path to the DC2 Directional Coupler.

For Band 0, the 3.81 to 6.2 GHz output of the A16 Modulator/Splitter is heterodyned in the A18 Modulator/Mixer with the fixed 3.8 GHz output of the A11 Cavity Oscillator. The resulting output from the Modulator/Mixer is Band 0, with a frequency range of 0.01 to 2.4 GHz. Power control and leveling is accomplished in the A18 Modulator/Mixer, by modulating the 3.8 GHz fixed input before mixing.

The A17 Amplifier boosts the mixed-down low-power output from the A18 assembly. The amplifier also serves to remove unwanted high-frequency mixing products. The A17A1 Amplifier Bias assembly is connected directly to the microcircuit, has no adjustable or replaceable parts, and is not separately replaceable.

The FL1 Low Pass Filter, with its breakpoint at 2.5 GHz reduces harmonic output when in Band 0.

The DC1 Directional Detector uses a broadband resistive bridge to couple off a portion of the RF energy. This energy is rectified and filtered to provide a detected output for Band 0 leveling.

The A15 DC Return allows YTF bias currents to pass to ground, while preventing them from affecting other circuits.

For Band 0, the A20 YTF provides a straight through path for the 0.01 to 2.4 GHz RF.

The DC2 Directional Coupler directs a portion of the RF energy to Detector CR1, producing a voltage proportional to the RF power level for leveling in Bands 1 through 3. Although the low-frequency (Band 0) output must pass through DC2, this coupler plays no part in Band 0 leveling.

The RF output is finally directed to the front panel RF output connector. On instruments with Option 004, different cabling takes the output to the rear panel connector. On instruments with Option 002, the A19 RF Step Attenuator is included, providing from 0 to 55 dB of attenuation in 5 dB steps. This attenuated output is then routed to the front panel connector (Option 002 only) or rear panel connector (Option 002 with Option 004).

MODEL 83592C OVERALL TROUBLESHOOTING

The purpose of this troubleshooting information is to provide an aid in isolating a problem in the Model 83592C to a specific assembly. Further troubleshooting information is supplied with each service sheet to isolate the problem to the component level.

The first step in overall troubleshooting is to identify the symptom(s) and determine under what conditions the problem exists. If the problem is an RF Plug-In error code (E001 or E050 through E053) refer to the Error Code section of this troubleshooting procedure. Also ensure that the Model 8350A/B used with the Model 83592C is calibrated and functionally operating.

A failure in the Model 83592C normally affects one of the following functions.

- Front Panel/Digital Control — Probable symptoms are error code E001, incorrect annunciator or digit displays, inability to control operation from the front panel, or erratic instrument response to front panel entries. The problem is generally on the A1, A2, or A3 assemblies, or with the Rf Plug-In/Model 8350A/B interface.

- Frequency Control — Frequency control problems include frequency inaccuracy, sweep control problems or power losses due to the YTM and YTF not tracking the YO frequency. If the Model 8350A/B VTUNE output and power supplies are verified, the problem is most likely on the A5, A6, A7, A8, or A9 assemblies, or in the RF Section. If a frequency accuracy problem occurs only during swept operation, and the inaccuracy increases with faster sweep times, the problem is most likely with the Delay Compensation circuit on the A8 YO Driver assembly. Power losses that can be corrected with the front panel FILTER PEAK, or PEAK control indicate that the YO/YTM/YTF Tracking needs calibration (Refer to Section V, Adjustments).

- Power Control — Typical problems are no RF output, maximum unleveled RF output, or excessive power level variations. The problem is most likely with the A4, A5, or RF Section. If the trouble is limited to power sweep and slope control, the problem is most likely with the Power Sweep DAC on the A5 assembly. If the power loss is in Bands 1—3, try adjusting the front panel FILTER PEAK and PEAK controls to peak the power. If the power losses are eliminated, perform the YO-YTM/YTF Tracking adjustments in Section V.

- RF Path — Problems associated with high-frequency microcircuits include spurious or harmonic distortion, no RF power, or full unleveled RF power. For a harmonic distortion problem, refer to Section V, Adjustments. For power problems, try peaking the power with the front panel FILTER PEAK, and PEAK controls, then refer to the A4 ALC Troubleshooting procedure before suspecting the RF components.

Once the problem is identified, exercise the RF Plug-In to determine under what conditions the problem exists. Some important conditions to check are:

- Band related — Does the problem exist only for Band 0 or Bands 1—3, or does it exist on all bands? If a power or leveling problem is restricted to one band, the problem is limited to the respective detector, modulator driver, or modulator.

- Sweep Mode related — Is there a problem only in swept modes of operation, or does it also exist in CW operation? If the problem still exists in CW operation, troubleshoot in this mode (it is easier to check waveforms and voltages in CW operation). For problems that occur only for swept operation, check if the problem exists for single band sweeps. If the problem occurs only for multiband sweeps, suspect the Bandswitch Control circuit on the A6 Sweep Control assembly.

- Control related — Try different methods of entering data (i.e. RPG, data entry keys, or increment/decrement keys). If the problem is related to a specific control, troubleshoot that control and respective circuits. If the problem is related to a specific type of control (e.g. pushbuttons) refer to the A1/A2 service sheet and troubleshoot the respective interface circuit.

- Sweep Time related — Swept frequency accuracy problems that get worse with faster sweep times are probably caused by the Delay Compensation circuit on the A8 YO Driver assembly. If it is necessary to adjust the front panel PEAK control for different sweep times, the trouble is probably caused by the Delay Compensation circuit on the A7 YTM/YTF Driver.

Error Codes

RF Plug-In error codes are displayed in the Model 8350A/B left FREQUENCY display. The error codes may be generated as a result of the Instrument Preset self test (E001, E052, or E053), or during normal instrument operation (error codes E050 or E051). A description of each error code is provided in Table 8-7. Further troubleshooting information for each error code follows.

Error Code E001. Error code E001 indicates that the Model 8350A/B microprocessor is unable to properly read the Plug-In ROM. Initial checks should be made to verify proper mating of rear panel connectors with the Model 8350A/B. Also check cable connections to the A3 Digital Interface and ensure A3 is properly installed. Refer to the A3 service sheet for specific troubleshooting information.

Error Code E050. Error code E050 is generated when the Model 8350A/B microprocessor responds to an RF Plug-In keyboard flag and no key has been pressed. Check the logic state of the FLAG input to the A3 Digital Interface (A3P1 pin 42). It should be a stable logic low until a front panel key is pressed (when it is briefly strobed high). If it is not a stable low, refer to the A2 service sheet for further troubleshooting. If FLAG is a stable low, check that the L PIFLG output of A3 (A3J1 pin 39) is a stable high and pulses low when a front panel key is pressed. If necessary, trace the logic state of L PIFLG on the Model 8350A/B A3 Microprocessor.

Error Code E051. Error code E051 indicates that an invalid keycode is received by the Model 8350A/B microprocessor. Refer to the A1/A2 service sheet to troubleshoot the keyboard matrix and Keyboard/Display Interface circuit.

Error Code E052. Error code E052 is generated if there is a problem with the Interval Timer on the A3 Digital Interface. A test routine is run at power-on or when Instrument Preset self test is initiated. If Error code E052 is generated, refer to the A3 Digital Interface service sheet for further troubleshooting.

Error Code E053. Error Code E053 is generated at power-on or Instrument Preset when there is a problem with the Peripheral Interface Adapter (PIA) on the A3 Digital Interface. If error code E053 is generated, refer to the A3 Digital Interface service sheet for further troubleshooting.

Digital Control/Front Panel

A digital control problem usually affects the entire Plug-In, but may disable only a section of the instrument. Generally, a digital control problem is indicated by a front panel failure. If the problem is limited to a specific type of control (pushbutton or RPG) or display (annunciator or digital display), the indication is that of a front panel failure. An RPG failure may indicate problems on the front panel assemblies of the Model 8350A/B mainframe, where RPG pulses are decoded. If multiple front panel functions are inoperative or erratic, the problem is most likely a digital control problem. Detailed troubleshooting procedures for checking front panel operation are provided in the A1/A2 service sheet. For digital control problems, refer to the A3 Digital Interface service sheet, and check the address, data, and control line outputs of the A3 assembly.

When there is a problem with a digital-to-analog interface (i.e. DAC), the symptom is generally a discontinuity in the analog response.

Frequency Control

Troubleshooting a frequency control problem can be greatly simplified by first defining the conditions under which the problem exists. For troubleshooting, the RF Plug-In should be operated in the least complicated mode that exhibits the frequency control problem. For instance, a CW frequency is less complicated than a swept mode, and a single-band sweep is less complicated than a multiband sweep.

NOTE

To ensure accurate frequency counter readings, check for adequate RF output power.

Frequency Accuracy Problem for Band 0 (0.01 to 2.4 GHz). Frequency accuracy problems that occur only in Band 0 are most likely related to the front panel FREQ CAL adjustment. Refer to Section III for the FREQ CAL adjustment procedure.

Frequency Accuracy Problem for Bands 1 −3 (2.3 to 20.0 GHz). There is a possibility that frequency accuracy problems may appear in Bands 1−3 only, if the error is compensated in Band 0 by the FREQ CAL adjustment. If the FREQ CAL potentiometer is adjusted close to one end of its range, troubleshoot for a frequency accuracy problem in all bands.

Frequency Accuracy Problem for All Bands. Frequency accuracy problems that affect all bands are most likely caused by the A8 YO Driver being out of calibration. Perform the related adjustments in Section V before further troubleshooting.

Swept Frequency Accuracy Problem. A frequency accuracy problem that occurs only during swept frequency modes is typically a delay compensation problem. Refer to the A8 YO Driver for further troubleshooting.

Power Control

Power control problems normally fall into one of the following categories.

- No RF output power
- Maximum unleveled RF output power (no power control)
- Excessive power variations

No RF Output Power. Remove the A4 ALC assembly: the RF output power should go to a maximum level. If not, the trouble is in the RF Section. If the RF output goes to maximum, the problem is in the A4 ALC assembly.

Maximum Unleveled RF Output Power. Check leveling in External and Meter leveling modes. If power is leveled for these modes, the problem is with the internal detector. Otherwise, refer to the troubleshooting information for the A4 ALC assembly.

Excessive Power Variations. Refer to the troubleshooting information for the A4 ALC assembly.

Low Power. If unable to obtain specified maximum leveled power for frequencies greater than 2.3 GHz, try peaking the power with the front panel FILTER PEAK, and PEAK functions. Set the Model 83592C to External ALC mode (this opens the ALC loop), press **[SHIFT] [POWER LEVEL]**, and adjust the POWER control to maximize the RF output power over the 2.3 to 20.0 GHz frequency range. If this works, perform the YO-YTM/YTF Tracking adjustments in Section V. Otherwise refer to the RF Section service sheet for further troubleshooting.

RF Section

RF Section problems are usually indicated by no RF power, full unleveled RF power, excessive harmonics, or spurious responses. For an RF power problem refer to the Power Control section of this troubleshooting information. For excessive harmonics in Band 0 (0.01 to 2.4 GHz) or spurious responses, refer to the RF Section service sheet for further troubleshooting.

Table 8-7. Model 83592C Error Codes

Error Code	Function Tested	Operator Initiated Test	Troubleshooting Hints
E001	HP 8350A/B-83592C		Check the RF Plug-In connections and cable connections to A3. Do Hex Data Write to front panel and Hex Data Read of A3S1 Configuration switch. See E001 Troubleshooting in this procedure for specifics.
E050	Plug-In keyboard		Check PIFLG.
E051	Invalid key code	SHIFT 04	See A1/A2 service sheets for further troubleshooting.
E052	Interval Timer	SHIFT 55	See A3 service sheet for further troubleshooting.
E053	PIA	SHIFT 55	See A3 service sheet for further troubleshooting.

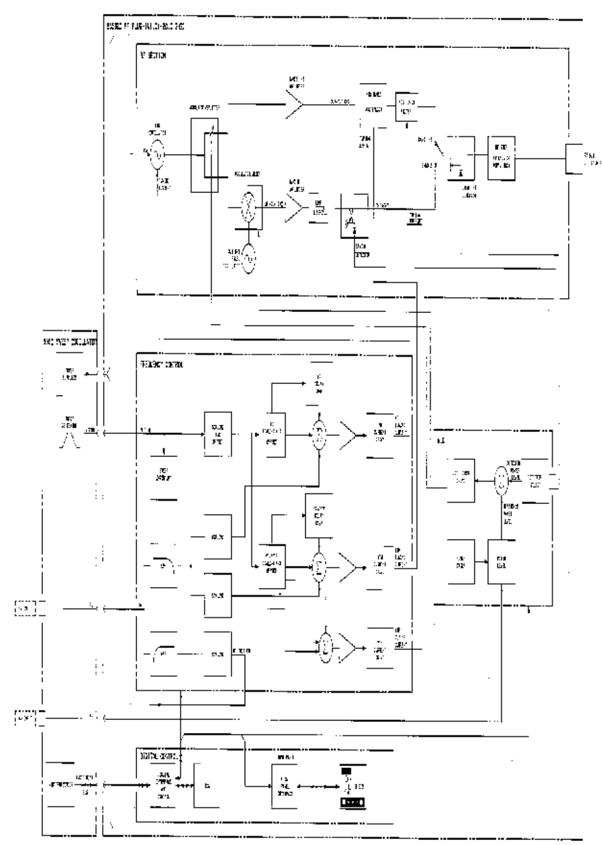


Figure 6-[illegible] RF Plug-in Simplified Block Diagram

A1 FRONT PANEL AND A2 FRONT PANEL INTERFACE, CIRCUIT DESCRIPTION

GENERAL

The A1 Front Panel and A2 Front Panel Interface assemblies provide communication between the instrument and the user. Keyboard and RPG commands are transmitted to the Model 8350A/B microprocessor for appropriate action. The numerical power level and Plug-In status information are displayed on front panel LEDs. External ALC power calibration, frequency calibration, and FILTER PEAK inputs are passed through the front panel to the Plug-In. Also, the programmable step attenuator controls and "1V/GHz" outputs are processed on the A2 assembly.

KEYBOARD

Pushbutton Switch Matrix A1: (J)

Keyboard/Display Interface A2: (A)

The pushbutton keyboard is arranged in a column-row matrix. The column lines are sequentially strobed, while the row lines are simultaneously sensed to determine when a key is depressed. The matrix scanning and sensing, along with the debouncing functions, are performed by U6, the Keyboard/Display Interface. U6 is a large-scale integrated device capable of monitoring the keyboard without continual attention from the Model 8350A/B microprocessor. When a key is depressed, U6 eliminates contact bounce, encodes and stores the column/row information in an internal register, and sets the FLAG line. When the microprocessor detects the flag, the keyboard codes are read from U6 and processed.

POWER DISPLAY

Power Display A1: (K)

Keyboard/Display Interface A2: (A)

Power Display Driver A2: (D)

The numerical power display is a four-digit, seven-segment LED configuration. Only one digit is enabled at any one time by the DIGn lines. These lines are continuously scanned by the buffered keyboard column lines from U6, providing a flicker-free display. The seven-segment and decimal point information corresponding to the enabled digit is provided by buffered lines from U6. When the display is updated, data is sequentially written into U6 from the microprocessor and stored internally. U6 is then responsible for scanning the display without requiring constant attention from the Model 8350A/B.

UNLEVELED ANNUNCIATOR DRIVER

LED Annunciators A1: (H)

Unleveled Annunciator Driver A2: (F)

U12A is one half of a dual timer serving as a triggered monostable, or one-shot. When the unleveled condition is detected, the trigger line pulses low. The monostable then goes high for a 50 millisecond period beginning at the trigger's falling edge. This ensures that the LED will stay lit long enough to be visible when triggered by a very narrow pulse. When L BP2 (Low=Blanking Pulse) is low and U9A is open, the trigger input is held high by CR6 so that the monostable cannot be triggered during retrace.

LED ANNUNCIATOR LATCH

LED Annunciators A1: (H)

LED Annunciator Latch A2: (B)

Octal latches U7 and U5 control the various front panel and pushbutton LED annunciators. When clocked by the FP3 or FP4 line from the A3 Digital Interface assembly, the latches store a byte of data from the data bus, and light the LEDs determined by the bit pattern. (Low=ON).

RF POWER CONTROL LATCH A2: (C)

U8 is a hex latch which stores six of eight data bits when clocked by the FP5 line from A3. These data lines control the programmable step attenuator (Option 002), RF on/off relay, and "1V/GHz" circuitry. The step attenuator has a 5, a 10, and two 20 dB pads internally, combining to provide up to 55 dB of attenuation in 5 dB steps. The enable (ENn) lines are inverted by U10A to provide disable (DISn) signals. The attenuator is a latching relay type, so that current is drawn only during switching. When the Plug-In RF OFF is selected, relay K1 opens and shuts down the RF path. When K1 is open, bias is removed from the low band RF amplifier (to increase on/off ratio), and the YIG Oscillator and the RF are shut off. CR3 protects U8 from high transient voltages when K1 turns off.

1V/GHz

Frequency Tracking Amplifier A2: (E)

1V/GHz Amplifier A2: (G)

U1B scales and offsets the YTF tuning voltage for the 1V/GHz circuit, providing a 0 to 6 volt ramp proportional to frequency. Switch U9D introduces an additional offset in the low frequency band only, since the RF output frequency is mixed down from a higher YO frequency. When internal leveling is used, U9C passes this voltage through Q3 to the A4 ALC and A5 FM Driver assemblies where it is used to compensate for frequency-dependent nonlinearities in various elements of the leveling loop. When external leveling is selected, U9B turns off Q3 to disable the compensation circuitry.

U1A further offsets and scales this voltage to provide 1V per GHz up to 18 GHz where U1A approaches the limit of its power supplies (current source Q2 increases this upper limit beyond the level U1A alone can produce). The 1V/GHz output is scaled regardless of the band chosen. This output is available at the rear panel of the Plug-In for use with HP 8410B network analyzers.

RPG (Rotary Pulse Generator) A1: (I)

External Leveled Power Calibration Control A1: (M)

Frequency Calibration Control A1: (L)

Filter Peak A1: (N)

The RPG provides control as selected by the keys below it (Power Sweep, Power Level, Peak, Slope), and encodes rotation into digital form for the microprocessor to use, providing a digitally-compatible control with an analog "feel". The two RPG lines pass directly to the Model 8350A/B's A2 Front Panel Interface assembly, passing through both Plug-In and mainframe motherboards. CAL adjustment introduces an offset to the leveling loop to match absolute RF power output to external leveling devices. The FREQ CAL adjustment is used to calibrate the RF frequency for Band 0 (0.01 to 2.4 GHz). This is accomplished by adding an offset to the A6 YO Driver assembly when operating in Band 0. This adjustment compensates for possible frequency changes in the A11 Cavity Oscillator, and provides improved frequency accuracy for operating at low frequencies (down to 10 MHz). The FILTER PEAK control is used to vary the offset of the YTF to provide minor tracking adjustment between the YTF and the YTM.

A1/A2 TROUBLESHOOTING

NOTE

Troubleshooting information for both the A1 Front Panel and A2 Front Panel Interface assemblies is combined. All reference designators refer to the A2 assembly unless otherwise noted.

NOTE

The entire Plug-In depends on the A3 Digital Interface assembly for control, address, and data signals. Before troubleshooting the A1/A2 assembly, verify proper functioning of A3. See Overall Troubleshooting for verification procedures.

Visually inspect the cabling inside the Plug-In for damage or loose connections. Check that the large ribbon cable connections (W29, P1 and P2) are properly seated over the correct pins on Motherboard A10J2 and A3 Digital Interface A3J1. (On Plug-Ins with Option 002 Attenuator, W29P2 may be difficult to see). Check that W3 ribbon cable connections are securely seated over A10J1 and A2J1.

Check power supplies to the front panel: +5V at A10XA3, pins 6 and 7. Then check continuity between these points and A10J1, pin 2.

Error Codes

Error codes E050 and E051 indicate a communication problem between the Front Panel Interface assembly and the Model 8350A/B microprocessor. Code implications and further troubleshooting hints are discussed later, under the subheading **Keyboard**.

Digital Display

The Plug-In display can be directly commanded by the Model 8350A/B microprocessor using Hex Data Write (see paragraph 8-22 for an explanation of Hex Data programming). An effective test pattern can be input which toggles the states of adjacent segment lines. The pattern should detect shorted lines or defective flip-flop. Press Model 8350A/B **[CW]**. Enter key sequence:

[SHIFT] [0] [0]	Hex Data mode
[2] [MHz] [ms] [0] [0]	Address location 2d00 (U6)
[M2]	Hex Data Write
[5] [5] [.] [.] [5] [5] [.] [.]	Enters four hex bytes: 55 AA 55 AA

The pattern seen in the Plug-In display should match that shown in Figure 8-9. If the patterns match, the Plug-In display is working properly, and any failures are probably due to the mainframe or Plug-In ROM.

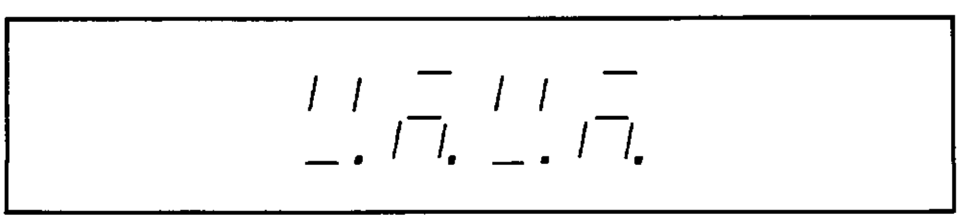


Figure 8-9. Display Test Pattern

If any of the digits in the display window appear to be stuck, or if the above test fails, remove the front panel and check the 200 kHz SCAN CLK at U6 pin 3. If no signal is detected, trace the line back through U4B to the A3 Digital Interface assembly.

Then, check the DIG1 through DIG4 lines for sequential low pulses. These can be accessed at the back of A1/A2 interconnect A2P1, pins 3, 5, 7, and 9. If they are absent, trace the problem back to U6.

The seven-segment lines, Ca through Cg, and Cdp, can be tested by programming the test pattern in Figure 8-9, then verifying activity at A2P1. Trace any problems back to U6.

To check for burned out display LEDs, make the key entry outlined above, except enter data: **[0] [0] [0] [0] [0] [0] [0] [0]**. All segments, with decimal points, should light up.

Display problems may be due to A3 Digital Interface failures. Check the L FP1 line at U6 pin 11, using Hex Data Rotation Write (see paragraph 8-22 for details).

[SHIFT] [0] [0]	Hex Data mode
[2] [MHz] [ms] [0] [0]	Address location 2d00 (U6)
[M4]	Hex Data Rotation Write

The data lines should also be checked in this mode. (Input and output patterns are illustrated in Figure 8-2.) Trace any problems back through A3.

Annunciators

Check for burned out LEDs by pressing and holding the **[INSTR PRESET]** key. All LEDs should light, except for units indicators (dBm, dB/GHz, and dB/Swp), and UNLEVELED annunciator.

Use Hex Data Write as follows, to check annunciator control capability. Press Model 8350A/B **[CW]** and enter:

[SHIFT] [0] [0]	Hex Data mode
[2] [dBm dB] [0] [0]	Address location 2E00 (U7)
[M2]	Hex Data Write
[5] [5]	Hex Data 55
[.] [.]	Hex Data AA

Alternate between 55 and AA, and check that each addressed annunciator is lit for one case and out for the other (excluding the UNLEVELED annunciator). Plug-In annunciators are controlled by two locations. Repeat the procedure for address location 2E80 (U5).

If these tests fail, remove the front panel assembly to expose the A2 assembly. Use Hex Data Rotation Write as follows:

[SHIFT] [0] [0]	Hex Data mode
[2] [dBm dB] [0] [0]	Address location 2E00 (U7)
[M4]	Hex Data Rotation Write

Check the enable lines for activity. The data bus inputs and latched outputs should also be checked for the patterns illustrated in Figure 8-2. Units annunicators are buffered by inverters, and drive current through the LED to ground rather than sinking current from +5V. The outputs of these buffers can be checked during Hex Data Rotation Write.

The UNLEVELED light is driven by pulse-stretching timer U12A, which is disabled by U9A during retrace. Check that U9 pin 3 is high during retrace (approximately 4 Vdc), and low during forward sweep. The UNLEVELED light should be lit when the available power is insufficient for leveling to the desired reference level (typically several dB beyond specified maximum leveled power).

If the UNLEVELED light is not functioning properly, select Model 8350A/B **[RF BLANK]** and disengage Model 83592C **[RF]** to turn the power off. In this mode, L UNLVL, J1-12, should be low during forward sweep and high during retrace. Connect oscilloscope channel B to the Model 8350A/B SWEEP OUTPUT, and select the A vs B mode to externally sweep the oscilloscope with the Model 8350A/B sweep ramp. Check the input (pin 6) and output (pin 5) of timer U12A. The output of U12 goes high for an initial low pulse at the Trigger input (T), and remains high for a period of approximately 50 milliseconds. Subsequent trigger pulses, occurring within the timing cycle, will not affect the output. However, if the Trigger input remains low for a longer duration than the timing cycle, the output will remain high for the duration of the trigger signal. If no trigger signal is present, check diodes CR5 and CR7, or trace the problem back to the A4 assembly.

Keyboard

The keyboard matrix is scanned continuously by U6. This LSI device continuously strobes the column lines, senses the row lines for depressed keys, eliminates contact bounce, stores the key code internally, and flags the Model 8350A/B to recover the key code. Troubleshooting is difficult because the device is so complicated, but it is worthwhile to check all signals to and from U6, probing directly on the pins of the chip, before replacing it.

Error codes E050 and E051 generally indicate U6-related problems:

- E050 occurs when the microprocessor has received a flag (L PIFLG) from the Plug-In (indicating a front panel key was pressed), but cannot recover the keycode (indicating that the key was NOT pressed). Check the FLAG output from A2U6 (accessible at A3P1-42). It should be TTL low, approximately 0 volts. Pressing a front panel pushbutton should result in a very rapid pulse. If the line appears to be locked high, replace A2U6. If it is good, check inverter A3U10F (accessible at A3J1-39) to see if it is locked low.
- E051 occurs when the key code received by the microprocessor cannot be decoded. This indicates a failure in A2U6 or a bad Row Sense line. If the Row Sense lines are good, troubleshoot the keyboard matrix with a continuity checker.

To troubleshoot the Plug-In keyboard matrix, initiate the Key Code Test. Enter **[SHIFT] [0] [4]**. Thereafter, when any Plug-In front panel key is pressed, the appropriate hexadecimal key code should appear in the mainframe FREQUENCY/TIME display window. The key codes are given in Table 8-8.

If this test indicates further troubleshooting, remove the front panel to make A2 accessible while connections between the front panel, Plug-In, and mainframe are still intact.

If the numerical display is blank, check power supplies on A2.

Check U6 pin 3 for the 200 kHz SCAN CLK signal. If it is missing, trace the problem back through U4B to the A3 Digital Interface assembly.

Initiate Hex Data Rotation Write and check the L FP2 line for activity:

[SHIFT] [0] [0]	Hex Data mode
[2] [MHz ms] [0] [0]	Address location 2d00 (U6)
[M4]	Hex Data Rotation Write

The data line inputs should also be checked in this mode. The pattern should match in Figure 8-2.

Check the COL0 through COL3 lines for sequential low pulses, as shown in Figure 8-13.

If the patterns are absent, but the 200 kHz clock is present, the problem is probably U6. Ensure that problems in U4B or the A1 assembly are not tying the lines down.

If the column strobes are present, probe both the column and row lines corresponding to the key in question at U6. Observe the traces while pushing the button. The two lines should track each other. If they track, but the microprocessor can't read the codes from U6, and the data bus is good, the problem is probably in U6.

If row and column do not track, separate the A1 and A2 assemblies and troubleshoot the keyboard matrix with a continuity tester.

Rotary Pulse Generator (RPG)

The RPG is a means of converting rotational information into digital signals which can be read by the microprocessor. The hardware components needed to decode the Plug-In RPG (counter and sign latch) are located on the Model 8350A/B A2 Front Panel Interface assembly. Some failures which appear to be in the Plug-In RPG, (e.g., 'run-away' POWER display or a locked-up sign) are likely to be caused by failures in the Model 8350A/B.

If the Plug-In RPG appears to be dead, remove the bottom cover of the Model 8350A/B and probe A10J1, pins 34 and 36. Check for the waveforms shown in Figure 8-14, while slowly rotating the RPG. If the signals are present, trace the PIRPGA and PIRPGB lines through the Model 8350A/B to the mainframe A2 assembly. Refer to Model 8350A/B A2 Service Sheet for more information.

If the signals are absent in the Plug-In, check for the +5V at A10J1, pin 2. Then remove the front panel and check for +5VR directly at the point where the RPG leads are soldered to the A1 Front Panel assembly. Then probe the two RPG output leads for the waveforms in Figure 8-11. If they are absent, check that the output leads are not shorted to ground. If not, replace the RPG.

Analog Circuitry

Analog circuitry on the A2 Front Panel Interface processes the YTF DRIVE V signal to produce the 1V/GHz rear panel output and FREQ TRK V, used in the ALC loop.

Check that the YTF DRIVE V signal is present at TP1. It should resemble the waveform shown in Figure 8-15. If it does not, trace the problem back to the A7 YTM/YTF Driver assembly.

If the YTF DRIVE V signal is present, check TP3 for the waveform shown in Figure 8-16. If it is present on the A2 assembly, but FREQ TRK V is missing on the A4 and A5 boards, probe the emitter of Q3 for the same waveform offset by approximately 0.6 Vdc.

Analog switches U9B, U9C, and U9D are controlled by latch U8. These switches apply an offset to FREQ TRK V in Band 0 only, and turn off FREQ TRK V when external leveling is used. These can be exercised by using Hex Data Write. Press Model 8350A/B **[CW]** and enter:

[SHIFT] [0] [0]	Hex Data mode
[2] [BKSP] [0] [0]	Address location 2F00 (U8)
[M2]	Hex Data Write
[0] [0]	Enters hex byte 00
[BKSP] [BKSP]	Enters hex byte FF

Note that these switches are not identical. U9B is open for logic 0, while U9C and U9D are closed.

The 1V/GHz Amplifier adds one more stage of gain and offset to FREQ TRK V, producing a scaled tuning ramp to follow the RF output frequency at exactly 1 Vdc per GHz. Check the rear panel 1V/GHz BNC output jack for the ramp. If it is absent, check TP2 for the waveform shown in Figure 8-17. If there is no signal at TP2, but there is a ramp at TP3, the problem is in U1A.

RF Power Control Latch

U8 stores commands for the RF Step Attenuator (Option 002 only) and the RF ON line, which supplies −10V bias for components in the RF path. It also controls analog switches used for the signals mentioned above.

Hex Data Rotation Write can be used to verify the outputs of U8.

NOTE

In Option 002 Plug-Ins, disconnect the attenuator cable at A2J3 before initiating Hex Data Rotation Write. The bit pattern shifts too fast to actuate the attenuator properly, and may damage it.

Initiate the check as follows:

[SHIFT] [0] [0]	Hex Data mode
[2] [BKSP] [0] [0]	Address location 2F00 (U8)
[M4]	Hex Data Rotation Write

Check L FP5 line for activity. Check data lines for the patterns illustrated in Figure 8-2.

To check the RF ON relay K1, make the same key entries as above, except enter **[M2]** for Hex Data Write. Then alternate between data inputs: **[0] [0]** and **[BKSP] [BKSP]** (FF). The RF ON line should toggle from 0 Vdc to −10 Vdc. If there is no change, check U8 pin 12 for high and low levels. If the output is locked high, check the protection diode CR3 before replacing U8. However, if CR3 is open, U8 may be damaged by actuating the relay. If the output at pin 12 is locked low, replace U8. If U8 pin 12 changes levels properly, replace relay K1.

Miscellaneous

The FREQ CAL, EXT/MTR ALC CAL, and FILTER PEAK offsets are generated by potentiometers on A1, with the wipers running between +10 Vdc and −10 Vdc. If the signals are absent, check for the +10V and −10V supplies. If the offset voltages still cannot be produced, replace the defective potentiometer, R2, R3, or R4.

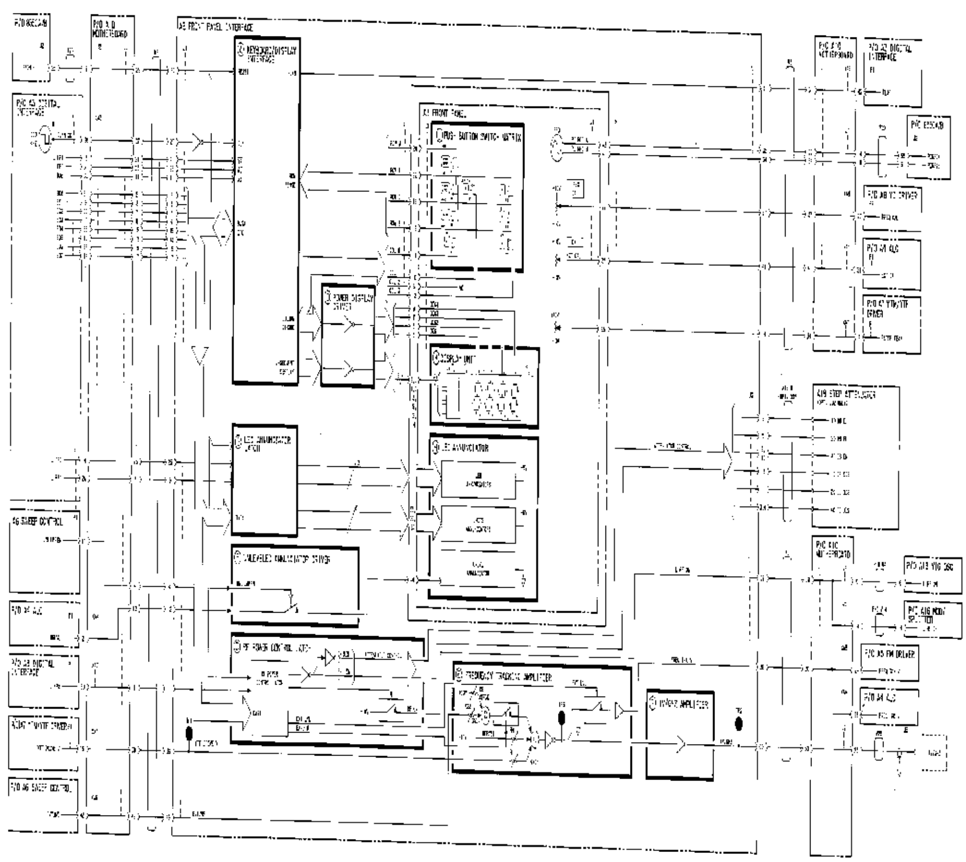


Table 8-9. Plug-In Key Codes

Key	Code	Column	Row
POWER SWEEP	5[illegible]	0	0
POWER LEVEL	[illegible]	0	[illegible]
SLOPE	[illegible]	0	[illegible]
RF	[illegible]	0	3
CW FILTER	[illegible]	1	[illegible]
NOT USED	[illegible]	[illegible]	[illegible]
NOT USED	[illegible]	[illegible]	3
NOT USED	[illegible]	[illegible]	0
NOT USED	[illegible]	[illegible]	1
NOT USED	[illegible]	[illegible]	[illegible]
NOT USED	[illegible]	[illegible]	[illegible]
INT	[illegible]	3	[illegible]
EXT	[illegible]	3	[illegible]
MTR	[illegible]	3	3

In [illegible] key [illegible] read the [illegible] column and row lines [illegible] with a continuity checker. If the [illegible] are [illegible] A2J5.

No keycode is defined for Row 0 [illegible] Column 1 or Column 3. A problem in this area of [illegible] result in Error Code PO[illegible].

A1/A2

Figure 8-19. A1 Front Panel/A2 Front Panel Interface, Block Diagram

A3 DIGITAL INTERFACE, CIRCUIT DESCRIPTION

The A3 Digital Interface assembly receives digital address, data, and control signals from the Model 8350A/B sweep oscillator. These signals are processed and then routed to the rest of the RF Plug-In. The ROM (Read-Only Memory) contains software dedicated to the RF Plug-In. The Interrupt Control circuit provides timing signals (which are controlled by the Model 8350A/B A3 Microprocessor) during bandswitching and at the beginning and end of each sweep. The A3 Digital Interface also provides data and timing information for the A2 Front Panel Interface and A1 Front Panel assemblies, as well as data, address and control signals for the rest of the RF Plug-In.

Sweep Oscillator Interface (A)

The digital data, address, and control signals from the Model 8350A/B sweep oscillator pass through the RF Plug-In interconnect and ribbon cable to J1 on the A3 Digital Interface assembly. They are buffered and inverted by Schmitt trigger inverters before passing on to the rest of the RF Plug-In. 100-ohm resistors in series with each line are included to reduce ringing on the instrument bus. U7A and U7D enable the bi-directional data buffer when either the Plug-In ROM (L BPIROME) or the Plug-In itself (L BI/OE2) is enabled. Blanking pulse L BP2 passes directly through A3 and is not buffered. It is used on the A2 Front Panel Interface for blanking the UNLEVELED light during retrace. Lastly, U10F receives the FLAG from the A2 Front Panel Interface and passes it back to the sweep oscillator.

Address Decoder (B)

The Address Decoder decodes the address and control lines to provide control signals throughout the RF Plug-In. Table 8-9 shows the decoded address lines and where they are used in the RF Plug-In.

ROM (C)

The RF Plug-In's Read-Only Memory consists of two 4k by 8-bit ROMs. This memory contains all of the firmware dedicated to the individual RF Plug-In for use by the microprocessor in the Model 8350A/B. Addresses 4000H through 4FFFH are read from U1, while 5000H through 5FFFH are found in U2. The A12 line, decoded in the Address Decoder, selects which ROM is enabled. The remaining twelve address lines (A0 through A11) determine the individual ROM address being read.

200 kHz Clock (D)

U3 is a simple oscillator with external timing elements configured to provide a stable 200 kHz pulse train. This signal is used to clock the Interrupt Control counters in U5 for interrupt timing. The 200 kHz clock is also used on the A2 Front Panel Interface to scan the keyboard and refresh the display.

Interrupt Control/Configuration Switch (E)

Triple programmable counter U5 contains three programmable down-counters and control circuitry. The counters are preloaded by the data bus, then down-counted by the 200 kHz Clock. When the count reaches zero, a pulse is produced on the corresponding output. In this way, the microprocessor can command a time interval of any duration, and will receive an interrupt when the count-down is complete.

Table 8-9. Digital Interface Address Decoding

Mnemonic	Address	Address Decoder Components	Components Addressed	Read or Write	Description
L WR	2800H to 287FH	U9	A3U5	Write	Write data to programmable interval timer.
L RD	2880H to 28FFH	U9	A3U5	Read	Read data from programmable interval timer.
L PIAE	2900H to 29FFH	U7B, U7C U8A, U10D	A3U4	RD/WR	Enable Peripheral Interface Adapter. (Also addressed 2B00H to 2BFF.)
L INST1	2C00H to 2C7FH	U10D, U13	A4, A5, A6	Write	Write control for A4 ALC, A5 FM Driver, and A6 Sweep Control.
L INST2	2C80H to 2CFFH	U10D, U13	A7, A8	RD/WR	Write to A7 YTM/YTF Driver and A8 YO Driver Control and read Offset and Gain switches.
L FP1	2D00H to 2D7FH	U10D, U13	A2	Write	Write to front panel displays.
L FP2	2D80H to 2DFFH	U10D, U13	A2	Read	Read front panel keyboard.
L FP3	2E00H to 2E7FH	U10D, U13	A2	Write	Write to front panel annunciators.
L FP4	2E80H to 2EFFH	U10D, U13	A2	Write	Write to front panel annunciators.
L FP5	2F00H to 2F7FH	U10D, U13	A2	Write	Write to RF control latch.
L ROM1	4000H to 4FFFH	U6C, U10A, U10B	A3U1	Read	Enable ROM U1.
L ROM2	5000H to 5FFFH	U6B, U10B	A3U2	Read	Enable ROM U2.

U4 is a Peripheral Interface Adapter (PIA) which controls the interrupts from U5 and reads the Configuration Switch S1. As an interrupt controller, U4 can be microprocessor-programmed to mask or enable any of four possible interrupts. These interrupts mark the end of timing intervals used during bandswitching.

Configuration Switch S1 is encoded with information to identify the Model of RF Plug-In installed (Model 83592C), and the Step Attenuator Option 002 if applicable, as well as with operator-chosen parameters such as FM sensitivity and power-up conditions. (See Table 8-10 for details.) The microprocessor addresses U4 to read the switch status at power-on or when Instrument Preset is initiated, and uses the information in subsequent calculations involving frequency range, power range, marker locations, and other Plug-In dependent parameters.

RF Plug-In Interface (F)

U17 and U14 buffer the address and data signals required throughout the rest of the RF Plug-In. U17 is a bi-directional, 8-bit data buffer, enabled when BI/OSTB, A10, and BI/OE2 are all high. Its direction is controlled by the L WRITE line. U14 is enabled by L BI/OE2 to pass four address lines (A0 through A3) to the rest of the RF Plug-In's circuitry.

A3 TROUBLESHOOTING

The A3 Digital Interface assembly is the principle exchange for digital data, address, and timing signals used throughout the RF Plug-In. The Read Only Memory (ROM) on the A3 assembly contains firmware used for Plug-In interrupt routines. Major enable lines used on the front panel and throughout the Plug-In are decoded on this assembly. Note that some digital control lines (e.g. the Stop-Sweep Request L SSRQ and RPG lines) do not pass through the Digital Interface assembly.

A failure in the A3 Digital Interface typically disables the entire RF Plug-In, and causes large errors in frequency, amplitude, and control. The front panel displays will probably be inoperative, and front panel controls will not produce any effect.

The Model 8350A/B sweep oscillator may or may not be disabled by a Plug-In failure. A simple test to determine whether the Model 8350A/B is at fault is to remove the Plug-In and press **[INSTR PRESET]** on the Model 8350A/B. If E001 is displayed, the Model 8350A/B is probably good. A different error code, especially E005, indicates problems in the Model 8350A/B.

General Troubleshooting

Visually inspect the Plug-In for damage, frayed cables, and loose connectors. Check ribbon cable W29 between the Plug-In interface and A3 assembly. Check the ribbon cable in the Model 8350A/B leading from its motherboard to the Plug-In interface.

Check the +5VB line at A3J1 pins 35, 36, or 38, to make sure power is being supplied to the Plug-In. The A3 assembly supplies +5V to the rest of the Plug-In; check A3P1 pins 6 or 7 for +5Vdc.

Check Configuration Switch A3S1 to make sure it is correctly coded for the Model 83592C Plug-In and for the Step Attenuator Option 002 if applicable, as well as for user-defined parameters (see Figure 8-10).

The A3 Digital Interface assembly is made accessible for service with the following procedure:

1. Remove the RF Plug-In from the Model 8350A/B.
2. Disconnect W29P1 from A3J1, and remove the A3 assembly from the Plug-In.
3. Replace the Plug-In in the Model 8350A/B.
4. Remove the top cover of the Model 8350A/B.
5. Insert a 44-pin extender board into A10XA3.

6. Install the A3 assembly on the extender board, and reconnect W29P1.

RF Plug-In Self Test

Major portions of the A3 Digital Interface assembly and the Instrument Bus connecting it to the Model 8350A/B are tested by the Self Test routine performed at Instrument Preset or power-on.

The Plug-In ROM is tested by reading a test pattern out of ROM, then performing a "checksum" on the entire range of ROM. If the test passes, this ensures that the data bus, address bus, and major timing lines to the A3 assembly, as well as the ROM address decoding and the ROM itself, are good. If the test fails, error code E001 appears, indicating a fault in these components or the Instrument Bus.

Other error codes (between E050 and E099) indicate specific problems in the Plug-In. These can occur either at Instrument Preset or power-on, or during normal operation, and are discussed in greater detail below.

The L IRD, FLAG, and PIIRQ lines are not tested by the routine, nor are the internal data busses (BD0 − BD7) and address busses (BA0 − BA3).

An error code indicates a failure in specific components. If Self Test passes, these components are very probably working correctly. Hence, the troubleshooting information below is in three sections:

- Error Code E001 Plug-In Failure
- Other Error Codes
- No Error Code Displayed

Refer to the appropriate section indicated by the Self Test results.

Error Code E001

Error code E001 indicates a failure in one or more of the following areas:

- Connections between Model 8350A/B-Plug-In interface and Instrument Bus
- Model 8350A/B-Plug-In interface
- Connections between Model 8350A/B-Plug-In interface and A3 assembly
- Plug-In buffers
- ROM Address Decoding
- ROM

The Instrument Bus internal to the Model 8350A/B is checked during Self Test and will produce error E005 on failure. However, branches from the Instrument Bus leading to the Plug-In are not tested.

In the Model 8350A/B, check cables between the Motherboard and the Model 8350A/B chassis connectors J2 and J3 leading to the Plug-In, for damage or loose connections. Likewise, in the Model 83592C, check the cabling between chassis P1 and P2 and the A10

Motherboard or A3 Digital Interface. Next, check the individual pins and sockets of the Model 8350A/B-Plug-In interface connectors for bent or missing pins.

Make sure that the A3 assembly is firmly seated into its motherboard socket, and that ribbon cable connections are making good contact.

Perform the Hex Data Read by entering:

[SHIFT] [0] [0]	Enters the Hex Data command
[4] [0] [0] [0]	Address location 4000
[M3]	Hex Data Read

The Model 8350A/B FREQUENCY/TIME display should indicate 55. Increment the address to 4001 by pressing [⇧], and the FREQUENCY/TIME display should indicate AA. If these numbers are read, the data lines and the 4000H ROM enable line are functional.

If these tests do not execute, run the Hex Data Rotation Write by entering:

[SHIFT] [0] [0]	Enters the Hex Data Write command
[4] [0] [0] [0]	Address location 4000
[M4]	Hex Data Rotation Write

Check the 4000H line to U1 for activity, and if there is none, troubleshoot the address decoding circuitry. Repeat the above key sequence substituting address location **[5] [0] [0] [0]**. Check the 5000H line to U2 for activity.

The address lines can be checked by using the Hex Data Write feature of the Model 8350A/B. Alternate ones and zeros are written on the address lines when writing to address location 5555H or 2AAAH. By performing a Hex Data Write to each address location, all thirteen address lines are pulsed high and low.

On the Model 8350A/B, enter:

[SHIFT] [0] [0]	Enters the Hex Data command
[5] [5] [5] [5]	Address location 5555
[M4]	Hex Data Rotation Write

Check that all even address lines (A0, A2, . . . A12) are pulsed high, and all odd address lines (A1, A3,...A11) are low.

On the Model 8350A/B, enter:

[SHIFT] [0] [0]	Enters Hex Data command
[2] [A] [A] [A]	Address location 2AAA
[M4]	Hex Data Rotation Write

Check that all odd address lines are pulsed high and all even address lines are low.

Other Error Codes

Error codes E052 and E053 indicate a failure on the A3 Digital Interface assembly. These codes, along with troubleshooting hints related to the indicated failures, are listed below.

Error Code E052

Error code E052 indicates a failure in triple programmable timer U5 or the 200 kHz Clock.

First check the 200 kHz Clock. The SCAN CLK line is accessible at U3 pin 3, at the top of the A3 assembly, so it is not necessary to remove the A3 board to test it. The output frequency should be approximately 200 kHz. The pulse train is NOT symmetrical, and has TTL levels. If no clock signal is found, suspect U3.

If the SCAN CLK is present, yet E052 occurs, then the failure is probably in U5. Press **[SHIFT] [5] [5]**, and check the L WR and L RD lines for the waveforms shown in Figure 8-19. If either control line is inactive, troubleshoot the address decoder U9. If the control lines are working, check the CTR 0 and CTR 1 waveforms as shown in Figure 8-21. If they are incorrect, replace U5.

Error Code E053

E053 generally indicates a failure in the PIA, U4. However, the problem might be in the output stages of U5. Enter **[SHIFT] [5] [5]**, and check CTR 0 and CTR 1 waveforms as shown in Figure 8-19. If they are correct, U5 is functional. Next, check the L PIAE line as shown in Figure 8-19, and make sure the L WRITE line shows activity. If not, troubleshoot the appropriate address decoding circuitry or buffer. Then check L PIIRQ for the square wave shown in Figure 8-21. If it is inactive, replace U4.

No Error Code

If no error code occurs and the Model 8350A/B display shows the correct START and STOP frequencies of the Plug-In, the Plug-In Self Test passed successfully. This verifies the Instrument Bus to the Plug-In, data and address busses on the A3 Digital Interface assembly, and Plug-In ROM. Any Plug-In failures which are traced back to the A3 assembly are due to failures in one or more of the following areas:

- Address Decoding
- Plug-In Buffers
- Interrupt Control/Configuration Switch
- Miscellaneous Control Lines

If problems occur only when a multiband sweep is performed, suspect the programmable timer, U5. If the Model 8350A/B display shows the wrong frequencies, first check Configuration Switch S1 against Table 8-10, and then troubleshoot the PIA, U4.

Address Decoder

The primary address decoding for the Plug-In occurs on the A3 assembly. The enable lines are then passed on to the rest of the instrument. The Major Address Decoder Test can be utilized to check all these lines. Enter:

[SHIFT] [5] [3]

Then check the outputs of U6B, U6C, U7B, U9, and U13 for the signals shown in Figure 8-22. The address lines have been verified by the Self Test. Therefore, if the L PIAE or ROM enable lines are faulty, troubleshoot the discrete address decoding logic involving U6, U7, U8, and U10, and replace the defective component. If other pulses are missing or displaced, replace the appropriate decoder, U9 or U13.

Plug-In Interface

U14 and U17 buffer the address and data lines for use throughout the Plug-In. The address and data busses on the A3 assembly have been verified by the Instrument Preset Self Test. Therefore, if address or data is not being passed to another assembly, the fault lies with U14, U17, U6A, or a motherboard connection.

The address lines can be exercised by performing the Minor Address Decoder Test. On the Model 8350A/B, enter:

[SHIFT] [5] [4]	Minor Address Decoder Test

Verify activity on each of the buffered address lines (BA0 − BA3).

Data lines can be verified by performing a Data Rotation Write to any address location between 2C00H and 2FFFH. On the Model 8350A/B, enter:

[CW]	Sets Model 8350A/B into CW mode
[SHIFT] [0] [0]	Enters the Hex Data command
[2] [GHz s] [0] [0]	Address location 2C00
[M4]	Hex Data Rotation Write

Check for activity on each of the buffered data lines (BD0 − BD7), and check for shorts between lines.

Interrupt Timer/PIA

The PIA is responsible for two functions:

- Reading the Configuration Switch
- Routing the Interrupts from the triple timer

NOTE

Before changing the Configuration Switch settings, write down the switch positions, and return the switches to their original settings after troubleshooting.

The PIA's read capability can be checked by entering:

[CW]	Sets the Model 8350A/B into CW mode
[SHIFT] [0] [0]	Enters Hex Data command
[2] [9] [0] [0]	Address location 2900
[M3]	Hex Data Read

Watch the display change as the Configuration Switch is toggled.

The triple timer and PIA's interrupt masking capability are tested using a special routine at **[INSTR PRESET]** or power-on. Error codes E052 or E053 are displayed if a failure is detected. If these error codes are found, or if either U4 or U5 are suspect for other reasons, a special test pattern can be accessed by entering:

[SHIFT] [5] [5]	Interrupt Control Test

The waveforms shown in Figure 8-21 should be displayed. Refer to "Other Error Codes" for details on these error codes and the **[SHIFT] [5] [5]** Operator Initiated Self Test.

A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION

The A4 Automatic Leveling Control (ALC) assembly is part of a closed loop power leveling function, designed to control the amplitude of the RF output power. The General section below describes loop operation, including some components external to the A4 assembly. The rest of this operational theory is devoted to detailed description of the circuits found on the A4 assembly.

General

The circuits which accomplish power control and power leveling can be divided into two categories: internal loop circuitry, and external components of the loop. Figure 8-24 illustrates this theme.

The Power Level Reference leg of the ALC establishes the desired power level. This is accomplished by pressing the Plug-In **[POWER LEVEL]** pushbutton and rotating the RPG or entering the desired reference on the Model 8350A/B front panel DATA ENTRY keys. This leg of the ALC is not an interdependent part of the loop, as shown in Figure 8-24.

The detector leg of the ALC loop samples the actual RF output power and produces a voltage proportional to RF amplitude. This voltage is converted to log scale and compared with the Power Level Reference signal. If the voltages at the summing junction (TP4) are not of equal magnitude an error voltage is generated. This error voltage is amplified and converted to a current drive for the RF modulators which vary the transmitted RF power to correct the error and achieve the desired RF power level.

Address Decoder and Control Latches (A)

U12 is a 3-to-8 decoder, selecting address 2C07H when it is present on the address bus. This address serves as a chip enable for octal latch U13. Information on the data bus is then latched into U13 and used throughout the A4 assembly.

Detector Inputs and Selection Switches (B)

Control lines MUX A0 and MUX A1 are encoded with leveling mode and band selection information. The lines are decoded in Table 8-13. U6 decodes these control lines to select the proper detector input for the desired operating mode.

R33 and R4 BIAS adjustments offset the Band 0 internal detector so that 0 volts at TP10 corresponds to no RF power.

EXT/MTR ALC input provides external crystal leveling capability within the −10 to −200 mV range. VR1 and VR2 provide protection against transients. Two Schottky diodes, CR2 and CR3, are mounted between the EXT/MTR ALC connector and the front panel casting for similar protection.

When MTR (power meter) leveling is selected, U1 inverts the positive RECORDER output (approximately 0 to +1 Vdc full scale) of the HP 432A R41 and C9 compensate for the power meter response. Additional compensation occurs in the Main ALC Amp (Block I).

Sample and Hold Driver (H)

Q2B switches between saturation and cutoff, controlling both of the sampling FETs, Q1 and Q3. The Sample and Hold function of the ALC loop is used in conjunction with pulse modulation. When PULSE ENABLE is high, and either L PULSE or SQ MOD input is low, Q2B will saturate, initiating the Hold mode.

The frequency of the sampling mode is dependent on the L PULSE or SQ MOD input. When the system is used with the HP 8756 Swept Amplitude Analyzer, the SQ MOD input will be a 27.8 kHz square wave, controlling the gates of Q1 (Block **D**) and Q3 (Block **G**). (Refer to Model 8350A/B Operating and Service Manual, Section V, for 27.8/1 kHz Oscillator adjustment.) This ensures that sampling occurs only during the ON pulse. The sample level is maintained during the OFF pulse, thus preventing saturation of the Log and Main ALC amplifiers.

The SQ MOD input is also connected to the PIN Mod 0 and PIN Mod 1 Drivers (Blocks **K** and **L**) for RF modulation when the Model 8350A/B internal squarewave modulation is used.

Input Sample and Hold (D)

The Input Sample and Hold function prevents the Log Amplifier from saturating during pulse modulation.

U8 is a unity gain follower with internal feedback which buffers the detector input. R59 compensates for the offset voltage of the operational amplifier. Q1 and C11 perform the sample and hold function. Q7 and Q8 in the Log Amplifier select the appropriate detector return for INTernal and EXTernal leveling modes.

Log Amplifier (E)

The logarithmic scaling function is performed by Q6A in the feedback loop of U7. Q6A collector current is proportional to the voltage at TP12 and exponentially related to its base-emitter voltage. Therefore, Q6A emitter voltage is logarithmically related to the input voltage at TP12.

Q6B compensates the Log Amp against changes in reverse saturation current with temperature.

CR4 provides a positive current path preventing U7 from saturating when the input is greater than or equal to 0 volts.

U6 decodes MUX A0 and MUX A1 (Table 8-12) to select the proper offset voltage for power calibration at the low end of the Plug-In power range. In EXTernal ALC, the power level calibration is set with the front panel EXT CAL potentiometer.

U5 amplifies the logged output for comparison with the Power Level Summing signal (Block **F**). R7 and R8 adjust the gain of U5, and calibrate midrange power levels for their respective bands. R9 is selected during power meter leveling to adjust the gain of the log amp for compatibility with the HP 432A Power Meter.

Guarded-gate FETs Q7 and Q8 select the appropriate detector return for INTernal and EXTternal leveling.

Power Level Reference (C)

Power Level Summing (F)

U14 is a 12-bit microprocessor-compatible D/A converter, which latches data in three 4-bit nibbles. The −10V REF input sets the DAC for a maximum output (TP2) of +10V. The voltage at TP2 is the product of −10V REF and the fractional binary input of the DAC.

The voltage at TP1 is the sum of several voltages, depending on the operating mode of the Plug-In. U3A sums PWR SWP/COMP and AM inputs. In addition, selected feedback resistors R2 and R3 reduce gain to compensate for detector deviation from square-law at the upper limits of the Plug-In power range.

The EXT CAL input is summed through amplifier U3C. R31, in the feedback loop of U3C, provides temperature compensation for the Log Amplifier and detectors.

Error, Sample and Hold (G)

TP4 is the summing junction for the Power Level Summing output, Log Amplifier output, and FREQ TRK V. FREQ TRK V is a 0 to 5 volt ramp proportional to the YTF DRIVE Voltage. R1 (SLP) adjusts the overall slope of Band 0.

Under leveled power conditions, the voltage at TP4 is zero. A non-zero voltage represents an error and forces a change in modulator current until power is again level.

U3D buffers the error voltage. Q3 provides sample and hold capability during pulse modulation. R69 reduces the coupling effect of parasitic capacitance in Q3.

C18 and C19 (Band 0 only) provide the proper sample and hold switching delay.

Main ALC Amp (I)

Unleveled Signal (J)

Both inputs to integrator U11 are at virtual ground under leveled power conditions, allowing for immediate response to an input error voltage.

R11 optimizes the speed at which the loop responds to power level changes.

L RFB goes low during bandswitching to blank the RF power, thus preventing the loop from saturating. When Model 8350A/B RF BLANK is selected, L RFB goes low during retrace also: U2D closes, pulling current through C22, forcing TP6 high and turning on the PIN modulators.

C21 compensates for the response time of the ALC loop during power meter leveling to prevent oscillations.

Under unleveled conditions, VR4 and VR5 will clamp the output of U11 at approximately −4 and +4 volts, preventing negative or positive saturation. When the output of U11 approaches −2 volts, comparator U15 activates the front panel LED indicating unleveled power.

Collector current in common-base transistor Q14 is exponentially related to the base-emitter voltage. PIN modulators are driven exponentially to maintain constant loop gain.

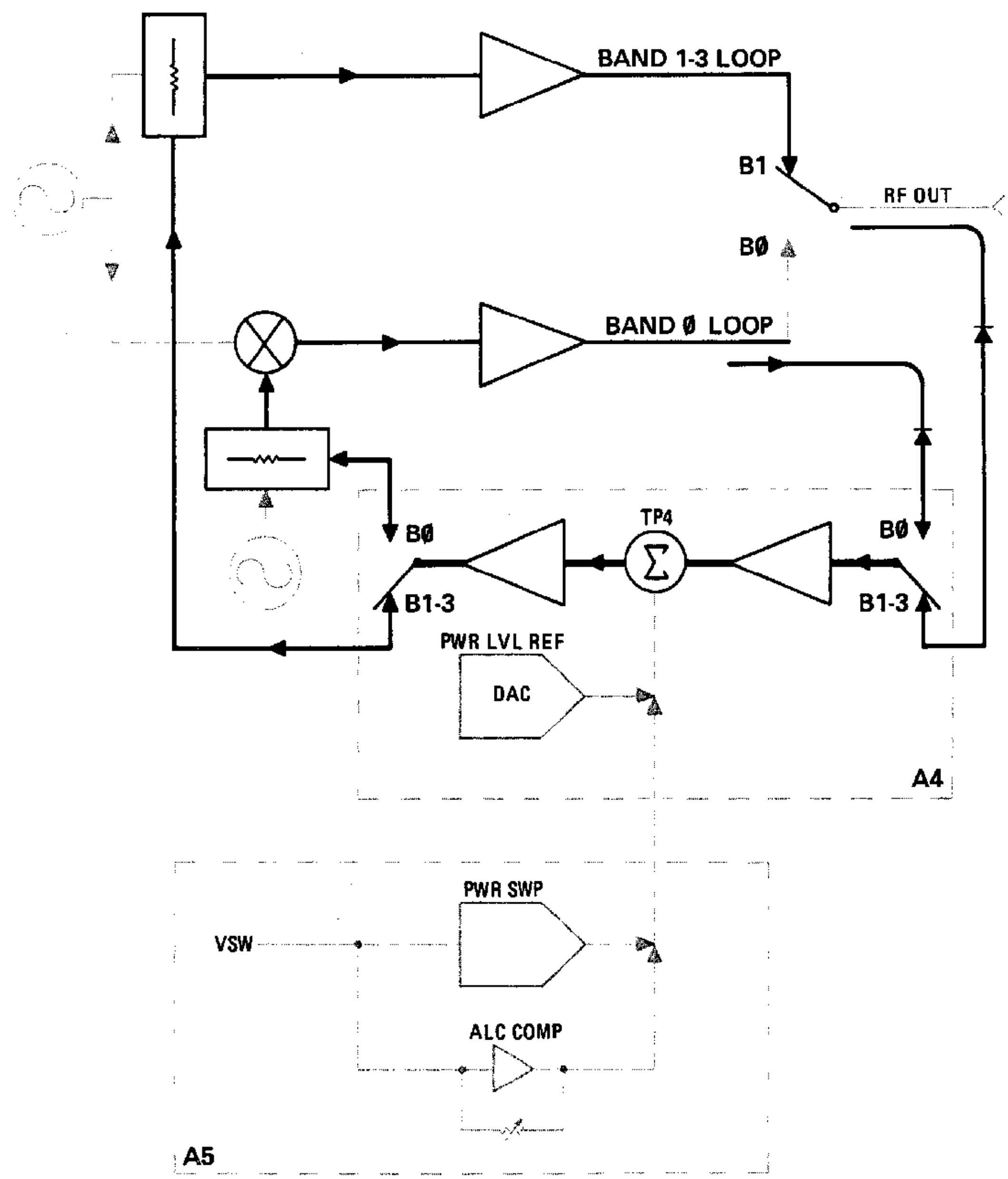
Emitter-follower Q13, and CR7 and CR9 control the gain of the exponential current drive.

PIN Mod 0 Driver (L)

PIN Mod 1 Driver (K)

R96 and R97 compensate for the loss of modulator sensitivity under high power conditions.

Q9 (Block L) or Q10 (Block K) increase isolation between Band 0 and Band 1 by shutting off the modulator in the inactive band. Q16 and Q17 provide squarewave modulation and RF blanking, when selected.



NOTE

DARKER LINES REPRESENT THE BAND Ø AND BAND 1-3 LEVELING LOOPS. LIGHTER LINES REPRESENT CIRCUITRY WHICH CONTRIBUTES TO, BUT IS NOT CONTAINED WITHIN, EITHER LOOP.

Figure 8-24. Simplified ALC Block Diagram

A4 ALC TROUBLESHOOTING

NOTE

To ensure that Option 002 Plug-Ins remain at the same attenuator setting during troubleshooting, press [SHIFT] [POWER SWEEP]. This allows full ALC control without changing attenuator settings.

Since the Automatic Leveling Control (ALC) function of the Model 83592C RF Plug-In includes many individual components arranged in a highly interdependent closed loop, the scope of the A4 ALC Troubleshooting section extends well beyond the limits of the A4 assembly. Portions of the A5 FM Driver assembly, and several microcircuit components which contribute to the power leveling function, are discussed below.

The ALC loop is a complex feedback loop which monitors the RF output power and continuously corrects for any deviation from the desired power level. Because it is a closed system, it is difficult to isolate cause from effect when a problem arises. Therefore, the key to troubleshooting is to examine individual components, correlating the expected output for a particular input signal.

This troubleshooting outline is organized into two major sections: Troubleshooting Symptoms, and Troubleshooting Diagnostics. The section entitled "Symptoms" (1) characterizes possible failure modes, (2) provides some general troubleshooting hints, and (3) refers the reader to more detailed procedures found under "Diagnostics."

Troubleshooting Symptoms

The procedures outlines below help to systematically characterize the failure as quickly as possible. The following failure symptoms are discussed:

RPG / POWER DISPLAY FAILURE
UNLEVELED (LED)
FLATNESS / OSCILLATIONS (Power Dropouts)
FULL UNLEVELED POWER
NO POWER (Single Band)
NO POWER (All Bands)
POWER SWEEP / FLATNESS

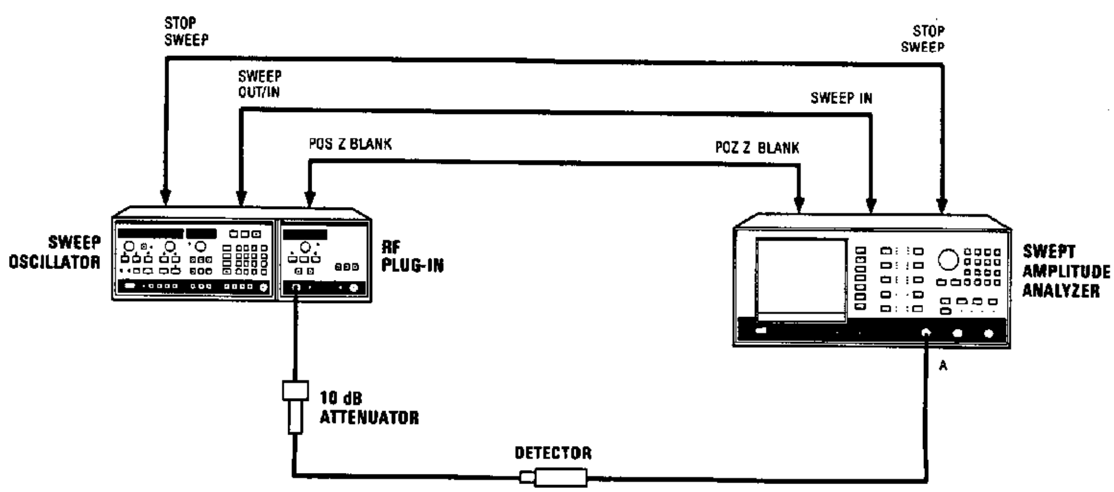


Figure 8-25. Typical ALC Troubleshooting Setup

Evaluating the specific failure may require an HP 432A Power Meter or the HP 8756A Swept Amplitude Analyzer with the HP 11664B Detector. (However, a crystal detector with an "A vs B" oscilloscope may often be substituted.) Figure 8-25 configures a typical test setup. Initiate all tests with the **[INSTR PRESET]** condition.

RPG / POWER DISPLAY FAILURE

Check that the POWER display changes when either the RPG is rotated or data is entered via the Model 8350A/B keyboard. This verifies that the digital information is reaching the mainframe, is properly processed, and is then displayed.

- If the display is flashing rapidly or showing random patterns, refer to A1/A2 Front Panel or A3 Digital Interface Troubleshooting. If the RPG causes a change in the measured RF power level, but the POWER display remains the same, refer to A1/A2 Troubleshooting. If the RPG produces no response whatsoever, or if the front panel display is blank, refer to A1/A2 Troubleshooting, and trace the problem back to the Model 8350A/B mainframe.

UNLEVELED (LED)

If the UNLEVELED light turns on during the sweep, enter a sweep time of 20 seconds (i.e. one second per GHz). Observe the sweep light on the Model 8350A/B Sweep Oscillator, and determine at which times during the sweep the UNLEVELED light turns on.

- If the UNLEVELED light remains lit during retrace, suspect problems in the front panel annunciator drivers. Refer to A1/A2 Troubleshooting.

- If the UNLEVELED light blinks briefly at the beginning of the sweep, the heterodyned Band 0 may be sweeping through 0 Hz and causing an ALC drop-out. Check this by slowly increasing the start frequency. If the UNLEVELED light stops blinking, enter a CW frequency of 0 MHz and adjust the Model 83592C front panel FREQ CAL knob to the center of its adjustment range that keeps the UNLEVELED light on. Press **[INSTR PRESET]** and observe the UNLEVELED light. A frequency counter may be used to check frequency accuracy at 10 MHz or 50 MHz. If necessary, refer to Section V, Adjustments, in this manual, and perform the Frequency Accuracy calibration procedure.

- If the UNLEVELED light is on only during the first two seconds of the sweep (10 MHz to 2.4 GHz), the problem is in the Band 0 loop. If it is lit after the first two seconds of the sweep but prior to retrace, the problem is related to Bands 1 through 3. In either case, the Reference leg of the ALC circuitry and those components common to all bands are probably NOT at fault. Check the appropriate detector, modulator, and detector selection switch.

- If the UNLEVELED light is on during the entire forward sweep, suspect components common to all bands.

- If the UNLEVELED light flashes on briefly three times during the sweep (at 2, 7, and 13.5 seconds into the trace), the problem occurs at the bandswitch points. Check for the RF blanking (L RFB) pulses during bandswitch at A4P1-29, as shown in Figure 8-32. If the signal is missing, trace the problem back through the Model 8350A/B, to the blanking request (L RFBRQ) line on the RF plug-in A6 assembly. If L RFB is present, but A4TP6 does not clamp at +4 Vdc during blankling, suspect A4U2D or A4U11.

- If the UNLEVELED light flashes briefly during the sweep, but does not imply any of the above failure modes, check power flatness. See below.

FLATNESS / OSCILLATIONS (Power Dropouts)

Monitor the RF output with the HP 8756A as shown in Figure 8-25. Optimize the output power with the front panel PEAK control.

- If the power level is constant across the sweep within approximately 5 dB, then the Plug-In may only require ALC flatness adjustments. Refer to Section V, Adjustments, in this manual, for the Internal Leveled Flatness adjustment procedure.

- If the measured power level lies between +10 and −5 dBm, but cannot be controlled via the front panel, refer to the Digital Control section under Troubleshooting Diagnosis.

- If the trace appears chopped or broken the loop may be oscillating. Refer to Section V, Adjustments, in this manual, and perform the ALC Gain adjustment procedure.

FULL UNLEVELED POWER (One or More Bands)

If power is unleveled in Band 0 only or Bands 1-3 only, select a sweep width within the unleveled band(s). If power is unleveled in all bands, continue to sweep the Plug-In's full range.

- Attempt to level the power externally using the HP 432A Power Meter as shown in Figure 8-26 (use HP K486A mount above 18 GHz). Select **[MTR]** leveling, and enter a 100 seconds sweep time. If the RF power is now leveled the failure is most likely in the detectors or the Detector Selection Switch, A4U6. Refer to the following paragraph. If this does not prove to be the case, the problem may be in the two analog switches U4B and U6A. It may be necessary to perform the ALC adjustments in Section V of this manual.

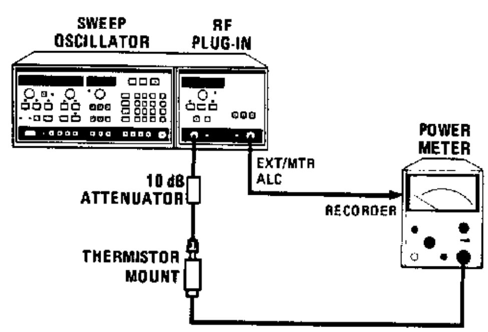


Figure 8-26. Power Meter Leveling Setup

- Check the Detector Selection Switch by entering a CW frequency within the band or leveling mode in question and trace the detector voltage through U6B. If the input to be selected does not match the output, check the MUX A0 and MUX A1 lines (see Table 8-12). Also check U12 and U13 as described under Digital Control.

- Check the voltage at TP6. If it is at +4 Vdc, suspect the Mod Drivers or Modulators. If it is below −2 Vdc, suspect the Detectors and Detector Leg.

NO POWER (Single Band Only)

If no power is detected in one band, but there is leveled power in another band, suspect the components of the RF path appropriate to the faulty band within the ALC loop.

NOTE

Turn off LINE switch before removing or installing any assembly.

With the ALC assembly removed from the Plug-In, 27.8 kHz squarewave modulation from the Model 8350A/B is not available. However, the HP 8756A 27.8 kHz squarewave can be connected to the rear panel PULSE IN connector to maintain HP 8756A compatibility.

- To check the RF components, remove the A4 ALC assembly from its socket. This removes all bias from the modulators, and should allow maximum power through the RF path in all bands. If full power (over +8 dBm) is then detected in all bands, the RF Amplifiers (A14 and A17), the Cavity Oscillator (A11), the DC Return (A15), the Isolator (AT1), the YTM (A12), and the YTF (A20) are verified. Suspect primarily the appropriate detector. Also inspect the appropriate modulator, as well as the A4 Mod Drivers and Detector Selection Switch.
- If the RF signal for Bands 1 through 3 is missing, check the A6 SRD and PIN Diode Bias circuit. If the PIN diode switch bias signal is not getting through, or the B0 control line is missing, the Switched YTF will come up in the Band 0 position.

NO POWER (All Bands)

NOTE

Turn off line power before removing or installing any assembly.

- If no power is detected in any band, remove the A4 ALC assembly. This removes all bias from the modulators, and should allow full RF power to be transmitted. If there is still no power, check the rear panel AUX OUTPUT for approximately 0 dBm to verify that the A13 YIG Oscillator is providing an RF output. Refer to RF Troubleshooting for details.
- If removing the A4 assembly causes full unleveled RF power to appear, reinstall the board and check A4TP6. If less than −2 Vdc is present, verify that TP9 is approximately −8 Vdc in Bands 1-3 (0 Vdc for Band 0). If A4TP6 is at +4 Vdc, suspect any circuitry between the Detector Selection Switch and A4TP6, particularly the Log Amp.

POWER SWEEP / FLATNESS

- If power increases smoothly with frequency, and POWER SWEEP is NOT selected, suspect problems with the A5 FM Driver assembly.

NOTE

Turn off line power before removing or installing any assembly.

- Remove the A5 board from the Plug-In. If the situation improves, suspect a failure on the A5 assembly.

- If the RF power is leveled within approximately 5 dB, refer to Section V, Adjustments, in this manual, and perform the Internal Leveled Flatness adjustment procedure.

Troubleshooting Diagnostics

The troubleshooting information below is organized into functional areas:

DIGITAL CONTROL Ⓐ
REFERENCE POWER LEVEL Ⓒ Ⓕ
DETECTORS DC1, CR1 / DETECTOR SELECTION SWITCH Ⓑ
DETECTOR LEG Ⓓ Ⓔ
MODULATOR LEG Ⓖ Ⓘ
MOD DRIVERS Ⓛ Ⓚ
MODULATORS A17, A13

DIGITAL CONTROL Ⓐ

Address Decoder U12 and Control Latch U13 control digital switches throughout the A4 assembly. Their operation can be confirmed by performing the Hex Data Rotation Write at address 2C07 Hex. Enter the following key strokes:

[SHIFT] [0] [0]	Enters Hex Data command
[2] [GHz s] [0] [7]	Address location 2C07 (U13)
[M4]	Hex Data Rotation Write

Check the outputs of U13 for the waveforms shown in Figure 8-2.

- If any output signal is missing or misplaced, check the data lines against Figure 8-2. If no output is found, look for activity at U13 pin 11. Check for L INST1 and BA3 to pulse low, while BA0, BA1, and BA2 pulse high. If these pulses are missing, trace the problem back to A3 Digital Interface.

If the Digital Control section is working, the primary outputs of U13 are easily controlled by selecting the appropriate front panel function while in the CW sweep mode. (e.g., B1 is held high by selecting a CW frequency in Bands 1 through 3; selecting MTR leveling holds the PM line high, etc.).

REFERENCE POWER LEVEL Ⓒ Ⓕ

The Reference Power Level Leg produces a voltage proportional to the desired power level. This signal is a summation of the absolute power reference, AM, ALC compensation, and power sweep signals.

The ALC compensation and power sweep signals are generated on the A5 FM Driver assembly. If an A5 failure is suspected, refer to troubleshooting information on the A5 Service Sheet. Unless A5 is suspect, simplify A4 troubleshooting by turning off the line power and removing the A5 assembly. Although power sweep will be disabled and the power flatness will be lost, the ALC loop should still level without the signals provided by the A5 assembly.

DAC U14 establishes the absolute power level. The −10V REF from the A6 assembly is scaled to yield from 0 Vdc (−5 dBm displayed) to +10 Vdc (+20 dBm displayed) at TP2. (This breaks down to a voltage step of 0.40 Vdc per 1.0 dB of power over the dynamic range, or 6.00 Vdc at +10 dBm.)

A self-test routine is available to exercise the ALC DAC. Enter:

[SHIFT] [5] [0]

The waveform in Figure 8-31 should be seen at TP2. Note that the exercise routine for the 12-bit DAC yields a staircased waveform with 13 levels. The first step shows the maximum +10 Vdc output with all bits high. The following levels represent the voltage at TP2 with successive bits loaded high in order from the Most Significant Bit to the Least Significant Bit.

- If the waveform at TP2 is not correct, check for −10V REF, and trace any problem back to the A8 assembly. Look for activity on L INST1, BA0, and BA1. BA2 and BA3 should pulse high as each new DAC value is loaded, pulsing the CS line (U14 pin 8) low. If any of these lines, or data line, appears dead, trace the problem back to the A3 assembly.

  U3A adds PWR SWP/COMP and AM, and provides detector flatness compensation at higher power levels with CR2 and CR3. Use the EXT MTR mode to bypass these diodes while troubleshooting.

  U3C adds the front panel amplitude adjustment (EXT CAL) used with external leveling. The following levels should be seen at TP1 with A5 removed and INT leveling selected: +0.3 Vdc for −5 dBm, and +7.0 Vdc for +20 dBm. An amplitude modulation (AM) signal of 1.0 V p-p at P1-4 will produce roughly 260 mV p-p at TP1. (Note that U4A, CR2, and CR3 in the feedback path around U3A change the gain depending on the band and the desired power level. This may result in a 1.0 Vdc difference between bands at +20 dBm.)

DETECTORS DC1, CR1 / DETECTOR SELECTION SWITCH (B)

The detectors DC1 (Band 0) and CR1 (Bands 1-3) are tested simply by checking their output voltages under full leveled power or full unleveled power conditions. The A4 assembly must be installed for troubleshooting in Band 0 as it supplies bias current to the Band 0 detector.

NOTE

The 27.8 kHz modulation signal required for HP 8756A compatibility is not available from the Model 8350A/B when the A4 assembly is removed from the Plug-In and must be supplied from the HP 8756A through the rear panel PULSE IN connector.

- If no power is measured in the suspected band, turn off the line power and remove the A4 assembly. Return power to the instrument. (If there is still no RF power, suspect components of the RF path. Refer to RF Troubleshooting.) If full unleveled RF power is obtained, apply two narrow strips of cellophane tape to the pin-edge connector at P1-19 and P1-44 to isolate the outputs of the modulator drivers from the modulators. Reinstall the A4 board. This removes bias from the modulators, allowing full RF power transmission, while providing detector bias.

If full leveled power (+4 dBm) or full unleveled power (at least +6 dBm) is measured, sweep only the band in question and check the voltages at the detector inputs against the values shown in Table 8-11. (Use high-impedance 10:1 probes.)

If the detectors are working and the Detector Selection Switch is suspected, sweep only in the faulty band and monitor TP15 for the voltages seen at the selected input of U6B.

Table 8-11. Detector Voltages

Band	Full Leveled	Full Unleveled
Band 0 (A4P1-21)	−60 to −80 mV	−120 to −80 mV
Bands 1−3 (A4P1-20)	−40 to −50 mV	−80 to −100 mV

If the EXT/MTR ALC INPUT circuits are suspected, select the desired mode and supply a test signal (low-level DC or sine wave) in the front panel BNC connector, and trace it through U6B at A4TP15.

NOTE

Remove any tape applied to edge connector pins in the previous procedure.

DETECTOR LEG

The Detector Leg of the ALC loop includes components between the Detector Selection Switch and the Error Summing Amplifier U3D.

Before troubleshooting the Detector Leg, be sure the Detectors and Detector Selection Switch are working correctly. See above.

The Detector Leg can be effectively tested by using the Open Loop method of troubleshooting. This procedure utilizes the external leveling mode EXT by supplying an external DC voltage or sine wave to the EXT/MTR ALC INPUT connector. This method breaks the ALC loop and allows waveforms to be checked against known test signals. See Figure 8-32.

MODULATOR LEG

The Modulator Leg includes the Error Sample & Hold and the Main ALC Amp.

U3D is a non-inverting unity-gain summing amplifier. Under leveled conditions, both TP4 and TP7 should be nearly 0.0 Vdc. Under any conditions (except during "hold), TP4 and TP7 should be at the same voltage. If not, suspect U3D, Q3, or the Sample & Hold Driver.

U11 forms an inverting integrator. When TP7 is positive, TP6 should be at −4 Vdc. If not, suspect U2D or U11. When TP7 is negative, TP6 should be at +4 Vdc. If this is not the case, suspect U11.

- The following procedure can be used to check U3D and U11:

  1. Remove jumper W3.

  2. Set power for −5 dBm at any CW frequency.

3. Press Model 83592C **[EXT]** ALC.
4. To check U3D, monitor TP4 and TP7 while adjusting the EXT/MTR ALC CAL knob between the extremes of its range. Both TP4 and TP7 should vary between approximately +0.5 and −0.5 Vdc.
5. Verify U11 by adjusting the CAL knob as described above and monitoring TP6. Since U11 is an integrator, TP6 should saturate and clamp (due to VR4 and VR5) at −4 Vdc and +4 Vdc, respectively. (When sweeping across a bandswitch point, RF blanking pulses will saturate TP6 at +4 Vdc regardless of input.)
6. Reinstall jumper W3.

Further troubleshooting of the Modulator Leg can be continued by following the Open Loop procedure outlined in Figure 8-32 and checking for the waveforms provided in Figure 8-33.

MODULATOR DRIVERS

The voltage-to-current conversion and current gain needed to drive the modulators is provided by Q13 and Q14 on the output of the Main ALC Amplifier. As the voltage increases at TP6 so does the current to the modulators, shunting more RF energy to ground and allowing less to pass through. Since the modulators are essentially current-controlled, the voltages measured at TP9, P1-19, and P1-44 do not vary much over a wide range of modulator attenuations.

Q13 is an emitter-follower followed by a common-base stage (Q14), with two diodes in between. Check the biases and base-emitter voltages to see if the transistors are damaged.

- To establish a bias level for the Mod Driver stages, TP6 can be forced high (+4 Vdc). Remove jumper W3. Press Model 8350A/B **[CW]** and select a CW frequency in the appropriate band. Select **[EXT]** ALC, and enter an RF power level of −5 dBm via front panel controls. Rotate the EXT/MTR ALC CAL knob fully counterclockwise. Verify a signal level of approximately +4 Vdc at TP6. Reinstall jumper W3.

MODULATORS

The two internal modulators for this Plug-In are housed in combination microcircuit packages: A17 Modulator/Mixer (Band 0), and A16 Modulator/Splitter (Bands 1-3). Figure 8-27 provides a simplified schematic for these positive-bias shunt-type attenuators. As more current is supplied through the modulator bias pin, the shunt diode turns on harder, sinking more RF power to ground and allowing less to reach the front panel.

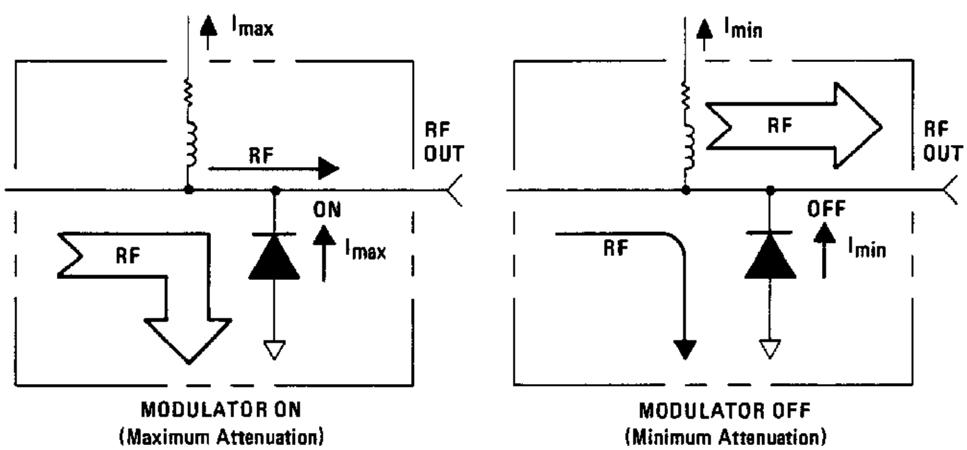


Figure 8-27. Simplified Modulator Schematic

The modulators are checked simply be noting whether actual RF attenuation is appropriate to the modulation bias present

NOTE

Turn off line power before removing or installing any assembly.

- If low or no RF power is observed, remove all modulator bias currents simply by removing the A4 assembly from the Motherboard. With no bias current, the RF power should pass through the modulator unhindered. If this is not the case, check the modulator diode as follows:

1. Select Model 83592C **[EXT]** ALC. Remove jumper W3. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully clockwise. This should result in −4 Vdc at TP6, essentially removing bias from the modulators. Check TP9 for −8 Vdc in Band 0 and 0 Vdc in Bands 1-3. If this is not the case, isolate each modulator from its drive circuitry by applying a piece of cellophane tape to the appropriate pin edge connection: P1−44 for Band 0 or P1−19 for Bands 1-3. If TP9 now measures −8 Vdc for Band 0, the modulator diode is probably shorted. If TP9 still does not measure −8 Vdc, suspect the band blanking circuitry: U9B and Q9 for Band 0, or U9C and Q10 for Bands 1-3.

NOTE

Remove any tape applies to the pin edge connectors in the previous procedure.

- If the modulators appear to be functioning properly, check the following RF levels with a power meter or spectrum analyzer. When checking power levels internal to the RF signal path, ensure that all critical ports are terminated in 50 ohms.

2. If power is low in all bands, check the RF level at the rear panel AUX OUT connector. Refer to the RF Schematic Diagram at the end of Section VIII for the proper levels.

3. If power is low in Band 0 only, measure the RF levels around the A18 Modulator/Mixer. With no modulation, approximately +13 dBm should be measured at the input of A18, with approximately −10 dBm at the output. If no output is measured, make sure the Cavity Oscillator A11 is yielding at least +8 dBm.

4. If the RF output for Bands 1-3 is low, check the RF levels around the Power Amplifier A14 with no modulation. A14 should output approximately +26 dBm with about +13 dBm at the input.

- If maximum unleveled RF power is observed, attempt to achieve maximum attenuation (minimum RF transmitted). Select Model 83592C **[EXT]** ALC. Remove jumper W3. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully counterclockwise. The voltage level at TP6 should be +4 Vdc. Concurrently, the voltage levels at the output of the Mod Drivers, P1-44 (Band 0) and P1−19 (Bands 1-3), should be approximately +0.6 Vdc to +0.8 Vdc.

1. If the voltages are significantly higher than this, the modulator diode is probably open.

2. Check TP9 for approximately +2.0 Vdc. The difference between the test point and the corresponding pin-edge connector gives an indication of how much current is flowing to the modulator.

A5 FM DRIVER, CIRCUIT DESCRIPTION

The A5 FM Driver is divided into three major sections: the YO/YTM/YTF Main Coil FM Drivers, the YO FM Coil Driver, and the ALC Flatness Adjustments and Power Sweep circuits for the A4 ALC assembly.

The FM input signal from the rear panel of the Model 8350A/B Sweep Oscillator provides the input to both the YO/YTM/YTF Main Coil Driver and FM Coil Driver circuits. For low frequency FM inputs, the YO and YTM/YTF Band Select Amplifiers scale and buffer the FM signal to produce outputs that are summed with the tuning voltage on their respective driver board assemblies (A7 YTM/YTF Driver and A8 YO Driver). Thus, these low frequency FM outputs are an extra tuning voltage input to the YO and YTM/YTF drivers, and may be used for phase locking, frequency offsetting, or low frequency FM applications (where up to 75 MHz deviations are required). The FM Coil Driver scales and buffers the FM input signal to produce the current drive for the FM coil in the YIG Oscillator for smaller deviation but wideband (up to 10MHz) FM applications. A current drive for the YTM and YTF is not necessary because the YTM and YTF bandwidths are wide enough to pass small frequency variations. Relay switches provide the option of selectable sensitivities of −6 or −20 MHz/Volt and/or DC coupling the FM input to the FM Coil Driver circuits. In the DC coupling mode, the Main Coil Driver is shut off and the FM Coil Driver operates over the frequency range of DC to 10 MHz with −20 MHz/Volt sensitivity. The relay switches are controlled by the state of the Configuration Switch on the A3 Digital Interface board.

The ALC Flatness Adjustments circuit is used to flatten output power versus frequency by introducing an error voltage into the ALC reference channel. The Power Sweep circuit is activated by the front panel POWER SWEEP pushbutton and produces a scaled ramp that is summed with the ALC reference voltage, causing the output power to increase level versus sweep (the amount of which is selected on the front panel).

YO and YTM/YTF Main Coil FM Drivers (C)(D)(H)

The YO and YTM/YTF Main Coil FM Drivers scale and buffer the Model 8350A/B rear panel FM input signal for FM frequencies between DC and 700 Hz, to produce two outputs. These are summed with the tuning voltage for the YO Main Coil on the A8 YO Driver board and the YTM and YTF on the A7 YTM/YTF Driver board. The Low Frequency Amplifier/Filter and the YO and YTM/YTF Band Select Amplifiers make up the YO and YTM/YTF Main Coil FM Driver. The FM input signal is filtered by 700 Hz low-pass filter R2/C1 and buffered by difference amplifier U7A. The gain of U7A is approximately 1.4. The output of U7A drives both the YO and YTM/YTF Band Select Amplifier circuits. Relay K2 is used to control the overall gain of inverting amplifiers U7B and U14D for the two sensitivities by changing the value of the input resistance. Relay K2 is either open or closed (shorting across parallel resistors R8 and R78) according to the state of the 6 MHz/V SEL control line (1 = −6 MHz/Volt, 0 = −20 MHz/Volt). The state of the 6MHz/V SEL control line is determined by the position of the Configuration Switch on the A3 Digital Interface board. Since the YTM and YTF may be tuned to the second or third harmonic of the YO, the LO FM outputs to the YO and YTM/YTF Drivers must be scaled according to the band of operation. This scaling is accomplished by the YO and YTM/YTF Band Select Amplifier circuits. The gain of each amplifier is set by the YO and YTM/YTF SEL inputs to the analog switches in their feedback paths. Table 8-15 lists the logic levels of these lines for each band. The YO Band Select Amplifier output (TP3) is summed directly with the main coil tuning voltage on the A8 YO Driver board. The YTM/YTF Band Select Amplifier output (TP2) is summed directly with the YTM and YTF tuning voltages on the A7 YTM/YTF Driver board. The YO and YTM/YTF Band Select Amplifiers are shut off with analog switches U3C and U13A when the DC coupling mode is selected on the A3 board Configuration Switch, causing control line L LO FM OFF (Low = Low Frequency FM OFF) to be true.

YO FM Coil Driver (E)(F)(I)

The YO FM Coil Driver scales and buffers the Model 8350A/B rear panel FM input for frequencies between DC and 10MHz to produce an output current that drives the YO FM coil. The FM Coil Driver is made up of a high-pass filter, buffers Q5A and Q5B, video amplifier U10, operational amplifier U19, and unity gain follower U20. The high-pass filter is made up of capacitors C2 through C6 and resistors R11 and R12. The filter has a 3 dB cutoff frequency of about 700 Hz. When the FM Driver is configured for the "crossover" mode as determined by the position of the Configuration Switch A3S1, the FM Coil Driver passes FM input signals above 700 Hz and the low-pass filter in the Main Coil Driver circuit passes signals below 700 Hz. If the DC coupling mode is selected, the Main Coil Driver is shut off and control line L DC COUPLE is true, activating relay K1. This shorts the high-pass filter network, and the FM driver is active for frequencies of DC to 10 MHz.

Selectable sensitivities of −6 MHz/Volt and −20 MHz/Volt are available and determined by the state of control line 6 MHz/V SEL (1 = −6 MHz/V, 0 = −20 MHz/V). When 6 MHz/V SEL is high, relay K2 is open and the FM input is scaled by a resistive divider made up of R11 and R12. When 6 MHz/V SEL is low, relay K2 is activated, shorting capacitors C4−C6 and resistor R11. The combination of C2, C3 and R12 still form a high-pass filter with a cutoff of 700 Hz. Note that in the DC coupled mode the sensitivity is always −20MHz/Volt.

The output of the filter network is limited to about ±3V with a network made up of VR1, VR2, R14, R15, CR3, and CR4. Q5A and Q5B are connected as emitter followers and buffer the output of the filter network to video amplifier U10. Analog switch U11 is always set to switch position zero. Frequency response shaping to compensate for the roll-off versus frequency of the FM coil is produced by the network made up of C11, C12, C14, R21, R22, R23, R75, and L1 connected across pins 9 and 4 of U10. This network is actually in the emitter of the input differential amplifier of U10, producing greater gain with decreasing impedance. Figure 8-35 shows the approximate response versus frequency of the YO FM coil and the compensation network. Adjustments R19 (FM OFFSET), R75 (HI), and C14 (LO) adjust the shape of the compensation network response.

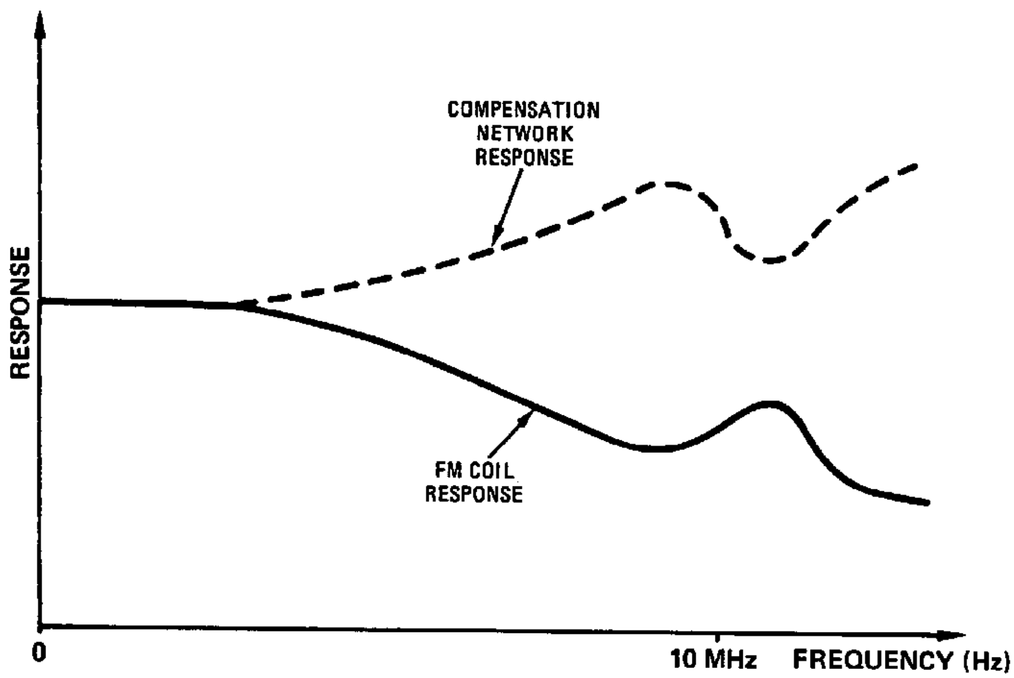


Figure 8-35. Plot of FM Coil Response Versus Modulation Frequency

The differential output of U10 drives the wideband Output Current Driver, U19 and U20. The voltage difference between the outputs of U10 at pins 6 and 7 is converted to a proportional current which directly drives the YO FM coil. The overall voltage gain of the Output Current Driver is determined by the YO SEL inputs to analog switches U12B, C, and D, and is selected according to the frequency band of operation. Resistive divider R30 through R32 sets the FM coil drive scale factor.

Address Decoder (A)

Address Decoder U18 generates three control lines (L EN 4, L EN 5, and L EN 6) by decoding the state of address lines BA0–3 and control line L INST 1. LEN 4 (Low Enable 4) and L EN 6 (Low Enable 6) load data into the Control Latches and L EN 5 (Low Enable 5) loads data into the Power Sweep DAC.

Control Latches (C)

Control latch U6 stores the state of six control lines that are used to control the amplification factor of the FM input signal according to the frequency band of the RF output (Bands 0 through 3). The control lines are loaded into U6 from data bus lines BD0–BD5 when the L EN 6 signal from U18 makes a low-to-high transition.

Control Latch U16 stores the state of four control lines that are used to set the signal path and amplification factor of the FM input signal. The state of the control lines is determined by the position of switches 5 and 6 of the Configuration Switch on the A3 Digital Interface board. The control lines are loaded into U16 from data bus lines BD2–BD5 when the L EN 4 signal from U18 makes a low-to-high transition.

ALC Flatness Adjustments (I)

The purpose of the ALC Flatness Adjustment circuit is to produce an RF output signal that is as flat as possible across the entire frequency band. The input of the ALC flatness circuit is a 0 to 5 volt ramp (in full sweep) labeled FREQ TRK V (Frequency Tracking Voltage). This ramp is dependent on the frequency START and STOP settings, so it will always be at least a portion of the 0 to 5 volt range.

The FREQ TRK V ramp is applied to four parallel circuits, each one adjusted to take effect at a different frequency (i.e., voltage threshold of FREQ TRK V) as the sweep progresses from START to STOP. Since the four circuits are identical (Q1, Q2, Q3, Q4), only the Q1 circuit will be discussed. Q1A is connected as a diode, is always conducting, and is in the circuit for temperature compensation of Q1B. The setting of adjustment BP1 (R34) determines at what point on the input ramp Q1B will conduct. When the summing point at the junction of U2C and R33 is at zero volts or greater, Q1B will conduct. The junction of resistors U1B and U1A forms another summing point. U1B applies a positive-going ramp from Q1B to this summing point, and a negative-going ramp comes through U1A from the output of U14C. Slope adjustment SL1 adjusts the amount of negative-going ramp contributed to the summing junction through U1A, and thus determines the resultant contribution of the Q1 circuit to the input of U14A. That is, the resultant signal may be either a positive-going ramp or a negative-going ramp as required to make the RF output signal flat over that frequency segment.

The composite correction signals from the four flatness adjustment circuits (Q1 through Q4) are summed at the input of U14A, then are applied to the Power Level Reference in the ALC circuit. TP1 shows this composite correction signal. Overall tilt is adjusted by SLP (Slope) adjustment R48.

Power Sweep (H)

When POWER SWEEP mode is selected at the front panel, L EN 4 (Low Enable 4) is generated by U18, enabling U17 on. This allows Power Sweep data from data lines BDO through BD7 to be loaded into U17. This data selects the gain of U14B by connecting or removing resistors in series with the input to U14B. The signal path of the VSW voltage sweep signal (0 to +10V) is through the selected gain resistors in U17 to input pin 6 of U14B. The feedback resistor for U14B is also within U17 and is internally connected to the input of the amplifier stage. The output of U14B is summed at the input of U14A with the ALC flatness signal then goes through amplifier U14A to the Power Level Reference in the ALC circuit.

When the Plug-In front panel SLOPE key is depressed, data lines BD0 through BD7 redefine the gain of the Power Sweep circuit to compensate the slope of the RF output in dB/GHz.

A5 FM DRIVER TROUBLESHOOTING

For troubleshooting purposes, the A5 FM Driver is divided into three groups.

- YO/YTM/YTF Main Coil FM Driver and YO FM Coil Driver circuits.
- FM Configuration Control circuits
- Power Sweep and ALC Flatness Adjustment circuits

YO/YTM/YTF Main Coil FM Driver and YO FM Coil Driver Troubleshooting

The most likely indication of a failure in these circuits is unpredictable or no FM operation. A failure in these circuits can also cause excessive residual FM or frequency offset.

Troubleshooting is divided into two ranges of modulation frequency. For FM frequencies less than or equal to 700 Hz, Table 8-16 provides voltages for troubleshooting. For FM frequencies greater than or equal to 700 Hz, Figure 8-40 provides waveforms for troubleshooting. The voltages and waveforms are arranged horizontally by test point and vertically by the FM input frequency. Figure 8-39 shows the test setup required to obtain the waveforms.

NOTE

Before altering the switch settings on A3S1, write down the present configuration. Return the switches to their original status after troubleshooting.

Prior to performing the test procedure, preset the A3S1 Configuration Switch sections 5, 6, and 8 to the closed (0) position. Several of the troubleshooting waveforms require different switch settings. A description of each switch setting follows.

- For 6 MHz/V sensitivity — set A3S1-5 to the open (1) position.
- For 20 MHz/V sensitivity — set A3S1-5 to the closed (0) position.
- For DC coupled mode — set A3S1-6 to the open (1) position.
- For cross-over coupled mode — set A3S1-6 to the closed (0) position.

- For front panel Phase-lock mode – set A3S1-8 to the closed (0) position.
- For the AUX OUT Phaselock mode – set A3S1-8 to the open (1) position.

NOTE

The Model 8350A/B front panel INSTR PRESET pushbutton must be pressed after each switch position change in order for the selected mode to take effect.

1. Adjust the function generator frequency and amplitude controls to obtain a 1 volt peak-to-peak waveform at TP11 for the frequency tested.
2. Verify the waveforms and voltages in the corresponding row.

Table 8-13. YO and YTM/YTF Gain Select Truth Table

	Front Panel Phase Lock (A3S1-8=0)					Aux Out Phase Lock (A3S1=1)				
	B0	B1	B2	B3	B4	B0	B1	B2	B3	B4
YO SEL 1	0	0	1	1	1	0	0	0	0	0
YO SEL 2	0	0	0	1	1	0	0	0	0	0
YO SEL 3	0	0	0	0	1	0	0	0	0	0
YTM SEL 1	1	1	1	1	1	1	1	0	0	0
YTM SEL 2	0	0	0	0	0	0	0	1	0	0
YTM SEL 3	0	0	0	0	0	0	0	0	1	0

FM Configuration Control Circuits Troubleshooting

The FM configuration control circuits include the Address Decoder, Control Latches, relays K1 and K2, and analog switches U3C and U11. Incorrect or no operation in a specific configuration mode is the most likely result of a failure in these circuits.The troubleshooting procedure for these circuits uses several of the Model 8350A/B Sweep Oscillator operator initiated self tests. Separate tests for each section of the configuration control circuits are provided in the following paragraphs.

Address Decoder. Check proper Address Decoder operation by performing a Minor Address Decoder Self Test.

On the Model 8350A/B, enter:

[SHIFT] [5] [4] Minor Address Decoder Test

Check the Address Decoder outputs L EN 4, L EN 5 and L EN 6 as shown in Figure 8-36.

Control Latches. Control latches U6 and U16 are checked by performing a Hex Data Rotation Write to U6 and U16, and then checking the outputs for the waveforms shown in Figure 8-2. The oscilloscope should be triggered from pin 15 of the addressed data latch.

Exercise U16 with Hex Data Rotation Write. Enter:

[SHIFT] [0] [0]	Enters Hex Data command
[2] [GHz] [s] [0] [4]	Address location 2C04 (U16)
[M4]	Hex Data Rotation Write

Check the outputs of U16 against waveforms shown in Figure 8-2.

To check control latch U6, press **[INSTR PRESET]** then repeat the above key entry sequence using address location 2C06.

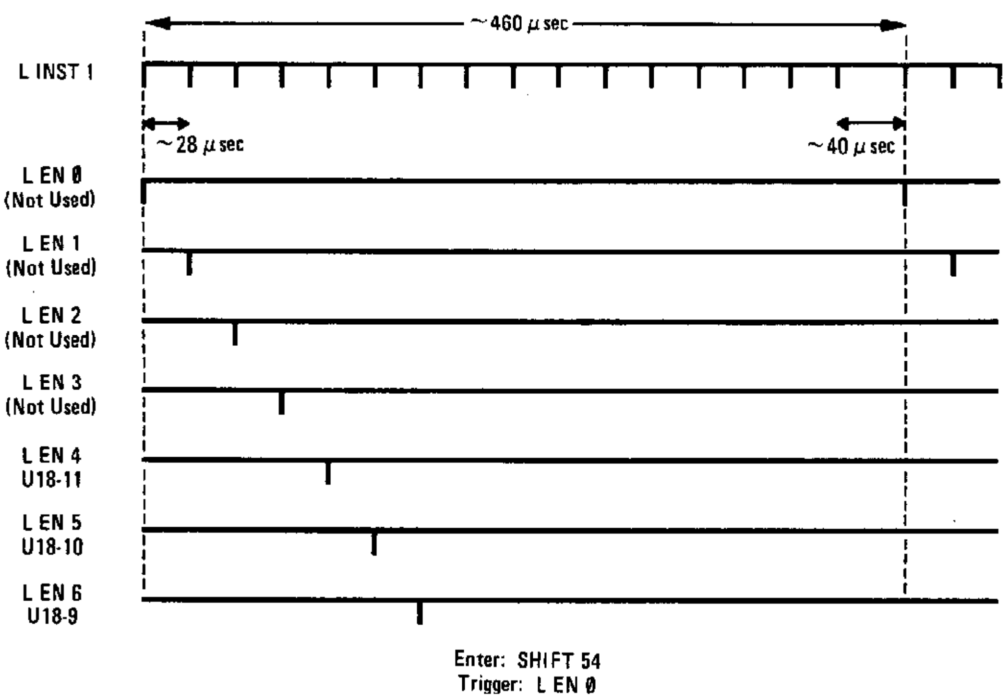


Figure 8-36. Address Decoder Timing Diagrams

Relays K1 and K2. A known FM input is applied and the waveform at TP4 is monitored. The Hex Data Write feature of the Model 8350A/B is used to control relays K1 and K2. Connect the equipment as shown in Figure 8-40. Adjust the function generator for a 500 Hz 1V peak-to-peak output with a +0.5 Vdc offset (use the function generator offset control).

To check relay K1, enter on the Model 8350A/B:

[SHIFT] [0] [0]	Enters Hex Data command
[2] [GHz s] [0] [4]	Address location 2C04 (U16)
[M2] [.] [8]	Hex Data Write A8

Relay K1 should be open. Verify that there is a signal centered around 0 Vdc at TP4.

On the Model 8350A/B, enter:

[M2] [8] [8]	Hex Data Write 88

Relay K1 should now be closed. Verify that the signal at TP4 is offset from being centered around 0 Vdc.

To check relay K2, enter on the Model 8350A/B:

[M2] [BKSP] [8]	Hex Data Write F8

Relay K2 should be closed. Note the level of the signals at TP3 and TP4.

Open relay K2 by entering on the Model 8350A/B:

[M2] [dBm dB] [0]	Hex Data Write E8

Relay K2 should now be open. Verify that the level of the signals at TP3 and TP4 is less than previously noted.

High/Low FM Switching. Analog switches U3C, U13A, and U11 are checked by using the Hex Data Write feature of the Model 8350A/B to control the switches. A known FM input is applied and switch operation is verified.

Connect the equipment as shown in Figure 8-39. Adjust the function generator for a 500 Hz 1V peak-to-peak output.

On the Model 8350A/B, enter:

[SHIFT] [0] [0]	Enters the Hex Data command
[2] [GHz] [0] [4]	Address location 2C04 (U16)
[M2] [dBm dB] [8]	Hex Data Write E8

Analog switches U3C and U13A should be closed. Verify there is a signal at TP3 and TP2.

On the Model 8350A/B, enter:

[M2] [dBm dB] [0]	Hex Data Write E0

Analog switches U3C and U13A should be open. Verify that there is no signal at TP3 and TP2.

On the Model 8350A/B, enter:

[M2] [dBm dB] [8]	Hex Data Write E8

Analog switch U11 should be set to the zero position. Verify that a signal is present at TP6.

On the Model 8350A/B, enter:

[M2] [dBm dB] [GHz s]	Hex Data Write EC

Analog switch U11 should be set to the one position. Verify that no signal is present at TP6.

Power Sweep/ALC Adjustments Troubleshooting

The most likely indication of a failure in these circuits is either incorrect or no operation of the Power Sweep function or inability to adjust the output power flatness. The Power Sweep DAC U17 is exercised by initiating the Power Sweep DAC self test, and the DAC output is checked at TP8. On the Model 8350A/B, enter:

[SHIFT] [5] [1]	Initiate Power Sweep DAC self test

Verify that the waveform at TP8 corresponds with the waveform in Figure 8-37.

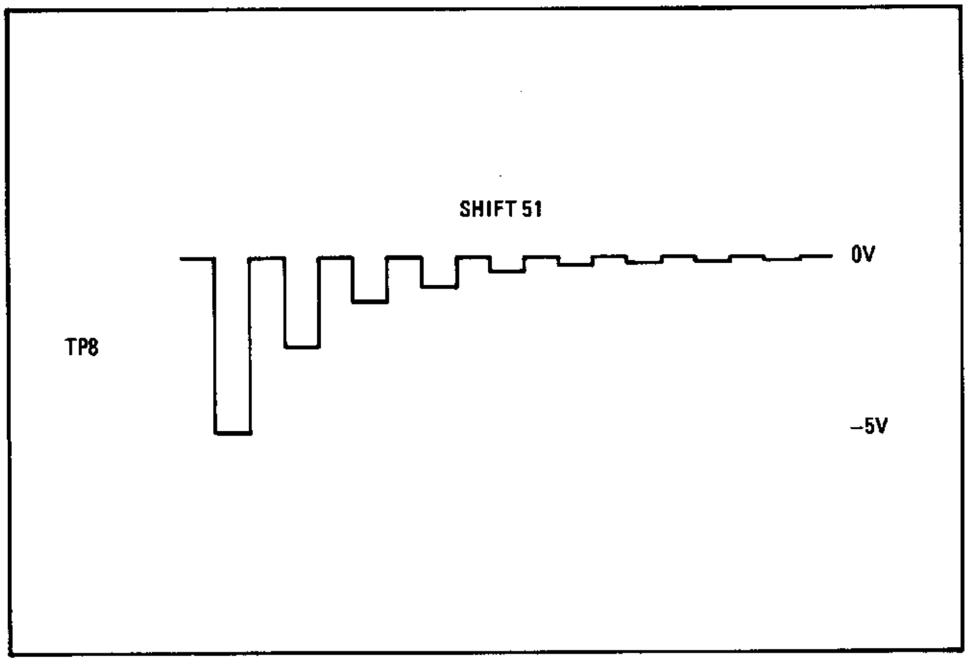


Figure 8-37. Power Sweep DAC Self Test Waveform

A6 SWEEP CONTROL CIRCUIT DESCRIPTION

General

The Sweep Control assembly buffers and scales the VTUNE (Tuning Voltage) from the Model 8350A/B mainframe for use by the A7 YTM/YTF and A8 YO Driver assemblies. The A6 assembly also controls each bandswitch sequence. The SRD and PIN Diode Bias circuit provides optimum biasing of the YTM Step Recovery diode for the frequency band selected and also biases the YTF PIN diode switch to select the proper path for Band 0, or Bands 1 to 3. The YTM PIN diode switch is not used and is always biased on. The Pulse Modulation circuit provides a drive current (PULSE MOD) to pulse modulate the RF output power. This modulation is initiated by the rear panel PULSE IN input or the amplitude marker from the Model 8350A/B mainframe.

Address Decoder (A)

The A6 Sweep Control uses hexadecimal address locations 2C00 through 2C0B. L INST2, BA0, BA1, and the L DAC EN output of U8D are decoded by the bandswitch DAC as hexadecimal addresses 2C08 through 2C0B. U17 is a 3-to-8 decoder that is enabled when L INST1 and address line BA3 are both low. U17 decodes address lines BA0 through BA2.

Data Latches and Output Data Buffer (D)

Two octal latches (U3 and U9) store various signals including the digital data for controlling the Bandswitch Comparator and Sweep Control/Interrupt Logic circuits.Each latch is clocked by a separate line from the Address Decoder to store the byte of data appearing on the Data Bus. The data is latched into U3 and U9 when their respective L EN clock inputs pulse low. Refer to the various circuit function blocks for detailed descriptions of these control lines.

Output buffer U13 outputs data to the Model 8350A/B microprocessor that relates to the current status of the sweep. Data is output when the L EN 2 clock input to U13 is pulsed low.

Tuning Voltage Buffer Amplifier (B)

U6 receives the tuning voltage from the Model 8350A/B mainframe and buffers it for use on the rest of the board. The circuit is arranged as a differential amplifier, with the tuning signal appearing at the inverting input and the cable shield at the noninverting terminal. This provides good common mode rejection to eliminate noise picked up on the cable. The waveform at TP5 is an inverted ramp, ranging from 0 to −10V for single band sweeps (Band 0, 1, 2 or 3), or for sweeping the full frequency range of the Plug-In. However, if the Configuration Switch A3S1 in the A3 Digital Interface is selected for Sequential Sweep mode only, the tuning voltage (VTUNE) is not rescaled to a 0 to +10V ramp for single band sweeps. Figure 8-47 shows the tuning voltage waveform for a 0.01 to 20.0 GHz sweep.

Bandswitch DAC (C)

Bandswitch DAC U18 provides an offset voltage at TP1 that is proportional to the next bandswitch point. This voltage is used as a reference voltage by the Bandswitch Comparator for initiating the next bandswitch sequence. This voltage is also summed with the output of the TV Buffer in the Variable Gain Amplifier.

U18 is a 12-bit multiplying DAC which scales a stable −10V REF voltage according to the binary pattern loaded at its inputs. Inverting amplifier U19 works with the DAC's internal feedback resistor to provide a programmable offset voltage between 0 and +10V at TP1. See Figure 8-47. CR2 protects the DAC from turn-on transients. C20 and the DAC's internal feedback resistor determine the bandwidth of the circuit.

For single band sweeps, the DAC is held in a reset condition by a logic low on the SEQ BAND input. This causes the voltage at TP2 to be held at 0 volts.

Variable Gain Amplifier (E)

The purpose of the Variable Gain Amplifier is to rescale the tuning voltage input into a series of 0 to −10V ramps, with each ramp corresponding to a frequency band (Band 0, 1, 2, or 3). The Bandswitch DAC output is summed in as an offset voltage to set the amplifier output to 0V at the beginning of each band. Amplifier gain is changed by analog switch U4 selecting a different feedback resistor for each band. Potentiometers B0 through B4 set the amplifier gain for each band. Analog switch U10D shorts across the feedback resistors for single band sweeps to disable the amplifier.

Figure 8-45 shows the relationship between the TV Buffer output, Bandswitch DAC output and the resultant Variable Gain Amplifier output for a 0.01 to 20.0 GHz sweep.

Single Band Switching (G)

The Single Band Switching circuit selects between the Variable Gain Amplifier output and the TV Buffer output to provide BVTUNE (Buffered Tune Voltage) to the YO and YTM/YTF Driver assemblies. The SEQ BAND (Sequential Band) input to analog switch U10B determines which input is used for BVTUNE. When the Model 83592C is sweeping a single band only, SEQ BAND is a logic low, and the TV Buffer output is selected. When the Model 83592C is in a multiband sweep or the Configuration Switch on A3 is set for Sequential Sweep mode only, SEQ BAND is a logic high, and the output of the Variable Gain Amplifier is selected. U20 is a noninverting voltage follower.

Bandswitch Comparator (F)

The Bandswitch Comparator circuit generates a FWD SWP BSW output to initiate each bandswitch during forward sweeps, and RTC BSW to generate each bandswitch during a sweep retrace.

A bandswitch point during a forward sweep is initiated by comparator U23. The buffered tuning voltage (TP5) appears at the inverting input of comparator U23. When the tuning voltage reaches a bandswitch point (as determined by the reference voltage applied to the inverting input of U23), the output of U23 changes. R42 provides hysteresis feedback to U23. If the selected frequency sweep does not require changing bands, switch U11D is opened, and R36 pulls the input to the comparator to +10V, disabling the bandswitch circuitry. The reference voltage for comparator U23 (TP2) is supplied by the Bandswitch DAC through operational amplifier U24A. This reference voltage is set during retrace or a bandswitch point to correspond to the next bandswitch point. The SP adjustment provides an offset to set accurate bandswitch points. During a sweep retrace, L RTS goes low to turn off Q7. This places a positive offset voltage at the inverting input of U24A, and effectively disables comparator U23 during sweep retrace by offsetting the reference voltage beyond any bandswitch points generated by Retrace Comparator U14. FET Q1 is turned on when Band 3 is selected; this grounds the comparator output to disable a bandswitch at the end of a sweep.

Retrace Comparator U14 initiates a bandswitch during a sweep retrace each time the Variable Gain Amplifier output (TP7) equals 0V. During sweep retrace, the L RTS input (inverted by U22A) turns on FET Q3, to set a 0V reference at the noninverting input of comparator U14. The inverting input comes from the Variable Gain Amplifier. Each time the amplifier output reaches 0V, comparator U14 outputs a logic high to initiate a bandswitch. During a forward sweep, FET Q3 is turned off, and a positive offset voltage is applied through R56 and R57. This offsets the reference input beyond any bandswitch points generated by the Forward Sweep Bandswitch Comparator (U23). When Band 1 is selected, Q1 is turned on to disable comparator U14 from initiating a bandswitch at the end of a sweep retrace.

Sweep Control/Interrupt Logic (H)

NOTE

Most of the signals discussed in this section are illustrated in Figure 8-46.

The Sweep Control/Interrupt Logic circuit provides the Stop Sweep (L SSRQ), Blanking Request (L BPRQ) and Sweep Interrupt (L SIRQ) signals at bandswitch points. End of Sweep Interrupt circuitry (U8B) provides requests for interrupts at the beginning or end of a sweep.

Whenever the Bandswitch Comparator outputs an active FWD SWP BSW or RTC BSW, the output of U2C goes high. Pin 13 of U2D is prevented from tracking pin 12 by C16. Consequently, the output of the XOR U2D will go high every time U2C changes states. Each pulse from U2D clocks flip-flop U8A.

The high output at U8A performs three functions: 1) U16B issues a L SSRQ (Low=Stop Sweep Request) to halt the sweep ramp generator in the Model 8350A/B mainframe; 2) U16A issues a L BPRQ (Low=Blanking Pulse Request) for display blanking during bandswitching; and 3) U16C issues a L SIRQ (Low=Sweep Interrupt Request) to alert the Model 8350A/B microprocessor that a bandswitch needs to be made.

The microprocessor now takes over control of the bandswitch by writing command bits to Data Latch U3. First, the SSHOLD (Stop Sweep Hold) line goes high, maintaining the Stop Sweep (L SSRQ) and Blanking (L BPRQ) requests. Simultaneously, the L SSRES (Low=Stop Sweep Reset) line goes low, resetting U8A and clearing the interrupt request (L SIRQ). The microprocessor now reads buffer U13 to determine what caused the sweep interrupt request (Forward Sweep Bandswitch, Retrace Bandswitch, Start or End of Retrace, or the Unleveled indicator turned on). Based on this information, the microprocessor blanks the RF power (causing L RFBRQ to go low), updates the DACs, change the Variable Gain Amplifier gain, changes various band-dependent control lines, and readies the Plug-In for sweeping the new band. After the YO has settled, the RF power is turned back on. After the RF power has come up, the sweep is resumed and the display is unblanked by releasing the SSHOLD line. The time intervals required for YO settling and RF power-up are provided by the programmable counter on the A3 Digital Interface assembly.

In addition to bandswitch points, the microprocessor is also interrupted at the beginning and end of each sweep. Each time L RTS (Low=Retrace Strobe) changes from high to low, or low to high, U2A pulses high. (Pin 2 of U2A is prevented from tracking pin 1 by C17. Consequently, the output of EXOR U2A will pulse high every time L RTS changes states). Each pulse from U2A clocks flip-flop U8B. The noninverting output of U8B is read together with the bandswitch interrupt to pull L SIRQ low and request microprocessor attention. L RTS is read through U13 to determine whether the forward sweep is beginning (L RTS=high) or ending (L RTS=low). U8B is then reset by L ESRES, and the microprocessor services the interrupt.

L RFBRQ goes low during bandswitch and sends an RF Blank Request to the Model 8350A/B to produce the blanking signal L RFB for the A4 ALC assembly.

SRD AND PIN DIODE BIAS (I)

The SRD and PIN Diode Bias circuit provides two bias voltages; one for the YTM (SRD BIAS), and the other for the YTF (PIN SW). For Bands 1 through 3, analog switch U11C is closed, and a negative bias is applied to the diode, enabling Bands 1 through 3.

The Step Recovery Diode in the YTM is biased by SRD BIAS. This bias is optimized for each band and changes in power level. Voltage follower/subtractor U24 provides a voltage for optimum biasing of the SRD for each frequency band. BVTUNE is applied to both its inverting and noninverting inputs. If BVTUNE alone was applied the U24 output would always be zero volts since both inputs have the same gain.Analog switches U11A and U11B sum in offset voltages for Band 1 resulting in a large negative bias to ensure maximum feedthrough of the fundamental oscillator frequency. Analog switches U1D, U1B and U1C provide an offset and affect the noninverting input gain. As a result, the U24 output for Bands 2 and 3 is offset from 0V, as determined by the two band "L" adjustments, with the slope determined by the two band "H" adjustments.

U26 is a variable gain differential amplifier that provides an output current for Bands 2, and 3 for controlling the SRD BIAS. The amplifier gain is determined by the U24 output applied through analog switch U1A to U26 pin 5. Analog switch U1A is open for Band 1, so the SRD BIAS for these bands is determined only by the output of U24, applied through R63 to the base of Q8. Threshold adjustment A6R78(T) determines at what modulator drive voltage (MOD 1) that power level compensation is provided. CR12 prevents U26 from affecting SRD BIAS when MOD 1 is more positive than the threshold voltage set by R78(T).

Pulse Modulation (J)

The Pulse Modulation circuit provides a PULSE MOD output to the A16 Modulator/ Splitter that is used to pulse-modulate the RF output. The L PULSE output is used on the A4 ALC assembly in a sample and hold circuit to maintain a leveled power condition (refer to the A4 Circuit Description for more details). The L PULSE output goes active low when either the L RFM (Low=RF Marker from the Model 8350A/B or the PULSE IN (from the rear panel Pulse In connector) goes low. If the PULSE IN input from the rear panel exceeds a TTL level, it is translated to a TTL level by the resistor-diode network on the U21A pin 13 input. When the L PULSE output is active low (switching RF power off), Q4 is biased on and Q6 is biased off: this provides a positive bias to the PIN diode in the modulator and attenuates the RF output power. When L PULSE is a logic high, Q6 is biased on and Q4 is biased off: this provides a negative bias to the PIN diode in the modulator so that it has no effect on the RF Power level.

A6 SWEEP CONTROL TROUBLESHOOTING

The A6 Sweep Control assembly rescales the tuning voltage (VTUNE) from the Model 8350A/B for use by the A7 YTM/YTF Driver and A8 YO Driver. The A6 assembly also initiates all bandswitch sequences.

NOTE

Unless specifically stated otherwise, the troubleshooting waveforms and voltages described below occur when the Plug-In is sweeping across its full range (INSTR PRESET conditions).

Buffered Tuning Voltage

NOTE

The BVTUNE output is normally scaled by the Variable Gain Amplifier only for multiband (sequential) sweeps, with the TV Buffer output used for single band sweeps. However, the A3S1 Configuration Switch (position 1) may be set to disable the selection of the TV Buffer output for single band sweeps. This procedure assumes that A3S1 switch posiltion 1 is set to the open position, thus enabling the A6 assembly to change the scaling of the BVTUNE signal for single band or multiband sweeps.

A failure in the BVTUNE signal may cause both the YO, YTM, and YTF to sweep between improper frequency endpoints, or not sweep at all. For a full band sweep (0.01 to 20.0 GHz), the BVTUNE output at TP8 should be a series of 0 to −10V ramps (see Figure 8-47). For a single band sweep (e.g. 0.01 to 2.4 GHz), BVTUNE should be a single 0 to −10V ramp.

1. If both waveforms are incorrect, verify the TV Buffer output at TP5.
2. If BVTUNE is incorrect for only the full band sweep, the problem is most likely with the Bandswitch DAC, the Variable Gain Amplifier, or the Bandswitch circuitry. (The TV Buffer is verified in single band sweep).
   a. Check the Bandswitch DAC output at TP1 as shown in Figure 8-47. If this signal is incorrect, run the Bandswitch DAC test by entering **[SHIFT] [5] [6]**. Then check TP1 for the waveform shown in Figure 8-46.
   b. Verify correct operation of the Variable Gain Amplifier by checking waveforms at TP4 and TP7 according to Figure 8-45. If any of the voltage levels are slightly out of tolerance, perform the Sweep Control and Band Overlap adjustments in Section V. If the voltage at TP4 is 0V, verify that analog switch U10D is open.
   c. Verify operation of the bandswitch circuitry with the procedure in the **Interrupt Control** section.
3. If BVTUNE is incorrect only for single band sweeps, verify that the SEQ BAND input to analog switch U10B/C is a logic low when sweeping only a single band. Also verify that Configuration Switch A3S1 switch number 1 is in the open position.

Interrupt Control

Symptoms of an interrupt failure may include loss of sweep, portions of the sweep trace missing, or failure to sweep across a bandswitch.

1. Verify operation of the Bandswitch Comparator by checking the FWD SWP BSW (U23 pin 7) and RTC BSW (U14 pin 7) waveforms as shown in Figure 8-48.
   a. If the FWD SWP BSW signal is not correct, check the Bandswitch DAC output at TP1 and the TV Buffer output at TP5 as shown in Figure 8-47.
   b. If the RTC BSW signal is incorrect, check the Variable Gain Amplifier output at TP7. Also verify that the noninverting input to U14 is about 0V during a sweep retrace.
2. With an oscilloscope, check the following edge-connector pins: P1-3 (L SIRQ), P1-1 (L RTS), and P1-23 (L SSRQ). The appropriate waveforms are shown in Figure 8-48.
   a. L RTS should go low at the end of each forward sweep. If it does not, trace the problem back through the Plug-In interconnect to the Model 8350A/B.

b. L SIRQ should pulse low briefly for end-of-sweep interrupts. If these pulses are missing, but L RTS is present, suspect U2A, U8B, U16C, or control lines from U3.

c. L SIRQ should also pulse low for bandswitch interrupts. If these pulses are missing, but FWD SWP BSW and RTC BSW show the proper waveforms, suspect U2C/D, U8A, U16C, or control lines from U3.

d. If L SIRQ stays low, or the pulses are exceptionally wide, check U3 with the procedure outlined under the **Digital Control** section. If U3 is functioning, the Model 8350A/B microprocessor probably did not receive the interrupt. Trace this signal back to the Model 8350A/B.

Digital Control

The Address Decoder and the Data Latches and Output Data Buffer comprise the digital control for the A6 assembly. A failure in these components usually results in large frequency errors, and will often disable the bandswitch circuitry.

To check the address decoding circuitry enter **[SHIFT] [5] [4]** and perform the following:

1. Examine L INST1 (P1-18) for activity. If none is found, troubleshoot the A3 assembly.

2. If L INST1 is functional, check each of the L ENn lines (U17) for the pulses shown in Figure 8-45. If these are incorrect, but the address lines show activity, replace U17. If the address lines seem locked high or low, troubleshoot the address buffer on the A3 assembly.

3. To check Output Buffer U13, press **[INSTR PRESET]**. Set the Model 8350A/B for a 5-second sweep rate and make the following key entry:

[SHIFT] [0] [0]	Enters the Hex Data command
[2] [GHz s] [0] [2]	Address location 2C02 (U13)
[M3]	Hex Data Read

The hex digits displayed in the Model 8350A/B front panel FREQUENCY/TIME window should change as the status read by U13 changes between forward sweep and retrace. Raising the power level until the UNLEVELED light comes on should also change the status bit being read by U13.

4. Exercise U3 and U9 with Hex Data Rotation Write. Enter:

[SHIFT] [0] [0]	Enters Hex Data command
[2] [GHz s] [0] [0]	Address location 2C00 (U3)
[M4]	Hex Data Rotation Write

Check the outputs of U3 against the waveforms shown in Figure 8-2. Verify operation of U9 by substituting hex address 2C01 (U9) in the procedure above.

SRD and PIN Diode Bias

A failure in the PIN Diode Bias circuit is indicated by a decrease or complete loss of RF output power for Band 0 or Bands 1−3. Check that the voltage at TP6 is +10V for Band 0, and −4.8V for Bands 1−3.

A failure in the SRD Bias circuit is usually indicated by low RF output power in Bands 1−3. Check the voltage at TP3 is +5V for Band 0 and −5V for Band 1. If these voltages are correct, perform the SRD Bias adjustment in Section V.

Pulse Modulation

The Pulse Modulation circuit can be checked by entering an amplitude marker on the Model 8350A/B and checking for activity on the L PULSE and PULSE MOD outputs. If L PULSE has activity, but PULSE MOD does not, disconnect W6 at A16J4 to eliminate the possibility of the modulator loading down the signal.

A7 YTM/YTF DRIVER / A9 REFERENCE RESISTOR, CIRCUIT DESCRIPTION

NOTE

All reference designators refer to the A7 assembly unless otherwise noted.

General

The A7 YTM/YTF Driver assembly converts the buffered tuning voltage from the A6 Sweep Control assembly into drive voltages. The A9 Reference Resistor assembly provides the current drivers to control the frequencies of the YIG Tuned Multiplier (YTM), and Yig Tuned Filter (YTF).

Multiplying Digital-to-Analog Converters (DACs) scale and offset the buffered tuning voltage to the frequency end-points in each band. Delay compensation is generated and summed with the tuning voltage in separate summing amplifiers for the YTM and YTF. Also summed with the tuning voltage is the low frequency external FM and Band 1 offset and gain. The resultant waveforms (YTM at TP6 and YTF at TP10) are then converted to current-drives for the YTM and YTF Main Coils.

Address Decoder and Data Latch (A)

The A7 YTM/YTF Driver uses hexadecimal address locations 2C88 through 2C8F. L INST2, BA0, BA1, and the L DAC EN output of U8C are decoded by the Scaled Voltage Tune and Offset DACs as hexadecimal addresses 2C88 through 2C8B. (Note that these addresses from U16 are not used.) U16 is a 3-to-8 decoder that is enabled when L INST2 is active low and address line BA3 is active high. U16 decodes address lines BA0 through BA2.

U12 is a control latch which stores commands from the Model 8350A/B for the control lines used on the A7 YTM/YTF Driver assembly, primarily for delay compensation. The command byte is latched into U12 when L EN 7 pulses low. Refer to the Delay Compensation and summing amplifier sections for detailed descriptions of these control lines.

Scaled Voltage Tune DAC (B)

Offset DAC (C)

The Scaled Voltage Tune and Offset DACs function together to determine the bandpass frequency of the YTM and YTF. The Offset DAC determines the start frequency of each band while the Scaling DAC scales the BVTUNE input to tune the YTM and YTF over the required frequency range for each band.

BVTUNE is a series of 0 to −10V ramps with each ramp corresponding to a frequency band. DAC U17 scales each ramp differently according to the frequency range the YTM and YTF must sweep to cover the frequency range of the band. (See SCVTUNE waveform at TP9 in Figure 8-56.) Since neither the YTM nor YTF is used as a filter for Band 0, the DAC output is set to 0V for Band 0.

U17 and U13 are 12-bit microprocessor-compatible DACs, which latch data in three four-bit nibbles. These DACs share the same address location, but are loaded by different data lines (D0−D3 load U13 and D4−D7 load U17).

U17 scales the buffered tuning voltage (BVTUNE) according to the binary pattern loaded at its inputs. Inverting amplifier U18 is included in the feedback path to convert the current output of the DAC to a voltage. CR1 prevents transients from damaging the DAC during turn-on. C18, along with the DAC's internal feedback resistor, determines the bandwidth of the circuit. The waveform at TP9 is a scaled ramp (sawtooth waveform for multiband sweeps), with a maximum range of 0 to +10Vdc. See Figure 8-56.

U13 scales a stable −10V REF voltage according to the binary pattern loaded at its inputs. Inverting amplifier U14 works with the DAC's internal feedback resistor to provide a programmable offset voltage between 0 and +10Vdc at TP1. See Figure 8-57. CR7 protects the DAC from turn-on transients. C15 and the DAC's internal feedback resistor determine the bandwidth of the circuit.

Delay Compensation (E)

The Delay Compensation circuit is used to compensate the A12 YTM and A20 YTF for the inherent inaccuracy caused by delay in the magnets at fast sweeps. SCVTUNE (a scaled ramp from the Scaled Voltage Tune DAC), OFFSET (an offset voltage that sets the start frequency of each band), and YTM LO FM (a voltage proportional the low frequency FM applied to the Model 8350A/B rear panel FM INPUT) are summed by U19 to provide a voltage with a slope proportional to the change in YTM/YTF frequency. This voltage ramp is sent to two separate signal processors: 1) a voltage follower/subtractor whose output is equal to zero at start of sweep and at the bandswitch points. The amplitude is proportional to the sweep width; and 2) a differentiator whose output is proportional to the rate of frequency change while sweeping. These two signals are then multiplied in the analog multiplier U20. The Delay Compensation is summed with the Main Coil Driver voltages in the YTM and YTF summing amplifiers.

During retrace, and momentarily during bandswitching, analog switch U10B closes. In this condition, U11C together with R6, R8, R9, and R7 form a subtractor circuit. The same signal is applied to both inputs of the operational amplifier, so that they cancel and the resulting output is 0V, regardless of the input level. With U10B closed, C4 charges to one half the value of the input signal (R8 and R9 form a voltage divider). U10B opens again during the sweep which leaves only C4 in the feedback path of U11C. Since there is no discharge path with U10B and U10A open, C4 remains charged to the level it had just before U10B was opened. U11C now operates as a voltage follower, with the output level-shifted by the voltage across C4. Therefore, the output of U11C has one half the slope of the input signal and returns to 0V whenever U10B is closed during retrace and bandswitching. Two sets of scaling (HI) and offset (LO) adjustments on the output of U11C accurately scale and offset the voltage follower/subtractor output for both a single (SGL) and sequential (SEQ) band sweep. Analog switches U10D and U10C select the correct input for inverting amplifier U11D. The output generated at TP5 is one input to the analog multiplier.

If the sweep is stopped momentarily, such as when an external counter is used, L SSRQ is pulled low by the Model 8350A/B mainframe. When U9A is closed by a low on the L SSRQ control line to U8A, C4 slowly recharges through R62. Thus when L SSRQ is pulled the output of U11C will begin to go to zero volts, but may or may not reach zero volts depending on the length of time L SSRQ was pulled. When L SSRQ goes high again and the sweep continues, U9A opens and U11C resumes its voltage follower operation.

The U19 summing amplifier output is also applied to a differentiator (U11B) with a time constant that is selected by analog switches U9A and U9B. By selecting either C6 (for sequential sweep) or C13 (for single band sweep) in parallel with C3, the U11B output is scaled for either single or multiband (sequential) sweeps. The output is amplified and inverted by U11A and is applied at TP2 to the second input of the analog multiplier. The output at TP4 is connected to U20 pin 7 to provide feedback for an operational amplifier internal to U20.The Z adjust at U20 pin 6 allows nulling of the offset voltage appearing at DLY COMP. This is done in CF ΔF mode where ΔF equals zero.

During sweep retrace, the YTM and YTF must change frequency rapidly from the high end of their range to the low end, and do not have enough time to naturally settle to the proper start frequency. Unless the YTM and YTF are forced to the low end of their range, this could result in a frequency tracking error, and a resultant loss of output power, at the start of each sweep. In order to force the YTM and YTF to settle more quickly, C17 is charged during the YTM/YTF retrace by the differentiator output through CR2. Timer U5 is triggered by L RTC COMP at the end of sweep retrace. The timer pulse output momentarily closes analog switch U9C, and C17 discharges through R57 and is applied as Retrace Compensation to the summing amplifier. This compensation voltage forces the YTM and YTF to the low end of their range to avoid frequency tracking errors after a retrace. The amount of compensation applied is proportional to the pulse width of the timer output, and is adjusted by R55.

Summing Amplifier (G) (M)

The follower operational amplifiers (YTM; U21, Block G. YTF; U23, Block M) provide the summing points for the scaled tuning and offset voltages, and supply drive voltages (YTM DRIVE V or YTF DRIVE V) for the Current Drivers. Several correction signals are summed at this junction:

SCVTUNE provides the scaled ramp portion of the YTM (or YTF) DRIVE Voltage. R19 (YTM, Block G) or R83 (YTF, Block M), GAIN, fine-tunes the signal from the scaling DAC.

OFFSET adjusts the YTM (or YTF) DRIVE Voltage so that the YTM (or YTF) Coil is driven between the proper end points, as determined by the front panel controls. The OFSet control R24 (YTM) or R85 (YTF), fine-tunes the range of the Offset DAC.

DLY COMP, from the Delay Compensation circuit, is added to correct for lags in the response time of the YTM and YTF. This compensation is derived from SCVTUNE.

RTC COMP, from the Delay Compensation circuit, is a momentary correction voltage that forces the YTM and YTF to the low end of their frequency range after a sweep retrace. This compensation is derived from SCVTUNE.

B1 OFS and B1 GAIN (Block G only) is summed in through U9D when the BAND 1 line from U12 is high.

YTM/YTF LO FM sums low frequency components of external FM signals into the drive voltage when crossover coupling of the FM signal is selected. (Configuration switch A3S1 provides this adjustment. Refer to the A3 Service Sheet for further detail.) Due to the response time limitations of the YIG Oscillator's main coil, deviation for frequencies above 700 Hz is small enough to occur within the passbands of the YTM and YTF.

FILTER PEAK is summed to allow minor offset adjustment of the YTF from the front panel.

Frequency Cal Switches/Output Data Buffers D

DIP switches S1 and S2, with their corresponding data bus buffers, are used for digital calibration of the low and high end frequencies in Band 2. The data on these switches is read by the microprocessor during power-up and INSTR PRESET and is used to calculate the settings for the Scale and Offset DACs. S1, with pull-up resistor package U1, is read through U3 when enabled by L EN 4. S1 determines the value of the Offset DAC and calibrates the low end frequency. S2, with pull-up resistor package U2, is read through U4 when enabled by L EN 5. This establishes the Scale DAC values, and calibrates the high end frequency. The ninth and tenth bits from S1 and S2 are read through U7.

S1 and S2 switch positions encode binary numbers to set up the Offset and Scaling DACs. Refer to the Frequency Accuracy adjustment procedure in Section V for instructions. Figure 8-55 illustrates the switch configurations.

Coil Current Sources (H) (K)

Coil Current Drivers A9 (I)(L)

The YTM and YTF Coil Current Drivers (YTM; Block H, YTF; Block K) work with the chassis-mounted Reference Resistors (YTM; R2, YTF; R105) and Coil Drivers (YTM; A9Q2, YTF; A9Q3) to drive a current proportional to the drive voltage through the respective main tuning coil.

The operational amplifier, zener diode, capacitor, and FET (YTM; U22, VR2, C23, Q2. YTF; U24, VR4, C22, Q3) scale the voltage and drive the main coil. The non-inverting input of the operational amplifier receives the drive voltage signal (either YTM or YTF DRIVE V). The inverting input monitors the voltage drop across the reference resistor (YTM; R2. YTF; R105), which is directly proportional to the collector current. If the drive current is not tracking the drive voltage, the operational amplifier will produce an error corrected voltage to correct the difference. The zener diode offsets the drive voltage to the FET. The capacitor prevents oscillation in the loop. VR1, CR5 in the YTM (YTF; VR3, CR6) protect the current drive transistors by limiting voltage spikes due to sudden changes in the coil current. R33 in the YTM (R100 in the YTF) helps to dampen ringing caused by the parasitic capacitance and inductance of the specific coil.

CR3, CR8 in the YTM (CR4, CR10 in the YTF) Driver and their associated factory select resistors provide a two breakpoint compensation network to correct for non-linearities in the coil characteristics.

NOTE

The values of the factory-select resistors are stamped on a label attached to the RF casting. Matching resistor sets (mounted on a header) are supplied with replacement YTMs or YTFs, and must be installed on the A7 YTM/YTF assembly. The new label indicating the replacement resistor values should be attached to the RF casting.

If the A7 YTM/YTF Driver Assembly is replaced, the shaping resistors from the defective board (which are mounted on a header) must be reinstalled in the new assembly.

NOTE

If the YTM or YTF needs little or no compensation, some or all of the factory-select resistors may be omitted.

A7 YTM/YTF Driver/A9 Reference Resistor Assemblies Troubleshooting

NOTE

All reference designators refer to the A7 assembly, unless otherwise noted.

The A7 YTM/YTF Driver and A9 Reference Resistor assemblies are primarily responsible for controlling the YTM/YTF bandpass frequency. These resistors are in parallel with R200 and R201 which are selected to adjust the overall circuit gain for optimum tuning. A failure in these assemblies usually results in a low RF power output. (Power losses that change with sweep time are usually related to delay compensation.) Power losses that may be corrected with the front panel PEAK and FILTER PEAK controls may be due to improper calibration. The problem may be relieved by performing the Frequency Accuracy adjustment in Section V.

General

Check that all power supply voltages are present. +20V (on the A7 assembly) and −40V (on the A12A1 assembly) supply the YTM and YTF. Ensure that cable plugs are correctly seated over the correct jacks throughout the Plug-In. With the line power off, remove and reseat the A7 assembly to assure good Motherboard contact.

NOTE

Unless specifically stated otherwise, the troubleshooting waveforms and voltages described below occur when the Plug-In is sweeping across its full range (INSTR PRESET conditions).

Sweep Circuitry

A failure in the sweep circuitry may cause the YTM or YTF to tune between improper frequency endpoints, or not sweep at all. If the YTM or YTF Drive Voltage is incorrect or missing, the instrument will have low RF output power for Bands 1 through 3.

1. Check the specific DRIVE V (YTM; TP6. YTF; TP10) for the waveform shown in Figure 8-59. If this waveform is correct, troubleshooting should continue with the respective Current Driver section below.

   a. If DRIVE V is incorrect, check BVTUNE (A6TP8) for a series of 0 to −10V ramps. If they are missing or of the wrong amplitude, refer to the A6 Sweep Control service sheet for further troubleshooting.

   b. If the DRIVE V waveform (YTM; TP6. YTF; TP10) appears to be level-shifted, check −10 VREF (A8TP12) for exactly −10 Vdc. Next, with the Plug-In sweeping its entire range, check OFFSET (TP1) for the waveform in Figure 8-57. If this signal is incorrect, select a CW frequency of 20.0 GHz and press **[SHIFT] [5] [2]**. Check TP1 for the waveform shown in Figure 8-54. If this fails, check address decoding using the Digital Control troubleshooting procedure described below.

2. If BVTUNE is correct, check SCVTUNE (TP9) against the waveform shown in Figure 8-56. If it appears to be bad, run the Scale DAC Test by setting a CW frequency of 20.0 GHz and pressing **[SHIFT] [5] [2]**. Check that U17 pin 15 is at −10 Vdc. Then check TP9 for the waveform shown in Figure 8-56. If this fails, check address decoding using the Digital Control troubleshooting below.

3. Finally, check that the summing junction (YTM; U21. YTF; U23) pin 2 is at 0 Vdc. If it is not, troubleshoot respective amplifier.

Delay Compensation

A failure in the Delay Compensation circuit is usually indicated by RF output power variations that change with sweep time. The delay compensation has little effect at sweep times greater than 100 milliseconds. On the Model 8350A/B press **[INSTR PRESET]** and check for the waveforms in Figure 8-58.

YTM and YTF Drive Circuits

The coil driver circuitry is responsible for converting the respective DRIVE V into a drive current for the coil. A failure here will usually result in extreme RF power losses for Bands 1-3.

1. Press **[INSTR PRESET]** to sweep the entire range of the Plug-In.

   YTM: Check TP7 for the waveform shown in Figure 8-59. This represents the voltage (not the current) across the main coil, and will give an indication as to whether current is passing through the coil. If this waveform is correct, suspect the A12 YTM or the SRD Bias circuit on the A6 Sweep Control assembly. Refer to the RF Section Service Sheet.

   YTF: Check TP11 for the waveform shown in Figure 8-59. This represents the voltage (not the current) across the YTF's main coil, and will give an indication as to whether current is passing through the coil. If this waveform is correct, suspect the A20 YTF. Refer to the RF Section Service Sheet.

2. YTM: Check TP3. This voltage should track the YTM DRIVE V (Figure 8-59). If it does not, troubleshoot U22, VR2, chassis-mounted R2, and A9Q2.

   YTF: Check TP12. This voltage should track the YTF DRIVE V (Figure 8-59). If it does not, troubleshoot U24, VR4, chassis mounted R105, and A9Q3.

   a. YTM and YTF: Chassis mounted R2 (YTF; R105) should be checked with the A9 assembly removed from the instrument. The ohmmeter reading should be approximately 40Ω.

   b. YTM and YTF: While the A9 assembly is removed from the instrument, check the gate-source junction of A9Q2 (YTF; A9Q3) with an ohmmeter. This junction should look like an open circuit. The resistance of the channel from drain to source should measure in the hundreds of ohms. If the FET is found to be defective, make sure that protection diodes (YTM; VR1, VR5, and CR5. YTF; VR3, VR6, and CR6) are good before replacing the transistor.

   c. If the above checks verify the components, replace the amplifier (YTM; U22. YTF; U24).

Digital Control

The Address Decoder and Data Latch and Frequency Cal Switches comprise the digital control for the A7 assembly. A failure in these components usually results in large power losses for Bands 1 through 3, and will often cause an unleveled power condition.

To check the address decoding circuitry enter **[SHIFT] [5] [4]** and perform the following:

1. Examine L INST2 (P1-18) for activity. If none is found, troubleshoot the A3 assembly.

2. If L INST2 is functional, check each of the L ENn lines (U16) for the pulses shown in Figure 8-53. If these are incorrect, but the address lines show activity, replace U16. If the address lines seem locked high or low, troubleshoot the address buffer on the A3 assembly.

NOTE

U3, U4, and U7 are checked by reading data while changing switch settings. Before altering the switch settings on A7S1 and A7S2, write down the present configuration. Return the switches to their original status after troubleshooting. If this is not done, the frequency endpoints will have to be recalibrated.

3. To check output buffer U7, press **[INSTR PRESET]** and make the following key entry:

[SHIFT] [0] [0]	Enters the Hex Data command
[2] [GHz s] [8] [dBm dB]	Address location 2C8E (U7)
[M3]	Hex Data Read

The hex digits displayed in the Model 8350A/B front panel FREQUENCY/TIME window should change when the S1 and S2 switch positions 8 and 9 are toggled.

4. U3 and U4 can each be checked with Hex Data Read (see above) at address 2C8C or 2C8D. The hex digits should change when the corresponding Freq Cal switches are changed.

5. Exercise U12 with Hex Data Rotation Write. Enter:

[SHIFT] [0] [0]	Enters Hex Data command
[2] [GHz s] [8] [BKSP]	Address location 2C8F (U12)
[M4]	Hex Data Rotation Write

Check the outputs of U12 against the waveforms shown in Figure 8-2.

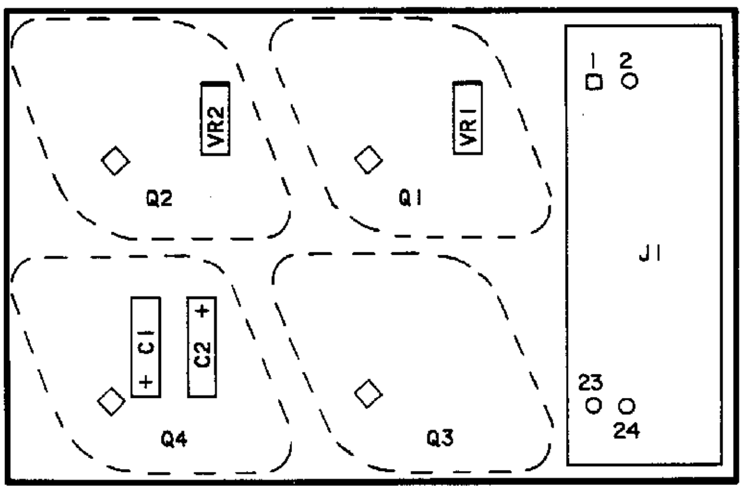


Figure 8-50. A9 Reference Resistor: Wiring List and Component Locations

A8 YO DRIVER / A9 REFERENCE RESISTOR, CIRCUIT DESCRIPTION

NOTE

All reference designators refer to the A8 assembly unless otherwise noted.

GENERAL

The A8 YO Driver assembly converts the buffered tuning voltage from the A6 Sweep Control assembly into a drive current. The A9 Reference Resistor assembly provides the current drive to control the frequency of the YIG Oscillator (YO).

Multiplying Digital-to-Analog Converters (DACs) scale and offset the buffered tuning voltage to the frequency end-points in each band. Delay compensation is generated and summed with the tuning voltage. Also summed with the tuning voltage are low frequency external FM, and the FREQ CAL offset from the front panel. The resultant waveform at TP10 is then converted to a current-drive for the YO's Main Coil.

Address Decoder and Data Latch (A)

The A8 YO Driver uses hexadecimal address locations 2C80 through 2C87. L INST2, BA0, BA1, and the L DAC EN output of U8D are decoded by the Scaled Voltage Tune and Offset DACs as hexadecimal addresses 2C80 through 2C83. (Note that these addresses from U16 are not used.) U16 is a 3-to-8 decoder that is enabled when L INST2 and address line BA3 are both low. U16 decodes address lines BA0 through BA2.

U13 is a control latch which stores commands from the Model 8350A/B for the control lines used on the A8 YO Driver assembly, primarily for delay compensation. The command byte is latched into U13 when L EN 7 pulses low. Refer to the Delay Compensation, summing amplifier, and YO Coil Current Source sections for detailed descriptions of these control lines.

Scaled Voltage Tune DAC (B)
Offset DAC (C)

The Scaled Voltage Tune and Offset DACs function together to determine the frequency of the YIG Oscillator. The Offset DAC determines the start frequency of each band, while the Scaling DAC scales the BVTUNE input to tune the YIG Oscillator over the required frequency range for each band.

BVTUNE is a series of 0 to −10V ramps with each ramp corresponding to a frequency band. DAC U17 scales each ramp differently according to the frequency range the YO must sweep to cover the frequency range of the band. (See SCVTUNE waveform at TP2 in Figure 8-67.)

U17 and U14 are 12-bit microprocessor-compatible DACs, which latch data in three four-bit nibbles. These DACs share the same address locations, but are loaded by different data lines (D0−D3 load U14 and D4−D7 load U17).

U17 scales the buffered tuning voltage (BVTUNE) according to the binary pattern loaded at its inputs. Inverting amplifier U18 is included in the feedback path to convert the current output of the DAC to a voltage. CR1 prevents transients from damaging the DAC during turn-on. C14, along with the DAC's internal feedback resistor, determines the bandwidth of the circuit. The waveform at TP2 is a scaled ramp (sawtooth waveform for multiband sweeps), with a maximum range of 0 to +10 Vdc. See Figure 8-67.

U14 scales a stable −10V REF voltage according to the binary pattern loaded at its inputs. Inverting amplifier U15 works with the DAC's internal feedback resistor to provide a programmable offset voltage between 0 and +10 Vdc at TP3. See Figure 8-68. CR7 protects the DAC from turn-on transients. C15 and the DAC's internal feedback resistor determine the bandwidth of the circuit.

Delay Compensation (E)

The Delay Compensation block circuitry is used to compensate the A13 YIG Oscillator for the inherent inaccuracy caused by delay in the magnets at fast sweeps. The input signal is SCVTUNE, a scaled ramp from the Scaled Voltage Tune DAC, the slope of which is proportional to the change in frequency. SCVTUNE is sent to two separate signal processors: 1) a voltage follower/subtractor whose output is equal to zero at start of sweep and at the bandswitch points. The amplitude is proportional to the sweep width; and 2) a differentiator whose output is proportional to the rate of frequency change while sweeping. These two signals are then multiplied in the analog multiplier U12. If the Sweep Oscillator is in a swept mode, U6 enables the Delay Compensation which is summed into the Main Coil Driver voltage in the summing amplifier.

During retrace, and momentarily during bandswitching, analog switch U19B closes. In this condition, U10C together with R6, R8, R9, and R7 form a subtractor circuit. The inputs cancel in the operational amplifier and the resulting output is 0V, regardless of the input level. With U19B closed, C4 charges to one half the value of the input signal (R8 and R9 form a voltage divider). U19B opens again during the sweep, which leaves only C4 in the feedback path of U10C. Since there is no discharge path with U19B and U19A open, C4 remains charged to the level it had just before U19B was opened. U10C now operates as a voltage follower, with the output level shifted by the voltage across C4. Therefore, the output of U10C has one half the slope of the input signal and returns to 0V whenever U19B is closed during retrace and bandswitching. The output of U10C is scaled by the HI adjust potentiometer and is applied, with an offset from the LO adjust potentiometer, to inverting amplifier U10D. The output generated at TP5 is one input to the analog multiplier.

If the sweep is stopped momentarily, such as when an external counter is used, L SSRQ is pulled low by the Model 8350A/B mainframe. When U19B is closed by a low on the L SSRQ control line to U8A, C4 slowly recharges through R62. Thus when L SSRQ is pulled, the output of U10C will begin to go to zero volts, but may or may not reach zero volts depending on the length of time L SSRQ was pulled. When L SSRQ goes high again and the sweep continues, U19A opens and U10C resumes its voltage follower operation.

SCVTUNE is also applied to differentiator C3 and U10B. The output is amplified and inverted by U10A and is applied at TP4 to the second input of the analog multiplier. The output at TP9 is connected to U12 pin 7 to provide feedback for an operational amplifier internal to U12. The Z adjust at U12 pin 6 allows nulling of the offset voltage appearing at DLY COMP. This is done in CF ΔF mode where ΔF equals zero.

During sweep retrace or at bandswitch points, the YIG Oscillator must change frequency rapidly from the high end of its range to the low end, and does not have enough time to settle naturally to the proper start frequency. Unless the YO is forced to the low end of its range, this could result in a frequency error at the start of each sweep and at each bandswitch point. In order to force the YO to settle more quickly, C20 is charged during the YO retrace by the differentiator output through CR2. Timer U9 is triggered by L RTC COMP at each bandswitch point and at the end of sweep retrace. The timer pulse output momentarily closes analog switch U19C, and C20 discharges through R67 and is applied as Retrace Compensation to the summing amplifier. This compensation voltage forces the YO to the low end of its range to avoid frequency errors after a retrace or bandswitch. The amount of compensation applied is proportional to the pulse width of the timer output, and is adjusted by R55. As the Model 83592C is sequentially sweeping up between bands, the frequency range the YO must retrace to reach the start frequency of the next band decreases. Thus, the amount of retrace compensation required is reduced. The timer output pulse width is reduced accordingly. This is accomplished by inverting the Offset DAC output through Q1, and applying this negative voltage to the timer control voltage input at U9 pin 5. VR5 level-shifts the Offset DAC output for proper biasing of Q1.

+20V Tracking (F)

Inverting amplifier U11 monitors the +20V line used to supply current to the YIG Oscillator. If the +20V supply becomes loaded down or drifts, the YO Main Coil current and, consequently, the frequency will try to change. However, U11 senses any drift in the +20V FREQ REF line, and provides a correction signal so that the resultant YO DRIVE Voltage (TP10) is compensated for the drift. ZRO adjustment R22 compensates for inaccuracies between U11 and summing amplifier U20.

Summing Amplifier (G)

U20 provides the summing point for the scaled tuning and offset voltages, and provides a drive voltage (YO DRIVE V) for the Current Driver. Several correction signals are summed at this junction:

SCVTUNE provides the scaled ramp portion of the YO DRIVE Voltage. R19, GAIN, fine-tunes the range of the scaling DAC.

OFFSET adjusts the YO DRIVE Voltage so that the YO Coil is driven between the proper end points, as determined by the front panel controls. R24, (OFS) fine-tunes the range of the Offset DAC.

SUPPLY VOLTAGE CORRECTION provides a compensation signal from the +20V Tracking Amplifier to offset changes in the reference supply.

DLY COMP, from the Delay Compensation circuit, is added to correct for lags in the response time of the YIG Oscillator. This compensation is derived from SCVTUNE.

RTC COMP, from the Delay Compensation circuit, is a momentary correction voltage that forces the YIG Oscillator to the low end of its frequency range after a sweep retrace and each bandswitch point. This compensation is derived from SCVTUNE.

FREQ CAL (from the A1/A2 Front Panel) is summed in through U19 when the BAND 0 line from U13 A is high. This offset corrects for errors in the Fixed Cavity and YIG Oscillator frequencies while in Band 0.

YO LO FM sums low frequency components of external FM signals into the drive voltage when crossover coupling of the FM signal is selected. (Configuration switch A3S1 provides this adjustment. Refer to the A3 Service Sheet for further detail.) Due to the response time limitations of the YIG Oscillator's main coil, only frequencies below 700 Hz are passed from the A5 FM Driver assembly to the A8 YO assembly.

−10V Reference (H)

Operational amplifier U5 generates a −10V output from the −6.2V reference voltage at its noninverting input. The amplifier gain is determined by feedback resistors R43, R44, and R45. Emitter follower Q2 provides the current. The −6.2V reference input to U5 is developed across 3 parallel zener diodes to reduce noise. Further noise reduction is provided by the RC network on the noninverting input of U5 and by C17 across the feedback path. −15VF, through R1, provides the initial start-up bias.

Frequency Cal Switches/Output Data Buffers (D)

DIP switches S1 and S2, with their corresponding data bus buffers, are used for digital calibration of the low and high end frequencies in Band 2. The data on these switches is read by the microprocessor during power-up and INSTR PRESET and is used to calculate the settings for the Scale F and Offset E DACs. S1, with pull-up resistor package U1, is read through U3 when enabled by L EN 4. S1 determines the value of the Offset DAC and calibrates the low end frequency. S2, with pull-up resistor package U2, is read through U4 when enabled by L EN 5. This establishes the Scale DAC values, and calibrates the high end frequency. The ninth and tenth bits from S1 and S2 are read through U7.

S1 and S2 switch positions encode binary numbers to set up the Offset and Scaling DACs. Refer to the Frequency Accuracy adjustment procedure in Section V for instructions. Figure 8-66 illustrates the switch configurations.

YO Coil Current Source (I)

YO Coil Current Driver A9 (K)

The YIG Coil Current Driver works with the chassis-mounted Reference Resistor R1 and YO Coil Driver A9Q1 to drive a current proportional to the drive voltage through the YIG's main tuning coil.

U21, Q3, Q4, and A9Q1 comprise a voltage-to-current converter and current driver for the YO's main coil. The non-inverting input of U21 receives the YO DRIVE Voltage signal. The inverting input of U21 monitors the voltage drop across reference resistor R1, which is directly proportional to the coil current. If the drive current is not tracking the drive voltage, U21 will produce an error voltage to correct the difference. Emitter-follower Q4 and common-emitter-stage Q3 provide the current gain needed to drive A9Q1. Q4 and Q3 emitter currents are also drawn through chassis-mounted R1, and therefore sensed by U21. VR1 and CR5 protect the current drive transistors by limiting voltage spikes caused by sudden changes in the coil current. R33 helps to dampen ringing caused by the parasitic capacitance and the inductance of the YO coil.

When Model 8350A/B CW and Model 83592C CW FILTER are selected, L CW goes low, energizing relay K1. C21 filters out noise in the YIG coil current, reducing the residual FM noise in the CW mode.

CR4, CR8, and their associated factory-select resistors provide a two-breakpoint compensation network to correct for non-linearities in the YO characteristics.

NOTE

The values of the factory-select resistors are stamped on a label attached to the RF casting. Matching resistor sets (mounted on a header) are supplied with replacement YOs and must be installed on the A8 YO assembly. The new label indicating the replacement resistor values should be attached to the RF casting.

If the A8 YO Driver assembly is replaced, the shaping resistors from the defective board (which are mounted on a header) must be reinstalled in the new assembly.

NOTE

If the YO needs little or no compensation, some or all of the factory-select resistors may be omitted.

+5V Regulator A9 (L)

A9Q3 is a +5 Vdc regulator mounted in a single package. It receives the +5V UNREG line (slightly more than 5V) from the mainframe, and regulates it for use in the Plug-In RF components.

A8 YO Driver / A9 Reference Resistor Assemblies Troubleshooting

NOTE

All reference designators refer to the A8 assembly, unless otherwise noted.

The A8 YO Driver and A9 Reference Resistor assemblies are primarily responsible for controlling the RF output frequency. A failure in these assemblies usually results in large frequency errors that may or may not be independent of sweep time. (Frequency errors that change with sweep time are usually related to delay compensation.) Frequency errors on the order of 500 MHz or less may be due to improper calibration. The problem may be relieved by performing the Frequency Accuracy adjustment in Section V.

General

Check that all power supply voltages are present. +20V (on the A8 asembly), −40V (on the A13A1 assembly), and +5V (on the A9 assembly) are the supplies for the YO. Ensure that cable plugs are correctly seated over the correct jacks throughout the Plug-In. With the line power off, remove and reseat the A8 assembly to ensure good Motherboard contact.

NOTE

Unless specifically stated otherwise, the troubleshooting waveforms and voltages described below occur when the Plug-In is sweeping across its full range (INSTR PRESET conditions).

Sweep Circuitry

A failure in the sweep circuitry may cause the YIG to sweep between improper frequency endpoints, or not sweep at all. If the YO Drive Voltage is missing, the instrument may toggle between two or more CW frequencies.

1. Check the YO DRIVE (V TP10) for the waveform shown in Figure 8-70. If this waveform is correct, troubleshooting should continue with the YO Current Driver section below.

   a. If the YO DRIVE V is incorrect, check BVTUNE (A6TP8) for a series of 0 to −10V ramps. If they are missing or of the wrong amplitude, refer to the A6 Sweep Control service sheet for further troubleshooting.

   b. If the waveform at TP10 appears to be level-shifted, check −10 VREF (TP12) for exactly −10 Vdc. Next, with the Plug-In sweeping its entire range, check OFFSET (TP3) for the waveform in Figure 8-68. If this signal is incorrect, select a CW frequency of 20.0 GHz and press **[SHIFT] [5] [2]**. Check TP3 for the waveform shown in Figure 8-65. If this fails, check address decoding and the DAC latches using the Digital Control troubleshooting procedure described below.

2. If BVTUNE is correct, check SCVTUNE (TP2) against the waveform shown in Figure 8-70. If it appears to be bad, run the Scale DAC Test by setting a CW frequency of 20.0 GHz and pressing **[SHIFT] [5] [2]**. Check that U17 pin 15 is at −10 Vdc. Then check TP2 for the waveform shown in Figure 8-65. If this fails, check address decoding using the Digital Control troubleshooting below.

3. Check that the +20V FREQ REF (A7TP12) measures for +20 Vdc ±10 mV. If it does not, trace the supply voltage back to the Model 8350A/B. Then check that SUPPLY VOLTAGE CORRECTION (U11 pin 6) is at approximately −7.5 Vdc. If it is not, troubleshoot U11.

4. Finally, check that the summing junction, U20 pin 2, is at 0 Vdc. If it is not, troubleshoot U20.

Delay Compensation

A failure in the Delay Compensation circuit is indicated by frequency errors that change with sweep time. For sweep times greater than 100 milliseconds, delay compensation has little effect on the frequency accuracy. On the Model 8350A/B, press **[INSTR PRESET]** and check waveforms in Figure 8-69.

YO Drive Circuits

1. Check +20V FREQ REF at A7TP12 for +20V ±10 mV. If it is not, troubleshoot back to the mainframe supply.

The circuitry surrounding U21 and A9Q1 is responsible for converting the YO DRIVE V to a drive current for the YO coil. A failure here will usually result in extreme frequency errors.

2. Press **[INSTR PRESET]** to sweep the entire range of the Plug-In. Check TP11 for the waveform shown in Figure 8-67. This represents the voltage (not the current) across the YO's main coil, and will give an indication as to whether current is passing through the coil. If this waveform is correct, suspect the YIG Oscillator. Refer to the RF Section service sheet.

3. Check TP6. This voltage should track the YO DRIVE V (Figure 8-67). If it does not, troubleshoot U21, Q3, Q4, chassis-mounted R1, and A9Q1.

   a. To verify proper operation of U21, ground TP6 (R1 is a 25 watt resistor). Press Model 8350A/B **[CW]**. Vary the voltage at U21 pin 3 by changing the CW frequency as indicated on the front panel (20.0 GHz = −5V; 2.4 GHz = +12V). With TP6 at 0 Vdc, U21 pin 6 should be at approximately +20 Vdc for positive input voltages, and approximately −10 Vdc for negative input voltages. If it is not, replace U21.

   b. Chassis mounted R1 should be checked by removing the A9 assembly from the instrument. The ohmmeter reading should be approximately 155Ω.

   c. While the A9 assembly is removed from the instrument, check the collector-base and base-emitter junctions of A9Q1 with an ohmmeter. These junctions should show only a few hundred ohms when forward biased, and a high impedance in the reverse direction. If A9Q1 is found to be shorted or opened, make sure that protection diodes VR1 and CR5 are good before replacing the transistor.

d. Q3 and Q4 can be checked, using the procedure above, while they are still in the circuit. The line power should be off.

Digital Control

The Address Decoder and Data Latch and the Frequency Cal Switches comprise the digital control for the A8 assembly. A failure in these components usually results in large frequency errors.

To check the address decoding circuitry press **[SHIFT] [5] [4]** and perform the following:

1. Examine L INST2 (P1-18) for activity. If none is found, troubleshoot the A3 assembly.
2. If L INST2 is functional, check each of the L ENn lines (U16) for the pulses shown in Figure 8-64. If these are incorrect, but the address lines show activity, replace U16. If the address lines seem locked high or low, troubleshoot the address buffer on the A3 assembly.

NOTE

U3, U4, and U7 are checked by reading data while changing switch settings. Before altering the switch settings on A8S1 and A8S2, write down the present configuration. Return the switches to their original status after troubleshooting. If this is not done, the frequency endpoints will have to be recalibrated.

3. To check output buffer U7, press **[INSTR PRESET]**, and make the following key entry:

[SHIFT] [0] [0]	Enters the Hex Data command
[2] [GHz s] [8] [6]	Address location 2C86 (U7)
[M3]	Hex Data Read

The hex digits displayed in the Model 8350A/B front panel FREQUENCY/TIME window should change as the S1 and S2 switch positions 8 and 9 are toggled.

4. U3 and U4 can each be checked with Hex Data Read (see above) at address 2C84 or 2C85. The hex digits should change when the corresponding Freq Cal switches are changed.
5. Exercise U13 with Hex Data Rotation Write. Enter:

[SHIFT] [0] [0]	Enters Hex Data command
[2] [GHz s] [8] [7]	Address location 2C87 (U13)
[M4]	Hex Data Rotation Write

Check the outputs of U13 against the waveforms shown in Figure 8-2.

−10V REFERENCE

Check TP12 for −10 Vdc ±1 mV. If this voltage is incorrect, perform the −10V Reference adjustment procedure provided in Section V of this manual. If the adjustment cannot be made, check the anodes of VR2−4 for −6.2 Vdc. If a voltage is incorrect, replace the zener diode. Check U5 pins 2 and 3 for −6.2 Vdc ±0.15 mV. If either measurement is incorrect, troubleshoot U5 and associated circuitry.

5V Regulator

Check A9U1 pin 1 for slightly over +5 Vdc (+5V UNREG from the Model 8350A/B). Remove RF ribbon cables W4 and W14 to check for the possibility of excess loading. Then check A9U1 pin 2 for +5 Vdc. If incorrect, replace A9U1.

CW Filter

Relay K1 and C21 reduce residual FM by filtering the noise from the YO Coil current. The relay is actuated by a line from U13. To check the data line, press Model 8350A/B **[CW]**. Enter:

[SHIFT] [0] [0]	Enters Hex Data command
[2] [GHz s] [8] [7]	Address location 2C87 (U13)
[M2]	Hex Data Write
[0] [0] / [BKSP] [BKSP]	Enters Hex Data 00 and FF

Alternate between 00 and FF. Check U13, pin 7. If it is inactive, make sure protection diode CR6 is good. Then replace U13.

If U13 is working, alternate between 00 and FF, as described above, and verify that contacts in relay K1 are opening and closing.

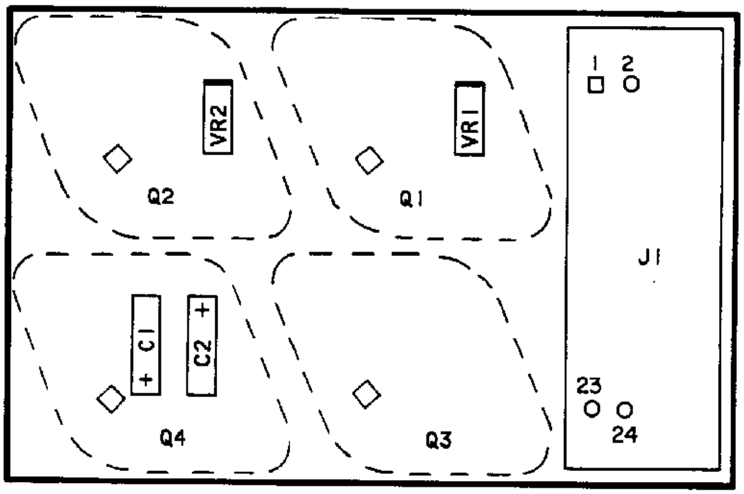


Figure 8-61. A9 Reference Resistor: Wiring List and Component Locations

RF SECTION, CIRCUIT DESCRIPTION

The RF Section includes the high frequency microcircuits, with their bias boards, that produce the actual RF output power. These components include A11 through A20; AT1, DC1, DC2, CR1, and FL1. All other Plug-In assemblies function essentially to control these RF components. The connections between the microcircuits and other assemblies are provided on the Overall Block Diagram. Refer to the Overall Block Diagram circuit description for a more general functional description.

NOTE

Assembly circuit descriptions are discussed in signal flow order. Headings indicate in which frequency band(s) the assembly is active.

BANDS 0 THRU 3

A13 YIG Oscillator

The A13 YIG (Yttrium-Iron-Garnet) Oscillator (YO) is a solid-state tunable microwave source. Its output frequency ranges from 2.3 to 7.0 GHz, with approximately +12 to +14 dBm of output power. The oscillator's resonant tank circuit is basically a small YIG sphere with a resonant frequency which depends on the surrounding magnetic field strength. The magnetic field is established by an opposing pair of electromagnetic "main coils." Changing the current through the coils changes the magnetic field strength, and hence the frequency of oscillation. The sphere is lightly coupled to a bipolar transistor, providing the gain necessary to sustain oscillation. A FET amplifier provides the final output power gain.

The A13A1 YO Bias assembly supplies the biasing for the oscillator and YO amplifier. This board is matched to the YO, and cannot be separately replaced. The bias assembly provides zener protection against high voltage transients that appear across the main coils. It also supplies current for a resistive heater that helps maintain the oscillator at a constant temperature. Factory adjustment R4 optimizes the FET gate bias for minimum harmonics.

A16 Modulator/Splitter

The A16 Modulator/Splitter divides the YO output into two paths (one for Band 0 and the other for Bands 1 through 3). The RF input from the YO is coupled off and supplied to the rear panel AUX OUTPUT with a power level of approximately 0 dBm.

The Modulator/Splitter uses two PIN diode modulators (a third is not used). The PULSE MOD input switches its PIN diode modulator full on or full off, and provides an RF on/off ratio of greater than 30 dB. Since this modulator is positioned ahead of the splitter, it provides pulse modulation for all bands.

The MOD 1 input provides amplitude control for Bands 1 through 3 and is used for amplitude leveling.

BAND 0

A18 Modulator/Mixer

The A18 Modulator/Mixer mixes a fixed 3.8 GHz signal with the swept 3.81 to 6.2 GHz YO output, producing the 0.01 to 2.4 GHz RF output in Band 0. Unwanted mixing products are minimized by frequency selective circuits within the microcircuit. The swept YO output, after passing through the A16 Modulator/Splitter, acts as the Local Oscillator signal for the mixer. The internal PIN diode modulator attenuates the fixed 3.8 GHz input, providing both amplitude leveling and squarewave modulation (generated by the Model 8350A/B mainframe) for Band 0. The mixer has a high conversion loss, and produces approximately −12 dBm of mixed output with +9 dBm of 3.8 GHz input and no modulator attenuation.

A11 Cavity Oscillator

The A11 Cavity Oscillator provides a fixed 3.8 GHz RF output at approximately +9 dBm to mix down the swept YO output, yielding the Band 0 heterodyned low-frequency output. This source is extremely stable in both frequency and amplitude. The +20V and −10V lines provide power for the A11 assembly, and two large, separately replaceable capacitors help filter these supplies to reduce residual FM noise.

A17 Amplifier

The A17 Amplifier provides approximately 40 dB of gain from 0.01 to 2.4 GHz for Band 0. The amplifier gain drops sharply at higher frequencies, providing a low-pass filter which rejects the unwanted mixing products. The A17A1 Amplifier Bias assembly provides the various bias currents for the Band 0 amplifier. It is matched and attached to the microcircuit at the factory, has no adjustments or replaceable parts, and cannot be replaced separately as an assembly. The +20V and L B0RF ON lines provide the power. When the RF is "off" or the Plug-In is operating in Bands 1−3, the bias is removed, shutting down the amplifier altogether.

FL1 Low Pass Filter

The FL1 Low Pass Filter follows the A17 amplifier, and reduces harmonic output above 2.4 GHz.

The filter is a multi-section device which gives approximately 35 dB attenuation at 2.5 GHz.

DC1 Directional Detector

The DC1 Directional Detector detects the RF power amplitude for Band 0 leveling. The insertion loss for the entire package is less than 3.5 dB.

A simple resistive directional bridge samples a portion of the RF energy to a diode detector. The RF is rectified and filtered, providing a voltage proportional to the peak RF amplitude, which is used for leveling in Band 0. A single resistor (A16A1R9) biases the detector diode through feed-through E1. Feed-through E2 carries the detected signal, and also carries a second bias current from the A4 assembly for a second, temperature-compensating diode. An internal resistor helps protect the static-sensitive diodes.

A15 DC Return

The A15 DC Return is simply a shunt RF choke which allows DC bias currents to flow to ground without shunting any RF energy. Insertion loss is typically less than 0.5 dB.

BANDS 1 THROUGH 3

A14 Power Amplifier

The A14 Power Amplifier amplifies the fundamental YO output, covering the 2.3 to 7.0 GHz range. The amplifier provides approximately 25 dB of gain at maximum leveled power.

The A14A1 Amplifier Bias assembly contains several factory adjusted bias adjustments. These are adjusted at the factory to minimize harmonics.

AT1 Isolator

AT1 provides 20 dB of isolation and is accountable for less than 1 dB of insertion loss. AT1 improves the match to the YTM.

BANDS 0 THROUGH 3

A12 YTM

For Bands 1 through 3, the A12 YIG Tuned Multiplier (YTM) receives RF from the AT1 Isolator. This RF input is applied through an impedance matching circuit to a Step Recovery Diode (SRD) which has an output that is rich in harmonics. The SRD Bias applied to the diode is changed for each band to optimize the generation of the harmonic used for that band (Band 1 = Fundamental, Band 2 = Second Harmonic, Band 3 = Third Harmonic). The YIG Tuned Filter is a tunable bandpass filter which is tuned to the RF output frequency by the YTM Coil drive current supplied by the A7 YTM/YTF Driver.

The filter's bandpass frequency is determined by a small YIG sphere with a resonant frequency that depends on the surrounding magnetic field strength. The magnetic field is established by an opposing pair of electromagnetic coils. Changing the current through the coils changes the magnetic field strength, and hence the bandpass frequency.

The dynamic response of the YTM (i.e. how fast the bandpass frequency changes for a fast change in coil current) is limited, due to the inductive and magnetic delays of the electromagnet coils and their poles. Delay compensation circuits help during a sweep, but frequency modulation is limited to low modulation frequencies. Since the range of deviation for high-frequency modulation is limited by the YIG Oscillator, the RF frequency stays within the bandpass of the YTM, and the YTM does not need to be modulated at higher rates.

The PIN diode switch in the YTM is not used. However for proper operation, the diode is continuously forward biased.

A20 YTF

The A20 Switched YIG Tuned Filter (YTF) uses a PIN diode switch to select either a through path from the A15 DC RETURN (Band 0), or the output from the A12 YTM (Bands 1 to 3). Insertion Loss for Band 0 is typically less than 0.5 dB.

For Bands 1 through 3, RF from the A12 YTM is selected. This RF is applied to a YIG Tuned Filter. The filter is a tunable bandpass filter tuned to the RF output frequency by the YTF coil drive current supplied by the A7 YTM/YTF Driver. The operation of the YTF is identical to that of the filter in the YTM.

DC2 Directional Coupler

The DC2 Directional Coupler has a −16 dB coupling coefficient. The reverse-coupled port is terminated. The coupled output is sent to the CR1 Detector for leveling in Bands 1 through 3. Although the Band 0 output (0.01 to 2.4 GHz) must pass through the DC2 assembly, it plays no part in Band 0 leveling. The insertion loss is less than 0.8 dB, not including the coupled power loss.

CR1 Detector

The CR1 Detector rectifies and filters the RF output coupled by the DC2 Directional Coupler for leveling in Bands 1 through 3. The internal diode is biased by circuitry on the A4 assembly.

A19 Step Attenuator (Option 002 Only)

On RF Plug-Ins equipped with Option 002, the A19 Step Attenuator provides 55 dB of attenuation in 5 dB steps. Combined with the range of the ALC loop, this yields a maximum power range of +10 to −60 dBm. The Step Attenuator is composed of four fixed attenuators, with 5, 10, 20, and 20 dB of attenuation. Latching relays close contacts which either insert these attenuators in the RF path or bypass them. The control and drive circuitry for the Attenuator is located on the A2 Front Panel Interface assembly. The insertion loss, with 0 dB attenuation selected, may be as much as 5 dB at 20 GHz (see specifications in Section I). Pressing SHIFT POWER SWEEP allows control of power within the ALC range without changing Attenuator settings. The display in the SHIFT POWER SWEEP mode disregards Attenuator settings and displays the ALC settings. Pressing SHIFT SLOPE allows control of Attenuator steps without affecting the ALC setting. In this mode the attenuator setting is displayed.

RF OUTPUT Connector

On Standard or Option 002 instruments the RF output is directed to the front panel. On Plug-Ins with Option 004 (with or without other options), the output is directed to the rear panel. The standard RF output connector is a Type N female connector.

RF PATH TROUBLESHOOTING

NOTE

Many RF path failure symptoms are closely related to A4 ALC failures. Refer to A4 Troubleshooting for additional information.

The RF Path consists of the microcircuits and their bias boards that produce the actual front-panel RF output. These microcircuits are sealed, cannot be repaired, and are costly to replace. Ensure that associated control circuits (e.g. the other printed circuit boards) are working correctly before replacing any microcircuit components. When certain of a failure in the RF components, isolate the problem to a single microcircuit assembly.

Six RF assemblies have bias boards attached directly to the microcircuit packages:

- The A17 Band 0 Amplifier is directly attached to its bias board. The A17A1 Amplifier Bias assembly cannot be repaired, is not separately replaceable, and is supplied with the A17 microcircuit.
- The bias boards for A12 through A14, A16, and A20 contain factory adjusted or factory selected components, and cannot be separately replaced. If a bias board component (e.g. protection diode or transistor) has been externally damaged, it is acceptable and economical to replace that individual component. However, a bias board failure often indicates a failure inside the microcircuit, and may require that the entire assembly be replaced.

WARNING

Many microcircuits are extremely sensistive to static electric discharges (more so when the microcircuits are removed from their bias boards or control circuits).

Before handling a microcircuit, discharge your own body by touching the instrument chassis or microcircuit package. Avoid touching the center conductors of the RF connectors and bias feed-throughs at all times.

Microcircuits should be stored and transported in static-protective packaging. Never package microcircuits with styrofoam, cellophane (unless treated for static), or adhesive tape.

Do not attempt to test any microcircuits, at a bias feed-through or the RF connectors, with an ohmmeter. Resistance measurements are rarely useful, and will often destroy a working microcircuit. Measure DC voltages at the bias feed-throughs with a high-impedance DC voltmeter only with bias or control connections intact.

The following troubleshooting procedure traces power levels through the RF path. RF measurements should be made with a high-frequency spectrum analyzer or an RF power meter. A type-N female to SMA adapter, along with a short flexible RF cable terminated at both ends with SMA male connectors, will make troubleshooting easier.

Included with Plug-In is a short section of cable which may be used if YO, YTM tracking adjustment is necessary.

Breaking RF connections within the ALC loop will cause the loop to go unleveled, producing abnormally high power levels (up to +20 dBm) and harmonic distortion. In Band 0, the ALC loop includes all connections between the A18 Modulator/Mixer and the DC1 Directional Detector. In Bands 1–3, the ALC loop includes connections between the A16 Modulator/Splitter and the DC2 Directional Coupler. (Figure 8-24, within the A4 Troubleshooting section, provides a graphic definition of the loop.) If necessary, the modulators may be externally biased using the Open Loop Procedure described in the A4 Troubleshooting Section. If possible, avoid breaking the ALC loop to make RF measurements. In any case, it is a good idea to begin troubleshooting just outside the ALC loop.

FAILURE SYMPTOMS

The information below should be used to help systematically troubleshoot to the individual RF assembly. Based on the failure symptom, the components most likely to have failed are listed with the most probable failure cited first. Hints for ensuring that the RF Path is actually responsible for the failure are also given. For troubleshooting information related to a specific assembly, refer to **Microcircuit Verification By Assembly** below.

NOTE

All references to test points, pin connections, etc., can be located on the RF Schematic.

NO RF POWER – All Bands

- A13 YIG Oscillator. A YO failure is indicated if the RF power at the rear panel AUX OUTPUT connector is less than −10 dBm (nominally 0 dBm). Check power supplies and bias levels. L RF ON (TP "ON") should be at −10 Vdc. TP "G" should be approximately −2 Vdc. Check TP "M" for the waveform entitled YO COIL, Figure 8-70, in the A8 service sheet. This waveform represents the current across the main coil. Check the RF output directly at the YO for approximately +14 dBm at several frequencies.

- A16 Modulator/Splitter. A Modulator/Splitter failure is indicated if there is not at least −10 dBm at the rear panel AUX OUTPUT connector. Disconnect PULSE MOD input to A16J4 to eliminate the possibility of the Pulse Modulation circuit on the A6 Sweep Control assembly turning the RF power off. If there is still no RF output power, check the Modulator/Splitter output power at A16J6 and J7.

- A12 YTM. The easiest place to access the A12 YTM RF output is at the W33 input to the A20 YTF. Also check the YTM power supplies and bias voltages.

- A20 Switched YTF. The easiest place to access the A20 YTF RF output is at the W15 input to the DC2 Directional Coupler. Also check the YTF power supplies and bias voltages.

NO RF POWER − Band 0

- A17 Amplifier. Check power supplies. Check the power directly out of A17. This will open the ALC loop. Expect to measure approximately +20 dBm unleveled RF output with high harmonic distortion. If this is undesirable, refer to A4 Troubleshooting and follow the Open Loop Procedure to externally level the RF while opening the ALC loop.

- A18 Modulator/Mixer. If A18 is the suspected component, remove the A4 assembly. This removes all modulator current and provides an unrestricted path for RF. If full unleveled RF power is achieved, refer to A4 Troubleshooting. If Band 0 remains dead, disconnect W23 and check the RF output directly out of the Mixer (open loop power should measure approximately −12 dBm).

- A11 Cavity Oscillator. Check power supplies. Check the RF output for approximately +9 dBm at 3.8 GHz.

NO RF POWER − Bands 1−3

- A16 Modulator/Splitter. Remove the A4 assembly. This removes all bias current from the modulator and provides an unrestricted path for RF. If full unleveled power is achieved, refer to A4 Troubleshooting. If Bands 1−3 remain dead, disconnect W20 and check the RF output directly out of A16 (open loop power should measure approximately +9 dBm).

- A14 Power Amplifier. Check power supplies. Verify that L AMP OFF is a logic high (pulled high on A14A1 and a no-connection on the A10 Motherboard). The easiest place to access the A14 output power is at the output of the AT1 Isolator (approximately +26 dBm). If there is no power at this point check the power directly at the A14 output.

- A12 YTM. Check power supplies. The easiest place to access the YTM RF output is at the W15 input to the DC2 Directional Coupler. Verify that the PIN switch is properly biased (−5V).

- A20 YTF. Verify that the PIN SW control voltage (A6TP6) is +10V for Band 0 and −5V for Bands 1−3. The easiest place to access the YTF RF output is at the W15 input to the DC2 Directional Coupler.

MAXIMUM UNLEVELED RF POWER − All Bands

- Refer to this symptom under A4 Troubleshooting.

MAXIMUM UNLEVELED RF POWER – Band 0

- DC1 Directional Detector. Select a CW frequency in Band 0. Verify maximum unleveled RF output power. Check INT DET 0 output to be equal to or more negative than –0.2 Vdc. (It may be necessary to perform INT DET 0 BIAS adjustment. Refer to Section V, Adjustments.) For more information refer to A4 Troubleshooting.

- A17 Modulator/Mixer. Check modulator bias line MOD 0. It should be slightly negative. If it is approximately +4 Vdc while A4TP6 is approximately +4 Vdc, the modulator diode is probably open. If MOD 0 is at 0.0 Vdc, but A4TP6 is at +4 Vdc, troubleshoot the A4 Mod Drivers and connections to the modulator.

MAXIMUM UNLEVELED RF POWER – Bands 1–3

- CR1 Detector. Select a CW frequency in Band 1 and check for maximum unleveled RF output power. Check the output of CR1 for approximately –0.05 Vdc, using an SMC tee or probing A4P1–20.

- A16 Modulator/Splitter. If CR1 will output about –0.05 Vdc, check that A4TP6 is at +4 Vdc. If not, troubleshoot A4. Then check MOD 1. It should be slightly negative. If it is approximately +4 Vdc the modulator diode is open. If MOD 1 is near 0.0 Vdc while A4TP6 measures +4 Vdc, check A4 Mod Drivers and the connections to the modulator.

HARMONIC DISTORTION – All Bands

- A13 YIG OSCILLATOR. Refer to Section V, Adjustments, and perform the harmonic adjustments. If harmonics are still unacceptable in all bands, check the spectral purity of the YO output. If harmonics are less than 14 dB below the fundamental, replace A13.

HARMONIC DISTORTION – Band 0

- A17 AMPLIFIER. Check the power level into the A18 Modulator/Mixer, and if it is too low, trace the problem back through the RF path. Measuring power or spectral content directly out of A18 or A17 will break the ALC loop, causing maximum unleveled power and high harmonic distortion even without a failure. Refer to A4 Troubleshooting and perform the Open Loop Procedure. This procedure externally biases the Modulators to level RF power while the ALC loop is open.

HARMONIC DISTORTION – Bands 1–3

- A14 Power Amplifier. Check power supplies and biases. Check power levels into A14. Measuring power or spectral content into or out of A14 will break the ALC loop and cause distortion even without a failure. Refer to A4 Troubleshooting and perform the Open Loop Procedure. This procedure externally biases the Modulators to level RF power while the ALC loop is open.

SPURIOUS DISTORTION – Band 0

- A18 MODULATOR/MIXER. Select a CW frequency in Band 0, and check the RF output for spurs 3.8 GHz removed from the carrier. The Mixer may be leaking the swept LO frequency (3.81 – 6.2 GHz). However, the A17 Amplifier should filter this out.

POWER DROPOUTS – Any Band

- A13 YIG OSCILLATOR. If power is present and leveled across part of a band, but drops out entirely for the rest of the band, suspect A13. Check for power dropouts at the rear panel AUX OUTPUT connector.

POWER HOLE – Any Band

- Check all RF connections in the proper loop(s). Narrow-band power dips or "holes" are usually the result of loose or faulty RF connections. Tighten all RF connectors internally. Secure the front-panel RF connection. Inspect the front-panel RF connector for damage or wear, and clean or replace parts as necessary. Section VI, Replaceable Parts, provides an exploded view of this connector.

DC BIAS at RF OUTPUT

- DC blocking is provided by a blocking capacitor in the RF OUTPUT connector J1. If a DC bias exists at the RF output, the failure is probably in the connector, and the connector assembly should be replaced. The part number is listed in Table 6-3, Replaceable Parts.

Microcircuit Verification by Assembly

The information below is organized by microcircuit assembly in RF signal-flow order. It provides troubleshooting tips to isolate a particular microcircuit failure. This information is intended as a guide. Any suspected failure should be thoroughly researched before replacements are made.

The general approach to troubleshooting is:

1. Make sure that all power supply voltages are present. If not, trace the problem back through the Model 83592C to the Model 8350A/B.
2. Make sure all bias and control signals are present. If not, trace the problem back to the supplying assemblies.
3. Check the RF levels into the suspected microcircuit. If they are faulty, trace the problem back through the RF path.
4. Check the RF levels out of the suspected microcircuit. If they are faulty, replace the assembly.

IN EVERY CASE, check power supply voltages. Make sure control signals and bias voltages are being supplied from the other circuits before replacing any microcircuit. Refer to the service sheet appropriate to the assembly supplying the control signals for voltage levels and waveforms.

A13 YIG OSCILLATOR

Check the RF output at the rear panel AUX OUT for greater than −10 dBm, then check the power directly from the YO for about +14 dBm.

A16 MODULATOR/SPLITTER

RF power into A16 can be checked at the rear panel AUX OUT. The Pulse Modulator can be disabled by disconnecting the PULSE MOD input at A16J4. Verify output power at both A16 outputs.

A11 CAVITY OSCILLATOR

The RF output power of this assembly should measure approximately +9 dBm at 3.8 GHz.

A18 MODULATOR/MIXER

Ensure that A11 is functioning, and that the A16 Modulator/Splitter is transmitting power in Band 0. Control line MOD 0 should be near +0.7 Vdc. If not, remove the modulation control wire and check for approximately +5 Vdc. If this is not the case, troubleshoot A4. To verify the Modulator/Mixer, remove the A4 assembly. Monitor the RF output directly from A18. In this open loop condition the power should measure approximately −12 dBm. (Expect high harmonic distortion.)

A17 AMPLIFIER (Band 0)

Check for power input as described under A18, above. Verify RF output at approximately +20 dBm unleveled with high harmonic distortion. When trying to isolate harmonic sources, refer to A4 Troubleshooting and follow the Open Loop Procedure. This procedure externally biases the modulators to level the RF power under open loop conditions.

DC1 DIRECTIONAL DETECTOR

Check for approximately +15 dBm of leveled output power. Ensure that Band 0 power is nominally +10 dBm and check the detector output, E2, for approximately −0.2 Vdc or more negative. If temperature drift is suspected, check that the INT DET 0 BIAS adjustment (A4R14) has an effect on the detected output level. If it does not, replace DC1.

A15 DC RETURN

An A15 failure is extremely unlikely. However, this component can be tested OUT OF CIRCUIT with an ohmmeter. Verify that both connectors provide a DC short to ground.

A14 POWER AMPLIFIER

Ensure that A16 transmits approximately +9 dBm RF power. If not, trace the problem back to the YO.

AT1 ISOLATOR

Check the RF output directly from the Isolator. Insertion loss through this device should be less than 1 dB.

A12 YTM

Insure that the PIN diode is properly biased (−5V). For Bands 1−3, check the SRD BIAS level. If RF output power is significantly increased by adjusting the front panel PEAK control, perform the YTM/YTF to YO Tracking adjustment in Section V.

A20 Switched YTF

For Band 0, the RF path is essentially a straight through path. Verify that the PIN SW input is +10 Vdc in Band 0.

For Bands 1−3, verify that PIN switch diode bias is −5V. The FILTER PEAK control adjusts tracking between the YTF and YTM.

DC2 DIRECTIONAL COUPLER

Insertion loss through the Coupler should be less than 1 dB in all bands. Failures here are extremely unlikely.

CR1 DETECTOR

Check the Detector output for approximately −0.05 Vdc in Bands 1−3 when leveled at +10 dBm, and slightly more negative when unleveled. This measurement can be taken at the Detector output using an SMC tee or by probing A4P1−20 (accessible on the underside of Motherboard A10).

A19 STEP ATTENUATOR (Option 002 Only)

Check the output of DC2 for approximately +10 dBm. Verify that Configuration Switch A3S1 is set for Option 002 (see A3 Service Sheet, Table 8-12). Engage SHIFT SLOPE mode to increment or decrement the Attenuator without affecting the ALC level (display reads Attenuator setting). Increment the power setting with the step keys to run the Attenuator through its 55 dB range. (Power meters will typically NOT have the dynamic range to verify this operation.) The control circuits can be manually exercised in this mode.

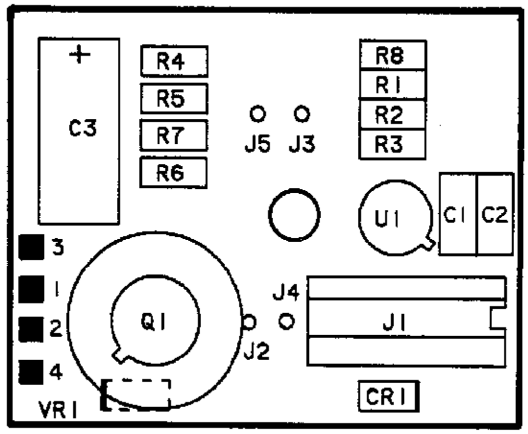


Figure 8-72. A12A1 YTM Bias, Component Locations

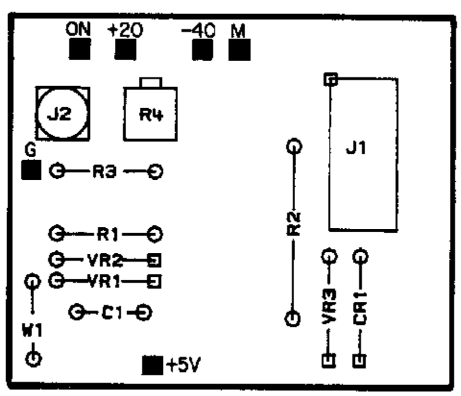


Figure 8-73. A13A1 YO Bias, Component Locations

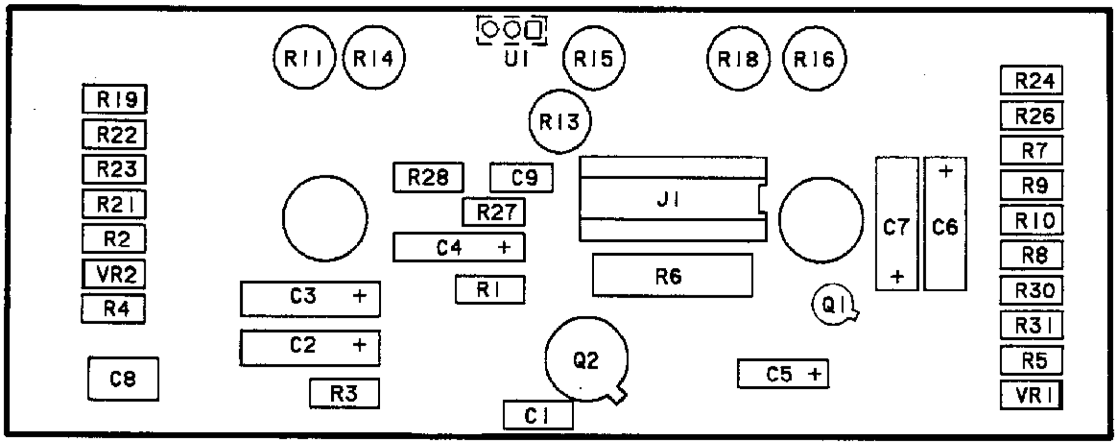


Figure 8-74. A14A1 Power Amplifier Bias, Component Locations

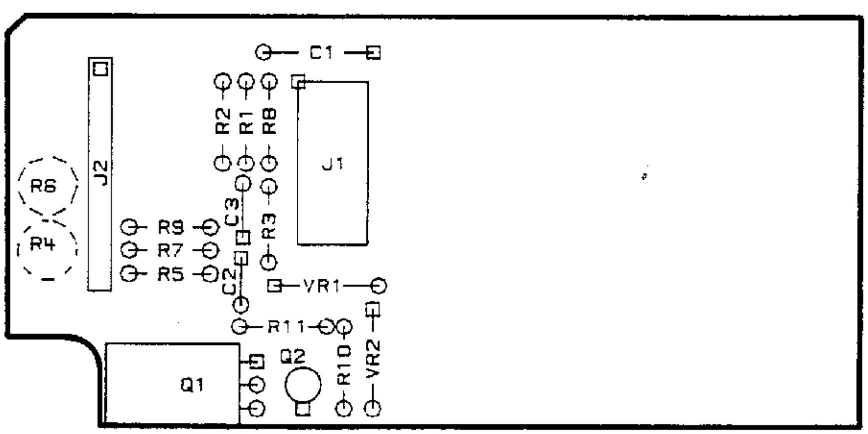


Figure 8-75. A16A1 Modulator/Splitter Bias, Component Locations

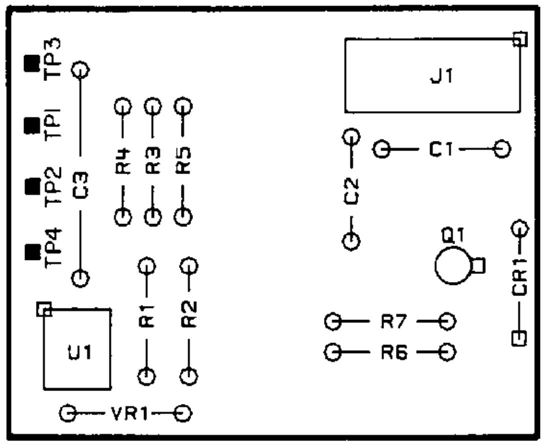
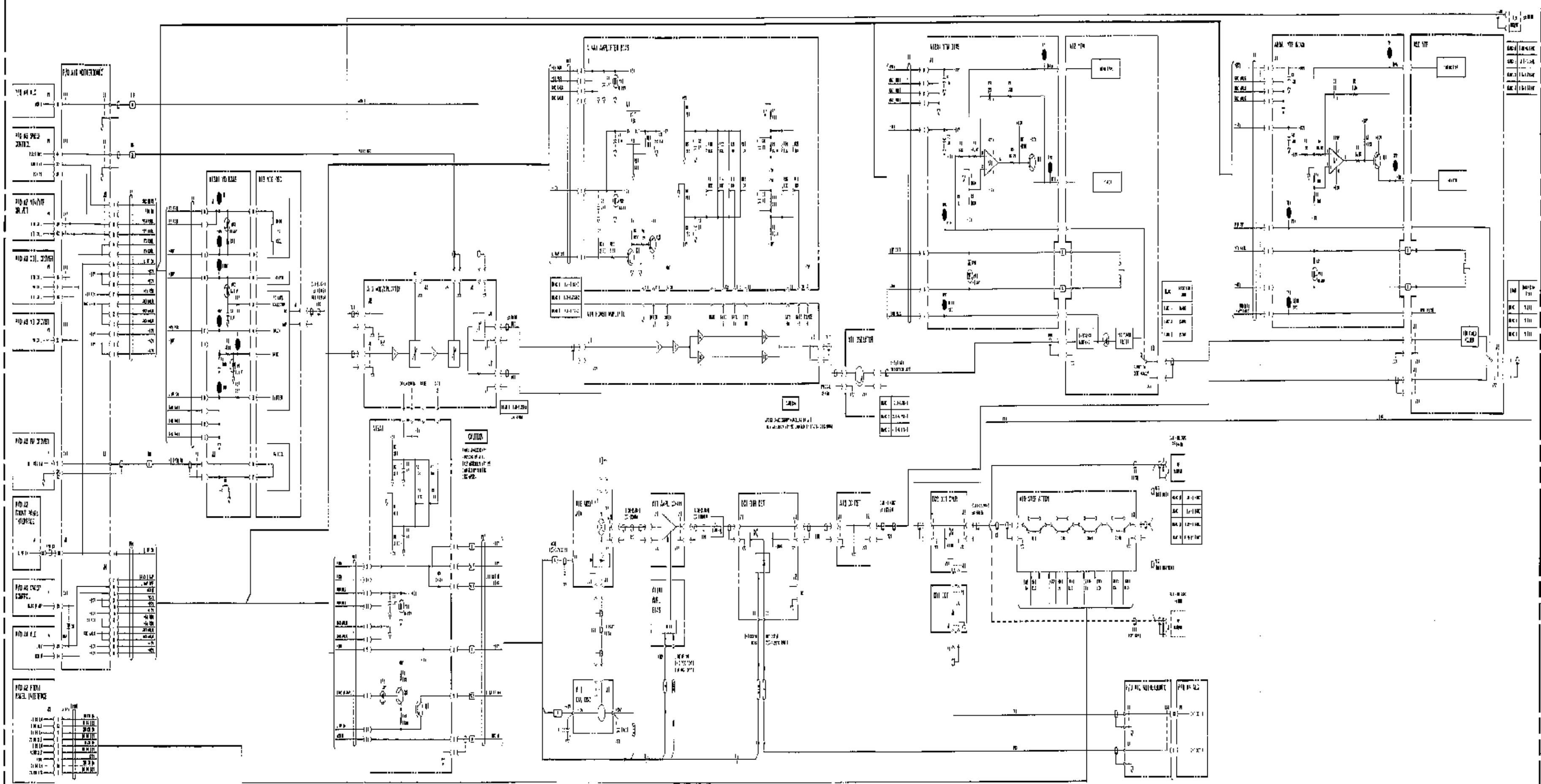


Figure 8-76. A20A1 YTF Bias, Component Locations

83592C RF SCHEMATIC



SERIAL PREFIX: 2638A

Figure 8-77. RF Schematic Diagram

Table 8-16. HP 83592C Cable List (1 of 2)

Cable	Description	Connections	
W1	Cable Assembly, Rigid, RF, RF Out	DC2 J1	Directional Coupler Front Panel RF Output APC-3.5 (m)
W2	Cable Assembly, Coax, Blue	J2 A10J6	Front Panel EXT/MTR ALC Input Motherboard
W3	Cable Assembly, Ribbon, Front Panel	A10J1 A2J1	Motherboard Front Panel
W4	Cable Assembly, Ribbon, RF Section	A10J4 A12 A13	Motherboard YTM YO
W5	Cable Assembly, Coax, White, Pulse In	J4 A10E9	Rear Panel BNC (Pulse In) Motherboard
W6	Cable Assembly, Coax, Red, Pulse Mod	A10E8 A16	Motherboard Modulator/Splitter
W7	Cable Assembly, Coax, Orange, Vtune	P1-A1 A10E7	Rear Panel Interface Motherboard
W8	Cable Assembly, Coax, Gray	CR1 A10E6	Detector (Bands 1-4) Motherboard
W9	Cable Assembly, Coax, Blue, FM	A10E5 A12A1J2	Motherboard YO (FM Coil)
W10	Cable Assembly, Coax, Purple	DC1 A10E4	Directional Detector Motherboard
W11	Cable Assembly, Coax, Green, FM In	A10E3	Motherboard
W12	Cable Assembly, Coax, Brown, AM In	P1-A4 A10E2	Rear Panel Interface Motherboard
W13	Cable Assembly, Coax, Yellow, Mod 1	A10E1 A16	Motherboard Modulator/Splitter
W14	Cable Assembly, Ribbon, RF Section	A10J5 A14A1J1 A16A1	Motherboard Power Amplifier (2.3 – 26.5 GHz) Modulator/Splitter
W15	Cable Assembly, Rigid, RF	A20 DC2	YTF Directional Coupler
W16	Cable Assembly, Rigid, RF	AT1 A12	Isolator YTM
W17	Cable Assembly, Rigid, RF	A14 AT1	Power Amplifier (2.3 – 26.5 GHz) Isolator

Table 8-16. HP 83592C Cable List (2 of 2)

Cable	Description	Connections	
W18	Cable Assembly, Rigid, RF	DC1	Directional Detector
		A15	DC Return
W19	Cable Assembly, Rigid, RF	FL1	Low Pass Filter
		DC1	Directional Detector
W20	Cable Assembly, Rigid, RF	A16	Modulator/Splitter
		A14	Power Amplifier (2.3 – 26.5 GHz)
W21	Cable Assembly, Rigid, RF	A16	Modulator/Splitter
		A18	Modulator/Mixer
W22	Cable Assembly, Rigid, RF	A11	Cavity Oscillator
		A18	Modulator/Mixer
W23	Cable Assembly, Rigid, RF	A18	Modulator/Mixer
		A17	Amplifier (.01 – 2.4 GHz)
W24	Cable Assembly, Rigid, RF	A15	DC Return
		A20	YTF
W25	Cable Assembly, Rigid, RF	A13	YO
		A16	Modulator/Splitter
W26	Cable Assembly, Rigid, RF	A16	Modulator/Splitter
		J3	Rear Panel Type N (AUX OUTPUT)
W27	Cable Assembly, RF Section	A16A1	Modulator/Splitter
		A11	Cavity Oscillator
		A17	Amplifier (0.1 – 2.4 GHz)
		A18	Modulator/Mixer
		DC1	Directional Detector
W28	Cable Assembly, Power Supply	P1	Rear Panel Interface
		A10J3	Motherboard
W29	Cable Assembly, Ribbon	P2	Rear Panel Interface
		A3J3	Digital Interface Board
		A10J2	Motherboard
		J5	Rear Panel BNC (1V/GHz Output)
W34	Cable Assembly, Rigid, RF	A12	YTM
		A20	YTF
W35	Cable Assembly, Rigid, RF	A17	Amplifier (.01 – 2.4 GHz)
		FL1	Low Pass Filter
W36	Cable Assembly, Ribbon	A10J7	Motherboard
		A9J1	Low Pass Filter

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February, 1986

HP 83592C
RF PLUG-IN
(Including Options 002 and 004)

SERIAL NUMBER

This manual applies directly to HP 83592C RF Plug-In having serial number prefix 2328A.

For additional information about serial numbers, refer to INSTRUMENTS COVERED BY MANUAL in Section I.

MANUAL PART NO. 83592-90038
Microfiche Part No. 83592-90039
Printed: DECEMBER 1983

HEWLETT PACKARD

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (NIST, formerly NBS), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

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This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of delivery. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

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Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

BP21.2

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Replace the warranty statement with the following warranty statement:

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This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of delivery, or, in the case of certain major components listed in section six of this Operating and Service manual, for the specified period. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

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1 General Information

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS

⚠ Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

⚡ Indicates hazardous voltages.

⏚ Indicates earth (ground) terminal.

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

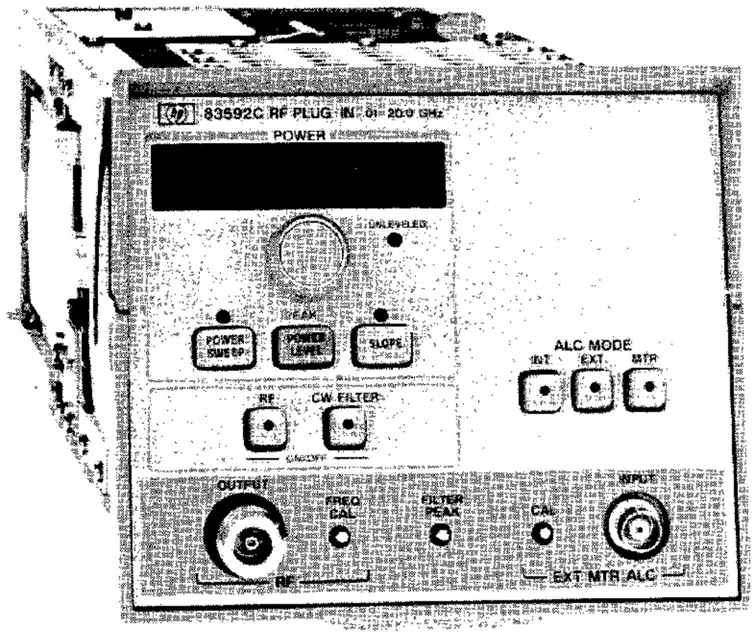
CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.



Model 83592C

Part No. 83525-20013

Figure 1-1. Model 83592C RF Plug-In and Accessory Cable

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 83592C RF Plug-In. Figure 1-1 shows the Model 83592C.

1-3. This manual is divided into eight major sections which provide the following information:

a. SECTION I, GENERAL INFORMATION, includes a brief description of the instrument, safety considerations, specifications, supplemental characteristics, instrument identification, options available, accessories available, and a list of recommended test equipment.

b. SECTION II, INSTALLATION, provides information for initial inspection, preparation for use, storage, and shipment.

c. SECTION III, OPERATION, explains the frequency resolution characteristics of the RF Plug-In in CW and swept frequency modes. Operating instructions include FM switch parameter settings, and crystal and power meter leveling instructions. A description of front and rear panel features and Plug-In error codes is also given.

d. SECTION IV, PERFORMANCE TESTS, presents procedures required to verify that performance of the RF Plug-In is in accordance with published specifications.

e. SECTION V, ADJUSTMENTS, presents procedures required to properly adjust and align the Model 83592C RF Plug-In after repair.

f. SECTION VI, REPLACEABLE PARTS, provides information required to order all parts and assemblies.

g. SECTION VII, MANUAL BACKDATING CHANGES, provides backdating information required to make this manual compatible with earlier shipment configurations.

h. SECTION VIII, SERVICE, provides an overall instrument block diagram with troubleshooting and repair procedures. Each assembly within the instrument is covered on a separate Service Sheet which contains a circuit description, schematic diagram, component location diagram, and troubleshooting information to aid in the proper maintenance of the instrument.

1-4. Supplied with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of the manual, which should be kept with the instrument for use by the instrument operator.

1-5. On the front cover of this manual is a Microfiche part number. This number may be used to order 10- by 15-centimeter (4- by 6-inch) microfilm transparencies of the manual. Each microfiche contains up to 60 photo duplicates of the manual pages. The microfiche package also includes the latest Manual Changes sheet as well as all pertinent Service Notes.

1-6. Refer any questions regarding this manual, the Manual Changes sheet, or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a worldwide listing of HP Sales/Service Offices.

1-7. SPECIFICATIONS

1-8. Listed in Table 1-1 are the specifications for the Model 83592C RF Plug-In. These specifications are the performance standards, or limits, against which the instrument may be tested. Table 1-2 lists the RF Plug-In supplemental performance characteristics. Supplemental performance characteristics are not specifications but are typical characteristics included as additional information for the user.

Table 1-1. Specifications for HP 83592C Installed in HP 8350A/B (1 of 3)

FREQUENCY [1]

Range: 0.01 to 20.0 GHz

Accuracy (25°C ±5°C)	**Frequency Bands (GHz)**				
	0.01 to 2.4	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**	**0.01 to 20.0**
CW Mode	±5 MHz [2]	±5 MHz	±10 MHz	±10 MHz	———
All Sweep Modes (Sweep time >100 ms)	±15 MHz [2]	±20 MHz	±25 MHz	±30 MHz	±50 MHz [2]
Frequency Markers (Sweep time ≥100 ms)	±15 MHz [2] ±0.5% of sweep width	±20 MHz ±0.5% of sweep width	±25 MHz ±0.5% of sweep width	±30 MHz ±0.5% of sweep width	±50 MHz [2] ±0.5% of sweep width
Stability					
With 10% Line Voltage Change	±50 kHz	±50kHz	±100 kHz	±150 kHz	±150 kHz
With 10 dB Power Level Change	±200 kHz	±200 kHz	±400 kHz	±600 kHz	±600 kHz
With 3:1 Load SWR	±100 kHz	±100 kHz	±200 kHz	±300 kHz	±300 kHz
Residual FM, Peak (10 Hz – 10 kHz Bandwidth) (CW Mode with CW Filter)	<5 kHz	<5 kHz	<7 kHz	<9 kHz	———

POWER OUTPUT [1]

	Frequency Bands (GHz)						
	0.01 to 2.4	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 18.6**	**13.5 to 20.0**	**0.01 to 18.6**	**0.01 to 20.0**
Maximum Leveled Output Power [3, 4, 5] (25°C)	+10 dBm	+6 dBm	+6 dBm	+6 dBm	+4 dBm	+6 dBm	+4 dBm
With Option 002	+10 dBm	+4.5 dBm	+4 dBm	+3.5 dBm	+1.5 dBm	+3.5 dBm	+1.5 dBm
Power Level Accuracy [12] (Internally Leveled)	<±1.5 dB	<±1.3 dB	<±1.3 dB	<±1.4 dB	<±1.4 dB	<±1.5 dB	<±1.5 dB
With Option 002 [6] (at 0 dB attenuator step)	<±1.7 dB	<±1.5 dB	<±1.5 dB	<±1.6 dB	<±1.6 dB	<±1.7 dB	<±1.7 dB

Table 1-1. Specifications for HP 83592C Installed in HP 8350A/B (2 of 3)

POWER OUTPUT (Cont'd)

Minimum Settable Power: −5 dBm

With Option 002: −60 dBm

Attenuator Accuracy	**Frequency Range (GHz)**	**Attenuator Setting (dB)**										
		5	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**
(±dB referenced from the 0 dB setting)	0.01 to 12.4	0.4	0.6	0.9	0.7	1.0	0.9	1.3	1.8	2.0	2.0	2.2
	12.4 to 18.0	0.5	0.7	1.0	0.9	1.2	1.2	1.6	2.0	2.2	2.3	2.5
	18.0 to 20.0	0.6	0.9	1.3	1.5	2.0	2.5	2.8	3.0	3.1	3.2	3.2

Power Variation (at specified Maximum Leveled Power or below)	**Frequency Bands (GHz)**				
	0.01 to 2.4	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**	**0.01 to 20.0**
Internally Leveled	±0.9 dB	±0.7 dB	±0.7 dB	±0.8 dB	±0.9 dB
Externally Leveled [7] Negative Crystal Detector [8] (Sweep time >100 ms)	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Externally Leveled Power Meter [9]	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Residual AM in 100 kHz Bandwidth (in dB below carrier and at specified Maximum Leveled Power)	≥50 dB	≥50 dB	≥50 dB	≥50 dB	≥50 dB

Spurious Signals (at specified Maximum Leveled Power)	**0.01 to 1.4**	**1.4 to 2.4**	**2.4 to 3.5**	**3.5 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**	**0.01 to 20.0**
Harmonics or Subharmonics (in dB below carrier)	>25 dB	>45 dB	>50 dB	>55 dB	>55 dB	>55 dB	>25 dB
Non-Harmonics	>25 dB	>25 dB	>55 dB	>55 dB	>55 dB	>55 dB	>25 dB
Output VSWR (Internally Leveled)	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9
With Option 002	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1

Power Sweep [10]	**0.01 to 2.4**	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 18.6**	**13.5 to 20.0**	**0.01 to 18.6**	**0.01 to 20.0**
Calibrated Range [11]	>15 dB	>11 dB	>11 dB	>11 dB	>9 dB	>11 dB	>9 dB
With Option 002	>15 dB	>9.5 dB	>9 dB	>8 dB	>6 dB	>8 dB	>6 dB

Table 1-1. Specifications for HP 83592C Installed in HP 8350A/B (3 of 3)

MODULATION[1]

External AM

Maximum Input: 15V

Internal AM

Selectable (by internal jumper in HP 8350A/B to 1 kHz or 27.8 kHz squarewave modulation. The 27.8 kHz modulation allows operation with HP 8756A Swept Amplitude Analyzer.

On/Off Ratio: ≥30 dB below specified Maximum Leveled Power.

Symmetry: 40/60

External FM

Maximum Deviations for Modulation Frequencies:

Modulation Frequency	Cross-Over Coupled	Direct Coupled
DC to 100 Hz	±75 MHz	±12 MHz
100 Hz to 1 MHz	±7 MHz	±7 MHz
1 MHz to 2 MHz	±5 MHz	±5 MHz
2 MHz to 10 MHz	±1 MHz	±1 MHz

GENERAL SPECIFICATIONS[1]

Minimum Sweep Time (over full band): 35 ms

Minimum Sweep Time (over single band: 10 ms

Bandswitch Points: Internal bandswitch points at approximately 2.4 GHz, 7.0 GHz, and 13.5 GHz.

RF Output Connector: Type N Female

1. Unless otherwise noted, all specifications are at the RF OUTPUT connector and at 0° to 55°C.
2. Accuracy when calibrated with the FREQ CAL adjustment.
3. For temperatures greater than 25°C, Maximum Leveled Output Power typically degrades 0.1 dB/°C.
4. When RF output is peaked with PEAK and FILTER PEAK controls.
5. 0.5 dB lower for Option 004.
6. Attenuator switch points are every 5 dB starting at −5 dBm indicated power.
7. Discontinuity at 2.4 GHz bandswitch point is typically <0.25 dB.
8. Excludes coupler and detector variation. Crystal detector output should be between −10Mv and −200mV at specified Maximum Leveled Power.
9. Use HP 432A/B/C Power Meter. Sweep time 100 seconds, typically ≥ seconds/GHz but not ≤10 seconds.
10. Power sweep and Slope compensation total must not exceed the specified Power Sweep calibrated range.
11. With Option 002, in Power Sweep or Slope functions, power can exceed the attenuator step by the amount that the Power Sweep calibrated range exceeds 5 dB (e.g. if the calibrated range is 7 dB, power can exceed the attenuator step by 2 dB).
12. Includes power level variations.

Table 1-2. Supplemental Performance Characteristics for HP 83592C Installed in HP 8350A/B (1 of 2)

NOTE

Values in this table are not specifications, but are typical characteristics included for user information.

FREQUENCY CHARACTERISTICS[1]

Accuracy (25°C ±5°C) [2]	**Frequency Bands (GHz)**				
	0.01 to 2.4	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**	**0.01 to 20.0**
CW Mode typically	±2 MHz	±2 MHz	±3 MHz	±4 MHz	———
Manual Sweep	≤15 MHz	≤30 MHz	≤30 MHz	≤30 MHz	≤100 MHz
All Sweep Modes (Sweep time 10 mS to 100 mS)	≤±5 MHz	≤±6 MHz	≤±8 MHz	≤±10 MHz	≤±35 MHz
Sweep Mode Linearity [3]	≤±2 MHz	≤±2 MHz	≤±4 MHz	≤±6 MHz	≤±10 MHz
Stability With Temperature	±200 kHz/°C	±200 kHz/°C	±400 kHz/°C	±600 kHz/°C	±600 kHz/°C
With Time (in a ten minute period after one hour warmup at the same frequency setting)	<±100 kHz	<±100 kHz	<±200 kHz	<±300 kHz	<±300 kHz

OUTPUT CHARACTERISTICS [1]

Power Output

Resolution (Displayed): 0.1 dB
Resolution (Power): Typically ±0.01 dB
Stability with Temperature (at specified Maximum Leveled Power): ±0.1 dB/°C

Power Variation (at specified Maximum Leveled Power or below)

Externally leveled with Negative Crystal Detector (sweep time 10 mS to 100 mS): [6] ±0.25 dB

Spurious Signals	**Frequency Bands (GHz)**					
(in dB below carrier and at specified Maximum Leveled Power)	**0.01 to 2.4**	**2.4 to 3.5**	**3.5 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**	**0.01 to 20.0**
Harmonics and Subharmonics	>35 dB	>55 dB	>60 dB	>60 dB	>60 dB	>35 dB
Non-Harmonics Typically	>40 dB	>60 dB	>60 dB	>60 dB	>60 dB	>40 dB

Impedance
50 Ohms

Power Sweep [4]
Accuracy (including Linearity): Typically ±1.5 dB
Resolution (Displayed): 0.1 dB

Table 1-2. Supplemental Performance Characteristics for HP 83592C Installed in HP 8350A/B (2 of 2)

OUTPUT CHARACTERISTICS (Cont'd)

Slope Compensation [4]

Linearity: Typically <0.2 dB
Calibrated Range: [5] Up to 5 dB/GHz; up to 15 dB for full sweep range
Resolution (Displayed): 0.01 dB/GHz

MODULATION CHARACTERISTICS [1]

External AM

Frequency Response: Typically 100 kHz
Input Impedance: Approximately 10k Ohm
Range of Amplitude Control: Typically 15 dB
Sensitivity: Typically 1 dB/V

Pulse In

TTL compatible: Logic high = RF on, Logic low = RF off

Squarewave Modulation	Pulse Modulation	
0.01 to 20.0 GHz	**10 MHz to 2.5 GHz**	**2.5 to 20.0 GHz**
up to 30 kHz	Rise/Fall Time: Typically 50 nS Minimum Pulse Width: Leveled: 5μS Unleveled Power Level set to +20 dBm: 200 nS	Rise/Fall Time: Typically 10 nS Minimum Pulse Width: Leveled: 5 μS Unleveled Power Level set to +20 dBm: 100 nS

External FM

Frequency Response (DC to 2 MHz): Typically ±3 dB
Sensitivity (Switch selectable):
Typically −20 MHz/V (FM Mode)
Typically −6 MHz/V (Phase-Lock Mode)
Input Impedance: 2000 Ohms nominal

GENERAL CHARACTERISTICS [1]

Frequency Reference Output (rear panel BNC output)

<1.0 GHz	1V/GHz ±25mV
1.0 to 18.0 GHz	1V/GHz ±2.5%

Auxiliary Output Rear panel 2.3 to 7.0 GHz fundamental oscillator output, nominally 0 dBm

Weight Net 6.0 kg (13.2 lb), Shipping 9.2 kg (20 lb.)

1. Unless otherwise noted, all characteristics are at the RF OUTPUT connector and at 0° to 55°C.
2. Accuracy when calibrated with the FREQ CAL adjustment.
3. With respect to the SWEEP OUT voltage.
4. Power Sweep and Slope compensation must not exceed the specified Power Sweep calibrated range.
5. With Option 002, in Power Sweep or Slope functions, power can exceed attenuator step by the amount that the Power Sweep calibrated range exceeds 5 dB (e.g. if the calibrated range is 7 dB, power can exceed the attenuator step by 2 dB).
6. Excludes coupler and detector variation. Crystal detector output should be between −10 mV and −mV at specified Maximum Leveled Power.

1-9. SAFETY CONSIDERATIONS

1-10. This product has been manufactured and tested in accordance with international safety standards. Before operation, this product and related documentation must be reviewed for familiarization with safety markings and instructions. A complete listing of Safety Considerations precedes Section I of this manual.

1-11. INSTRUMENTS COVERED BY MANUAL

1-12. Attached to the rear panel of the instrument is a serial number plate. A typical serial number plate is shown in Figure 1-2. The serial number is in two parts. The first four digits followed by a letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The content of this manual applies directly to instruments having the same serial number prefix as listed on the title page of this manual under SERIAL NUMBER.

1-13. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. An unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for the instrument is then supplied with a Manual Changes supplement that contains information which documents the differences.

1-14. In addition to change information, the Manual Changes supplement may contain information for correcting errors in the manual. To keep this manual as current as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to the manual's print date and part number, both of which appear on the title page. Complimentary copies of the Manual Changes supplement are available on request from Hewlett-Packard.

1-15. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes Supplement, contact your nearest Hewlett-Packard Sales/Service Office.

1-16. DESCRIPTION

1-17. The Model 83592C is an RF Plug-In which has been designed for use with the Model 8350A/B Sweep Oscillator. The Model 83592C covers the frequency range of 0.01 to 20.0 GHz in four bands. A YIG Oscillator is used as the tunable RF frequency source for all bands. The lowest band (Band 0) uses a fixed 3.8 GHz oscillator which is mixed with the YIG Oscillator to generate a 0.1 to 2.4 GHz RF output. The YIG Oscillator fundamental frequency is used for Band 1 (2.3 to 7.0 GHz). A YIG Tuned Multiplier (YTM) is used to multiply the YIG Oscillator frequency for Bands 2 and 3 (6.9 to 13.5 GHz, and 13.4 to 20.0 GHz).

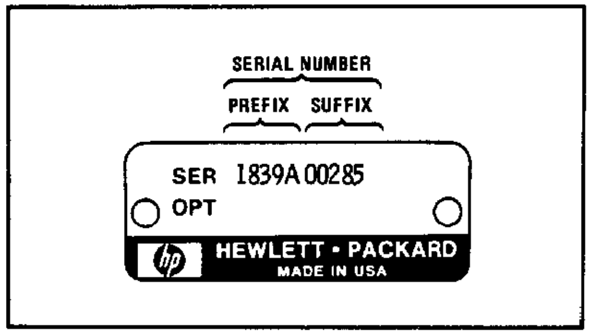


Figure 1-2. Typical Serial Number Plate

1-18. Model 83592C front panel functional controls, pushbuttons, and the Rotary Pulse Generator (RPG), are monitored by the Model 8350A/B via the RF Plug-In interface circuits. The Model 8350A/B generates a tuning voltage according to the mode of operation (CW, START/STOP, CF/ΔF). This signal is scaled and offset by the Plug-In to provide a voltage ramp (in swept modes) proportional to the YIG Oscillator and YTM/YTF frequency. The Model 83592C tuning circuits accept the tuning ramp output from the Model 8350A/B and convert it to a current which drives the YIG Oscillator and YTM/YTF tuning coil.

1-19. The standard Model 83592C offers a maximum leveled RF output power of +10 dBm to 2.4 GHz (+6 dBm from 2.4 to 18.6 GHz, and +4 dBm from 18.6 to 20 GHz). Internal (INT), External (EXT), and Power Meter (MTR) leveling are available as selected by the front panel pushbuttons. A front panel EXT/MTR ALC input connector and gain control (CAL) are provided to use with an external leveling loop. A front panel LED indicates when the RF output becomes unleveled. The RF output level is controlled by the Model 83592C RPG, the Model 8350A/B data entry controls (keypad and step keys), or through HP-IB control via the Model 8350A/B.

1-20. A power sweep function allows the RF output power to be swept at least 5 dB during CW mode or swept frequency modes. Power sweep is selected by the front panel POWER SWEEP pushbutton. Slope compensation control is also available by selecting the SLOPE pushbutton and rotating the Model 83592C RPG or manipulating the Model 8350A/B data entry controls. The power sweep function and slope compensation may both be selected and modified through HP-IB control via the Model 8350A/B. HP-IB (Hewlett-Packard Interface Bus) is Hewlett-Packard's system of instrument-to-instrument communication. HP-IB is electrically compatible with the IEEE-488 and IEC-625 worldwide interface standards. In addition, HP-IB includes extensive hardware, software, documentation, and instrument-system support.

1-21. The RF output may be internally or externally amplitude modulated, or externally frequency modulated. The internal squarewave modulation frequency is selectable by the Model 8350A/B front panel or HP-IB. An internal 8350A/B jumper selects either 1 kHz or 27.8 kHz (for use with the Model 8756A Swept Amplitude Analyzer). Rear panel BNC connectors accept an external AM or FM signal. FM coupling (direct coupled or cross-over) and sensitivity are selected by an internal configuration switch in the Model 83592C. Refer to Section III, Operation, of this manual for detailed information on the configuration switch.

1-22. A rear panel 1V/GHz signal corresponds to the RF output frequency up to 18 GHz. This output voltage may by used as a reference for pretuning external equipment in phase-locking applications. (The Model 8410B/8411A Network Analyzer utilizes this output in such a configuration.)

1-23. The RF output may be turned off by the RF ON/OFF pushbutton. An internal switch is set to select whether the RF is on or off at turn on. RF power ON is indicated by the LED in the center of the pushbutton. Additionally, in CW mode, the CW FILTER, when selected, places a capacitor across the YIG Oscillator tuning coil to filter high frequency noise which would appear at the RF output. All front panel functions, with the exception of the FREQ CAL, EXT/MTR ALC CAL, and FILTER PEAK adjustments, may be set or altered via the HP-IB bus connection on the Model 8350A/B.

1-24. OPTIONS

1-25. Option 002, 55 dB Attenuator

1-26. Option 002 instruments contain a digitally controlled attenuator just before the RF output. Up to 55 dB of attenuation in 5 dB steps is automatically selected as required to attenuate the RF output power to the indicated level. The continuously variable power level function operates as in a standard instrument with the data entry controls.

1-27. Option 004, Rear Panel RF Output

1-28. Option 004 instruments have the Type N(f) RF OUTPUT connector and the BNC EXT/MTR ALC input connector on the rear panel instead of the front panel.

1-29. SUPPLIED ACCESSORY

1-30. Figure 1-1 shows the HP 83592C RF Plug-In and the accessory cable supplied. The cable type and part number are as follows:

- Accessory Cable HP Part No. 83525-20013.

1-31. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-32. To have a complete operating Sweep Oscillator unit, the Model 83592C RF Plug-In must be installed in a Model 8350A/B Sweep Oscillator mainframe. Refer to Section II, Installation, in this manual for a detailed description of RF Plug-In installation.

1-33. EQUIPMENT AVAILABLE

1-34. Service Accessories

1-35. A Service Accessory Kit (HP Part Number 08350-60020) is available for servicing the Model 83592C RF Plug-In and the Model 8350A/B Sweep Oscillator. HP Part Numbers for the individual pieces of the kit are provided in Table 1-3. The accessory kit includes:

- Two 44-pin printed circuit board extenders. These boards have keyed slots which allow them to be used in each of the keyed PC board receptacles in the Model 83592C, and in the Model 8350A/B as well.

- An RF Plug-In extender cable set that provides all electrical connections when the RF Plug-In is removed from the Sweep Oscillator. The RF Plug-In Interface connector (P2) and the Power Supply Interface connector (P1) are extended by separate cables.

- One Hex Balldriver for use in Model 8350A/B front panel repairs.

- One 16-pin and one 20-pin I.C. Test Clip for probing integrated circuits.

1-36. A listing of service accessories available including service cables, wrenches, adapters, and extender boards is given in Table 1-3.

1-37. Model 8410B/8411A Network Analyzer

1-38. The Model 8350A/B Sweep Oscillator, with the Model 83592C RF Plug-In installed, is compatible with the HP Model 8410B Network Analyzer system. The combination of the Model 8410B Network Analyzer, the Model 8411A Frequency Converter, and an appropriate display Plug-In, forms a phasemeter and a ratiometer for direct phase and amplitude ratio measurement of RF voltages. These measurements can be made on CW frequencies and on swept frequencies from 110 MHz to 18 GHz. The Model 8350A/B-83592C combination is capable of operation over this full frequency range. The Model 8410B has an Auto-Frequency range mode which gives it the capability of automatically tracking the Model 8350A/B Sweep Oscillator over octave and multi-octave frequency bands. Two interconnections to the Model 8350A/B are necessary to ensure that the Model 8410B will phase-lock properly. The Model 8410B Source Control Cable (HP 08410-60146) connects the Model 8410B rear panel SOURCE CONTROL connector to the Model 8350A/B rear panel PROGRAMMING connector. Additionally, the Model 83592C RF Plug-In rear panel 1V/GHz output connects to the Model 8410B rear panel FREQ REF INPUT. The Model 8410B Source Control Cable connector pins and signals are illustrated in the Model 8350A/B Sweep Oscillator Operating and Service Manual.

1-39. Model 8756A Frequency Response Test Set

1-40. The Model 8350A/B sweep oscillator with the Model 83592C RF Plug-In installed is compatible with the Model 8755C and 8756A Frequency Response Test Sets for broadband swept scalar measurements. The Model 8350A/B provides internal 27.8 kHz squarewave modulation of the RF output, eliminating unnecessary cable connections to the Model 8755C or 8756A, or the use of an external modulator. The Model 8350A/B can also produce alternate sweeps through use of the ALT n Function, allowing display of two different measurement states on the Model 8755C or 8756A.

1-41. Power Meters and Crystal Detectors

1-42. The RF output can be externally leveled using the HP Model 432A Power Meter or negative polarity output crystal detectors. Refer to Section III, Operation, of this manual for detailed information on leveling techniques that may be used with the Model 8350A/RF Plug-In combination.

NOTE

The Model 435A and 436A Power Meters should not be used in Model 8350A/B-Model 83592C external leveling systems.

1-43. RECOMMENDED TEST EQUIPMENT

1-44. Equipment required for testing and adjusting the instrument is listed in Table 1-4. Other equipment may be substituted if it meets or exceeds the critical specifications indicated in the table.

Table 1-3. Model 83592C Service Accessories Available

Name	HP Part Number	Description
44-pin printed circuit board extender	08350-60031*	Extends printed circuit boards
RF Plug-In Extender Cables	08350-60034*	Extends RF Plug-In Interface connector (P2)
	08350-60035*	Extends RF Plug-In Power Supply Interface connector (P1)
Adjustment Tool	8830-0024	Fits miniature adjustment slot on potentiometers
Wrenches	08555-20097	5/16" slotted box/open end
	8710-0946	15/64" open end
Service Cables	8120-1578	46 cm (18") coax with SMA (m) connector on each end
	83525-60019	25 cm (10") coax with SMB snap on (f) and SMA (m)
Adapters	1250-0777	Type N (f) to BNC (m)
	1250-0082	Type N (m) to BNC (m)
	1250-1404	Type N (f) to SMA (f)
	1250-1158	SMA (f) to SMA (f)
	1250-0674	SMA (f) to SMB (m)
	1250-0675	SMA (f) to SMC (m)
	1250-0069	SMB snap on (m) to SMB snap on (m)
	1250-1743	APC-3.5 (m) to N (m)
	1250-1750	APC-3.5 (m) to N (f)
	1250-1744	APC-3.5 (f) to N (m)
	1250-1745	APC 3.5 (f) to N(f)
	1250-1746	APC-3.5 (m) to APC-7
	1250-1747	APC-3.5 (f) to APC-7
	1250-1748	APC-3.5 (m) to APC-3.5 (m)
	1250-1749	APC-3.5 (f) to APC-3.5 (f)
Hex Balldriver	8710-0523*	Removes front panel hold down plate hex screws in 8350A
IC Test Clip	1400-0734*	16-pin IC test clip
	1400-0979*	20-pin IC test clip

*These items are included in a Service Accessories Kit HP Part No. 08350-60020 (2 board extenders are included in this kit).

Table 1-4. Recommended Test Equipment (1 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Sweep Oscillator	No substitute	HP 8350A/B	P,A,T
Digital Voltmeter (DVM)	Range: −50V to +50V Accuracy: ±0.01% Input Impedance: ≥10M Ohms	HP 3456A	A,T
Oscilloscope	Dual Channel Bandwidth: DC to 100 MHz Vertical Sensitivity: ≤5 mV/DIV Horizontal Sweep Rate: ≤0.1μS/DIV External Sweep Capability	HP 1740A	P,A,T
Oscilloscope Probe	1:1 General Purpose Probe	HP 10008B	A
Frequency Counter	Frequency Range: 0.01 to 20 GHz Input Impedance: 50 Ohms Resolution: ≤1 MHz	HP 5343A	P,A
Spectrum Analyzer	Frequency Range: 0.01 to 20 GHz Residual FM: <100 Hz	HP 8565A or 8569A or HP 8566A	P,T

Table 1-4. Recommended Test Equipment (2 of 3)

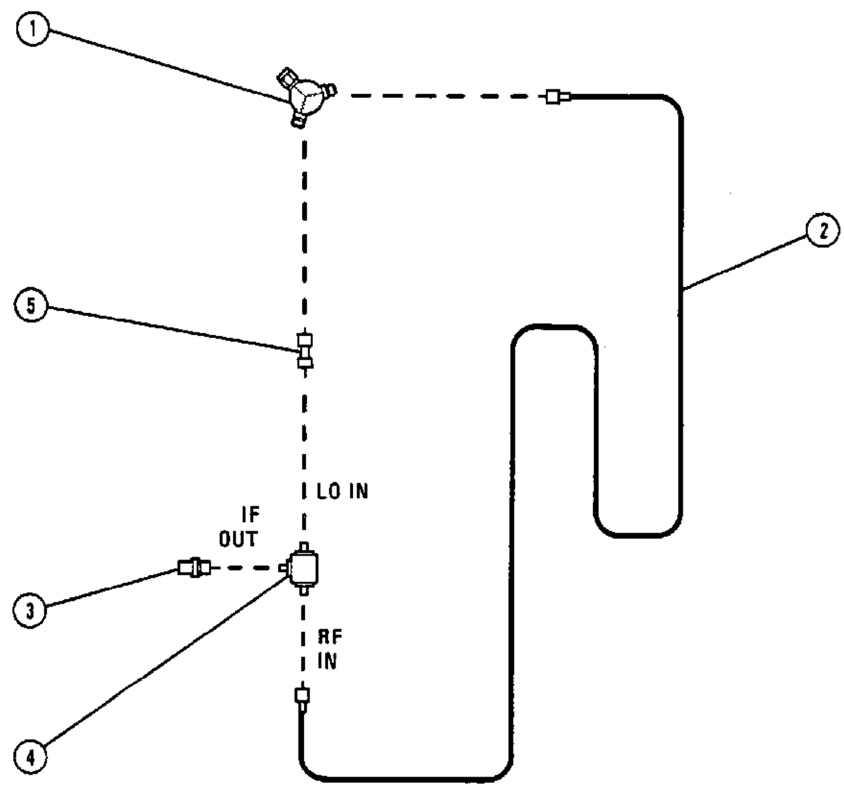
Instrument	Critical Specifications	Recommended Model	Use*
Swept Amplitude Analyzer	Capable of Transmission Measurements Power Resolution: ≤0.25 dB. Capable of ≤30mS Sweeptime	HP 8755C	A
Display Mainframe	Compatible with Model 8755C Swept Amplitude Analyzer	HP 180TR, 182T	A
Swept Amplitude Analyzer	Capable of Transmission Measurements Power Resolution ≤0.25 dB	HP 8756A	A
Detectors (2)	Compatible with Swept Amplitude Analyzer Frequency Range: 0.01 to 20 GHz Power Range: −20 to +10 dBm	HP 11664B	A
Frequency Meter	Frequency Accuracy: ≤0.17% Calibration Increments: ≤2 MHz Frequency Range: 0.96 to 4.0 GHz 4.0 to 12.4 GHz 12.4 to 18 GHz 18.0 to 26.5 GHz	 HP 536A HP 537A HP P532A HP K532A	 A A A A
Function Generator	Frequency Range: 0.1 Hz to 10 MHz Sinewave and squarewave output Output Level: 10Vp-p into 50 Ohms Output Level Flatness: ≤±3% from 10 Hz to 100 kHz ≤±10% from 100 kHz to 10 MHz	HP 3312A	P,A,T
Power Meter	Power Range −20 to +10 dBm (No substitute when used for external power meter leveling).	HP 432A	P,A
Thermistor Sensor	Frequency Range: 0.01 to 18 GHz Maximum SWR: ≤1.75	HP 8478B	P,A
Thermistor Sensor	Frequency Range 18 to 20 GHz Maximum SWR: ≤2.0	HP K486	P,A
Adapter	Waveguide to APC3.5 (f) for use with HP K486	HP K281C	A
Power Meter	Power Range: 1μW to 100mV	HP 436A	P,A
Power Sensor	Frequency Range: 0.05 to 20 GHz	HP 8485A	P,A
Crystal Detector**	Frequency Response: 0.01 to 20 GHz Maximum Input Power: 100mV	HP 8473C	P,A
Attenuator**	Frequency Range: 0.01 to 20 GHz Maximum Input Power: +20 dBm Attenuation: 20 dB ± 1.0 dB 10 dB ± 0.8 dB 6 dB ± 0.6 dB 3 dB ± 0.5 dB	 HP 8493C-020 HP 8493C-101 HP 8493C-006 HP 8493C-003	 P P,A P P

Table 1-4. Recommended Test Equipment (3 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Power Splitter**	Frequency Range: 0.01 to 20 GHz Maximum Input Power: ≥+20 dBm	Weinschel Model 1579A	P, A
Directional Coupler	Frequency Range: 0.1 to 2.0 GHz Nominal Coupling: ≥20 dB Maximum Coupling Variation: ≥±1 dB Minimum Directivity: ≥32 dB	HP 778D	P
Directional Coupler	Frequency Range: 2.0 to 18 GHz Nominal Coupling: ≥22 dB Maximum Coupling Variation: ±1 dB Minimum Directivity: 26 dB	HP 11691D	P
Directional Coupler	Frequency Range: 18 to 20 GHz Nominal Coupling: 10 dB Maximum Coupling Variation: ±0.5 dB Minimum Directivity: 40 dB	HP K752C	P
RMS Voltmeter	dB Range: −20 to −70 dBm (0 dBm = 1 mW into 600 ohms) Frequency Range: 10 Hz to 10 MHz Accuracy: ±5% of full scale	HP 3400A	P
Air Line Extension (2 required)	Impendance: 50 Ohms Frequency Range: DC to 18 GHz Reflection Coefficient: 0.018 to 0.001 (times the frequency in GHz)	HP 11567A	P
Step Attenuator	Frequency Range: DC to 18 GHz Incremental Attenuation: 0 to 70 dB in 10 dB steps Calibration Accuracy: ≤±0.1 dB at all steps	HP 8495B Option 890	P
Adjustable Short	Frequency Range: 1.1 to 18 GHz Impendance: 50 ±1.5 Ohms	Maury Microwave 1953-2	P
DC Power Supply	DC Output: 0 to 6.5 Vdc ±0.05 Vdc	HP 6213A	A
50 Ohm Termination	Type N, 50 ±0.5 Ohms	HP 909A	P
Delay Line Discriminator	Refer to Figure 1-3.		P, A
PC Board Extender	44-pin, extends printed circuit boards	HP Part No 08350-60031	A,T

* P = Performance Test; A = Adjustments; T = Troubleshooting
** For testing at frequency of ≤18 GHz, the following equipment may be substituted:

ATTENUATORS	POWER SPLITTER	CRYSTAL DETECTOR
20 dB HP 8491B Option 020	HP 11667A	HP 8470B
10 dB HP 8491B Option 010		
6 dB HP 8491B Option 006		
3 dB HP 8491B Option 003		



Item	Description	HP Part Number
1	Power Splitter: Weinschel Model 1579B	none
2	Delay Line:> 1 meter (3 feet) in length, SMA Male connectors	08503-20038
3	Adapter: BNC Female to SMA Male	1250-1200
4	Mixer: Double Balanced RHG Electronics Part No. DMS - 26 RHG Electronis Laboratories, Inc. Deer Park, NY 11729	
5	Adapter: SMA Male to SMA Male	1250-1159

Figure 1-3. Delay Line Discriminator

II Installation

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides installation instructions for the Model 83592C RF Plug-In. This section also includes information about initial inspection, damage claims, preparation for use, packaging, storage, and shipment.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV, Performance Tests, of this Operating and Service Manual. If the instrument combination does not pass the electrical Performance Tests, refer to Section V, Adjustments, of this manual. If, after the adjustments have been made, the instrument combination still fails to meet specifications, and a circuit malfunction is suspected, refer to troubleshooting procedures in Section VIII, Service, in this manual. If the instrument does not pass the above electrical tests, if the shipment contents are incomplete, or if there is mechanical damage or defect, notify the nearest Hewlett-Packard Office. If the shipping container is damaged, or if the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard Office. Keep the shipping materials for the carrier's inspection. The HP Office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. When the Model 83592C RF Plug-In is properly installed, it obtains all power through the rear panel interface connector from the Model 8350A/B Sweep Oscillator.

2-8. RF Plug-In Configuration Switch

2-9. The Model 83592C RF Plug-In has a configuration switch (A3S1) located on the A3 Digital Interface Board. This switch must be preset prior to RF Plug-In operation in the Model 8350A/B. The configuration switch is an 8-section multiple switch. Each separate switch section corresponds to a separate RF Plug-In function such as FM sensitivity selection, FM input coupling selection (direct coupled or cross-over), RF power level at power on (maximum or off), and Option 002 Step Attenuator operation. Refer to Section III, Operation, in this manual for a complete description of the configuration switch and instructions on how to set the switches.

2-10. Interconnections

2-11. There are two rear panel interconnections from the Model 83592C RF Plug-In to the Model 8350A/B Sweep Oscillator. These are the RF Plug-In Interface connector (P2) and the Power Supply Interface connector (P1). A complete listing of pins and associated signals for these connectors is provided in Figures 2-1 and 2-2.

2-12. Mating Connectors

2-13. All of the externally mounted connectors on the Model 83592C are listed in Table 2-1. Opposite each connector is an industry identification, the HP part number of a mating connector, and the part number of an alternate source for the mating connector. For HP part numbers of the externally mounted connectors themselves, refer to Section VI, Replaceable Parts, of this manual.

2-14. Operating Environment

2-15. Temperature. The instrument may be operated in temperatures from 0°C to +55°C.

Table 2-1. Model 83592C Mating Connectors

HP 83592C Connector		Mating Connector	
Connector Name	**Industry Identification**	**HP Part Number**	**Alternate Source**
J1 RF OUTPUT	Type N (f)	1250-0882	Specialty Connector 25-P117-2
J2 EXT/MTR ALC INPUT	BNC (f)	1250-0256 Straight cable	Specialty Connector 25-P118-1
J3 AUX OUTPUT	Type N (f)	1250-0882 Straight cable	Specialty Connector 25-P117-2
J4 PULSE IN	BNC (f)	120-0256 Straight cable	Specialty Connector 25-P118-1
J5 1V/GHz	BNC (f)	1250-0256 Straight cable	Specialty Connector 25-P118-1

2-16. Humidity. The instrument may be operated in environments with humidity from 5% to 80% relative at +25°C to +40°C. However, the instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-17. Altitude. The instrument may be operated at altitudes up to 4572 meters (15,000 feet).

2-18. Cooling. When the Model 83592C RF Plug-In is properly installed in the Model 8350A/B Sweep Oscillator, it obtains all of its cooling airflow by forced ventilation from the fan in the Model 8350A/B. A diagram showing the various cooling airflow paths within the Sweep Oscillator is given in Section II, Installation, of the Model 8350A/B Sweep Oscillator Operating and Service Manual. Ensure that all airflow passages in the Model 8350A/B and the Model 83592C are clear before installing the RF Plug-In in the Sweep Oscillator.

2-19. Installation Instructions

2-20. To operate as a completely functional Sweep Oscillator, the Model 83592C RF Plug-In must be installed in a Model 8350A/B Sweep Oscillator. To install the Model 83592C RF Plug-In in the Model 8350A/B Sweep Oscillator:

a. Set the Model 8350A/B mainframe LINE switch to OFF.

b. Remove all connectors and accessories from the front and rear panel connectors of the Model 83592C to prevent them from being damaged.

c. Position the RF Plug-In unit latching handle in the fully raised position. The latching handle should spring easily into the raised position and be held by spring tension.

d. Ensure that the Model 8350A/B RF Plug-In channel is clear. Align the RF Plug-In in the channel and slide it carefully into place toward the rear of the channel. It should slide easily without binding.

e. The drawer latch handle slot will engage with the locking pin just before the RF Plug-In is fully seated in position.

f. Press the latch handle downward, while still pushing in on the RF Plug-In, until the drawer latch is fully closed and the front panel of the RF Plug-In is aligned with the Sweep Oscillator front panel.

2-21. STORAGE AND SHIPMENT

2-22. Environment

2-23. The instrument may be stored or shipped in environments within the following limits:

Temperature .... −40°C to +75°C
Humidity .... 5% to 95% relative at 0° to +40°C
Altitude .... Up to 15240 meters (approximately 50,000 feet)

2-24. The instrument should also be protected from temperature extremes which may cause condensation in the instrument.

2-25. Packaging

2-26. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. A complete diagram and listing of packaging materials used for the Model 83592C is shown in Figure 2-3. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number (located on the rear panel serial plate). Mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-27. Other Packaging. The following general instructions should be used for repackaging with commercially available packaging materials:

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

b. Use a strong shipping container.

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

d. Seal the shipping container securely.

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

f. In any correspondence, refer to the instrument by model number and full serial number.

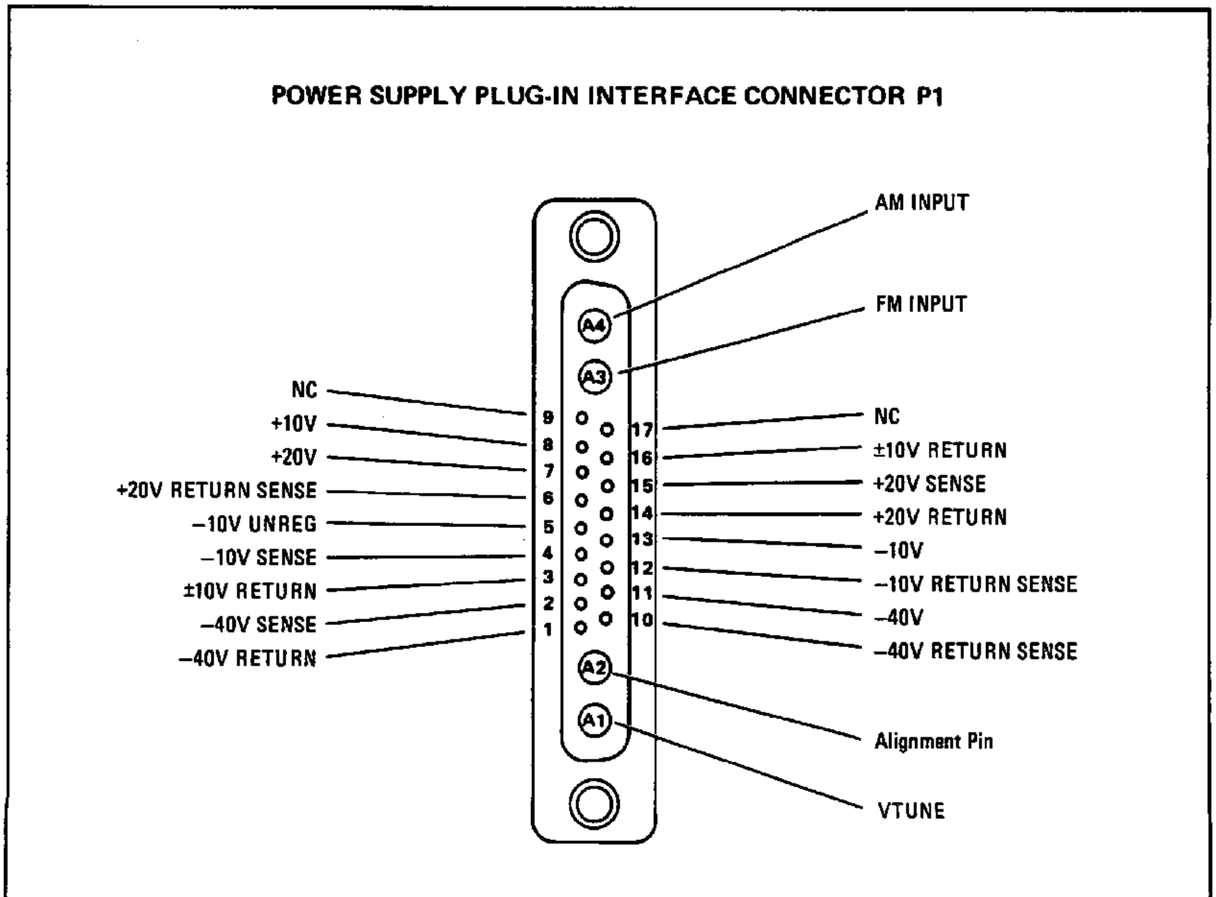


Figure 2-1. Interface Signals on Connector P1

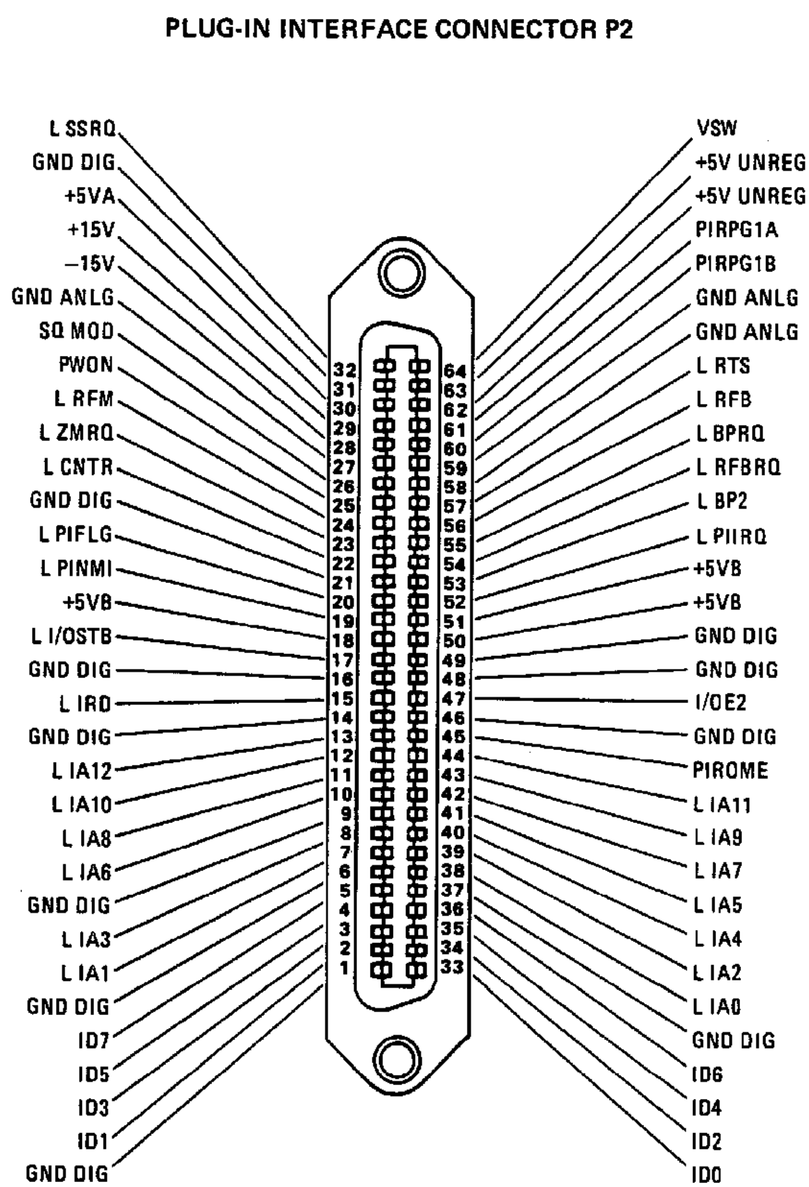
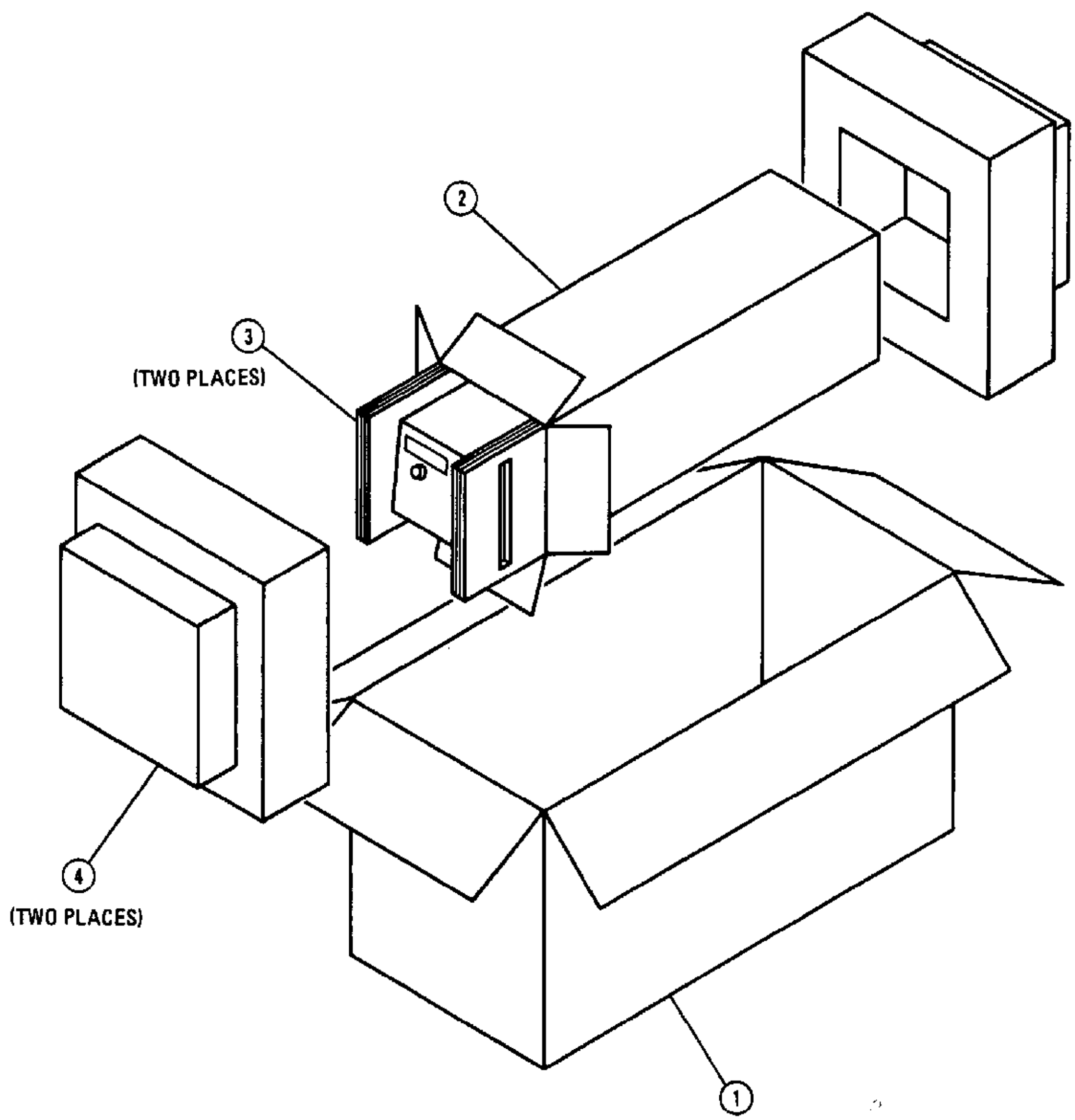


Figure 2-2. Interface Signals on Connector P2



Item	Quantity	HP Part Number	CD	Description
1	1	9211-4781	0	Outer Carton
2	1	9211-4782	1	Inner Carton
3	2	83592-80016	1	Side Pads — corrugated cardboard
4	2	9220-3406	3	Foam Pads
	1	9222-0943	1	Anti-static Bag — to cover instrument

Figure 2-3. Packaging for Shipment Using Factory Packaging Materials

III Operation

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section is divided into four major parts. Operating Characteristics explains the bandswitching and frequency resolution characteristics in CW and swept modes. Front and rear panel Panel Features are shown with illustrated descriptions. Operating Instructions provide a front panel frequency calibration procedure, configuration switch setting instructions, and crystal detector and power meter leveling instructions. Operator's Maintenance includes information on the Plug-In error codes, fuses, and service tags.

3-3. OPERATING CHARACTERISTICS

3-4. Bandswitching and Resolution

3-5. The following paragraphs describe the bandswitching and frequency resolution characteristics of the Model 83592C RF Plug-In.

3-6. The Model 83592C 10 MHz to 20 GHz RF output is provided in four bands. When sweeping a range of frequencies larger than a single band, the switching between these bands is done automatically. Careful selection of sweep frequencies may avoid problems associated with bandswitching such as harmonics, sweep time, stability, or switching discontinuities. Figure 3-1 illustrates the bandswitching points in the sequential and single band sweep modes.

3-7. The mainframe controls both input resolution (resolution of tuning voltage into parts by the DAC) and displayed resolution (number of digits shown on the frequency display). For further information refer to the appropriate mainframe manual.

3-8. PANEL FEATURES

3-9. Front and rear panel features are described in Figures 3-2 and 3-3, respectively. Numbered callouts on the features described match numbered descriptions below each figure.

3-10. OPERATORS CHECKS

3-11. The Operator's Checks portion (Local and Remote) of the Model 8350A/B Sweep Oscillator manual provides a quick evaluation of both Model 8350A/B and Model 83592C main functions. Error codes 50 to 99, displayed on the Model 8350A/B FREQUENCY display, are reserved to indicate Plug-In related problems. The Model 8350A/B Local Check covers the Sweep Oscillator and RF Plug-In. If the correct indications are not obtained, trouble may be in either of the units. If the RF Plug-In is suspected, follow the troubleshooting information in Section VIII, Service, in this manual, to isolate the problem.

3-12. OPERATING INSTRUCTIONS

3-13. Front Panel FREQ CAL

NOTE

The Model 83592C RF Plug-In may not meet the frequency accuracy specifications unless the front panel FREQ CAL (frequency calibration) procedure is performed.

3-14. The front panel FREQ CAL procedure, shown in Figure 3-4, should be performed after the instrument has warmed up for at least one hour. This procedure calibrates the RF output frequency for Band 0 with an external frequency counter.

3-15. Peaking RF Output Power

3-16. Front panel PEAK and FILTER PEAK are controls used to optimize output power by adjusting tracking between the YTF, YTM, and YTO. These controls allow optimization at frequencies of interest, or as compensation for mistracking due to aging. FILTER PEAK controls YTF/YTM to YTO tracking. FILTER PEAK should be adjusted first. The front panel PEAK function is accessed by pressing **[SHIFT] [POWER LEVEL]**. In order to monitor the effect of the Peaking function on the RF output, the Model 83592C must be set for an unleveled

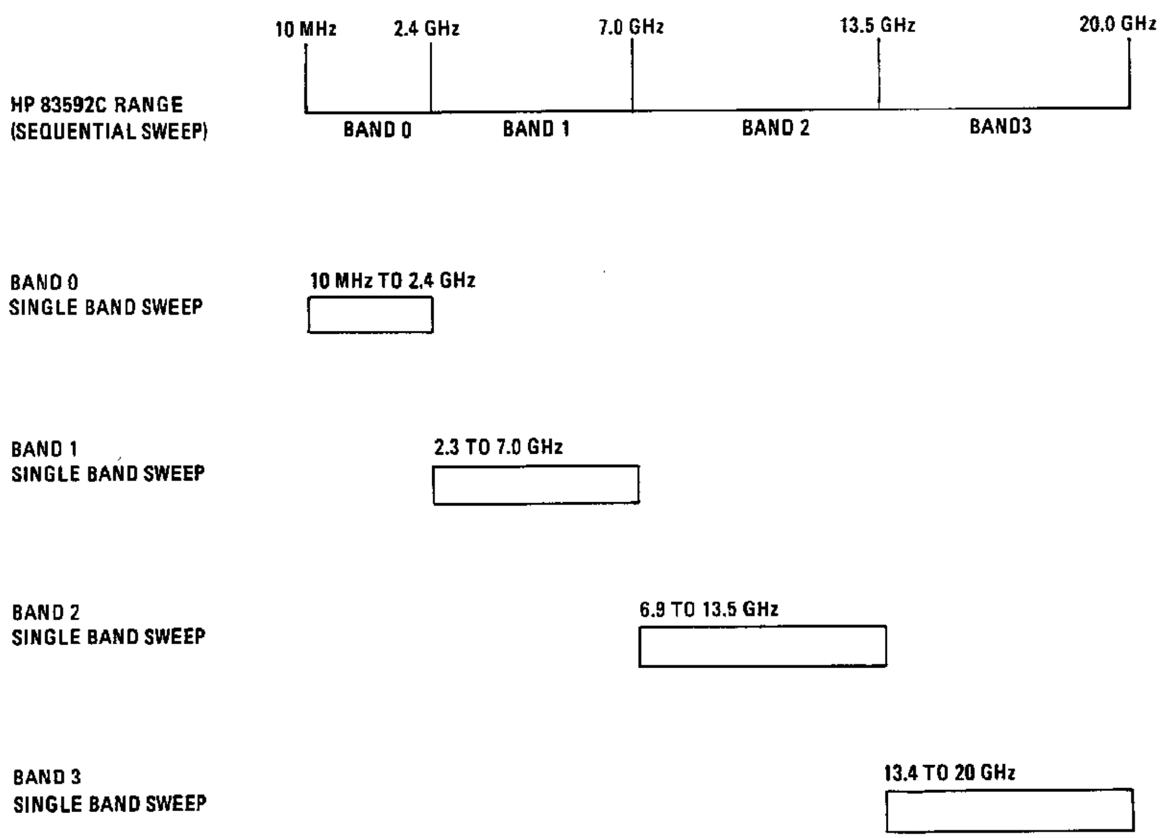
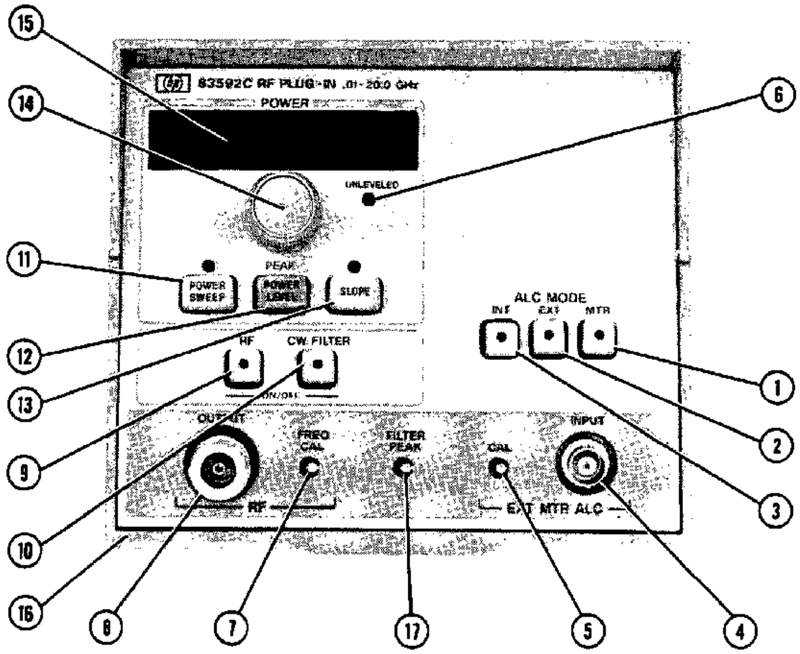


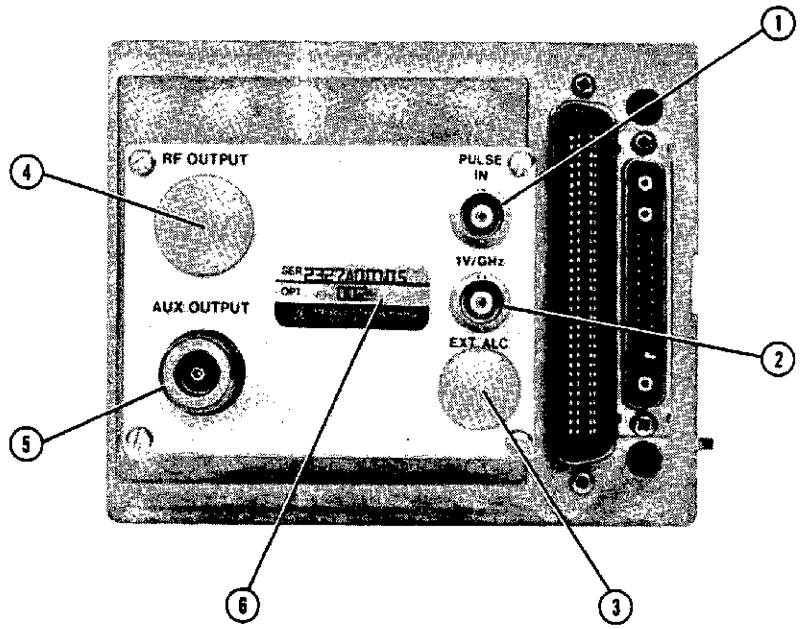
Figure 3-1. Bandswitching in Sequential and Single Band Sweep Modes



FRONT PANEL FEATURES

1. Power meter automatic leveling control selection (HP 432 only).
2. External (crystal detector) automatic leveling control selection (negative crystal output).
3. Internal leveling control selection.
4. Connector (BNC) for power meter or external crystal leveling inputs (rear panel on Option 004).
5. Power level CAL adjust, for setting external (MTR or EXT) ALC.
6. UNLEVELED lamp lights if output power is unleveled.
7. Fine frequency adjust used for front panel frequency calibration.
8. Type N(f) 50-ohm RF OUTPUT connector (rear panel on Option 004.
9. RF on-off key. Used for zeroing a power meter or referencing an X-Y recorder.
10. CW FILTER enables an oscillator tune voltage filter in CW mode.
11. POWER SWEEP allows setting an increase in power per sweep (dB/SWP). **[SHIFT] [POWER SWEEP]** (Option 002) latches the Step Attenuator at its current setting. Power Level changes are controlled by the ALC loop.
12. POWER LEVEL allows setting of output power for all ALC modes (may be calibrated for external leveling). PEAK allows peaking of RF output power (selected when **[SHIFT] [POWER LEVEL]** is pressed).
13. SLOPE allows setting of the frequency slope compensation in dB/GHz (for lossy devices). **[SHIFT] [SLOPE]** (Option 002) latches the ALC loop at its current reference level. Power level changes are controlled by the Step Attenuator (5 dB steps).
14. Power control knob for controlling power sweep, power level, peak, or slope.
15. Plug-In display provides readout of selected power mode in dBm, dB/GHz, or dB/SWP to a tenth of a dB/dBm.
16. Plug-In latch handle is used to remove, install, and latch the RF Plug-In in the Sweep Oscillator.
17. FILTER PEAK allows peaking of RF power (use before PEAK).

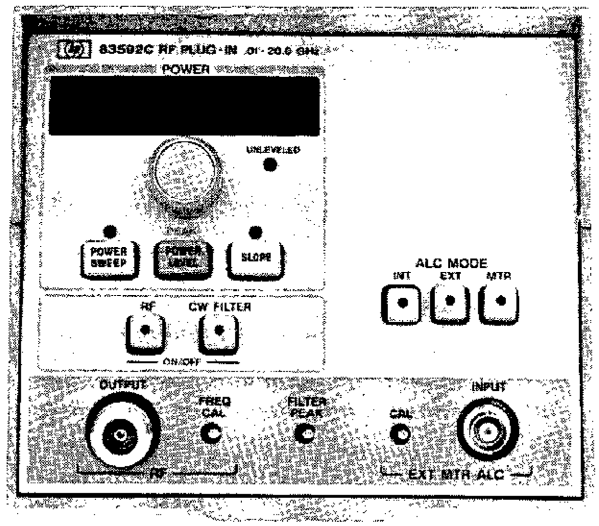
Figure 3-2. Front Panel Features



REAR PANEL FEATURES

1. PULSE IN connector is used to input external pulse or squarewave modulation.
2. 1V/GHz connector provides a frequency reference output of approximately 1 volt DC per GHz (to 18 GHz only).
3. EXT ALC connector replaces front panel EXT ALC connector on Option 004 Plug-Ins.
4. RF OUTPUT connector replaces front panel RF output connector in Option 004 Plug-Ins.
5. AUX OUTPUT connector provides 2.3 to 7.0 GHz fundamental oscillator output at approximately 0 dBm.
6. Serial Number plate has a ten digit serial number (used in any correspondence concerning Plug-In) and Option number if applicable.

Figure 3-3. Rear Panel Features



FREQ CAL PROCEDURE

1. Press Model 8350A/B **[INSTR PRESET] [CW] [5] [0] [MHz]**.

2. Connect external frequency counter through a 10 dB attenuator to the RF OUTPUT connector.

3. Adjust FREQ CAL control for a frequency counter indication of 50.0 MHz.

ALTERNATE FREQ CAL PROCEDURE

NOTE

This alternate FREQ CAL procedure is not as accurate as using an external counter, but normally calibrates the Band 0 frequency accuracy within specifications.

1. Press **[INSTR PRESET] [CW] [0] [MHz]**.

2. Adjust FREQ CAL control through its range and note the portion of its range that the UNLEVELED light is turned on. Set the FREQ CAL control to the center of this range.

Figure 3-4. Front Panel FREQ CAL Procedure power condition. This can be accomplished by setting the ALC Mode to External (without an external detector) or increasing the Power setting until the RF output is unleveled. With the Peak function selected and an unleveled RF output, the POWER control should be adjusted to maximize the RF output power over the 2.4 to 20 GHz frequency range.

3-17. Internal Leveling

3-18. The most convenient method of RF output leveling is internal leveling. A portion of the RF output is coupled out of an internal directional detector, producing a DC voltage proportional to the RF output signal. This detected DC voltage is applied to the automatic leveling control circuit (ALC).

3-19. External Crystal Detector Leveling

3-20. RF output power may also be leveled externally using a power splitter (or external directional coupler) and a negative output crystal detector. This leveling system uses a power splitter to sample a portion of the RF output signal with a crystal detector to produce a DC voltage proportional to the RF output power level. The detector output voltage is compared with an internal reference voltage, and the difference voltage is applied, as modulator drive, to a PIN Modulator which changes the output power level to keep a constant RF output power level. A directional coupler may be used instead of a power splitter to sample the RF signal for the leveling loop. Directional couplers are usually narrow band devices, whereas the power splitter has a flatter frequency response over a wide frequency range. The advantage of a directional coupler is that it does not have as great a coupled loss as the 6dB loss encountered with the power splitter, therefore a higher maximum leveled output power may be obtained. Figure 3-5 illustrates a typical crystal detector leveling setup.

3-21. External Power Meter Leveling

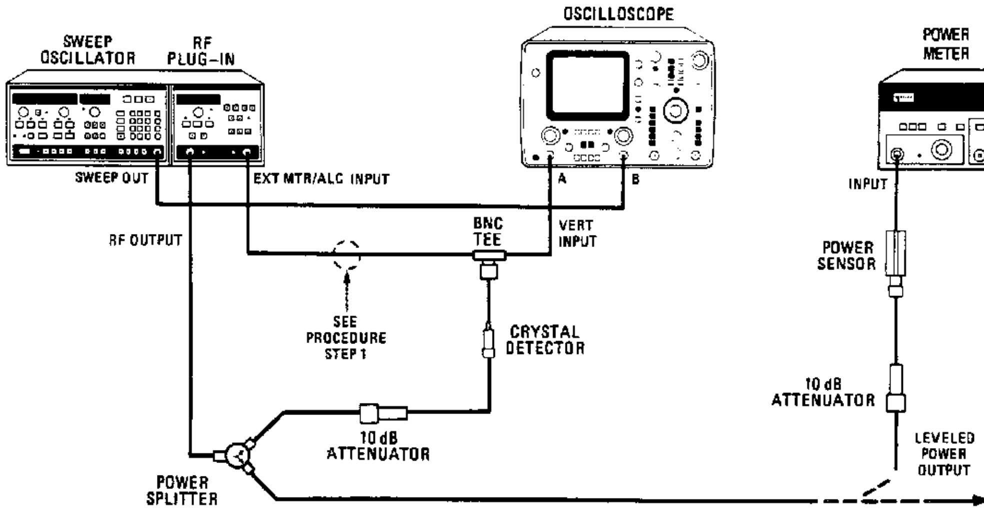
3-22. RF output power may also be leveled with a power meter and power splitter (or directional coupler) as shown in Figure 3-6. The sweep time is limited to greater than 100 seconds when this leveling method is used. A sample of the RF output signal is routed to a power meter which produces a DC output voltage proportional to the RF input signal level. This DC voltage is applied to the Model 83592C ALC circuits and compared with an internal reference voltage. A difference voltage is produced and amplified by the ALC amplifier before being applied, as modulator drive, to a PIN Modulator.

3-23. External FM

3-24. The Model 83592C RF output signal can be frequency modulated using an external modulating signal applied to the Model 8350A/B rear panel FM INPUT connector. The external FM function provides a means of obtaining an output frequency that varies under the control of an external modulating signal. A positive-going voltage at the FM INPUT causes output frequency to decrease, while a negative-going voltage causes output frequency to increase. The sensitivity and coupling of the modulating signal may be set via configuration switch A3S1. Figure 3-7 lists the available configuration switch settings override Model 8350A/B Sweep Oscillator non-volatile memory settings at Instrument Preset.

3-25. External Amplitude Modulation

3-26. Pulse Modulation (PULSE IN Connector on Plug-In). The PULSE IN connector provides pulsed or squarewave modulation, where the RF output is switched on and off. This input provides an on/off power ratio of greater than 30 dB below specified maximum leveled power. The PULSE IN input is normally at a TTL HIGH (approximately + volts DC). When a TTL LOW signal (approximately 0 volts DC) is applied, the RF output is turned off. To get the best pulse modulation performance, the RF output power should be set at +20 dBm. With this power setting, a pulse repetition rate of up to 1 MHz is achievable in the 0.01 to 7.0 GHz frequency bands. With leveled power in this frequency range, pulse repetition rates may be up to 100 kHz. In the 7.0 to 20 GHz frequency bands, RF power may be squarewave modulated at repetition rates up to 30 kHz at any power output setting. The input impedance for TTL level signals is approximately 500 ohms. If the PULSE IN circuit is driven beyond TTL levels, the input impedance is reduced to approximately 200 ohms due to the diode clamping action. See the specifications and supplemental characteristics in Section I for more details on the modulation characteristics when using this input.



EXTERNAL CRYSTAL DETECTOR LEVELING

EQUIPMENT:

Sweep Oscillator	HP 8350A/B
RF Plug-In	HP 83592C
Oscilloscope	HP 1740A
Power Meter	HP 436A
Power Sensor	HP 8485A
Crystal Detector	HP 8473C
Power Splitter	Weinschel Model 1579
BNC Tee	HP 1250-0781

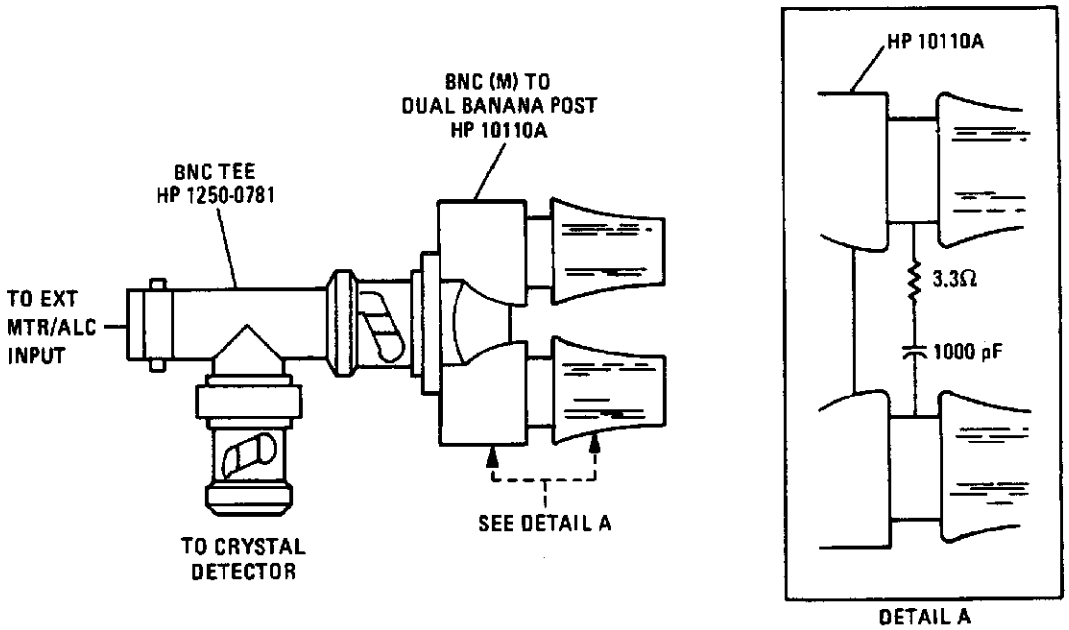
PROCEDURE:

NOTE

Crystal output signal must be between −10 mVdc and −200 mVdc.

1. Connect equipment as shown in test setup.

Figure 3-5. External Crystal Detector Leveling (1 of 2)



NOTE

Between 10 MHz and 50 MHz RF feedthrough as high as 3 dB may be observed on the envelope of the video output. During external leveling at 10 to 50 MHz, the RF feedthrough may be damped out by insertion of the circuit shown above in the test setup. The circuit may be inserted in the line to the EXT INPUT of the RF Plug-In.

2. Switch on Model 8350A/B LINE switch. Press **[INSTR PRESET]** key. The START and STOP indicators should be on.

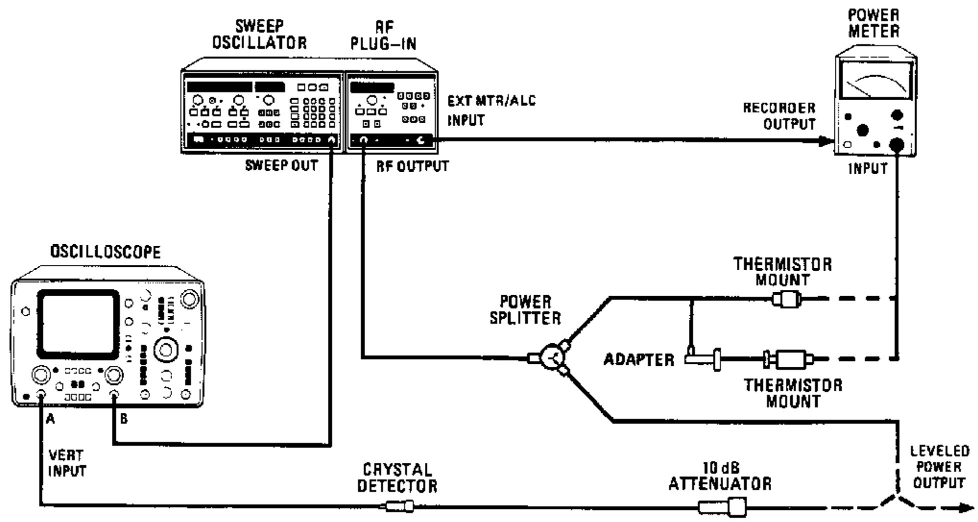
3. Set controls as follows:

   Model 83592C:
   ALC MODE .... EXT

4. Adjust EXT/MTR ALC CAL for a power meter reading equal to the front panel output power.

5. To use leveled RF power output for testing external equipment, make connection at point marked "Leveled Power Output."

Figure 3-5. External Crystal Detector Leveling (2 of 2)



EXTERNAL POWER METER LEVELING

EQUIPMENT

Sweep Oscillator	HP 8350A/B
RF Plug-In	HP 83592C
Power Meter	HP 432A
Thermistor Mount (0.01 to 18.0 GHz)	HP 8478A
Thermistor Mount (18.0 to 20.0 GHz)	HP K486A
Oscilloscope	HP 1740A
Crystal Detector	HP 8473C
10 dB Attenuator	HP 8493C
Power Splitter	Weinschel Model 1579
Adapter	HP K281C

NOTE

For power meter leveling, sweep rate should be 100 sec/sweep to ensure proper leveling due to the slow response of the thermistor mount. The HP 435 and HP 436 power meters will not power meter level this Plug-In. Only an HP 432 may be used.

PROCEDURE:

1. Connect equipment as shown in test setup. Use the HP 8478A thermistor mount for output frequencies between 0.01 and 18.0 GHz or the HP K486A thermistor mount and HP K281C adapter for frequencies between 18.0 and 20 GHz.

2. Set LINE switch to turn on Sweep Oscillator. The START and STOP indicators should light, indicating the START/STOP mode is selected.

Figure 3-6. External Power Meter Leveling (1 of 2)

3. Set controls as follows:

   Model 8350A/B: Press **[INSTR PRESET]**

   SWEEP TIME .... 100 sec
   START/STOP FREQUENCY ..... As required within thermistor mount limits

   Model 83592C: Set power to maximum specified.

   ALC MODE.. MTR

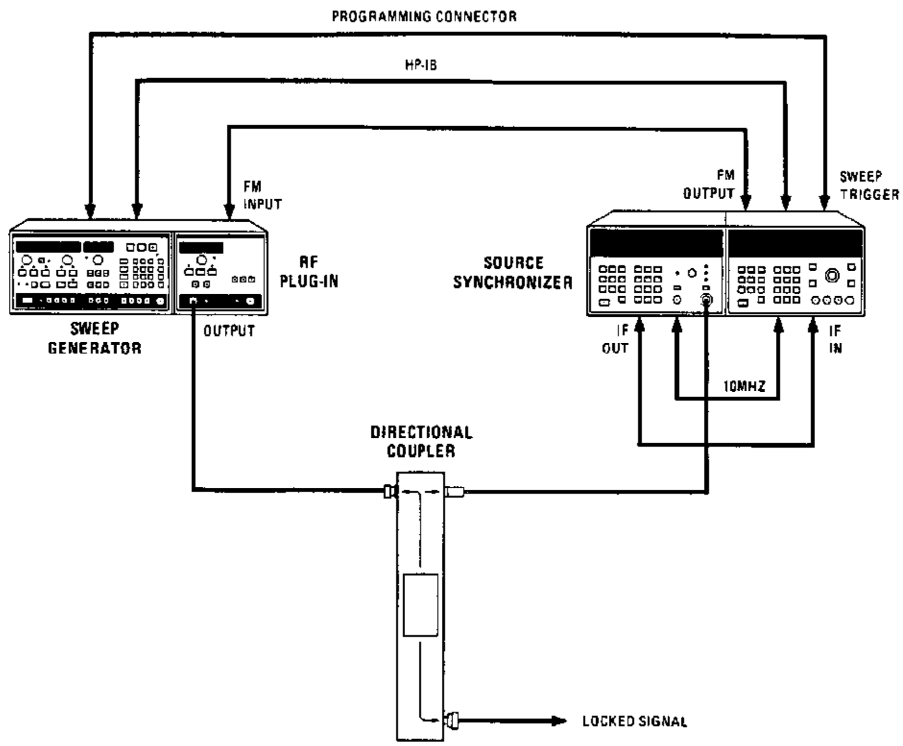
4. Select +10 dBm range on power meter.

5. Adjust Model 83592C EXT/MTR ALC CAL for a +7 dBm reading on the HP 432A power meter. Press Model 8350A/B SWEEP TRIGGER **[SINGLE]** key twice to set single sweep mode and start a sweep.

6. To use level RF power output for testing external equipment, make connection at point in test setup marked "Leveled Power Output."

Figure 3-6. External Power Meter Leveling (2 of 2)

PHASELOCKING USING THE HP 5344S SOURCE SYNCHRONIZER



EQUIPMENT:

Sweep Oscillator................................ HP 8350A/B
RF Plug-In.................................... HP 83592C
Source Synchronizer .... HP 5344S Opt. 043
Directional Coupler (2 to 18 GHz) .... HP 11691D

DESCRIPTION:

The required CW frequency for the Model 83592C is automatically tuned and locked by the HP 5344S, with the HP 5344S acting as an HP-IB controller. No manual tuning is required. The Model 8350A/B Sweep Oscillator and the HP 5344S Source Synchronizer must be set to the same HP-IB address.

Figure 3-7. Phase-Locking Using the HP 5344S Source Synchronizer (1 of 2)

NOTE

This setup can be used for phase-locking from 2.0 to 18.0 GHz, the range of the HP 11691D Directional Coupler. For phase-locking without the use of a broadband coupling device, the Model 83592C rear-panel AUX OUTPUT fundamental oscillator frequency signal can be used.

PROCEDURE:

1. Set the Model 83592C Configuration Switch (A3S1) for an FM Sensitivity of −6 MHz/V, Cross-Over Coupled FM, and front panel RF OUTPUT Phaselock (See Figure 3-8 for specific settings of A3S1).
2. Connect the equipment as shown in the test setup. Connect the HP-IB connector of the Model 8350A/B to the HP-IB connector of the HP 5344A section of the HP 5344S.
3. Set the HP 5344A HP-IB address to 19 (equal to the Model 8350A/B) by setting the bottom five switches to 10011.
4. Set the HP 5344A to the System Controller mode by setting the top HP-IB switch to the left (SYS CONT).
5. On the Model 8350A/B press **[INSTR PRESET]** .
6. On the Model 83592C press **[CW FILTER]** to turn off the CW filter (pushbutton LED turned off). Set the Model 83592C Power Level between 0 and +5 dBm.
7. Set the Model 8350A/B HP-IB address to 19 if it is not already. Press **[SHIFT] [LCL] [0] [GHz s]**. The HP-IB address will be shown on the Model 8350A/B FREQUENCY/TIME display.
8. On the HP 5344A, make sure that MANUAL LOCK and AUTO LOCK are both set to off (pushbutton LEDs off). Verify that the front panel CONT lamp is on.
9. Press the HP 5344A **[MODE]** key until the CW annunciator lights. The MODE key will scroll through the four modes of operation. If you pass CW, continue pressing MODE until you return to CW.
10. On the HP 5344A, enter the frequency required for the Model 83592C RF output signal.
11. Press the HP 5344A **[AUTO LOCK]** key. The Model 83592C RF output signal will now be programmed and locked to the specified CW frequency.

Figure 3-7. Phase-Locking Using the HP 5344S Source Synchronizer (2 of 2)

3-27. Amplitude Modulation (AM INPUT Connector on Model 8350A/B). The AM INPUT provides linear amplitude changes (up to approximately 15 dB) proportional to the modulating input voltage. It is limited to a frequency response of about 100 kHz. For maximum depth of modulation (i.e. maximum modulation index), the RF power level should be set to the middle of the control range (e.g. +2.5 dBm for a Plug-In with calibrated power control from −5 to +10 dBm). For Plug-Ins equipped with Option 002 (55 dB step attenuator), the middle of the attenuator range would be selected. The center of the power control range may be selected with the front panel power control or by applying a DC bias voltage on the external modulating signal. A positive (+) DC voltage into the AM INPUT causes a decrease in RF output power; a negative (−) DC voltage causes an increase in RF output power.

3-28. RF Power Control

3-29. The RF power set at power-up (during Instrument Preset) may be either 4 dBm or RF power OFF as selected by the configuration switch (A3S1). Refer to Figure 3-8 for this setting. Configuration switch settings relating to the specific model Plug-In used and Option 002 Step Attenuator equipped instruments must be set prior to operation. Configuration switch number 7 is set at the factory and should not be changed.

3-30. Option 002 Step Attenuator

3-31. With Option 002 installed, the RF output power may be continuously controlled from maximum leveled output power down to −60 dBm. When the selected POWER setting goes below −5 dBm, the step attenuator increments as required in 5 dB steps to a maximum attenuation of 55 dB. Within the individual 5 dB steps of the attenuator, the ALC loop adjusts the power output to the power level programmed by the front panel POWER control. Pressing **[SHIFT] [POWER SWEEP]** allows control of power within the ALC range without changing attenuator settings. The display in the **[SHIFT] [POWER SWEEP]** mode disregards attenuator settings and only displays the ALC setting. Pressing **[SHIFT] [SLOPE]** allows control of attenuator steps without affecting ALC setting. In this mode the attenuator setting is displayed.

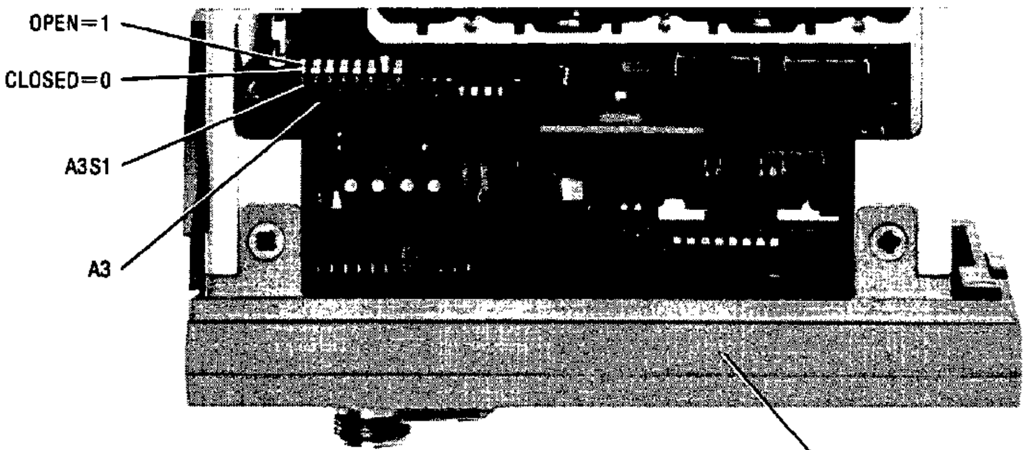
3-32. Alternate Sweep Mode

3-33. If the alternate sweep mode is used and the Model 83592C changes frequency bands (e.g. Band 1 to Band 3) between each sweep, the minimum sweep time recommended is 100 milliseconds. This allows enough time for the bandswitch operation and settling time for the fundamental oscillator for the next sweep.

3-34. If the Option 002 attenuator is installed, and alternate sweep mode is selected, a slow sweep default condition of 1 second/sweep may occur. This default condition only occurs when the POWER settings of the two alternate sweeps require the attenuator to switch after each sweep. The attenuator is prevented from switching faster than one step per second to prevent damage to the attenuator relay coils due to overheating.

3-35. Phase-Lock Operation

3-36. The RF output signal of the Model 83592C can be phase-locked to a specified CW frequency using the HP 5344S Option 043 Microwave Source Synchronizer. The Model 83592C signal is automatically tuned by the HP 5344S. Alternatively the Model 83592C signal can be phase-locked to an external reference oscillator. In either case, the phase-lock signal is applied to the Model 8350A/B rear panel FM INPUT connector. The phase-lock function provides a means of obtaining a very stable CW signal by transferring the frequency stability of the HP 5344S Source Synchronizer or the reference oscillator to the Model 8350A/B and eliminating frequency drift. The Model 83592C CW frequency used for phase-locking may be either the RF output or the fundamental oscillator frequency available at the rear panel AUX OUTPUT. However, use of the front panel RF output requires a broadband coupling device. Therefore it is preferable to use the rear panel AUX OUTPUT for phase-locking. Configuration Switch A3S1 switch position 8 must be set according to which Model 83592C output signal is used as the CW source for phase-locking (see Figure 3-8). The CW filter should be turned off in phase-lock operation. Figure 3-7 shows an example of phase-locking the Model 83592C front panel RF output signal using the HP 5344S Source Synchronizer and the HP 11691D 2 to 18 GHz Directional Coupler.



Description	Switch Number							
	1	2	3	4	5	6	7	8
Normal Sweep	0	X	X	X	X	X	X	X
Sequential Sweep Only	1	X	X	X	X	X	X	X
No RF Power at Instrument Preset	X	X	X	1	X	X	X	X
Maximum RF Power at Instrument Preset	X	X	X	0	X	X	X	X
−6 MHz/V FM Sensitivity	X	X	X	X	1	X	X	X
−20 MHz/V FM Sensitivity	X	X	X	X	0	X	X	X
Direct-Coupled FM (−20 MHz/V)	X	X	X	X	X	1	X	X
Cross-Over Coupled FM	X	X	X	X	X	0	X	X
Step Attenuator Option 002 Installed	X	X	X	X	X	X	1	X
No Step Attenuator	X	X	X	X	X	X	0	X
AUX OUT Phase Lock	X	X	X	X	X	X	X	1
RF OUTPUT Phase Lock	X	X	X	X	X	X	X	0

NOTES

1. Switch Positions:

   1 = Switch Open = High
   0 = Switch Closed = Low (Ground)
   X = Don't Care
   * = Varies, 1 of Opt. 002, 0 if no Opt. 002.

2. Switch is set at the factory as follows:

Switch No.	1	2	3	4	5	6	7	8
Position	0	X	X	0	0	0	*	0

Figure 3-8. Configuration Switch

3-37. OPERATOR'S MAINTENANCE

3-38. Plug-In Error Codes

3-39. The Model 8350A/B FREQUENCY window will display RF Plug-In error codes (50 to 99) or Sweep Oscillator error codes. Information necessary to interpret Plug-In error codes may be found in Section VIII, Service, in this manual.

3-40. Fuses

3-41. Power circuits for the Model 83592C RF Plug-In are fused in the Model 8350A/B Sweep Oscillator. See the Model 8350A/B Sweep Oscillator Operating and Service Manual for fuse locations and replacement instructions.

3-42. Blue Service Tags

3-43. If the Model 83592C RF Plug-In requires service, the instrument may be sent to your local HP service organization as described in Section II, Installation, in this manual. Before sending the instrument back, fill out and attach one of the blue service tags. Record any error codes noted on the failure symptoms/special control settings portion of the tag.

HEWLETT PACKARD

Should one of your HP instruments need repair, the HP service organization is ready to serve you. However, you can help us serve you more effectively. When sending an instrument to HP for repair, please fill out this card and attach it to the product. Increased repair efficiency and reduced turn-around time should result.

COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER ________

over

HEWLETT PACKARD

Should one of your HP instruments need repair, the HP service organization is ready to serve you. However, you can help us serve you more effectively. When sending an instrument to HP for repair, please fill out this card and attach it to the product. Increased repair efficiency and reduced turn-around time should result.

COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER ________

over

HEWLETT PACKARD

Should one of your HP instruments need repair, the HP service organization is ready to serve you. However, you can help us serve you more effectively. When sending an instrument to HP for repair, please fill out this card and attach it to the product. Increased repair efficiency and reduced turn-around time should result.

COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER ________

over

HEWLETT PACKARD

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MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER ________

over

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PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER ________

over

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COMPANY

ADDRESS

TECHNICAL CONTACT PERSON

PHONE NO. EXT.

MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

☐ NONE ☐ CABLE(S)

☐ POWER CABLE ☐ ADAPTER(S)

OTHER ________

over

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ____________________

____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS ____________________

If unit is part of system list model number(s) of other interconnected instruments. ____________________

9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ____________________

____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS ____________________

If unit is part of system list model number(s) of other interconnected instruments. ____________________

9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ____________________

____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS ____________________

If unit is part of system list model number(s) of other interconnected instruments. ____________________

9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ____________________

____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS ____________________

If unit is part of system list model number(s) of other interconnected instruments. ____________________

9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ____________________

____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS ____________________

If unit is part of system list model number(s) of other interconnected instruments. ____________________

9320-3896 Printed in U.S.A.

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER ____________________

____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS ____________________

If unit is part of system list model number(s) of other interconnected instruments. ____________________

9320-3896 Printed in U.S.A.

IV Performance Tests

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of the Model 83592C RF Plug-In/Model 8350A/B Sweep Oscillator combination with the specifications of the Plug-In used as the performance standards. These specifications may be found in Section I of this manual. Due to the extended frequency range of the Model 83592C, the performance tests in the Model 8350A/B Operating and Service manual do not apply. None of the tests require access to the interior of the Model 83592C RF Plug-In.

NOTE

Allow the Model 83592C RF Plug-In and Model 8350A/B Sweep Oscillator to warm up for one hour prior to doing any performance tests.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for testing is listed in the Recommended Test Equipment table in Section I of this manual. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model.

4-5. OPERATION VERIFICATION

4-6. Operation Verification consists of performing the tests listed in paragraph 4-13 steps 1 to 13 and paragraph 4-14 steps 1 to 13. Operation Verification of the HP-IB functions may be verified by executing the program listed in Section IV of the Model 8350A/B Operating and Service Manual. These tests provide reasonable assurance that the Sweep Oscillator and Plug-In are functioning properly and should meet the needs of an incoming inspection (80% verification).

4-7 TEST RECORD

4-8. Table 4-14 provides a tabulated index of the performance tests, their acceptable limits, and a column for recording actual measurements.

4-9. TEST SEQUENCE

4-10. The performance tests should be performed in the order they occur.

4-11. CALIBRATION CYCLE

4-12. The performance tests in this section should be performed at intervals of six months or less for the Model 83592C.

Table 4-1 Performance Tests

Performance Test	83592C Adjustment	8350A/B Adjustment
4-13. Frequency Range and Accuracy		
CW Accuracy	5-14, 5-16, 5-17	5-19
Swept Frequency Accuracy	5-14 through 5-19, 5-24	
Marker Accuracy	5-14 through 5-19, 5-24	5-20
4-14. Output Amplitude		
Power Level Accuracy	5-26 through 5-29	
Power Meter Leveling	5-28	
Crystal Detector Leveling	5-30	
4-15. Frequency Stability		5-11
4-16. Residual FM		5-11
4-17. Spurious Signals		
Harmonics	5-21	
Nonharmonics	5-21	
4-18. Output SWR	–	
4-19. Residual AM	5-21, 5-29	5-11
4-20. External FM	5-31	
4-21. AM On/Off Ratio		
Squarewave Symmetry	5-29	
4-22. Step Attenuator Accuracy	–	

4-13. FREQUENCY RANGE AND ACCURACY TEST

SPECIFICATION:

Bands (GHz)	0.01–2.4	2.4–7.0	7.0–13.5	13.5–20.0	0.01–20.0
CW Mode	±5 MHz	±5 MHz	±10 MHz	±15 MHz	—
All Sweep Modes	±15 MHz	±20 MHz	±25 MHz	±30 MHz	±50 MHz
Frequency Markers	±15 MHz	±20 MHz	±25 MHz	±30 MHz	±50 MHz
	±0.5% of sweep width	±0.5 % of sweep width	±0.5% of sweep width	±0.5% of sweep width	±0.5% of sweep width

DESCRIPTION:

A frequency counter is used to check frequency range and accuracy in the CW mode. The frequency counter is also used to check swept frequency accuracy and markers in the START/STOP mode.

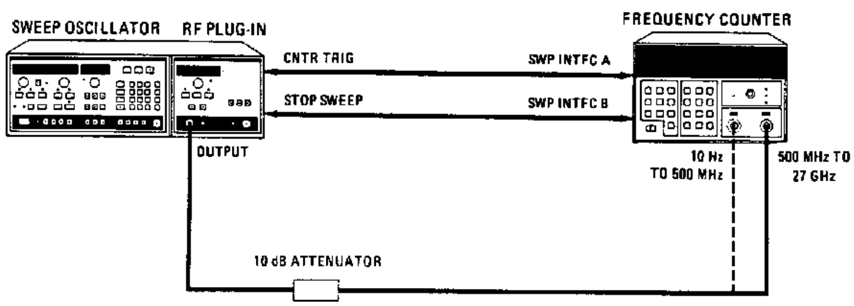


Figure 4-1. Frequency Range and CW Accuracy Test Setup

EQUIPMENT:

Sweep Oscillator. . . . . HP 8350A/B
Frequency Counter . . . . HP 5343A
10-dB Attenuator. . . . . HP 8493C-010

PROCEDURE:

1. Connect equipment as shown in Figure 4-1.

2. Set controls as follows:

   Frequency Counter

   LINE. . . . . ON
   SAMPLE RATE . . . . minimum (full CCW)
   Range Connector. . . . . As required
   Impedance Switch. 50Ω
   ACQ TIME (rear panel). . . . . FAST

4-13. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

3. Press Model 8350A/B **[INSTR PRESET]**. Note that the Sweep Oscillator display indicates a start frequency of 10 MHz and a stop frequency of 20.0 GHz.

Frequency Calibration

4. Press Model 8350A/B **[CW]** and enter a CW frequency of 50 MHz.

5. Adjust the Model 83592C FREQ CAL adjustment for a frequency counter indication of 50.00 MHz.

Frequency Range

6. Press Model 8350A/B **[CW]** key and enter a CW frequency of 10 MHz. If the frequency observed on the frequency counter is greater than 10 MHz, rotate the Model 8350A/B CW control counterclockwise until the frequency counter reading is at or below 10 MHz.

7. Enter a CW frequency of 20.0 GHz. If the frequency observed on the frequency counter is lower than 20.0 GHz, rotate the Model 8350A/B CW control clockwise until the frequency counter reading is at or above 20.0 GHz.

CW Frequency Accuracy.

8. Check the CW frequency accuracy for each CW frequency listed in Table 4-2. Verify that the frequency counter indication at the three points on each band is within the accuracy tolerance in Table 4-2. Follow the sequence of frequencies listed for each band from top to bottom to avoid band crossover problems.

Table 4-2. CW Frequency Accuracy

Bands (Accuracy)			
Band 0 (±5 MHz)	**Band 1 (±5 MHz)**	**Band 2 (±10 MHz)**	**Band 3 (±15 MHz)**
10 MHz	4.0 GHz	10 GHz	17.0 GHz
1.0 GHz	2.5 GHz	7.1 GHz	14.0 GHz
2.4 GHz	7.0 GHz	13.5 GHz	20.0 GHz

Swept Frequency Accuracy

9. Press frequency counter **[RESET] [SWP M]** (Light on), **[SHIFT] [1 KHz]**. Press Model 8350A/B **[INSTR PRESET]** and set sweep time to 105 msec.

10. Enter the START and STOP frequencies on the Model 8350A/B for each band listed in Table 4-3.

11. Press Model 8350A/B **[START] [SHIFT] [M2]**. Check the frequency counter reading for the START frequency listed in Table 4-3 and record on test record.

4-13. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

12. Press Model 8350A/B **[STOP] [SHIFT] [M2]**. Check the frequency counter reading for the STOP frequency listed in Table 4-3 and record it on test record.

13. Repeat steps 10 through 12 for each band listed.

Table 4-3. Swept Frequency Accuracy Table

Band	Start	Stop	Tolerance
Full Band	10 MHz	20.0 GHz	±50 MHz
Band 0	10 MHz	2.4 GHz	±15 MHz
Band 1	2.4 GHz	7.0 GHz	±20 MHz
Band 2	7.0 GHz	13.5 GHz	±25 MHz
Band 3	13.5 GHz	20.0 GHz	±30 MHz

Frequency Marker Accuracy

14. Press Model 8350A/B **[INSTR PRESET]** and set sweep time to 105 msec.

15. Set first band's START – STOP frequencies as listed in Table 4-4.

16. Set the Model 8350A/B markers to the frequencies listed and verify that the frequency counter readings are within tolerance. Enter **[SHIFT] [M2]**, then the marker to be checked.

17. Set the START and STOP frequencies for each band listed and repeat the previous step with the markers set as listed.

Table 4-4. Frequency Marker Accuracy

Band	Sweep Range Start – Stop	Marker Frequencies M1	M2	M3	M4	M5	Tolerance
Full Band	0.01 – 20 GHz	1 GHz	4 GHz	8 GHz	14 GHz	18 GHz	± 150 MHz
Band 0	0.01 – 2.4 GHz	1 GHz	2 GHz	—	—	—	± 26 MHz
Band 1	2.4 – 7.0 GHz	3.0 GHz	6.0 GHz	—	—	—	± 43 MHz
Band 2	7 – 13.5 GHz	8.0 GHz	12 GHz	—	—	—	± 58 MHz
Band 3	13.5 – 20 GHz	15.0 GHz	18.0 GHz	—	—	—	± 63 MHz

4-14. OUTPUT AMPLITUDE TEST

SPECIFICATION:

	Frequency Bands (GHz)						
	0.01 to 2.4	2.4 to 7.0	7.0 to 13.5	13.5 to 18.6	13.5 to 20.0	0.01 to 18.6	0.01 to 20.0
Maximum Leveled Output Power [2,4,5] (25°C)	+10 dBm	+6 dBm	+6 dBm	+6 dBm	+4 dBm	+6 dBm	+4 dBm
With Option 002	+10 dBm	+4.5 dBm	+4 dBm	+3.5 dBm	+1.5 dBm	+3.5 dBm	+1.5 dBm
Power Level Accuracy [12] (Internally Leveled)	<±1.5 dB	<±1.3 dB	<±1.3 dB	<±1.4 dB	<±1.4 dB	<±1.5 dB	<±1.5 dB
With Option 002 [6] (at 0 dB attenuator step)	<±1.7 dB	<±1.5 dB	<±1.5 dB	<±1.6 dB	<±1.6 dB	<±1.7 dB	<±1.7 dB

Minimum Settable Power: −5 dBm
With Option 002: −60 dBm

Power Variation (at specified Maximum Leveled Power or below)	Frequency Bands (GHz)				
	0.01 to 2.4	2.4 to 7.0	7.0 to 13.5	13.5 to 20.0	0.01 to 20.0
Internally Leveled	±0.9 dB	±0.7 dB	±0.7 dB	±0.8 dB	±0.9 dB
Externally Leveled [7] Negative Crystal Detector [8] (Sweep time >100 ms)	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Externally Leveled Power Meter [9]	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB

DESCRIPTION:

A power meter is used to check power level accuracy, maximum leveled output power, and power variations.

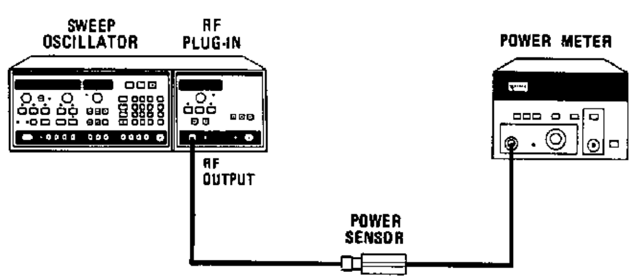


Figure 4-2. Output Amplitude Test Setup

4-14. OUTPUT AMPLITUDE TEST (Cont'd)

EQUIPMENT:

Sweep Oscillator .... HP 8350A/B
Power Meter .... HP 436A
Power Sensor .... HP 8485A
Power Meter .... HP 432A
Thermistor Mount .... HP 8478B
Thermistor Mount .... HP K486A
Crystal Detector .... HP 8473C
10 dB Attenuator .... HP 8493C-010
Power Splitter .... Weinschel Model 1579A
Oscilloscope .... HP 1740A
Adapter, Waveguide to APC-3.5 female .... HP K281C
BNC TEE 1250-0781

PROCEDURE:

1. Connect equipment as shown in Figure 4-2.
2. Press Model 8350A/B **[INSTR PRESET]**, and set SWEEP to **[MAN]**.

Maximum Leveled Power and Power Variations

3. Set START and STOP frequencies and POWER LEVEL for the first frequency range listed in Table 4-5 (0.05 to 2.40 GHz at +10 dBm).
4. Slowly tune the Model 8350A/B FREQUENCY/TIME control and note the minimum power level in the band. Leave the frequency at this low power point.
5. Adjust the Model 83592C POWER control for a power meter reading equal to the specified maximum leveled output power.
6. Slowly tune the Model 8350A/B FREQUENCY/TIME control through the frequency band. Note and record maximum power deviation on the test record.
7. Repeat steps 3 through 6 for the other frequency band settings as listed in Table 4-5.

Table 4-5. Frequency and Power Settings

Frequency Range	Maximum Leveled Power		Power Sweep Range	
	(Standard)	(Option 002)	(Standard)	(Option 002)
0.05 to 2.4 GHz	+10 dBm	+10 dBm	15 dB/SWP	15 dB/SWP
2.4 to 7.0 GHz	+6 dBm	+4.5 dBm	11 dB/SWP	9.5 dB/SWP
7.0 to 13.5 GHz	+6 dBm	+4 dBm	11 dB/SWP	9 dB/SWP
13.5 to 18.6 GHz	+6 dBm	+3.5 dBm	11 dB/SWP	8.5 dB/SWP
13.5 to 20.0 GHz	+4 dBm	+1.5 dBm	9 dB/SWP	6.5 dB/SWP
0.05 to 18.6 GHz	+6 dBm	+3.5 dBm	11 dB/SWP	8.5 dB/SWP
0.5 to 20.0 GHz	+4 dBm	+1.5 dBm	9 dB/SWP	6.5 dB/SWP

4-14. OUTPUT AMPLITUDE TEST (Cont'd)

Power Level Accuracy, Range and Power Sweep

8. Set START and STOP frequencies and POWER LEVEL for the first frequency band in Table 4-5 (0.05 to 2.40 GHz at +10 dBm). Engage the Model 83592C **[POWER SWEEP]** and set the dB/SWP level to 16 dB/SWP. Disengage **[POWER SWEEP]** key.
9. Slowly tune the Model 8350A/B FREQUENCY/TIME control through the frequency band and note the maximum power level variations above and below the displayed power level setting. Record these on the test record.
10. Press the Model 83592C POWER LEVEL key. Use the Model 8350A/B ⇩ key to step the power down 1 dB.
11. Repeat steps 9 and 10 to check power level accuracy over the full calibrated range (down to −5 dBm).
12. Adjust the FREQUENCY/TIME control for the highest frequency and the note power meter level. Engage **[POWER SWEEP]** and set it for maximum leveled power (UNLEVELED light off). Record the power meter level change on the test record.
13. Repeat steps 8 through 12 for the frequencies and power levels listed in Table 4-5.

Power Meter Leveling

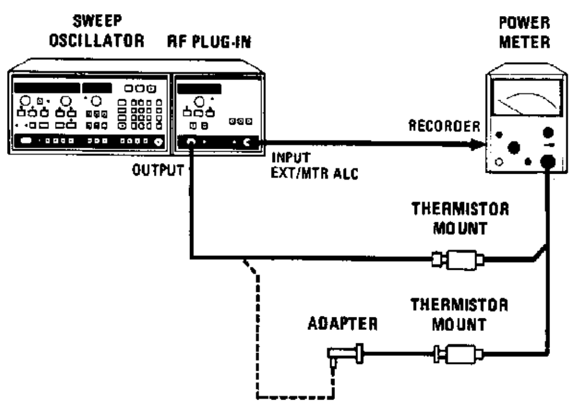


Figure 4-3. Power Meter Leveling Test Setup (Using HP 432A Power Meter)

14. Connect equipment as shown in Figure 4-3 using HP 8478B Thermistor Sensor.
15. Press Model 8350A/B **[INSTR PRESET]** and set STOP frequency to 18 GHz. Set SWEEP TIME to 100 seconds and SWEEP TRIGGER to **[SINGLE]**.
16. Adjust ALC EXT/MTR CAL control and power meter range switch for a power meter indication corresponding to the Model 83592C POWER display.
17. Press SWEEP TRIGGER **[SINGLE]** key and note power meter variations.

4-14. OUTPUT AMPLITUDE TEST (Cont'd)

18. When the SWP light goes out, press Model 8350A/B **[CW]** and set a CW frequency of 18 GHz. Note the power meter indication.

19. Change to the HP K486A Thermistor Sensor and adjust the ALC EXT/MTR CAL control for the same power meter indication noted in step 18.

20. Set the Sweep Oscillator for a START/STOP frequency of 18 to 20 GHz and a SWEEP TIME of 10 seconds.

21. Press SWEEP TRIGGER **[SINGLE]** key and note power variations. The combined variations from steps 17 and 21 should be ≤±0.2 dB.

External Crystal Detector Leveling

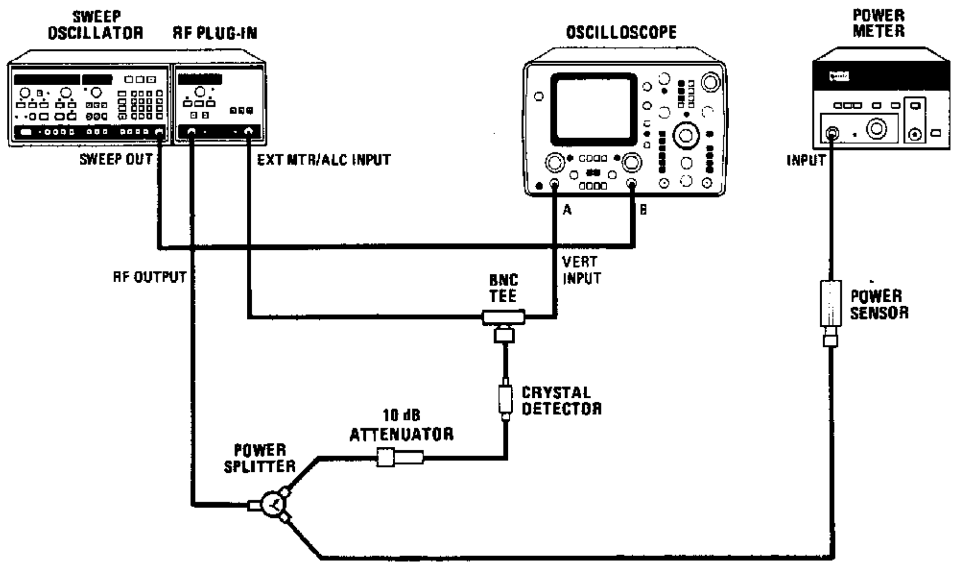


Figure 4-4. Crystal Detector Leveling Test Setup (Using HP 436A Power Meter)

22. Connect equipment as shown in Figure 4-4. Press Model 8350A/B **[INSTR PRESET]** and set SWEEP TIME to 100 milliseconds. Set the oscilloscope for external sweep mode (A vs B).

23. Press Model 8350A/B **[CW]**. Adjust the oscilloscope to the center graticule. Adjust the Model 83592C POWER LEVEL to decrease the power meter indication by 0.4 dB. Note the new trace position on the oscilloscope: the area between the trace and the center graticule represents the leveling tolerance of ± 0.2 dB.

24. Press Model 8350A/B **[START]**.

25. Adjust the oscilloscope trace position so that the lowest point of the trace is on the center graticule. The highest point of the trace should be within the leveled variation limits established in step 23.

4-15. FREQUENCY STABILITY TEST

SPECIFICATION:

Frequency Bands (GHz)	0.1 to 2.4 GHz	2.4 to 7.0 GHz	7.0 to 13.5 GHz	13.5 to 20.0 GHz	.01 to 20.0 GHz
Stability					
With 10% Line Voltage Change	±50 kHz	±50 kHz	±100 kHz	±150 kHz	±150 kHz
With 10 dB Power Level Change	±200 kHz	±200 kHz	±400 kHz	±600 kHz	±600 kHz
With 3:1 Load SWR	±100 kHz	±100 kHz	±200 kHz	±300 kHz	±300 kHz

DESCRIPTION:

A frequency counter is used to check frequency change due to line voltage changes, time, output power level changes, and load impedance changes.

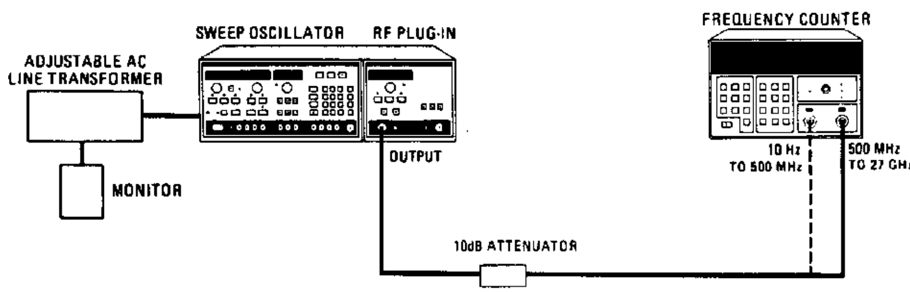


Figure 4-5. Frequency Change with Line Voltage Change

EQUIPMENT:

NOTE

More than one model number is listed for some test equipment. Use only the equipment needed to cover the line voltage used.

Sweep Oscillator . . . . HP 8350A/B
Frequency Counter . . . . HP 5343A
10 dB Attenuator . . . . HP 8493C-010
3 dB Attenuator . . . . HP 8493C-003

Adjustable AC Line Transformer and monitor (Select for line voltage needed)
100–120 volt . . . . General Radio W5MTB
120 V Monitor . . . . RCA WV 120B
220-240 volt . . . . General Radio W10HM73
240V Monitor . . . . RCA WV 503A
Adjustable Short . . . . Maury Microwave 1959-1
Adjustable Short (18–20.0 GHz) . . . . HP K920B
Adapter . . . . HP K281C

4-15. FREQUENCY STABILITY TEST (Cont'd)

PROCEDURE:

Frequency Change with Line Voltage Change

1. Connect equipment as shown in Figure 4-5 and set Model 8350A/B LINE switch to ON.

2. Set adjustable line transformer using suitable monitor to the line voltage set on the Model 8350A/B power module. Press the Model 8350A/B **[INSTR PRESET]** and **[CW]** keys and enter the appropriate frequency. Rotate frequency counter SAMPLE RATE knob to HOLD, and press **[SET]** **[OFS MHz]** **[SHIFT]**, then rotate the Frequency Counter SAMPLE RATE knob counterclockwise back to the normal position.

Table 4-6. High and Low Line Voltage Selection Table

Nominal Line Voltage	100V	115/120V	220V	240V
Low Line Voltage	90V	108V	198V	216V
High Line Voltage	105V	126V	231V	252V

3. Set adjustable line transformer to the low line voltage using suitable monitor which corresponds to the selected nominal voltage in Table 4-6. Check and record on the test card step 3 the difference frequency displayed on counter.

4. Set adjustable line transformer using suitable monitor to the high line voltage using suitable monitor which corresponds to the selected nominal voltage. Check and record on the test record card step 4 the difference frequency displayed on counter. Repeat steps 3 and 4 for CW frequencies listed in Table 4-7.

Table 4-7. Frequency Change with Line Voltage Change

Band	CW Frequency	Frequency Change
Band 0	1.0 GHz	±50 kHz
Band 1	6.0 GHz	±50 kHz
Band 2	12.0 GHz	±100 kHz
Band 3	18 GHz	±150 kHz

4-15. FREQUENCY STABILITY TEST (Cont'd)

Frequency Change with 10 dB Power Level Change

5. Enter **[CW] [1] [GHz]**.

6. Rotate the frequency counter SAMPLE RATE knob to HOLD, press **[SET] [OFFSET] [SHIFT]**, then rotate the frequency counter SAMPLE RATE knob counterclockwise back to the normal position. Enter **[POWER LEVEL] [0] [dBm]**. Verify the frequency change is less than given in Table 4-8.

7. Repeat steps 5 and 6 for the other frequencies given in Table 4-8.

Table 4-8. Frequency Change with Power Level Change

Band	CW Frequency	Frequency Change
Band 0	1.0 GHz	±200 kHz
Band 1	6.0 GHz	±200 kHz
Band 2	12.0 GHz	±400 kHz
Band 3	18 GHz	±600 kHz

Frequency Change With 3:1 Load SWR

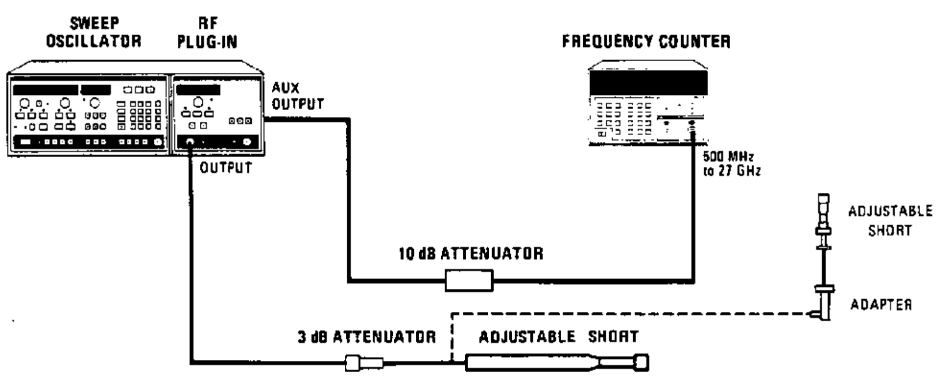


Figure 4-6. Frequency Change with 3:1 Load SWR Test Setup

8. Connect equipment as shown in Figure 4-6. Press the Model 8350A/B **[INSTR PRESET]**, **[CW] [1] [GHz]**, then **[POWER LEVEL] [1] [0] [dBm]**.

4-15. FREQUENCY STABILITY TEST (Cont'd)

9. Since the frequency of the AUX OUTPUT is being counted, a multiplication factor must be entered for bands 2 and 3 only to yield actual RF OUTPUT frequency errors. No factor is needed for band 1. Band 0 is offset by 3.8 GHz. In band 2 press **[SET] [.]** (decimal point) **[2] [ENTER]** on counter. In band 3, press **[SET] [.] [3] [ENTER]**. Note that in band 0, the counter will not read the desired output frequency. This is because the AUX OUTPUT frequency is mixed down to yield the front panel frequency.

10. On counter rotate the SAMPLE RATE knob clockwise to HOLD, and press **[SET] [OFS MHz] [SHIFT]**, then rotate the SAMPLE RATE knob counterclockwise to the normal position on the Frequency Counter.

11. Adjust the adjustable short through its range while observing the frequency counter for the greatest plus and minus frequency change. Check that the peak-to-peak frequency change is less than given in Table 4-9.

12. Enter the next CW frequency and repeat steps 10 and 11. To clear the counter multiplication factor, press **[SET] [.] [ENTER]**.

Table 4-9. Frequency Change with 3:1 Load SWR

Band	CW Frequency	Frequency Change
Band 0	1.0 GHz	±100 kHz
Band 1	6.0 GHz	±100 kHz
Band 2	12.0 GHz	±200 kHz
Band 3	18 GHz	±300 kHz

4-16. RESIDUAL FM TEST

SPECIFICATION:

10 Hz to 10 kHz Bandwidth, CW mode with CW Filter

0.01 to 7.0 GHz: <8 kHz (peak)
7.0 to 20.0 GHz: <15 kHz (peak)

DESCRIPTION:

The CW RF output signal is slope-detected by using the linear portion of a spectrum analyzer resolution bandwidth filter in the zero-span mode.

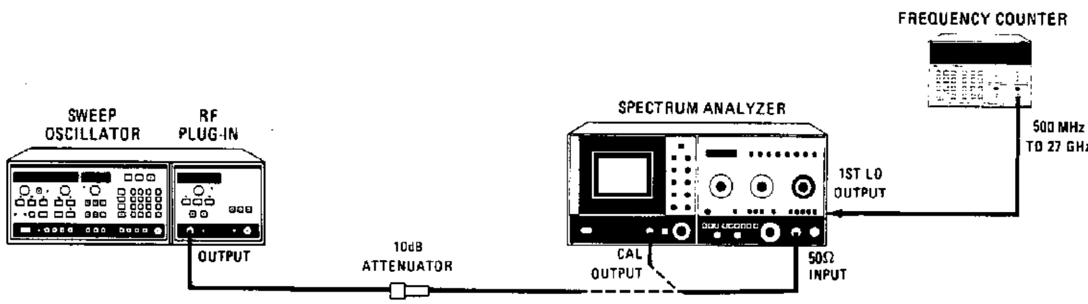


Figure 4-7. Residual FM Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A/B
Spectrum Analyzer	HP 8565A
Frequency Counter	HP 5343A
10 dB Attenuator	HP 8493C-010

PROCEDURE:

1. Connect equipment as shown in Figure 4-7. Connect the spectrum analyzer CAL OUTPUT to the spectrum analyzer input.
2. Press Model 8350A/B **[INSTR PRESET]**, **[CW]**. Enter a CW frequency of 6.0 GHz.

NOTE

To mimimize drift, allow five minutes warmup before continuing with test.

4-16. RESIDUAL FM TEST (Cont'd)

3. Set spectrum analyzer controls as follows:

TUNING	0.100 GHz
FREQUENCY SPAN/DIV	.5 MHz
RESOLUTION BW	300 kHz (uncoupled)
INPUT ATTEN	−30 dB
REFERENCE LEVEL	−10 dBm
AMPLITUDE SCALE	LIN
AUTO STABILIZER	ON
SWEEP TIME/DIV	10 msec/DIV
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	fully counterclockwise (OFF)
VIDEO FILTER	.01

4. Adjust spectrum analyzer TUNING to center the 100 MHz CAL OUTPUT signal on the spectrum analyzer display.

5. Adjust spectrum analyzer REFERENCE LEVEL controls to place the peak of the signal trace at the reference level (top) graticule line.

6. Reduce RESOLUTION BW to 100 kHz and FREQUENCY SPAN/DIV to 100 kHz while keeping the signal centered with the FINE TUNING control. The spectrum analyzer display should be as shown in Figure 4-8.

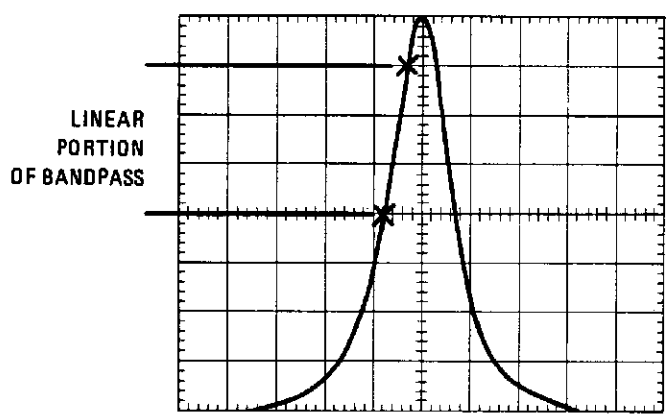


Figure 4-8. Spectrum Analyzer Display for Residual FM Test

7. Set the FREQUENCY SPAN MODE to ZERO SPAN and adjust the FINE TUNING control counterclockwise to position the CRT trace on the center horizontal graticule. Note the frequency counter indication: ______________ kHz.

8. Adjust the FINE TUNING control clockwise to position the CRT trace on the seventh graticule (one division below the Reference Level). Be sure to stay tuned on the lower frequency side of the signal bandpass. Note the frequency counter indication: ______________ kHz.

4-16. RESIDUAL FM TEST (Cont'd)

9. The spectrum analyzer demodulation sensitivity per division is calculated as one third of the difference frequency between the frequencies noted in steps 7 and 8. Calculate the demodulation sensitivity: ______________ kHz/Div.

10. Connect the Model 8350A/B RF OUTPUT signal to the spectrum analyzer.

11. Set spectrum analyzer controls as follows:

    TUNING .... 6.00 GHz
    FREQUENCY SPAN/DIV .... .5 MHz
    AMPLITUDE SCALE .... LIN
    REFERENCE LEVEL .... +10 dBm

12. Adjust spectrum analyzer REFERENCE LEVEL controls to place the peak of the signal trace at the reference level (top) graticule line.

13. Reduce FREQUENCY SPAN/DIV to 0 while keeping the signal centered on the CRT with the FINE TUNING control.

14. Position the trace between the fifth and seventh graticules by turning the FINE TUNING control counterclockwise. STORE a single trace.

15. Note the maximum peak-to-peak deviation in divisions of the CRT trace. The peak deviation is one-half the peak-to-peak deviation. Multiply the peak deviation by the modulation sensitivity calculated in step 8.

    Residual FM (kHz) = (peak-to-peak deviation/2) X (demodulation sensitivity) =______________ kHz

16. Verify that residual FM is within tolerance given in Table 4-10.

17. Repeat steps 11 through 17 with spectrum analyzer and RF Plug-In tuned to each frequency listed in Table 4-10.

Table 4-10. Residual FM

Band	CW Frequency	Residual FM
Band 0	1.0 GHz	<8 kHz
Band 1	6.0 GHz	<8 kHz
Band 2	12.0 GHz	<15 kHz
Band 3	18 GHz	<15 kHz

4-17. SPURIOUS SIGNALS TEST

SPECIFICATION:

Spurious Signals (at specified Maximum Leveled Power)	**Frequency Bands (GHz)**						
	0.01–1.4	**1.4–2.4**	**2.4–3.5**	**3.5–7.0**	**7.0–13.5**	**13.5–20**	**0.01–20**
Harmonics or Subharmonics (in dB below carrier)	>25 dB	>45 dB	>50 dB	>55 dB	>55 dB	>55 dB	>25 dB
Non-Harmonics	>25 dB	>25 dB	>55 dB	>55 dB	>55 dB	>55 dB	>25 dB

DESCRIPTION:

The RF output signal from the Sweep Oscillator is displayed on a spectrum analyzer to verify that harmonic and non-harmonic spurious signals are at or below the specified level.

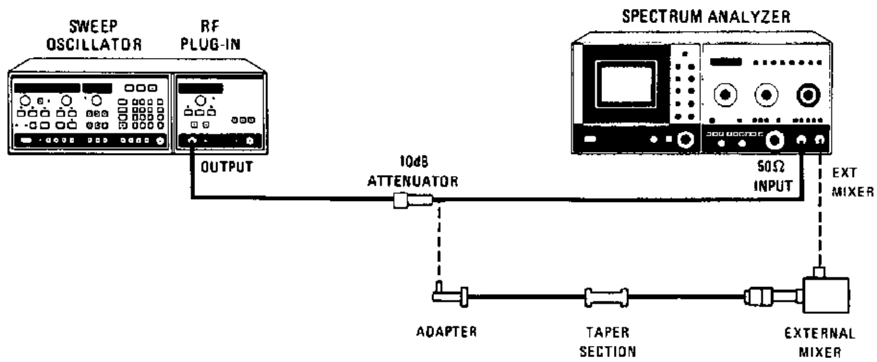


Figure 4-9. Spurious Signals Test Setup

EQUIPMENT:

Sweep Oscillator.. HP 8350A/B
Spectrum Analyzer .... HP 8565A
10 dB Attenuator.. HP 8493C-010
Adapter, K band waveguide to SMA female..................... HP K281C
External Mixer.. HP 11517A
Taper Section .... HP 11519A

PROCEDURE:

1. Connect equipment as shown in Figure 4-9.

4-17. SPURIOUS SIGNALS TEST (Cont'd)

2. Set controls as follows:

Model 8565A:

Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz .... .01 to 1.8
INPUT ATTEN .... 10 dB
REF LEVEL dBm.. +10 dBm
FREQUENCY SPAN MODE .... FULL BAND

Model 8350A/B

Press **[INSTR PRESET]**, **[CW]** **[1]** **[0]** **[MHz]**.

Model 83592C

POWER .... Specified Maximum Leveled Power
CW FILTER .... ON

NOTE

The spectrum analyzer originates some mixing products that may appear on the display. If a signal is in question, increase the spectrum analyzer input attenuation by 10 dB, note if the signal decreases in amplitude by 10 dB, then return the attenuator to the original position. If the signal in question comes from an external source, it will change by 10 dB. If the signal in question originates in the spectrum analyzer, the level will either change by greater or less than 10 dB or may not change at all.

The Model 8350A/B CW control when being rotated may generate some noise spikes. These signals should disappear when rotation is stopped.

If a spurious signal is found that appears to be out of specifications, check the fundamental signal amplitude to ensure it is at maximum specified power. Then check spurious signal level by substituting a known amplitude signal on the spectrum analyzer.

3. Adjust the Model 8350A/B CW control through the entire frequency range of the RF Plug-In (0.01 to 20.0 GHz) and check that any harmonic and non-harmonic spurious signals are at or below the specified levels listed at the beginning of this test.

4. Change the spectrum analyzer to each of the next higher frequency bands and repeat the previous step.

4-18. OUTPUT SWR TEST

SPECIFICATION:

Output SWR: <1.9
Option 002 (0.01 to 20 GHz): <2.1

DESCRIPTION:

The RF output signal is measured using a directional coupler, crystal detector, and oscilloscope. The signal at the oscilloscope contains (1) the incident signal from the oscillator, and (2) the reflected signal. The reflected signal is developed as follows: The incident signal travels down the 20 cm air lines (2 to 18 GHz), directional coupler with short (18 to 20.0 GHz), or 3 to 6 metres of coaxial cable (.01 to 2 GHz), encounters the open end, and is reflected back to the source. If the reflected signal at the RF OUTPUT connector encounters a perfect 50-ohm source match, no signal is reflected back. However, the greater the mismatch, the greater the reflected signal. This reflected signal either adds to or subtracts from the incident signal. This variation is displayed on the oscilloscope.

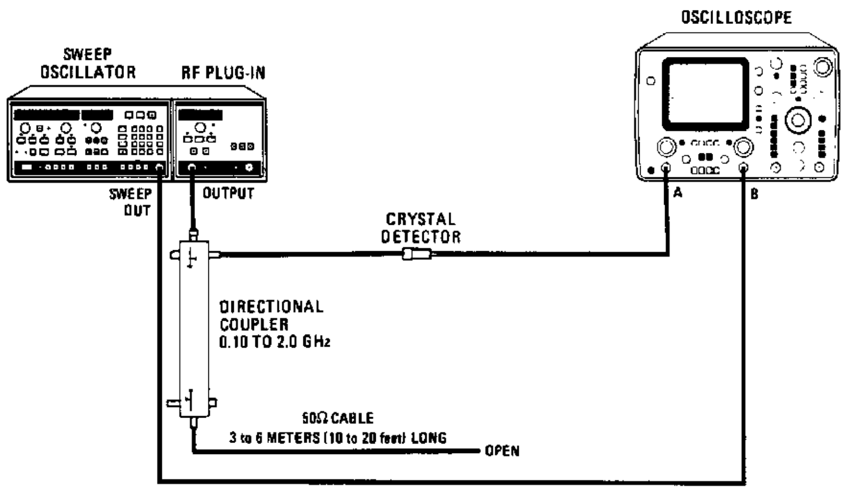


Figure 4-10. Low Frequency Output SWR Test Setup

EQUIPMENT:

Sweep Oscillator........ HP 8350A/B
Oscilloscope........ Any general purpose oscilloscope such as HP 1222A or 1740A
Crystal Detector........ HP 8473C
Crystal Detector........ HP K422A
Directional Couplers
- 0.10 to 2 GHz........ HP 778D
- 1.7 to 18 GHz........ HP 11691D
- 18 to 20.0 GHz........ HP K752C

Cable
- 0.01 to 2 GHz........ 3 to 6 metres (10 to 20 feet) see Table 4-11
- 2 to 18 GHz........ HP 11567A 20-cm Air Lines (2 required)

Adjustable Short........ HP K920B
Adapter, APC-3.5 to Waveguide........ HP K281C

4-18. OUTPUT SWR TEST (Cont'd)

PROCEDURE:

Low Frequency Output SWR Test

NOTE

A single 3 to 6 metre (10 to 20 foot) section of 50-ohm cable is required to avoid mismatch of connectors when performing the low frequency SWR test.

1. Connect equipment as shown in Figure 4-10.

2. Press **[INSTR PRESET]**, **[STOP]** **[2]** **[GHz/s]** on the Model 8350A/B. Set **[DISPL BLANKING]** off and **[RF BLANKING]** on.

3. Adjust the POWER level control on the Plug-In for a maximum output power of −25 millivolts peak trace on Oscilloscope display in order to keep the crystal in square-law output range.

4. Select several points on the trace and calculate V MAX/V MIN (see Figure 4-11).

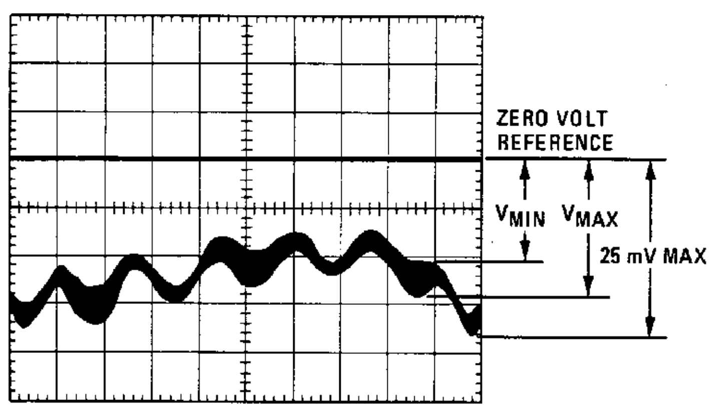


Figure 4-11. Typical Low Frequency Swept SWR Measurement

5. Determine the cable loss at selected frequency of the length of coaxial cable (between coupler end and cable open end), using manufacturer's specifications for loss/foot. (Refer to Table 4-11.)

6. Convert the V MAX/V MIN ratio noted in step 4 into source match SWR, using Figure 4-14 and the cable loss calculated in step 5. The SWR should be less than 1.9 (2.1 for Option 002).

Mid Frequency Output SWR Test

7. Connect equipment as shown in Figure 4-12.

4-18. OUTPUT SWR TEST (Cont'd)

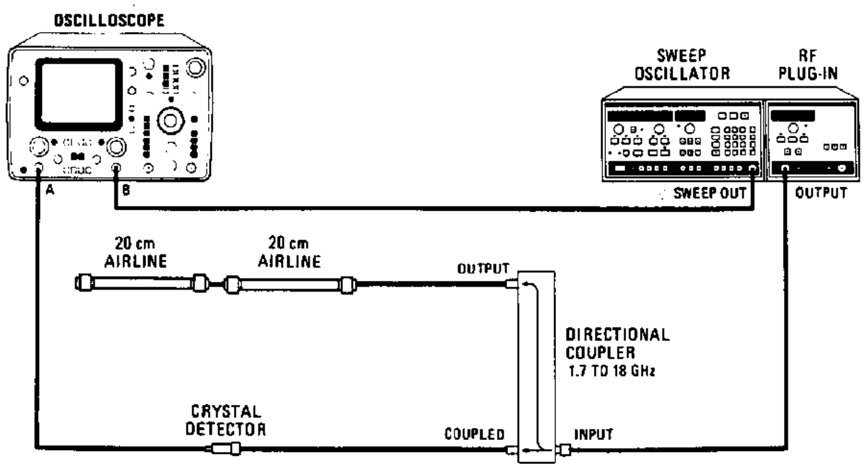


Figure 4-12. Mid Frequency Output SWR Test Setup

8. Press **[INSTR PRESET]**, **[START]** **[2]** **[GHz]** **[STOP]** **[1]** **[8]** **[GHz]** on the Model 8350A/B. Set **[DISPL BLANKING]** off and **[RF BLANKING]** on.

9. Adjust the POWER control on the Plug-In for a maximum output power of −25 millivolts peak trace on the Oscilloscope display in order to keep the crystal in square-law output range.

10. Select points on the trace where V MAX and V MIN appear to have the greatest separation and calculate V MAX and V MIN for each point.

11. Convert the greatest V MAX and V MIN ratio noted in step 10 into source match SWR using the 0 dB LOSS line in Figure 4-14. The SWR should be less than 1.9 (2.1 for Option 002).

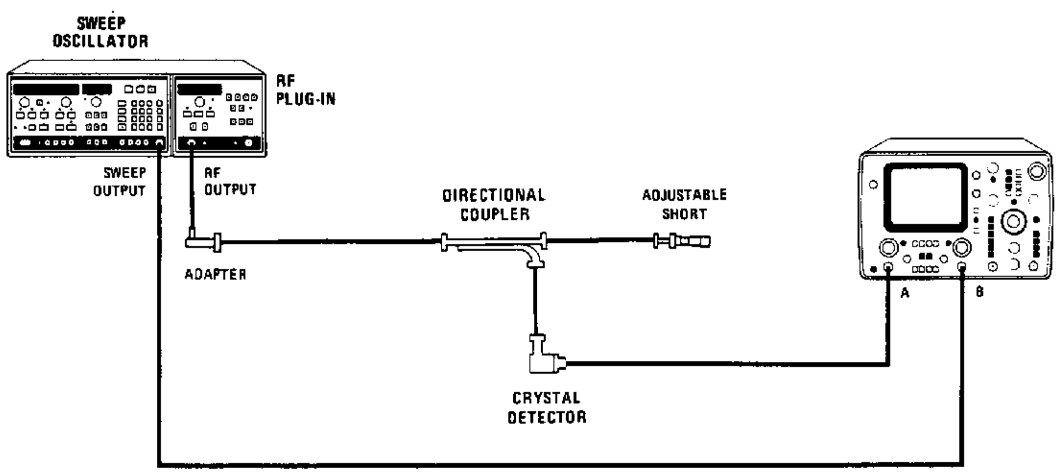


Figure 4-13. High Frequency Output SWR Test Setup

4-18. OUTPUT SWR TEST (Cont'd)

High Frequency Output SWR Test

12. Connect equipment as shown in Figure 4-13.
13. Press **[START] [18] [STOP] [2] [0] [GHz]** on the Model 8350A/B. Set **[DISPL BLANKING]** off and **[RF BLANKING]** on.
14. Adjust the POWER control on the Plug-In for a maximum output power of −25 millivolts peak trace on the Oscilloscope display in order to keep the crystal in squarelaw output range.
15. Select points on trace where V MAX and V MIN appear to have the greatest separation and calculate V MAX and V MIN for each point.
16. Convert the greatest V MAX and V MIN ratio noted in step 15 into source match SWR using Figure 4-14 on the 0 dB loss line. Record SWR on test record step 16.

Table 4-11. Loss in Coaxial Cable

RG Cable Type	Attenuation (dB/100 ft.) at Selected Frequency					
	0.1 GHz	0.2 GHz	0.4 GHz	0.6 GHz	1 GHz	3 GHz
58/U	2.4	3.6	5.2	6.6	8.8	16.7
98/U	2.3	3.4	5.2	6.5	9.0	17.0
55A/U	4.8	7.0	10.5	13.0	17.0	32.0
58A/U	6.2	9.2	14.0	17.5	23.5	45.0
58C/U	6.2	9.2	14.0	17.5	23.5	45.0
177/U	0.95	1.5	2.4	3.2	4.5	9.5
212/U	2.4	3.6	5.2	6.6	8.8	16.7
213/U	2.1	3.1	5.0	6.5	8.8	17.5
214/U	2.3	3.4	5.2	6.5	9.0	17.0
215/U	2.1	3.1	5.0	6.5	8.8	16.7
217/U	1.5	2.3	3.5	4.4	6.0	11.7
218/U	0.95	1.5	2.4	3.2	4.5	9.5
219/U	0.95	1.5	2.4	3.2	4.5	9.5
220/U	0.69	1.12	1.85	—	3.6	7.7
221/U	0.69	1.12	1.85	—	3.6	7.7
223/U	4.8	7.0	10.5	13.0	17.0	32.0
224/U	1.5	2.3	3.5	4.4	6.0	11.7

4-18. OUTPUT SWR TEST (Cont'd)

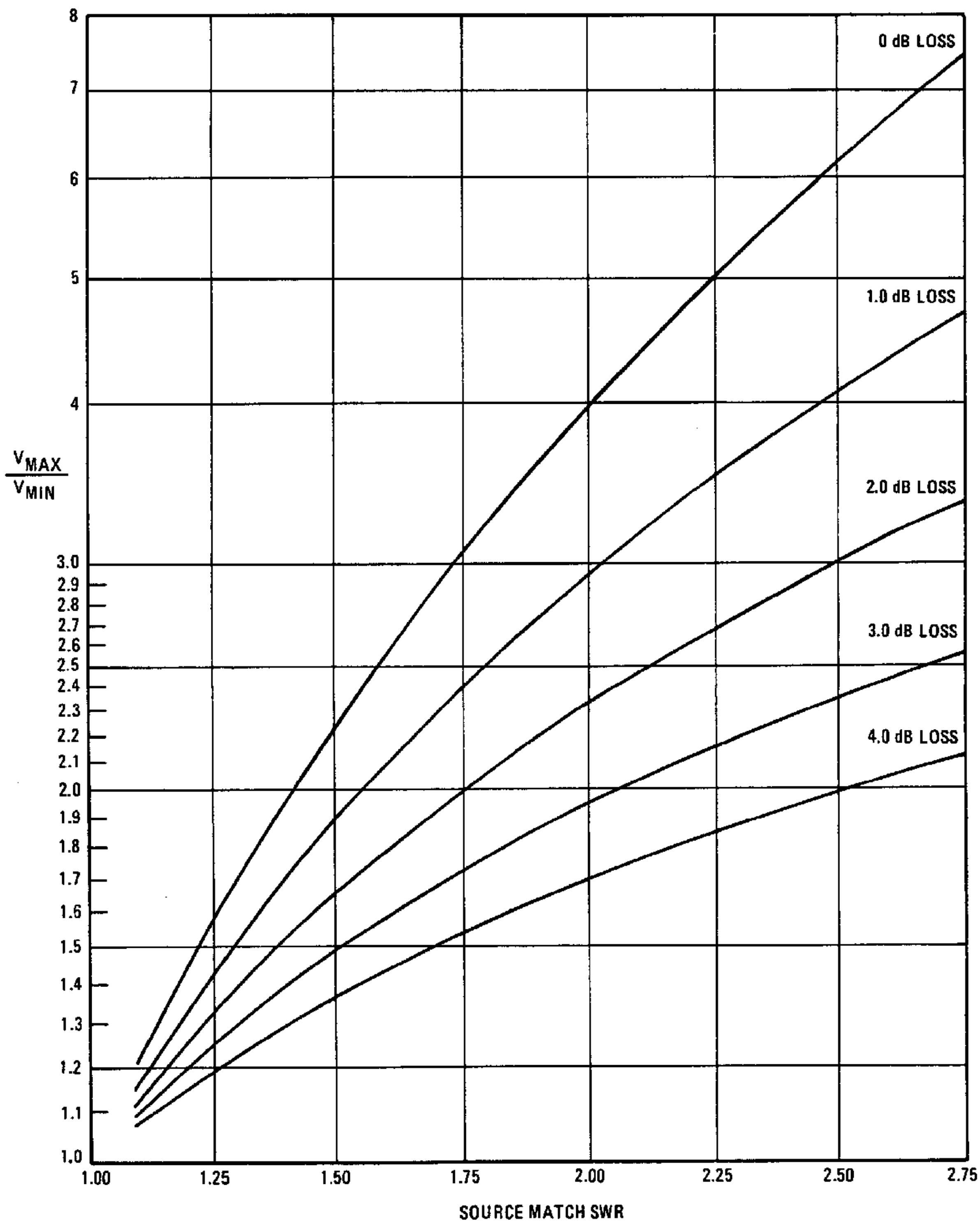


Figure 4-14. Conversion of Oscilloscope Trace to Source Match SWR

4-19. RESIDUAL AM

SPECIFICATION:

Residual AM in 100 kHz Bandwidth: ≥50 dB (in dB below carrier and at specified maximum leveled power).

DESCRIPTION:

The RF Output signal from the RF Plug-In is amplitude modulated with a squarewave from the Model 8350A/B. This modulated signal is used to establish a reference on the RMS voltmeter that is 9 dB below the actual carrier signal. The 9 dB reduction occurs because of voltmeter response to squarewave and square-law response of the crystal detector. Modulation is then removed and the magnitude of the Residual AM component is measured with respect to the established reference.

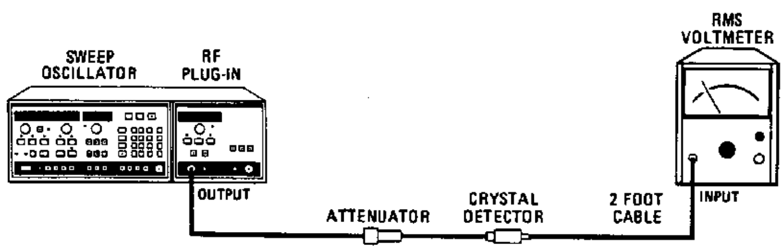


Figure 4-15. Residual AM Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A/B
RMS Voltmeter	HP 3400A
Crystal Detector	HP 8473C
Attenuator	Refer to PROCEDURE
60 cm (24 in) cable (Limits bandwidth to approximately 100 kHz)	HP11170B

PROCEDURE:

1. Connect equipment as shown in Figure 4-15 using a 20 dB attenuator.
2. Press **[INSTR PRESET]**, **[CW]** **[⊔⊓ MOD]** (1 kHz or 27.8 kHz), disengage **[DISPL BLANK]**.

NOTE

A 41 dB decrease in the RMS voltmeter indication corresponds to a 50 dB reduction in signal level. A correction factor of 9 dB is added because of the RMS voltmeter response to a square wave and the square-law response of the crystal detector.

3. Set POWER LEVEL to specified Maximum Leveled Power and CW frequency to 1 GHz.

4-19. RESIDUAL AM (Cont'd)

4. Vary attenuation using 3 dB, 6 dB, and 10 dB attenuators until the reading on the RMS voltmeter is −28 dB ±3 dB. Note voltmeter reading.

5. Disengage [⊔⊓ **MOD**]. Change RMS voltmeter range switch to obtain an on-scale indication. Calculate the difference between this reading and the indication noted in step 4. Add 9 dB to compensate for square-law inequities, and verify that it meets the tolerance in Table 4-12.

6. Engage [⊔⊓ **MOD**]. Repeat steps 3, 4 and 5 for frequencies given in Table 4-12.

Table 4-12. Residual AM

Band	CW Frequency	Residual AM (dB below carrier)
Band 0	1.0 GHz	>50 dB
Band 1	6.0 GHz	>50 dB
Band 2	12.0 GHz	>50 dB
Band 3	18.0 GHz	>50 dB

4-20. EXTERNAL FREQUENCY MODULATION TEST

SPECIFICATION:

Modulation Frequency	Cross-Over Coupled	Direct Coupled
DC to 100 Hz:	±75 MHz	±12 MHz
100 Hz to 1 MHz:	±7 MHz	±7 MHz
1 MHz to 2 MHz:	±5 MHz	±5 MHz
2 MHz to 10 MHz:	±1 MHz	±1 MHz

DESCRIPTION:

The RF Output is modulated with an external signal at 100 Hz, 1 MHz, 2 MHz and 10 MHz. The 100 Hz deviation is measured directly on a spectrum analyzer. The deviation at the higher frequencies is found by using a delay line discriminator to observe an increase in the modulation on an oscilloscope until distortion is observed. This frequency change is measured on a frequency counter.

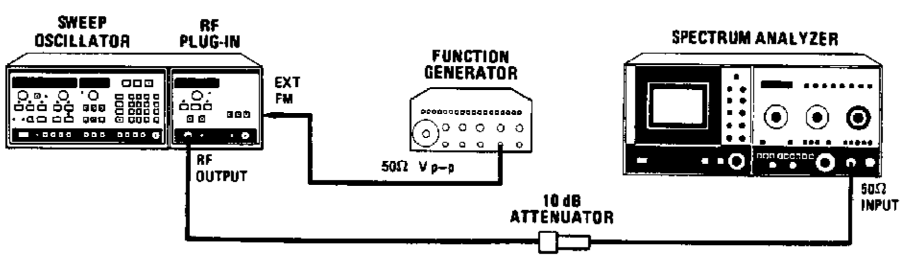


Figure 4-16. 100 Hz External Frequency Modulation Test Setup

EQUIPMENT:

Sweep Oscillator. . . . . HP 8350A/B
Spectrum Analyzer . . . . HP 8565A
Frequency Counter . . . . HP 5343A
Function Generator. . . . . HP 3312A
Oscilloscope . . . . Any general purpose oscilloscope such as HP 1222A* or 1740A
10 dB Attenuator. . . . . HP 8491B Option 010
Power Splitter. . . . . HP 11667A
Delay Line Discriminator . . . . (See Figure 1-3)

* Add a 50 load and BNC tee to each oscilloscope input.

4-20. EXTERNAL FREQUENCY MODULATION TEST (Cont'd)

PROCEDURE:

100 Hz Modulation

1. Ensure that modulation sensitivity is set to −20 MHz/volt and modulation coupling to DC (see Figure 3-10, Configuration Switch). Connect equipment as shown in Figure 4-16.

2. Press Model 8350A/B **[INSTR PRESET]**, **[CW]** and disengage the **[DISPL BLANK]** key. Disengage RF Plug-In **[CW FILTER]** key. Center fundamental signal on spectrum analyzer CRT display. Set function generator frequency to 100 Hz sinewave and amplitude to full counterclockwise. Adjust function generator amplitude control slowly clockwise while monitoring display on spectrum analyzer. Deviation from center line should be symmetrical at first then become non-symmetrical as deviation increases.

3. Note the point at which deviation becomes non-symmetrical and verify that it is greater than ±12 MHz.

4. Turn Model 8350A/B LINE switch to off. Remove RF Plug-In and switch modulation coupling to crossover (see Figure 3-10, Configuration Switch). Install the RF Plug-In and turn the Model 8350A/B line switch to on. Then repeat steps 2 and 3. The highest symmetrical deviation frequency should be greater than ±75 MHz.

>100 Hz FM Modulation

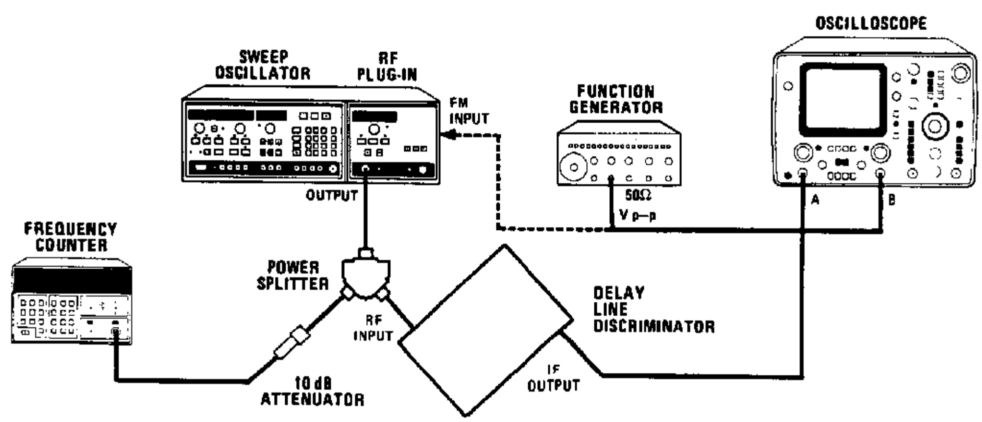


Figure 4-17. >100 Hz Frequency Modulation Test Setup

5. Set function generator frequency to 1 MHz. Set both oscilloscope inputs to 50Ω

6. Set function generator output amplitude to 0.1 volt p-p output. Connect equipment as shown in Figure 4-17 with function generator output not connected. Adjust CW and CW VERNIER for a delay line discriminator output of 0 volts as observed on Channel A of the oscilloscope. Note frequency counter reading.

4-20. EXTERNAL FREQUENCY MODULATION TEST (Cont'd)

7. Connect the function generator output to Model 8350A/B FM INPUT (rear panel) and adjust Channel A of the oscilloscope for a clear display of the function generator sinewave.

8. Increase the function generator output amplitude until the deviation displayed on Channel A becomes non-symmetrical or distorted. Use Channel B of the oscilloscope to monitor the function generator output. If the output is offset the test is invalid.

9. Mark the peak of the sinewave displayed on Channel A with a grease pencil. Remove the function generator output from FM INPUT and adjust CW/CW VERNIER to the grease pencil mark. Calculate the difference between the present frequency counter reading and the previous reading (step 6). Verify that the frequency difference is greater than the minimum given in the table below for the FM frequency range tested.

10. Set the function generator to 2 MHz and then 10 MHz, repeating steps 6 through 9 for each frequency, and verify the results according to the table below.

11. Change the mode of Plug-In modulation coupling and repeat steps 6 through 10. Verify the results according to the table below.

Modulation Frequency	Cross-Over Coupled	Direct Coupled
1 MHz	±7 MHz	±7 MHz
2 MHz	±5 MHz	±5 MHz
10 MHz	±1 MHz	±1 MHz

4-21. AM ON/OFF RATIO AND SQUARE WAVE SYMMETRY TEST

SPECIFICATION:

On/Off Ratio: ≥ 30 dB

Symmetry: 40/60

DESCRIPTION:

The AM ON/OFF ratio is checked on the amplitude axis of a video triggered spectrum analyzer display. The symmetry is checked by calculating the on/off time ratio on the frequency axis.

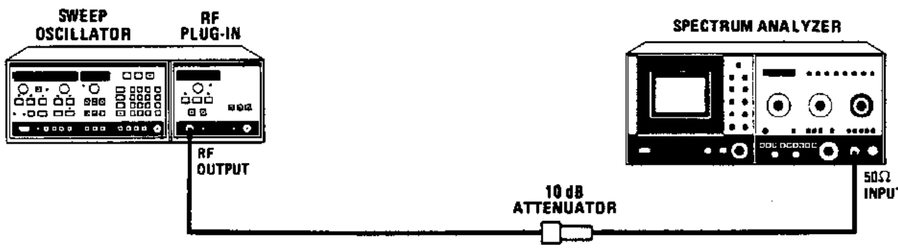


Figure 4-18. AM ON/OFF Ratio and Square Wave Symmetry Test Setup

EQUIPMENT:

Sweep Oscillator. . . . . HP 8350A/B
10 dB Attenuator. . . . . HP 8491B Option 010
Spectrum Analyzer . . . . HP 8565A

PROCEDURE:

1. Connect equipment as shown in Figure 4-18. Press Model 8350A/B **[INSTR PRESET]**, **[CW]** **[1]** **[GHz]** and engage [⊔⊓ **MOD]**. Set Model 83592C POWER LEVEL to +10 dBm.

2. Set controls as follows:

   Model 8565A:

   Set all Normal settings (controls marked with green).

   FREQUENCY BAND GHz. . . . . 0.01 to 1.8 GHz
   INPUT ATTENUATION. . . . . 10 dB
   REFERENCE LEVEL. . . . . 10 dBm
   FREQUENCY SPAN MODE. . . . . ZERO SPAN
   SWEEP TRIGGER . . . . VIDEO
   RESOLUTION BW. . . . . 3 MHz
   AUTO STABILIZER . . . . OFF
   SWEEP TIME/DIV. . . . . 0.1 sec for 1 kHz, 5μsec for 27.8 kHz

3. Adjust spectrum analyzer TUNING control to center 1 GHz signal on CRT. Adjust REFERENCE LEVEL to set signal on top trace. Verify that the AM ON/OFF ratio (peak-to-peak signal variation) is greater than 30 dB.

4. Verify that the squarewave symmetry of the observed signal is between 40 and 60 percent.

5. Set the CW frequency to 4 GHz and repeat steps 3 and 4.

4-22. STEP ATTENUATOR ACCURACY TEST (OPTION 002)

SPECIFICATION:

Attenuator Accuracy	Frequency Range (GHz)	Attenuator Setting (dB)										
		5	10	15	20	25	30	35	40	45	50	55
(±dB referenced from the 0 dB setting)	0.01 to 12.4	0.4	0.6	0.9	0.7	1.0	0.9	1.3	1.8	2.0	2.0	2.2
	12.4 to 18.0	0.5	0.7	1.0	0.9	1.2	1.2	1.6	2.0	2.2	2.3	2.5
	18.0 to 20.0	0.6	0.9	1.3	1.5	2.0	2.5	2.8	3.0	3.1	3.2	3.2

DESCRIPTION:

The Plug-In RF output is compared to a specially calibrated attenuator and displayed on a spectrum analyzer.

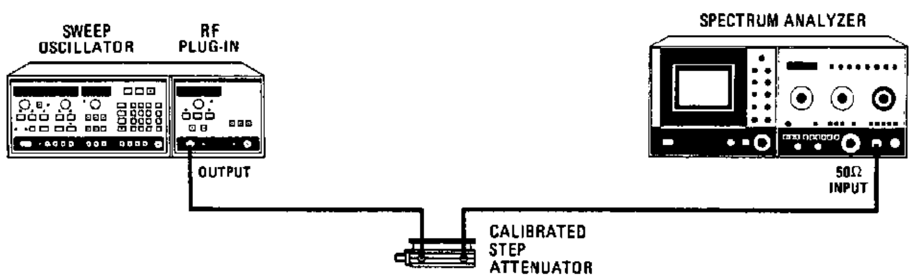


Figure 4-19. Attenuator Accuracy Test Setup

EQUIPMENT:

Sweep Oscillator . . . . HP 8350A/B
Step Attenuator . . . . HP 8495A Opt. 890
Spectrum Analyzer . . . . HP 8565A

PROCEDURE:

1. Connect equipment as shown in Figure 4-19. Press Model 8350A/B **[INSTR PRESET]**, **[CW] [4] [GHz]**. Set the Model 83592C POWER LEVEL to −1 dBm.
2. Set controls as follows:

   Step Attenuator

   ATTENUATION . . . . 50 dB

4-22. STEP ATTENUATOR ACCURACY TEST (OPTION 002) (Cont'd)

Spectrum Analyzer

Set all normal settings (controls marked with green)
INPUT ATTEN .... 10 dB
REFERENCE LEVEL... −50 dBm
RESOLUTION BANDWIDTH .... 1 MHz
FREQUENCY SPAN/DIV .... 5 MHz
FREQUENCY SPAN MODE .... FULL BAND
VIDEO FILTER.................................... Adjust as necessary
FREQUENCY BAND.................................... 3.8 to 8.5 GHz

3. Press Model 8350A/B **[SHIFT] [SLOPE]**. The SHIFT SLOPE mode allows the attenuator to be stepped in the smallest increments while the attenuator setting is displayed without affecting ALC circuit.

4. Note the actual attenuation values on the calibrated step attenuator's (Option 890) calibration report at the frequency and attenuation steps used. Calculate the Reference Attenuator Error for each step as shown below; record this error in the Attenuation Error column of Table 4-13 below.

   Attenuation Error = (Cal. Ref Atten. − Cal. Step Atten.) − (Ref. Setting − Step Setting)

   For example, with a Reference setting of 70 dB, the calculation for the 30 dB step setting is as follows [Note that the actual attenuation stepped in this example is 38.75 dB (69.55 dB − 30.80 dB)]:

   Example Calibration Report values:

   70 dB setting is actually 69.55 dB
   30 dB setting is actually 30.80 dB

   Attenuation Error = (69.55 dB − 30.80 dB) − (70 dB − 30 dB) = −1.25 dB

5. Adjust spectrum analyzer TUNING control to center notch on Sweep Oscillator output signal. Reduce spectrum analyzer FREQUENCY SPAN/DIV to .2 MHz and recenter TUNING control. Press FREQUENCY SPAN MODE ZERO SPAN key and adjust FINE TUNING to peak signal on spectrum analyzer display. Press spectrum analyzer 1 dB/DIV and adjust REFERENCE LEVEL VERNIER for a trace at the center graticule line.

6. Press the Model 8350A/B ◆ key twice for a display of 10 and decrease the reference attenuation by 10 dB.

7. Record the power level variation from the center graticule (reference) on the spectrum analyzer display (be sure to designate the direction of change: + is above and − is below the reference).

8. Algebraically add the Attenuation Error and Deviation from 0 reference and record the sum in the table below. Repeat steps 6 and 7 for the 20, 30, 40 and 50 dB attenuation values.

9. Step the Plug-In attenuation to 0 dB. Adjust REFERENCE LEVEL VERNIER for trace on top graticule.

4-22. STEP ATTENUATOR ACCURACY TEST (OPTION 002) (Cont'd)

10. Press the Model 8350A/B ◆ key for 5 dB Plug-In attenuation. Note the amount the trace is offset from the −5 dB line and record on deviation from 0 ref for 5 dB attenuator step. Adjust the spectrum analyzer REFERENCE LEVEL VERNIER for the same offset from the −4 dB line and repeat steps 6 and 7 for 15, 25, 35, 45, and 55 dB steps.

11. Repeat this procedure at 15 GHz and at 18 GHz.

Table 4-13. Reference Attenuator Accuracy

Ref Atten Step	Atten Step	Calibrated Change	Deviation from 0 ref	Attenuator Accuracy
50-40	10	______	______	______
50-30	20	______	______	______
50-20	30	______	______	______
50-10	40	______	______	______
50-0	50	______	______	______
50-50	5	0	0	______
50-40	15	______	______	______
50-30	25	______	______	______
50-20	35	______	______	______
50-10	45	______	______	______

Table 4-14. Model 83592C Performance Test Record Card (1 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-13. Frequency Range and Accuracy					
CW Mode					
	6.	Start frequency = 10 MHz		______	10 MHz
	7.	Stop frequency = 20 GHz	20 GHz	______	
0.01 to 2.4 GHz: ±5 MHz	8.	CW frequency = 10 MHz	5 MHz	______	15 MHz
		CW frequency = 1 GHz	0.995 GHz	______	1.005 GHz
		CW frequency = 2.4 GHz	2.395 GHz	______	2.405 GHz
2.4 to 7.0 GHz: ±5 MHz		CW frequency = 4 GHz	3.995 GHz	______	4.005 GHz
		CW frequency = 2.5 GHz	2.495 GHz	______	2.505 GHz
		CW frequency = 7.0 GHz	6.995 GHz	______	7.005 GHz
7.0 to 13.5 GHz: ±10 MHz		CW frequency = 10 GHz	9.99 GHz	______	10.01 GHz
		CW frequency = 7.1 GHz	7.09 GHz	______	7.11 GHz
		CW frequency = 13.5 GHz	13.49 GHz	______	13.51 GHz
13.5 to 20 GHz: ±15 MHz		CW frequency = 17.0 GHz	16.985 GHz	______	17.015 GHz
		CW frequency = 14.0 GHz	13.985 GHz	______	14.015 GHz
		CW frequency = 20.0 GHz	19.985 GHz	______	20.015 GHz
Swept Frequency Accuracy					
0.01 to 20 GHz: ±50 MHz	11.	Start frequency = 10 MHz	0 MHz	______	60 MHz
	12.	Stop frequency = 20 GHz	19.95 GHz	______	20.05 GHz
0.01 to 2.4 GHz: ±15 MHz	13.	Start frequency = 10 MHz	0 MHz	______	25 MHz
		Stop frequency = 2.4 GHz	2.385 GHz	______	2.415 GHz
2.4 to 7.0 GHz: ±20 MHz		Start frequency = 2.4 GHz	2.38 GHz	______	2.42 GHz
		Stop frequency = 7.0 GHz	6.98 GHz	______	7.02 GHz
7.0 to 13.5 GHz: ±25 MHz		Start frequency = 7.0 GHz	6.975 GHz	______	7.025 GHz
		Stop frequency = 13.5 GHz	13.475 GHz	______	13.525 GHz
13.5 to 20 GHz: ±30 MHz		Start frequency = 13.5 GHz	13.47 GHz	______	13.53 GHz
		Stop frequency = 20 GHz	19.95 GHz	______	20.05 GHz
Marker Accuracy					
0.01 to 20 GHz ±50 MHz ±.5% of sweep width	16.	M1 = 1 GHz	850.05 MHz	______	1.14995 GHz
		M2 = 4 GHz	3.85005 GHz	______	4.14995 GHz
		M3 = 8 GHz	7.85005 GHz	______	8.14995 GHz
		M4 = 14 GHz	13.85005 GHz	______	14.14995 GHz
		M5 = 18 GHz	17.85005 GHz	______	18.14995 GHz
0.01 to 2.4 GHz ±15 MHz ±.5% of sweep width	17.	M1 = 1 GHz	973.05 MHz	______	1.02695 GHz
		M2 = 2 GHz	1.97305 GHz	______	2.02695 GHz
2.4 to 7 GHz ±20 MHz ±.5% of sweep width		M1 = 3 GHz	2.957 GHz	______	3.043 GHz
		M2 = 6 GHz	5.957 GHz	______	6.043 GHz
7 to 13.5 GHz ±25 MHz ±.5% of sweep width		M1 = 8 GHz	7.9425 GHz	______	8.0575 GHz
		M2 = 12 GHz	11.9425 GHz	______	12.0575 GHz
13.5 to 20 GHz ±30 MHz ±.5% of sweep width		M1 = 15 GHz	14.9375 GHz	______	15.0625 GHz
		M2 = 18 GHz	17.9375 GHz	______	18.0625 GHz

Table 4-14. Model 83592C Performance Test Record Card (2 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-14. Output Amplitude					
Power Variations at Maximum Pwr:	6.	0.05 to 2.4 GHz @ +10 dBm	+10 dBm	________	+11.8 dBm
		2.4 to 7.0 GHz @ +6 dBm	+6 dBm	________	+7.4 dBm
		7.0 to 13.5 GHz @ +6 dBm	+6 dBm	________	+7.4 dBm
		13.5 to 18.6 GHz @ +6 dBm	+6 dBm	________	+7.6 dBm
		13.5 to 20 GHz @ +4 dBm	+4 dBm	________	+5.6 dBm
		0.01 to 18.6 GHz @ +6 dBm	+6 dBm	________	+7.8 dBm
		0.01 to 20 GHz @ +4 dBm	+4 dBm	________	+5.8 dBm
Option 002:	6.	0.05 to 2.4 GHz @ +10 dBm	+10 dBm	________	+11.8 dBm
		2.4 to 7.0 GHz @ +6 dBm	+6 dBm	________	+7.4 dBm
		7.0 to 13.5 GHz @ +4 dBm	+4 dBm	________	+5.4 dBm
		13.5 to 18.6 GHz @ +3 dBm	+3 dBm	________	+4.6 dBm
		13.5 to 20 GHz @ +1 dBm	+1 dBm	________	+2.6 dBm
		0.01 to 18.6 GHz @ +3 dBm	+3 dBm	________	+4.8 dBm
		0.01 to 20 GHz @ +1 dBm	+1 dBm	________	+2.8 dBm
Power Level Accuracy 0.01 to 2.4 GHz		Power = +10 dBm	+8.5 dBm	________	+11.5 dBm
		= +9 dBm	+7.5 dBm	________	+10.5 dBm
		= +8 dBm	+6.5 dBm	________	+9.5 dBm
		= +7 dBm	+5.5 dBm	________	+8.5 dBm
		= +6 dBm	+4.5 dBm	________	+7.5 dBm
		= +5 dBm	+3.5 dBm	________	+6.5 dBm
		= +4 dBm	+2.5 dBm	________	+5.5 dBm
		= +3 dBm	+1.5 dBm	________	+4.5 dBm
		= +2 dBm	+0.5 dBm	________	+3.5 dBm
		= +1 dBm	−0.5 dBm	________	+2.5 dBm
		= 0 dBm	−1.5 dBm	________	+1.5 dBm
		= −1 dBm	−2.5 dBm	________	+0.5 dBm
		= −2 dBm	−3.5 dBm	________	−0.5 dBm
		= −3 dBm	−4.5 dBm	________	−1.5 dBm
		= −4 dBm	−5.5 dBm	________	−2.5 dBm
		= −5 dBm	−6.5 dBm	________	−3.5 dBm
2.4 to 7.0 GHz		Power = +6 dBm	+4.7 dBm	________	+7.3 dBm
		= +5 dBm	+3.7 dBm	________	+6.3 dBm
		= +4 dBm	+2.7 dBm	________	+5.3 dBm
		= +3 dBm	+1.7 dBm	________	+4.3 dBm
		= +2 dBm	+0.7 dBm	________	+3.3 dBm
		= +1 dBm	−0.3 dBm	________	+2.3 dBm
		= 0 dBm	−1.3 dBm	________	+1.3 dBm
		= −1 dBm	−2.3 dBm	________	+0.3 dBm
		= −2 dBm	−3.3 dBm	________	−0.7 dBm
		= −3 dBm	−4.3 dBm	________	−1.7 dBm
		= −4 dBm	−5.3 dBm	________	−2.7 dBm
		= −5 dBm	−6.3 dBm	________	−3.7 dBm

Table 4-14. Model 83592C Performance Test Record Card (3 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-14. Output Amplitude (Cont'd)					
Power Level Accuracy (Cont'd)					
7.0 to 13.5 GHz		Power = +6 dBm	+4.7 dBm	________	+7.3 dBm
		= +5 dBm	+3.7 dBm	________	+6.3 dBm
		= +4 dBm	+2.7 dBm	________	+5.3 dBm
		= +3 dBm	+1.7 dBm	________	+4.3 dBm
		= +2 dBm	+0.7 dBm	________	+3.3 dBm
		= +1 dBm	−0.3 dBm	________	+2.3 dBm
		= 0 dBm	−1.3 dBm	________	+1.3 dBm
		= −1 dBm	−2.3 dBm	________	+0.3 dBm
		= −2 dBm	−3.3 dBm	________	−0.7 dBm
		= −3 dBm	−4.3 dBm	________	−1.7 dBm
		= −4 dBm	−5.3 dBm	________	−2.7 dBm
		= −5 dBm	−6.3 dBm	________	−3.7 dBm
13.5 to 18.6 GHz		Power = +6 dBm	+4.6 dBm	________	+7.4 dBm
		= +5 dBm	+3.6 dBm	________	+6.4 dBm
		= +4 dBm	+2.6 dBm	________	+5.4 dBm
		= +3 dBm	+1.6 dBm	________	+4.4 dBm
		= +2 dBm	+0.6 dBm	________	+3.4 dBm
		= +1 dBm	−0.4 dBm	________	+2.4 dBm
		= 0 dBm	−1.4 dBm	________	+1.4 dBm
		= −1 dBm	−2.4 dBm	________	+0.4 dBm
		= −2 dBm	−3.4 dBm	________	−0.6 dBm
		= −3 dBm	−4.4 dBm	________	−1.6 dBm
		= −4 dBm	−5.4 dBm	________	−2.6 dBm
		= −5 dBm	−6.4 dBm	________	−3.6 dBm
13.5 to 20 GHz		Power = +4 dBm	+2.6 dBm	________	+5.4 dBm
		= +3 dBm	+1.6 dBm	________	+4.4 dBm
		= +2 dBm	+0.6 dBm	________	+3.4 dBm
		= +1 dBm	−0.4 dBm	________	+2.4 dBm
		= 0 dBm	−1.4 dBm	________	+1.4 dBm
		= −1 dBm	−2.4 dBm	________	+0.4 dBm
		= −2 dBm	−3.4 dBm	________	−0.6 dBm
		= −3 dBm	−4.4 dBm	________	−1.6 dBm
		= −4 dBm	−5.4 dBm	________	−2.6 dBm
		= −5 dBm	−6.4 dBm	________	−3.6 dBm
0.01 to 18.6 GHz		Power = +6 dBm	+4.5 dBm	________	+7.5 dBm
		= +5 dBm	+3.5 dBm	________	+6.5 dBm
		= +4 dBm	+2.5 dBm	________	+5.5 dBm
		= +3 dBm	+1.5 dBm	________	+4.5 dBm
		= +2 dBm	+0.5 dBm	________	+3.5 dBm
		= +1 dBm	−0.5 dBm	________	+2.5 dBm
		= 0 dBm	−1.5 dBm	________	+1.5 dBm
		= −1 dBm	−2.5 dBm	________	+0.5 dBm
		= −2 dBm	−3.5 dBm	________	−0.5 dBm
		= −3 dBm	−4.5 dBm	________	−1.5 dBm
		= −4 dBm	−5.5 dBm	________	−2.5 dBm
		= −5 dBm	−6.5 dBm	________	−3.5 dBm

Table 4-14. Model 83592C Performance Test Record Card (4 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-14. Output Amplitude (Cont'd)					
Power Level Accuracy (Cont'd)					
0.01 to 20 GHz		Power = +4 dBm	+2.5 dBm	______	+5.5 dBm
		= +3 dBm	+1.5 dBm	______	+4.5 dBm
		= +2 dBm	+0.5 dBm	______	+3.5 dBm
		= +1 dBm	−0.5 dBm	______	+2.5 dBm
		= 0 dBm	−1.5 dBm	______	+1.5 dBm
		= −1 dBm	−2.5 dBm	______	+0.5 dBm
		= −2 dBm	−3.5 dBm	______	−0.5 dBm
		= −3 dBm	−4.5 dBm	______	−1.5 dBm
		= −4 dBm	−5.5 dBm	______	−2.5 dBm
		= −5 dBm	−6.5 dBm	______	−3.5 dBm
Option 002:					
0.01 to 2.4 GHz		Power = +10 dBm	+8.3 dBm	______	+11.7 dBm
		= +9 dBm	+7.3 dBm	______	+10.7 dBm
		= +8 dBm	+6.3 dBm	______	+9.7 dBm
		= +7 dBm	+5.3 dBm	______	+8.7 dBm
		= +6 dBm	+4.3 dBm	______	+7.7 dBm
		= +5 dBm	+3.3 dBm	______	+6.7 dBm
		= +4 dBm	+2.3 dBm	______	+5.7 dBm
		= +3 dBm	+1.3 dBm	______	+4.7 dBm
		= +2 dBm	+0.3 dBm	______	+3.7 dBm
		= +1 dBm	−0.7 dBm	______	+2.7 dBm
		= 0 dBm	−1.7 dBm	______	+1.7 dBm
		= −1 dBm	−2.7 dBm	______	+0.7 dBm
		= −2 dBm	−3.7 dBm	______	−0.3 dBm
		= −3 dBm	−4.7 dBm	______	−1.3 dBm
		= −4 dBm	−5.7 dBm	______	−2.3 dBm
		= −5 dBm	−6.7 dBm	______	−3.3 dBm
2.4 to 7.0 GHz		Power = +4.5 dBm	+3.0 dBm	______	+6.0 dBm
		= +4 dBm	+2.5 dBm	______	+5.5 dBm
		= +3 dBm	+1.5 dBm	______	+4.5 dBm
		= +2 dBm	+0.5 dBm	______	+3.5 dBm
		= +1 dBm	−0.5 dBm	______	+2.5 dBm
		= 0 dBm	−1.5 dBm	______	+1.5 dBm
		= −1 dBm	−2.5 dBm	______	+0.5 dBm
		= −2 dBm	−3.5 dBm	______	−0.5 dBm
		= −3 dBm	−4.5 dBm	______	−1.5 dBm
		= −4 dBm	−5.5 dBm	______	−2.5 dBm
		= −5 dBm	−6.5 dBm	______	−3.5 dBm
7.0 to 13.5 GHz		Power = +4 dBm	+2.5 dBm	______	+5.5 dBm
		= +3 dBm	+1.5 dBm	______	+4.5 dBm
		= +2 dBm	+0.5 dBm	______	+3.5 dBm
		= +1 dBm	−0.5 dBm	______	+2.5 dBm
		= 0 dBm	−1.5 dBm	______	+1.5 dBm
		= −1 dBm	−2.5 dBm	______	+0.5 dBm
		= −2 dBm	−3.5 dBm	______	−0.5 dBm
		= −3 dBm	−4.5 dBm	______	−1.5 dBm
		= −4 dBm	−5.5 dBm	______	−2.5 dBm
		= −5 dBm	−6.5 dBm	______	−3.5 dBm

Table 4-14. Model 83592C Performance Test Record Card (5 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-14. Output Amplitude (Cont'd)					
Power Level Accuracy (Cont'd)					
Option 002: (Cont'd)					
13.5 to 18.6 GHz		Power = +3 dBm	+1.4 dBm	________	+4.6 dBm
		= +2 dBm	+0.4 dBm	________	+3.6 dBm
		= +1 dBm	−0.6 dBm	________	+2.6 dBm
		= 0 dBm	−1.6 dBm	________	+1.6 dBm
		= −1 dBm	−2.6 dBm	________	+0.6 dBm
		= −2 dBm	−3.6 dBm	________	−0.4 dBm
		= −3 dBm	−4.6 dBm	________	−1.4 dBm
		= −4 dBm	−5.6 dBm	________	−2.4 dBm
		= −5 dBm	−6.6 dBm	________	−3.4 dBm
13.5 to 20 GHz		Power = +1 dBm	−0.6 dBm	________	+2.6 dBm
		= 0 dBm	−1.6 dBm	________	+1.6 dBm
		= −1 dBm	−2.6 dBm	________	+0.6 dBm
		= −2 dBm	−3.6 dBm	________	−0.4 dBm
		= −3 dBm	−4.6 dBm	________	−1.4 dBm
		= −4 dBm	−5.6 dBm	________	−2.4 dBm
		= −5 dBm	−6.6 dBm	________	−3.4 dBm
0.01 to 18.6 GHz		Power = +3 dBm	+0.3 dBm	________	+3.7 dBm
		= +2 dBm	−0.7 dBm	________	+2.7 dBm
		= +1 dBm	−1.7 dBm	________	+1.7 dBm
		= 0 dBm	−2.7 dBm	________	+0.7 dBm
		= −1 dBm	−3.7 dBm	________	−0.3 dBm
		= −2 dBm	−4.7 dBm	________	−1.3 dBm
		= −3 dBm	−5.7 dBm	________	−2.3 dBm
		= −4 dBm	−6.7 dBm	________	−3.3 dBm
		= −5 dBm			
0.01 to 20 GHz		Power = +1 dBm	−0.7 dBm	________	+2.7 dBm
		= 0 dBm	−1.7 dBm	________	+1.7 dBm
		= −1 dBm	−2.7 dBm	________	+0.7 dBm
		= −2 dBm	−3.7 dBm	________	−0.3 dBm
		= −3 dBm	−4.7 dBm	________	−1.3 dBm
		= −4 dBm	−5.7 dBm	________	−2.3 dBm
		= −5 dBm	−6.7 dBm	________	−3.3 dBm
Power sweep	12.	Power Level = −5 dBm			
0.01 to 2.4 GHz			15 dB	________	
2.4 to 7.0 GHz			11 dB	________	
7.0 to 13.5 GHz			11 dB	________	
13.5 to 18.6 GHz			11 dB	________	
13.5 to 20 GHz			9 dB	________	
0.01 to 18.6 GHz			11 dB	________	
0.01 to 20 GHz			9 dB	________	
Option 002	12.	Power level = −5 dBm			
0.01 to 2.4 GHz			15 dB	________	
2.4 to 7.0 GHz			9.5 dB	________	
7.0 to 13.5 GHz			9 dB	________	
13.5 to 18.6 GHz			8 dB	________	
13.5 to 20 GHz			6 dB	________	
0.01 to 18.6 GHz			8 dB	________	
0.01 to 20 GHz			6 dB	________	

Table 4-14. Model 83592C Performance Test Record Card (6 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-14. Output Amplitude (Cont'd)					
Power Meter Leveled					
≤±0.2 dB	20.			______	≤±0.2 dB
Crystal Det. Leveled					
≤±0.2 dB	24.			______	≤±0.2 dB
4-15. Frequency Stability					
+5 to −10% V Line Change:					
Band 0, 1 GHz ≤±50 kHz	3.	Low line frequency change		______	≤±50 kHz
	4.	High line frequency change		______	≤±50 kHz
Band 1, 6 GHz ≤±50 kHz	5.	Low line frequency change		______	≤±50 kHz
		High line frequency change		______	≤±50 kHz
Band 2, 12 GHz ≤±100 kHz		Low line frequency change		______	≤±100 kHz
		High line frequency change		______	≤±100 kHz
Band 3, 18 GHz ≤±150 kHz		Low line frequency change		______	≤±150 kHz
		High line frequency change		______	≤±150 kHz
10 dB Power Change:					
Band 0, 1 GHz: ≤±200 kHz	11.	Frequency change with power		______	≤±200 kHz
Band 1, 6 GHz: ≤±200 kHz		Frequency change with power		______	≤±200 kHz
Band 2, 12 GHz: ≤±400 kHz		Frequency change with power		______	≤±400 kHz
Band 3, 18 GHz: ≤±600 kHz				______	≤±600 kHz
3 : 1 Load SWR:					
Band 0, 1 GHz: ≤±100 kHz		3 : 1 SWR		______	≤±100 kHz
Band 1, 6 GHz: ≤±100 kHz		3 : 1 SWR		______	≤±100 kHz
Band 2, 12 GHz: ≤±200 kHz		3 : 1 SWR		______	≤±200 kHz
Band 3, 18 GHz: ≤±300 kHz		3 : 1 SWR		______	≤±300 kHz
4-16. Residual FM					
≤8 kHz Band 0, 1 GHz	9.	CW frequency = 1 GHz		______	≤8 kHz
≤8 kHz Band 1, 6 GHz	18.	CW frequency = 6 GHz		______	≤8 kHz
≤15 kHz Band 2, 12 GHz		CW frequency = 12 GHz		______	≤15 kHz
≤15 kHz Band 3, 18 GHz		CW frequency = 18 GHz		______	≤15 kHz
4-17. Spurious Signals					
Harmonic:	3.	Measure relative to carrier			
0.01 to 2.4 GHz: >−25 dB			>−25 dB	______	
2.4 to 7 GHz: >−25 dB			>−25 dB	______	
7 to 13.5 GHz: >−25 dB			>−25 dB	______	
13.5 to 20 GHz: >−25 dB			>−25 dB	______	
Non-harmonic:					
0.01 to 2.4 GHz: >−25 dB			>−25 dB	______	
2.4 to 7 GHz: >−50 dB			>−50 dB	______	
7 to 13.5 GHz: >−50 dB			>−50 dB	______	
13.5 to 20 GHz: >−50 dB			>−50 dB	______	

Table 4-14. Model 83592C Performance Test Record Card (7 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-18. Output VSWR					
0.01 to 2 GHz: <1.9	6.	Range: 0.1 to 2 GHz		________	<1.9
Option 002: <2.1				________	<2.1
2 to 20 GHz: <1.9	11.	Range: 2 to 18 GHz		________	<1.9
Option 002: <2.1				________	<2.1
4-19. Residual AM					
1 GHz: ≥−50 dB	5.	Measure relative to carrier		________	≥−50 dB
6 GHz: ≥−50 dB				________	≥−50 dB
12 GHz: ≥−50 dB				________	≥−50 dB
18 GHz: ≥−50 dB				________	≥−50 dB
4-20. External FM					
Direct coupled:	1.	A3S1: Close switch 5, open 6.			
DC to 100 Hz: ≥±12 MHz	3.		≥±12 MHz	________	
Cross Over Coupled:	4.	A3S1: Close switch 6.			
DC to 100 Hz: ≥±75 MHz			≥±75 MHz	________	
Direct/Cross Over coupling					
100 Hz to 1 MHz: ≥±7 MHz	9.		≥±7 MHz	________	
1 to 2 MHz: ≥±5 MHz	10.		≥±5 MHz	________	
2 to 10 MHz: ≥±1 MHz			≥±1 MHz	________	
	11.	A3S1: Change switch 6	≥±7 MHz	________	
		from previous setting	≥±5 MHz	________	
			≥±1 MHz	________	

Table 4-14. Model 83592C Performance Test Record Card (8 of 8)

SPECIFICATIONS TESTED Limits		Step	TEST Conditions				LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-22. Step Attenuator Accuracy (Option 002) (Referenced from 0 dB) 0.01 to 12.4 GHz		1.	CW frequency = 4.0 GHz Power =− 1.0 dBm						
		2.	Reference Attenuation = 50 dB						
Attn. Step	**Accuracy**		**Ref. Attn. Step**	**Attn. Error**	+	**Deviation from 0 ref.**			
10 dB	≤±0.6 dB	4.	50 − 40		+				≤±0.6 dB
20 dB	≤±0.7 dB	7.	50 − 30		+				≤±0.7 dB
30 dB	≤±0.9 dB	8.	50 − 20		+				≤±0.9 dB
40 dB	≤±1.8 dB		50 − 10		+				≤±1.8 dB
50 dB	≤±2.0 dB		50 − 0		+				≤±2.0 dB
5 dB	≤±0.4 dB		50 − 50		+				≤±0.4 dB
15 dB	≤±0.9 dB		50 − 40		+				≤±0.9 dB
25 dB	≤±1.0 dB		50 − 30		+				≤±1.0 dB
35 dB	≤±1.3 dB		50 − 20		+				≤±1.3 dB
45 dB	≤±2.0 dB		50 − 10		+				≤±2.0 dB
55 dB	≤±2.2 dB		50 − 0		+				≤±2.2 dB
12.4 to 18 GHz		11.	CW frequency = 15 GHz Power =− 1.0 dBm Reference Attenuation = 50 dB						
Attn. Step	**Accuracy**		**Ref. Attn. Step**	**Attn. Error**	+	**Deviation from 0 ref.**			
10 dB	≤±0.7 dB		50 − 40		+				≤±0.7 dB
20 dB	≤±0.9 dB		50 − 30		+				≤±0.9 dB
30 dB	≤±1.2 dB		50 − 20		+				≤±1.2 dB
40 dB	≤±2.0 dB		50 − 10		+				≤±2.0 dB
50 dB	≤±2.3 dB		50 − 0		+				≤±2.3 dB
5 dB	≤±0.5 dB		50 − 50		+				≤±0.5 dB
15 dB	≤±1.0 dB		50 − 40		+				≤±1.0 dB
25 dB	≤±1.2 dB		50 − 30		+				≤±1.2 dB
35 dB	≤±1.6 dB		50 − 20		+				≤±1.6 dB
45 dB	≤±2.2 dB		50 − 10		+				≤±2.2 dB
55 dB	≤±2.5 dB		50 − 0		+				≤±2.5 dB
18 to 20.0 GHz		11.	CW frequency = 18 GHz Power = −1.0 dBm Reference Attenuation = 50 dB						
Attn. Step	**Accuracy**		**Ref. Attn. Step**	**Attn. Error**	+	**Deviation from 0 ref.**			
10 dB	≤±0.9 dB		50 − 40		+				≤±0.9 dB
20 dB	≤±1.5 dB		50 − 30		+				≤±1.5 dB
30 dB	≤±2.5 dB		50 − 20		+				≤±2.5 dB
40 dB	≤±3.0 dB		50 − 10		+				≤±3.0 dB
50 dB	≤±3.2 dB		50 − 0		+				≤±3.2 dB
5 dB	≤±0.6 dB		50 − 50		+				≤±0.6 dB
15 dB	≤±1.3 dB		50 − 40		+				≤±1.3 dB
25 dB	≤±2.0 dB		50 − 30		+				≤±2.0 dB
35 dB	≤±2.8 dB		50 − 20		+				≤±2.8 dB
45 dB	≤±3.1 dB		50 − 10		+				≤±3.1 dB
55 dB	≤±3.2 dB		50 − 0		+				≤±3.2 dB

V Adjustments

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section provides adjustment procedures for the Model 83592C RF Plug-In. These procedures should not be performed as routine maintenance but should be used (1) after replacement of a part or component, or (2) when performance tests show that the specifications of Table 1-1 cannot be met. Table 5-1 lists all of the adjustments by reference designation, adjustment name, adjustment paragraph, and description. Each procedure includes a test setup illustration and one or more adjustment location illustrations. Table 5-2 lists the adjustments included in this section.

NOTE

Allow the Model 83592C Rf Plug-In and the Model 8350A/B Sweep Oscillator to warm up for one hour prior to making any adjustments.

5-3. SAFETY CONSIDERATIONS

5-4. Although this instrument has been designed in accordance with international safety standards, this Manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by a skilled person who is aware of the hazards involved.

WARNING

Adjustments in this section are performed with power supplied to the instrument while protective covers are removed. There are voltages at points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Adjustments should be performed only by a skilled person who is aware of the hazards involved. Capacitors inside the instrument may still be charged, even if the instrument has been disconnected from its source of supply.

NOTE

Use a non-metallic adjustment tool whenever possible.

5-5. EQUIPMENT REQUIRED

5-6. The equipment required for the adjustment procedures is listed in Section I of this Manual. If the test equipment recommended is not available, other equipment may be used if its performance meets the critical specifications listed in the table. The equipment required for each adjustment is specified in each procedure.

5-7. FACTORY-SELECTED COMPONENTS

5-8. Table 5-3 is a list of factory-selected components, and includes the reference designator, the paragraph number of the related adjustment procedure, the allowable range of values, and the basis of selection. Nominal values are given for the factory-selected components, which are designated by an asterisk (*) on the schematic diagram and in the replacement parts list. HP part numbers for standard value replacement components are given in Table 5-4.

5-9. RELATED ADJUSTMENTS

5-10. Interactive adjustments are noted in the adjustment procedures. Table 5-5 indicates by paragraph numbers the adjustments that must be performed if an assembly has been repaired or replaced or if an adjustment has been made to an assembly.

5-11. ADJUSTMENT PROCEDURES

5-12. Adjustment procedures are given in the proper sequence to allow for interrelated adjustments.

Table 5-1. Adjustable Components (1 of 3)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A2R1	GAIN	5-24	Sets gain of frequency reference in Bands 1, 2, and 3 (1V/GHz).
A2R4	OFFSET	5-24	Sets offset of frequency reference in Bands 1, 2, and 3 (1V/GHz).
A2R6	BAND 0 OFFSET	5-24	Sets offset of frequency reference in Band 0 (1 V/GHz).
A2R23	BAND 0 GAIN	5-24	Sets gain of frequency reference in Band 0 (1 V/GHz).
A3S1	Configuration Switch	5-13	Selects plug-in code, power up power level, FM sensitivity, FM modulation coupling, step attenuator option code, normal or sequential sweep option, and phase lock operation.
A4R1	SLP	5-25	Slope Adjustment for B0.
A4R2	0 HI	5-25	Sets power calibration at the high end of the power range (+10 dBm) in Band 0.
A4R3	1 HI	5-25	Sets power calibration at the high end of the power range (+10 dBm) in Bands 1, 2, 3, and 4.
A4R4	BIAS	5-25	Sets bias on the internal detector line for 0 volts with RF power OFF.
A4R5	1 LO	5-25	Sets power calibration at the low end of the power range (−5 dBm) in Bands 1, 2, 3, and 4.
A4R6	0 LO	5-25	Sets power calibration at the low end of the power range (−5 dBm) in Bands 1, 2, 3, and 4.
A4R7	0 MD	5-25	Sets power calibration at the middle of the power range (+7 dBm) in Band 0.
A4R8	1 MD	5-25	Sets power calibration at the middle of the power range (+7 dBm) in Bands 1, 2, 3, and 4.
A4R9	PM	5-27	Sets power meter leveling calibration.
A4R11	GAIN	5-28	Sets gain of U11 Main ALC Amplifier.
A4R47	OFS 1	5-25	Adjusts for zero offset through U7-Q6 log amplifier circuit.
A4R56	OFS 2	5-25	Adjusts for zero offset through U5 log amplifier circuit.
A4R59	OFS 3	5-25	Adjusts for zero offset through U8-Q1 Sample and Hold circuit.
A4R67	OFS 4	5-25	Adjusts for zero offset through U11 Main ALC Amplifier.
A5C14	LO	5-30	Adjusts low frequency for best frequency response flatness through U10.
A5R18	FM OFFSET	5-30	Adjusts shape of U10 Video Amplifier compensation network response.
A5R19	FM	5-30	Sets DC offset of U10 Video Amplifier.
A5R34	BP 1	5-26	Breakpoint that works with SL1 (Slope 1) for ALC flatness.
A5R36	BP 2	5-26	Breakpoint that works with SL2 (Slope 2) for ALC flatness.
A5R38	BP 3	5-26	Breakpoint that works with SL3 (Slope 3) for ALC flatness.
A5R40	BP4	5-26	Breakpoint that works with SL4 (Slope 4) for ALC flatness.
A5R41	SL 1	5-26	Slope adjustment for best ALC flatness.
A5R42	SL 2	5-26	Slope adjustment for best ALC flatness.
A5R43	SL3	5-26	Slope adjustment for best ALC flatness.

Table 5-1. Adjustable Components (2 of 3)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A5R48	SL4	5-26	Slope adjustment for best ALC flatness.
A5R44	SLP	5-26	Sets overall slope of internal leveling ALC.
A5R50	PWSP	5-29	Sets range for power sweep.
A5R75	HI	5-30	Works in conjunction with C14 to set frequency response flatness of FM Coil.
A6R12	C	5-20, 5-21	Adjusts YTM SRD bias to peak power in all bands at low power settings.
A6R16	TV GAIN	5-15	Sets the gain of U6 Tune Voltage buffer amplifier.
A6R21	DAC CAL	5-15	Adjusts the gain of U5 Variable Gain Amplifier during all single band sweeps.
A6R24	B3	5-15, 5-23	Adjusts the gain of U5 Variable Gain Amplifier in Bands 3 and 4 during sequential sweeps.
A6R26	B2	5-15, 5-23	Adjusts the gain of U5 Variable Gain Amplifier in Band 2 during sequential sweeps.
A6R28	B1	5-15, 5-23	Adjusts the gain of U5 Variable Gain Amplifier in Band 1 during sequential sweeps.
A6R30	B0	5-15	Adjusts the gain of U5 Variable Gain Amplifier in Band 0 during sequential sweeps.
A6R34	−10V OFFSET	5-15	Offsets the −10 volt reference voltage to U15.
A6R37	SP	5-15	Offsets input voltage to U24A forward sweep bandswitch amplifier.
A6R63	3HL	5-20, 5-21	Adjusts balance of SRD bias circuit.
A6R68	2H	5-20, 5-21	Adjusts YTM SRD bias at high power, high frequency end of Band 2.
A6R69	3H	5-20, 5-21	Adjusts YTM SRD bias at high power, high frequency end of Band 3.
A6R73	2L	5-20, 5-21	Adjusts YTM SRD bias at high power, low frequency end of Band 2.
A6R74	3L	5-20, 5-21	Adjusts YTM SRD bias at high power, low frequency end of Band 3.
A6R78	T	5-20, 5-21	Adjusts YTM SRD bias at an intermediate power level for Bands 2 and 3.
A7R10	SGL HI	5-22	Adjusts offset of YTM/YTF delay compensation signal at the high end of single band sweeps.
A7R12	SGL LO	5-22	Adjusts offset of YTM/YTF delay compensation signal at the low end of single band sweeps.
A7R18	Z	5-16	Adjusts offset of U20 delay compensation amplifier to minimize the difference between CW and ΔF ±0 with YTM/YTF delay compensation circuits.
A7R19	GAIN	5-16	Adjusts the Scaled Voltage Tune DAC input signal to U21 YTM Summing Amplifier and U23 YTF Summing Amplifier.

Table 5-1. Adjustable Components (3 of 3)

Reference Designation	Adjustment Name	Adjustment Paragraph	Description
A7R24	OFS	5-16	Adjusts Offset DAC input signal to U21 YTM Summing Amplifier.
A7R42	SEQ HI	5-22	Adjusts offset of YTM delay compensation signal at high end of sequential band sweeps.
A7R43	SEQ LO	5-22	Adjusts offset of YTM delay compensation signal at low end of sequential band sweeps.
A7R45	SEQ TC	5-22	Adjusts gain of YTM delay compensation signal in sequential band sweeps.
A7R46	SGL TC	5-22	Adjusts gain of YTM delay compensation signal in single band sweeps.
A7R51	B1 OFS	5-20, 5-24	Adjusts offset of U21 Summing Amplifier in single band sweeps.
A7R55	RTC COMP	5-22	Adjusts the pulse width of YTM retrace compensation signal.
A7R76	B1 Gain	5-20, 5-24	Adjusts offset of U21 Summing Amp in single band sweeps.
A7R83	YTF Gain	5-16	Adjusts Gain DAC input signal to U23 YTF Summing Amp.
A7R85	YTF Offset	5-16	Adjusts Offset DAC input signal to U23 YTF Summing Amp.
A7R105	YTF Delay Comp	5-22	Adjusts the delay comp gain signal to the U23 YTF Summing Amp.
A7S1	OFFSET	5-20	Adjusts low end of band YTM to YO tracking at slow sweep speeds.
A7S2	GAIN	5-20	Adjusts high end of band YTM to YO tracking at slow speeds.
A8R10	HI	5-19	Adjusts YO delay compensation at high frequency end of band.
A8R12	LO	5-19	Adjusts YO delay compensation at low frequency end of band.
A8R18	Z	5-16, 5-19	Adjusts offset to minimize the difference between CW and ΔF ±0 with YO delay compensation circuits.
A8R19	GAIN	5-16	Adjusts Scaled Voltage Tune DAC input signal to U20 Summing Amplifier.
A8R22	ZRO	5-16	Adjusts supply correction voltage to U20 Summing Amplifier.
A8R24	OFS	5-16	Adjusts Offset DAC input signal to U20 Summing Amplifier.
A8R44	−10V	5-14	Sets −10 volt reference voltage source.
A8R55	RTC COMP	5-18	Adjusts the pulse width of the YO retrace compensation signal.
A8S1	OFFSET	5-17	Adjusts the low end of band YO frequency accuracy.
A8S2	GAIN	5-17	Adjusts the high end of band YO frequency accuracy.
A13A1R4		none	Factory adjusted.
A14A1R11		none	Factory adjusted.
A14A1R13		none	Factory adjusted.
A14A1R14		none	Factory adjusted.
A14A1R15		none	Factory adjusted.
A14A1R16		none	Factory adjusted.
A14A1R18		none	Factory adjusted.
A16A1R4		none	Factory adjusted.
A16A1R6		none	Factory adjusted.

Table 5-2. Adjustment Procedures

Paragraph	Adjustments	Paragraph	Adjustments
5-13	Configuration Switch A3S1	5-23	YTM/YTF Delay Compensation
5-14	−10 Volt Reference On A8 YO Driver	5-24	Band Overlap Adjustment
5-15	Sweep Control Adjustments	5-25	Frequency Reference 1V/GHz Output
5-16	YO, YTM, and YTF DAC Calibration	5-26	ALC Adjustments
5-17	Frequency Accuracy	5-27	ALC Internally Leveled Flatness Adjustment
5-18	YO Retrace Compensation	5-28	Power Meter Leveling Calibration
5-19	YO Delay Compensation	5-29	ALC Gain Adjustment
5-20	Slow Speed YTM/YTF to YO Tracking	5-30	Power Sweep
5-21	SRD Bias	5-31	FM Driver Adjustments
5-22	Slow Speed YTM to YO Tracking		

Table 5-3. Factory Selected Components

Reference Designator	Adjustment Paragraph	Allowable Range of Values	Basis of Selection
A5R31	5-30	200 to 300 Ohms	Selects scaling of current drive of YO FM coil near 100 kHz.
A7R34, 35, 38, 39, 69, 70	none		Selected at Factory to correct for frequency nonlinearity in YTM.
A7R88, 89, 90, 91, 92, 93	none		Selected at factory to correct for frequency nonlinearity in YTF.
A7R200, 201			Selected at factory to scale drive voltage gain.
A8R36	none		Selected at factory to correct for frequency nonlinearity in the YO.
A8R37−39	none		
A13A1R1	none		Selected at factory to optimize YO bandwidth, power, and harmonics.
A13A1R2	none		

Table 5-4. HP Part Numbers of Standard Value Replacement Components

RESISTORS

RANGE: 10 to 464K Ohms
TYPE: Fixed-Film
WATTAGE: .125 at 125°C
TOLERANCE: ±1.0%

Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D
10.0	0757-0346	2	464	0698-0082	7	21.5K	0757-0199	3
11.0	0757-0378	0	511	0757-0416	7	23.7K	0698-3158	4
12.1	0757-0379	1	562	0757-0417	8	26.1K	0698-3159	5
13.3	0698-3427	0	619	0757-0418	9	28.7K	0698-3449	6
14.7	0698-3428	1	681	0757-0419	0	31.6K	0698-3160	8
16.2	0757-0382	6	750	0757-0420	3	34.8K	0757-0123	3
17.8	0757-0294	9	825	0757-0421	4	38.3K	0698-3161	9
19.6	0698-3429	2	909	0757-0422	5	42.2K	0698-3450	9
21.5	0698-3430	5	1.0K	0757-0280	3	46.4K	0698-3162	0
23.7	0698-3431	6	1.1K	0757-0424	7	51.1K	0757-0458	7
26.1	0698-3432	7	1.21K	0757-0274	5	56.2K	0757-0459	8
28.7	0698-3433	8	1.33K	0757-0317	7	61.9K	0757-0460	1
31.6	0757-0180	2	1.47K	0757-1094	9	68.1K	0757-0461	2
34.8	0698-3434	9	1.62K	0757-0428	1	75.0K	0757-0462	3
38.3	0698-3435	0	1.78K	0757-0278	9	82.5K	0757-0463	4
42.2	0757-0316	6	1.96K	0698-0083	8	90.9K	0757-0464	5
46.4	0698-4037	0	2.15K	0698-0084	9	100K	0757-0465	6
51.1	0757-0394	0	2.37K	0698-3150	6	110K	0757-0466	7
56.2	0757-0395	1	2.61K	0698-0085	0	121K	0757-0467	8
61.9	0757-0276	7	2.87K	0698-3151	7	133K	0698-3451	0
68.1	0757-0397	3	3.16K	0757-0279	0	147K	0698-3452	1
75.0	0757-0398	4	3.48K	0698-3152	8	162K	0757-0470	3
82.5	0757-0399	5	3.83K	0698-3153	9	178K	0698-3243	8
90.0	0757-0400	9	4.22K	0698-3154	0	196K	0698-3453	2
100	0757-0401	0	4.64K	0698-3155	1	215K	0698-3454	3
110	0757-0402	1	5.11K	0757-0438	3	237K	0698-3266	5
121	0757-0403	2	5.62K	0757-0200	7	261K	0698-3455	4
133	0698-3437	2	6.19K	0757-0290	5	287K	0698-3456	5
147	0698-3438	3	6.81K	0757-0439	4	316K	0698-3457	6
162	0757-0405	4	7.50K	0757-0440	7	348K	0698-3458	7
178	0698-3439	4	8.25K	0757-0441	8	383K	0698-3459	8
196	0698-3440	7	9.09K	0757-0288	1	422K	0698-3460	1
215	0698-3441	8	10.0K	0757-0442	9	464K	0698-3260	9
237	0698-3442	9	11.0K	0757-0443	0			
261	0698-3132	4	12.1K	0757-0444	1			
287	0698-3443	0	13.3K	0757-0289	2			
316	0698-3444	1	14.7K	0698-3156	2			
348	0698-3445	2	16.2K	0757-0447	4			
383	0698-3446	3	17.8K	0698-3136	8			
422	0698-3447	4	19.6K	0698-3157	3			

Table 5-5. Interactive Adjustments

Assembly Changed or Repaired	Related Assemblies (in order of Adjustments)	Perform the Following Paragraph Number
A1/A2 Front Panel	A2	5-25
A3 Digital Interface	A3	5-13
A4 ALC	A4, A5	5-26 thru 5-29
A5 FM	A4, A5	5-26 thru 5-31
A6 Sweep Control	A6, A8, A7	5-15 thru 5-24
A7 YTM/YTF Driver	A6, A8, A7	5-15 thru 5-24
A8 YO Driver	A6, A8, A7	5-15 thru 5-24
A11 Cavity Oscillator	A4, A5	5-26 thru 5-29
A12 YIG Tuned Multiplier	A6, A8, A7	5-15 thru 5-24
A13 2.2 — 7.0 GHz Oscillator	A6, A8, A7, A2, A5	5-15 thru 5-25
A14 Power Amplifier	A4, A5	5-26 thru 5-29
A15 DC Return	A4, A5	5-26 thru 5-29
A16 Modulator/Splitter	A4, A5	5-26 thru 5-29
A17 0.01 — 2.4 GHz Amplifier	A4, A5	5-26 thru 5-29
A18 Modulator/Mixer	A4, A5	5-26 thru 5-29
AT1 Isolator	A4, A5	5-26 thru 5-29
DC1 Directional Detector	A4, A5	5-26 thru 5-29
DC2 Directional Coupler	A4, A5	5-26 thru 5-29
A20 Switched YIG Tuned Tuned Filter	A6, A8, A7, A2	5-15 thru 5-20, 5-23, 5-24

5-13. CONFIGURATION SWITCH A3S1

REFERENCE:

Performance Test: None
Service Sheet: A3

DESCRIPTION:

Switch A3S1 is set at the factory for a combination of operating modes (refer to Table 5-6). Other operating modes are selected by setting the eight switches on A3S1.

PROCEDURE:

NOTE

All adjustment procedures assume that A3S1 is set to the factory setting (unless otherwise specified in the test). If other procedures are to be performed, set A3S1 to the factory setting until the procedures are completed, then set A3S1 to the desired operating mode before putting the instrument back in service.

1. Refer to Table 5-6 and determine if the factory-selected mode at A3S1 is correct for your application.
2. Set configuration switch A3S1 (Figure 5-1) for the desired operating mode.
3. On the Model 8350A/B, press **[INSTR PRESET]** to set the instrument into the operating mode selected by the configuration switch.

NOTE

[INSTR PRESET] must be pressed after the configuration switch A3S1 positions are modified, in order to set the instrument immediately to the desired operating mode set by the configuration switch.

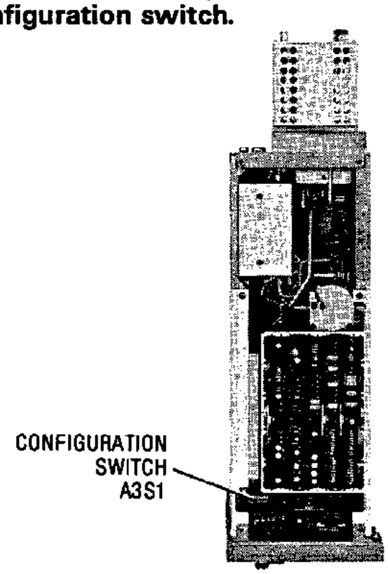


Figure 5-1. Configuration Switch A3S1 Location

Table 5-6. Configuration Switch on A3 Digital Interface Board

Description	Switch Number							
	1	2	3	4	5	6	7	8
Plug-In: HP 83592C								
Normal Sweep								
Sequential Sweep Only	x	x	x	x	x	x	x	x
*No RF Power at Power-Up	0	x	x	x	x	x	x	x
Maximum RF Power at Power-Up	1	x	x	x	x	x	x	x
−6 MHz/V FM Sensitivity	x	x	x	1	x	x	x	x
−20 MHz/V FM Sensitivity	x	x	x	0	x	x	x	x
Direct-Coupled FM Modulation (−20 MHz/V)	x	x	x	x	1	x	x	x
Cross-Over Coupled FM Modulation	x	x	x	x	0	x	x	x
Step Attenuator Option	x	x	x	x	x	1	x	x
No Step Attenuator Option	x	x	x	x	x	0	x	x
AUX OUT Phase Lock	x	x	x	x	x	x	1	x
RF OUTPUT Phase Lock	x	x	x	x	x	x	0	x
	x	x	x	x	x	x	x	1
	x	x	x	x	x	x	x	0

NOTE

1 = Switch Open = High
0 = Switch Closed = Low (Ground)
x = Don't Care

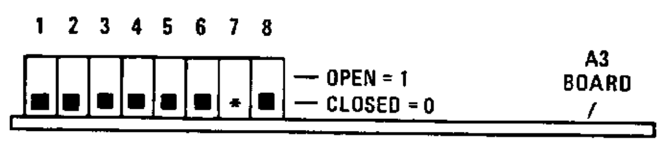
*With the configuration switch set for an Instrument Preset condition of "RF Power OFF," bias is removed from A13 YIG Oscillator. In addition, the Model 8350A/B microprocessor issues a blanking pulse to the Plug-In: L RFB (Low = RF Blank) biases the modulator on hard, closing off the RF signal path. When RF power is manually turned on, via the front panel pushbutton, L RFB remains low for a short period to allow the RF microcircuit components to reach full capacity before releasing the ALC amplifier. This prevents the ALC loop from correcting for a large error voltage at initial power up, thus preventing overshoot.

A3S1 Factory Setting

Switch No.	Position
1	0
2	0
3	0
4	0
5	0
6	0
7	*
8	0

*"1" if Opt. 002 installed; "0" if Opt. 002 not installed.

A3S1



■ = DEPRESSED SWITCH POSITION

5-14. −10 VOLT REFERENCE ON A8 YO DRIVER

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A8

DESCRIPTION:

The −10 volt source on the A8 YO Driver board is used as a reference voltage for the DACs on the A4 ALC, the A6 Sweep Control, the A7 YTM/YTF Driver, and the A8 YO Driver boards. The −10 volt reference output voltage is set by the potentiometer A8R44 (−10V) while monitoring A8TP12.

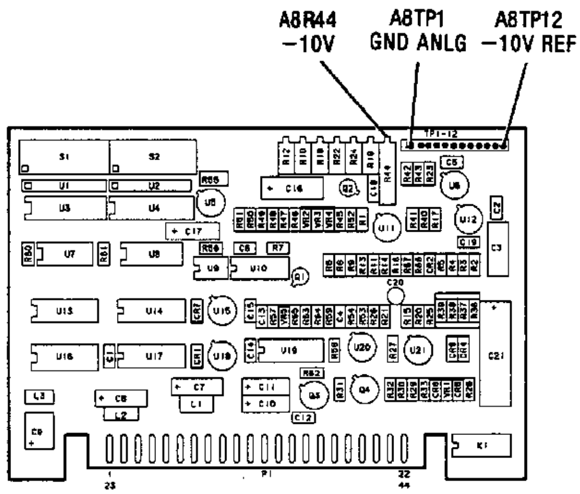


Figure 5-2. −10V Reference Adjustment Locations

EQUIPMENT:

Digital Voltmeter (DVM) .... HP 3456A
Sweep Oscillator.. HP 8350A/B

PROCEDURE:

1. Connect the DVM to A8TP12 (−10V) with reference to A8TP1 (GND ANLG).
2. Adjust A8R44 (−10V) for a DVM reading of −10 ± 0.001 Vdc. Refer to Figure 5-2 for the locations of A8R44 and A8TP12.

5-15. SWEEP CONTROL ADJUSTMENTS

REFERENCE:

Performance Test: Paragraph 4-13
Service sheet: A6

DESCRIPTION:

With the tuning voltage (VTUNE) set to +10 V (CW frequency of 20.0 GHz), the TV Buffer is set for unity gain, and the DAC CAL adjustment is set to equalize the Bandswitch Comparator DAC and TV Buffer inputs to the Variable Gain Amplifier (the DAC CAL is set for 0V at A6TP4). The −10V OFFSET adjustment is set to offset the Variable Gain Amplifier output by −10V. The gain of the Variable Gain Amplifier is calibrated at the low end of each frequency band. The Model 83592C is then swept across its full frequency range and the Switch Point adjust A6R37 (SP) is adjusted to set the bandswitch points.

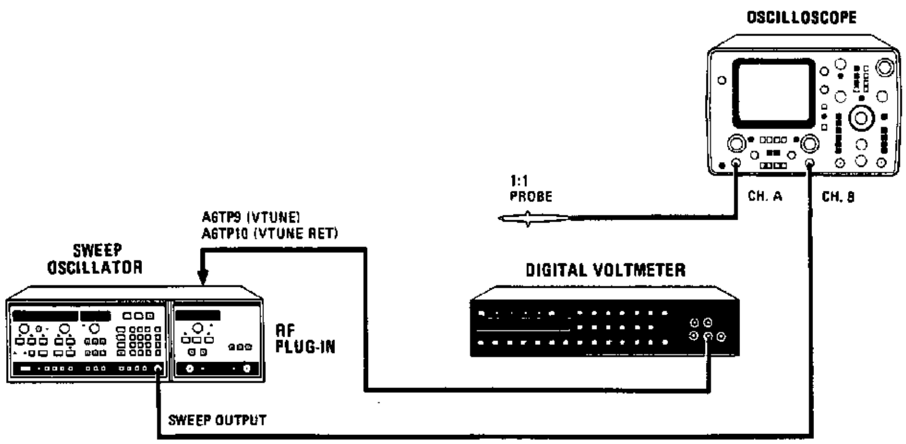


Figure 5-3. Sweep Control Adjustments Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3456A
Oscilloscope	HP 1740A
1:1 Probe	HP 10008B
Sweep Oscillator	HP 8350A/B

PROCEDURE:

1. Ensure that the A3S1 position 1 switch in in the OPEN (up) position. Refer to paragraph 5-13 for instructions on setting A3S1.

2. Set up the equipment as shown in Figure 5-3 with the DVM connected to A6TP9 (VTUNE) and the DVM reference probe connected to A6TP10 (VTUNE RET). Do not connect the Oscilloscope probe yet. Allow the instrument to warm up for one hour.

3. On the Model 8350A/B, press **[INSTR PRESET] [CW] [2] [0] [GHz] [VERNIER]**.

5-15. SWEEP CONTROL ADJUSTMENTS (Cont'd)

4. Adjust the Model 8350A/B FREQ VERNIER for a DVM reading of 10 ± 0.001 Vdc.

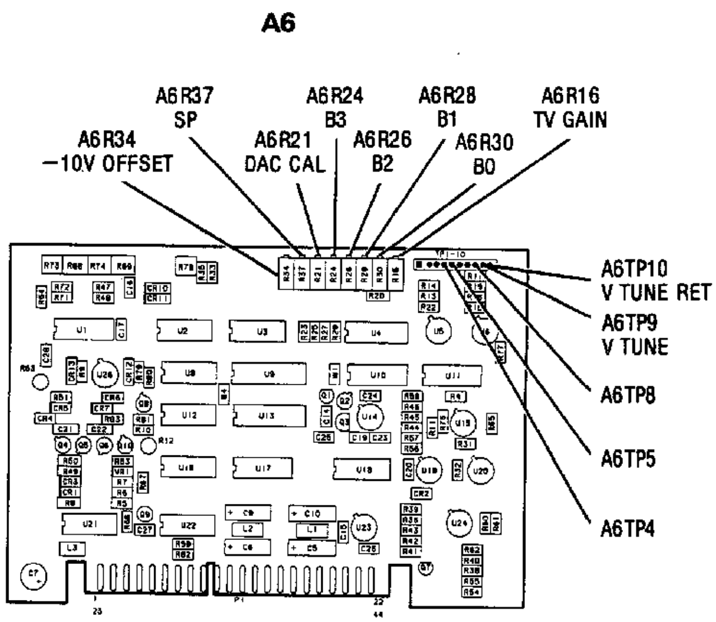
NOTE

The following voltage measurement procedures on the A6 Sweep Control board are made with the DVM reference probe connected to A8TP1 (which is electrically the same as motherboard ground).

5. Connect the DVM to A6TP5 and adjust A6R16 (TV GAIN) for a DVM reading of −10 ± 0.001 Vdc. Refer to Figure 5-4 for sweep control adjustment locations.
6. Connect the DVM to A6TP4 and adjust A6R21 (DAC CAL) for a DVM reading of 0 ± 0.001 Vdc.
7. Connect the DVM to A6TP8 (BVTUNE) and adjust A6R34 for a DVM reading of −10 ± 0.001 Vdc.
8. On the Model 8350A/B, press **[CW] [1] [3] [.] [5] [GHz]**.
9. Connect the DVM to A6TP5 and adjust the Model 8350A/B FREQ VERNIER control for a DVM reading of −6.74837 ± 0.00005 Vdc.
10. Connect the DVM to A6TP8 and adjust A6R24 (B3) for a DVM reading of 0 ± 0.001 Vdc.
11. On the Model 8350A/B, press **[CW] [7] [GHz]**.
12. Connect the DVM to A6TP5 and adjust the Model 8350A/B FREQ VERNIER control for a DVM reading of −3.49675 ± 0.00005 Vdc.
13. Connect the DVM to A6TP8 and adjust A6R26 (B2) for a DVM reading of 0.001 Vdc.
14. On the Model 8350A/B, press **[CW] [2] [.] [4] [GHz]**.
15. Connect the DVM to A6TP5 and adjust the Model 8350A/B FREQ VERNIER control for a DVM reading of 1.19560 ± 0.00005.
16. Connect the DVM to A6TP8 and adjust A6R28 (B1) for a DVM reading of 0 ± 0.001 Vdc.
17. On the Model 8350A/B, press **[CW] [1] [0] [MHz]**.
18. Connect the DVM to A6TP5 and adjust the Model 8350A/B FREQ VERNIER control for a DVM reading of 0 ± 0.00005 Vdc.
19. Connect the DVM to A6TP8 and adjust A6R30 (B0) for a DVM reading of 0 ± 0.001 Vdc.
20. On the 8350A/B, press **[INSTR PRESET]**.
21. Connect the Oscilloscope probe to A6TP8. Set the Oscilloscope as follows:

    Mode . . . . A vs B
    Vertical Sensitivity . . . . 0.5 V/DIV
    Coupling . . . . DC

5-15. SWEEP CONTROL ADJUSTMENTS (Cont'd)



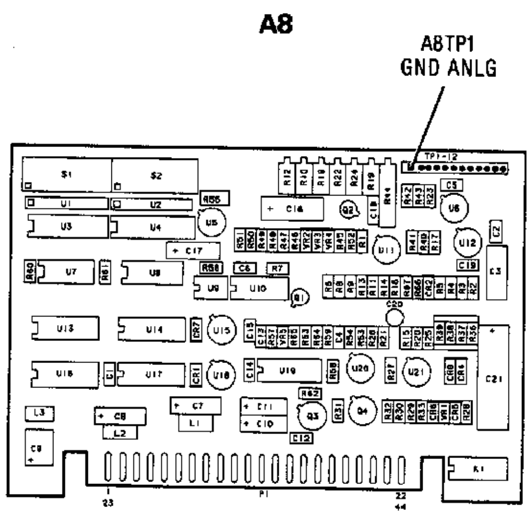


Figure 5-4. Sweep Control Adjustment Locations

5-15. SWEEP CONTROL ADJUSTMENTS (Cont'd)

22. Adjust the Oscilloscope vertical position control to set the top of the first full 0 to −10 volt sweep ramp on the centerline as shown in Figure 5-5.

23. Adjust A6R37 (SP) to bring the tops of the remaining 0 to −10 volt sweep ramps to the center graticule as shown in Figure 5-5.

24. Reset A3S1 to the closed (down) position before continuing with the adjustment procedures.

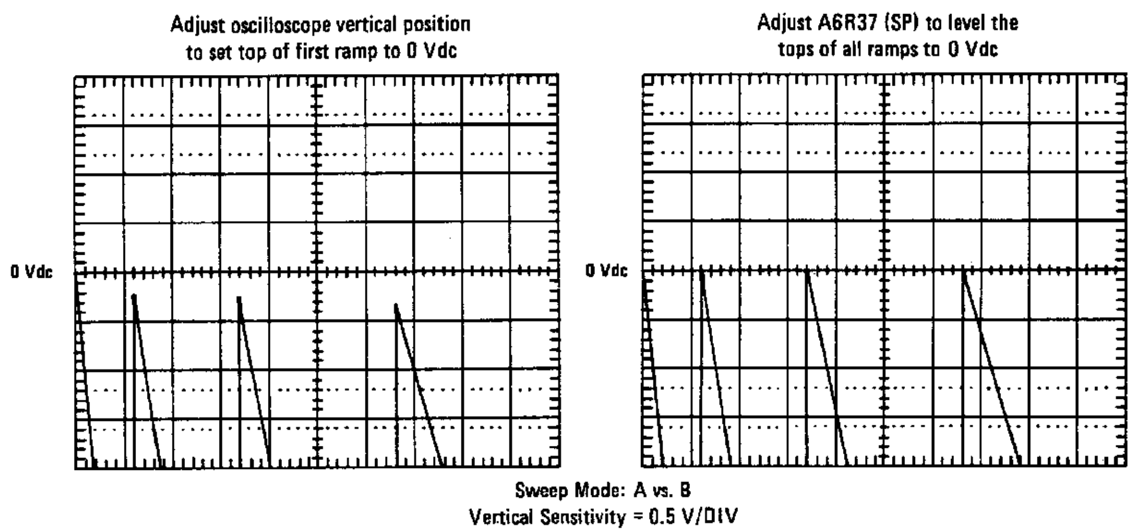


Figure 5-5. Sweep Control Adjustment Waveforms

5-16. YO AND YTM/YTF DAC CALIBRATION

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A7 and A8

DESCRIPTION:

The Model 8350A/B is set for a CW frequency of 20.0 GHz and then fine-tuned for a tuning voltage (VTUNE) of +10V. The Hex Data Write feature of the Model 8350A/B is used to load each DAC with either all ones or all zeros. The A8 YO Driver is adjusted first. With both the Scaled Voltage Tune and Offset DACs loaded with all zeros, the YO Collector output is monitored and the +20V Tracking Amplifier ZRO adjustment is set. Each DAC is then loaded with all ones and the respective Offset or Gain adjustment is set. The A7 YTM/YTF Driver is adjusted the same way. The Model 8350A/B is then set into the Swept CW mode and the Delay Compensation circuits on both A7 and A8 are adjusted for 0V output.

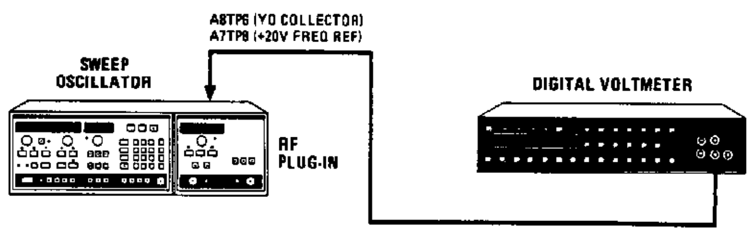


Figure 5-6. YO and YTM/YTF DAC Calibration Adjustment Locations

EQUIPMENT:

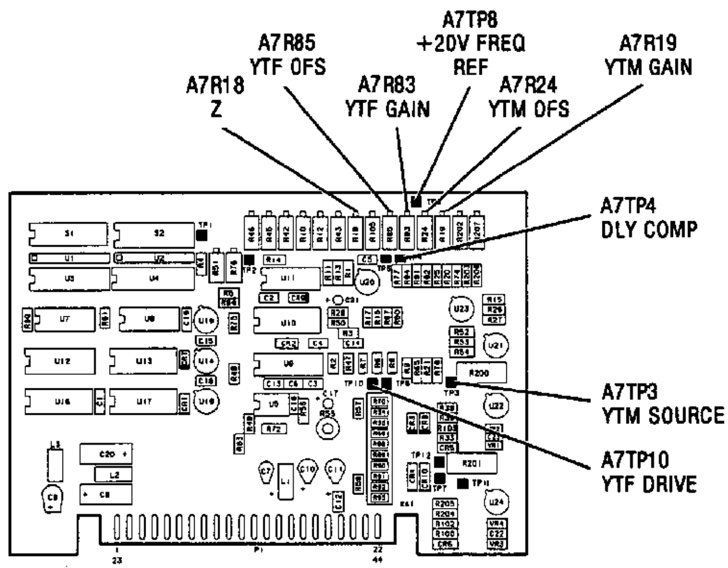
Digital Voltmeter .... HP 3456A
Sweep Oscillator .... HP 8350A/B

PROCEDURE:

1. Connect the equipment as shown in Figure 5-6. First connect the DVM to A6TP9 (VTUNE) and the reference probe to A6TP10 (VTUNE RET). Refer to Figure 5-7 for test point and adjustment locations. Allow the RF Plug-In to warm up for one hour.
2. On the Model 8350A/B, press **[INSTR PRESET] [CW] [2] [0] [GHz]**.
3. Adjust the Model 8350A/B FREQ VERNIER for a DVM reading of 10 ± 0.001 Vdc.
4. Float the ground on the DVM. Connect the DVM to A8TP6 (YO COLLECTOR) with the reference probe connected to A7TP8 (+20V FREQ REF).

5-16. YO AND YTM/YTF DAC CALIBRATION (Cont'd)

A7



A8

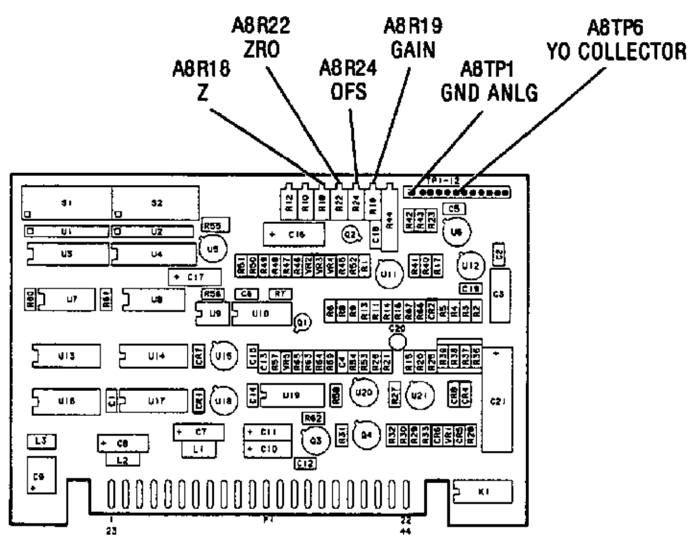


Figure 5-7. YO and YTM/YTF DAC Calibration Adjustment Locations

5-16. YO AND YTM/YTF DAC CALIBRATION (Cont'd)

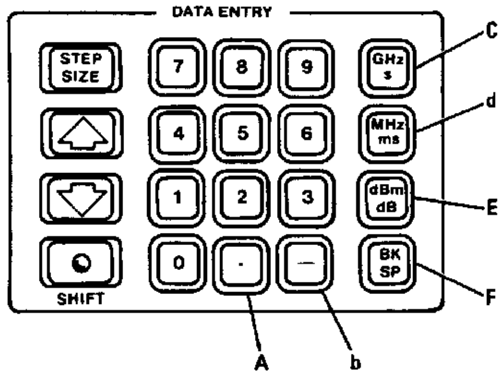


Figure 5-8. Front Panel Hexadecimal Entry Keys

5. Use the Hex Data Write feature to write all zeros to both DACs on the A8 YO Driver.

[SHIFT] [0] [0]	Enter Hex Data command
[2] [GHz] [8] [0]	Address Location 2C80
[M2]	Hex Data Write
[0] [0]	Enter hex data 00
▲ [0] [0]	Increment address to 2C81 and write 00
▲ [0] [0]	Increment address to 2C82 and write 00
▲ [0] [0]	Increment address to 2C83 and write 00

6. Adjust A8R22 (ZRO) for a DVM reading of −7.000 ± 0.001 Vdc.

7. Use the Hex Data Write feature to write zeros to the Scaled Voltage Tune DAC and ones to the Offset DAC as follows:

▼▼▼	Decrement address to 2C80
[0] [BKSP]	Enter hex data 0F
▲ [0] [F]	Increment address to 2C81 and write 0F
▲ [0] [F]	Increment address to 2C82 and write 0F
▲ [0] [F]	Increment address to 2C83 and write 0F

8. Adjust A8R24 (OFS) for a DVM reading of −20.000 ± 0.001 Vdc.

9. Use the Hex Data Write feature to write ones to the Scaled Voltage Tune DAC and zeros to the Offset DAC as follows:

▼▼▼	Decrement address to 2C80
[F] [0]	Enter hex data F0
▲ [F] [0]	Increment address to 2C81 and write F0
▲ [F] [0]	Increment address to 2C82 and write F0
▲ [F] [0]	Increment address to 2C83 and write F0

10. Adjust A8R19 (GAIN) for a DVM reading of −26.500 ± 0.001 Vdc.

5-16. YO AND YTM/YTF DAC CALIBRATION (Cont'd)

11. Use the Hex Data Write feature to write all zeros to both DACs on the A7 YTM/YTF Driver as follows:

▲▲▲▲▲	Increment address to 2C88
[0] [0]	Enter hex data 00
▲ [0] [0]	Increment address to 2C89 and write 00
▲ [0] [0]	Increment address to 2C8A and write 00
▲ [0] [0]	Increment address to 2C8B and write 00

12. Set the front panel FILTER PEAK potentiometer to its mid-range. Connect the DVM to A7TP10 (YTF SOURCE) with the reference probe at A8TP1 (GND ANLG). The DVM should read 0.000 ± 0.0001. If not, adjust the FILTER PEAK potentiometer.

13. Use the Hex Data Write feature to write zeros to the Scaled Voltage Tune DAC and ones to the Offset DAC as follows:

▼▼▼	Decrement address to 2C88
[0] [BKSP]	Enter hex data 0F
▲[0] [F]	Increment address to 2C89 and write 0F
▲[0] [F]	Increment address to 2C8A and write 0F
▲[0] [F]	Increment address to 2C8B and write 0F

14. Connect the DVM to A7TP3 (reference probe at A8TP1). Adjust A7R24 (OFS) for a DVM reading of −10.4583 ± 0.001 Vdc.

15. Connect the DVM to A7TP10 (with the reference probe still at A8TP1). Adjust A7R85 (YTF OFS) for a DVM reading of −10.4583 ± 0.001 Vdc.

16. Use the Hex Data Write feature to write ones to the Scaled Volgate Tune DAC and zeros to the Offset DAC as follows:

▼▼▼	Decrement address to 2C88
[BKSP] [0]	Enter hex data F0
▲[F] [0]	Increment address to 2C89 and write F0
▲[F] [0]	Increment address to 2C8A and write F0
▲[F] [0]	Increment address to 2C8B and write F0

17. Connect the DVM to A7TP3. Adjust A7R19 (GAIN) for a DVM reading of −4.1212 ± 0.001 Vdc.

18. Connect the DVM to A7TP10. Adjust A7R83 (YTF GAIN) for a DVM reading of −4.1212 ± 0.001 Vdc.

19. On the Model 8350A/B, press **[INSTR PRESET] [SHIFT] [CW]**.

20. Connect the DVM to A7TP4 with reference to A8TP1 (GND ANLG).

21. Adjust A7R18 (Z) for a DVM reading of 0.000 ± 0.001 Vdc.

22. Connect the DVM to A8TP9 with reference to A8TP1 (GND ANLG).

23. Adjust A8R18 (Z) for a DVM reading of 0.000 ± 0.001 Vdc.

5-17. FREQUENCY ACCURACY

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A8

DESCRIPTION:

The Model 83592C CW frequency is set first at the low end and then at the high end of Band 2. Special calibration modes are used for this procedure (SHIFT 90 for the low end of Band 2 and SHIFT 91 for the high end of Band 2). When the output frequency matches the front panel frequency display, the calibration switches on the YO Driver board A8 are set for the appropriate correction factor. A8S1 calibrates the lower portion of the band and A8S2 calibrates the high portion of the band.

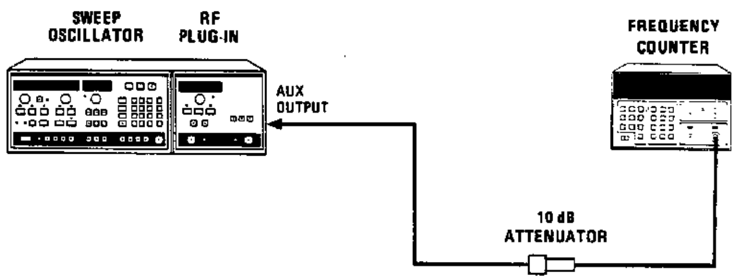


Figure 5-9. Frequency Accuracy Test Setup

EQUIPMENT:

Frequency Counter .... HP 5343A
10 dB Attenuator.................................. HP 8491B Option 010
Sweep Oscillator... HP 8350A/B

PROCEDURE:

1. Connect the equipment as shown in Figure 5-9 with the Frequency Counter connected to the 83592C rear-panel AUX OUTPUT connector through the 10 dB attenuator. Allow the equipment to warm up for one hour.
2. Adjust the Model 83592C **[FREQ CAL]** control to the center of its mechanical range.
3. On the Model 8350A/B press **[INSTR PRESET] [CW] [6] [.] [9] [GHz] [SAVE] [1]**.
4. On the Model 8350A/B, press **[CW] [1] [3] [.] [5] [GHz] [SAVE] [2]**.
5. On the HP 5343A Frequency Counter, press **[SET] [.] [2] [ENTER]**. This sets the Frequency Counter in a mode which displays twice the input frequency. This step is necessary to compensate for the frequency of the rear-panel AUX OUTPUT (which is the YO fundamental frequency, approximately half of the Model 8350A/B displayed frequency in Band 2).

5-17. FREQUENCY ACCURACY (Cont'd)

Low End Frequency Calibration

6. On the Model 8350A/B, press **[RECALL] [1]**. The Model 8350A/B FREQUENCY display should show 6.900 GHz.
7. On the Model 8350A/B, press **[SHIFT] [9] [0]** to select the low end frequency calibration mode.
8. Adjust the Model 83592C POWER control if necessary to display 6.900 ± 0.003 GHz on the Frequency Counter.
9. Set switch A8S1 for the hexadecimal value displayed in the Model 83592C POWER display. Refer to Figure 5-10 for the location of the frequency calibration switches. Refer to Figure 5-11 for an illustration of the calibration switch configuration.
10. On the Model 8350A/B, press **[INSTR PRESET] [RECALL] [1]**. Verify that the Frequency Counter reads 6.900 ± 0.010 GHz.

High End Frequency Calibration

11. On the Model 8350A/B, press **[RECALL] [2]**.The Model 8350A/B FREQUENCY display should show 13.500 GHz.
12. On the Model 8350A/B, press **[SHIFT] [9] [1]** to select the high end frequency calibration mode.
13. Adjust the Model 83592C POWER control if necessary to display 13.500 ± 0.003 GHz on the Frequency Counter.
14. Set switch A8S2 for the value displayed in the Model 83592C POWER display in the manner described in step 9.
15. On the Model 8350A/B, press **[INSTR PRESET] [RECALL] [2]**. Verify that the Frequency Counter reads 13.500 ± 0.010 GHz.
16. On the Model 8350A/B, press **[RECALL] [1]**. Manually adjust the Model 8350A/B FREQUENCY control across Band 2 (6.9 to 13.5 GHz) and check for Frequency Counter readings which correspond to the displayed Model 81350A/B FREQUENCY display reading ± 10 MHz. If necessary repeat steps 6 through 15.

5-17. FREQUENCY ACCURACY (Cont'd)

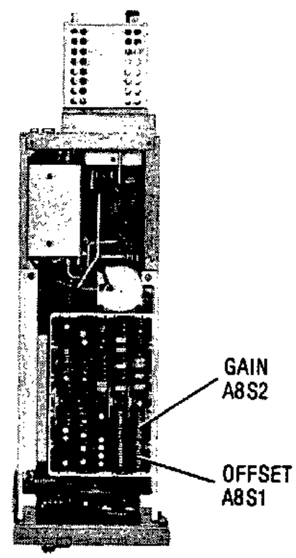


Figure 5-10. Frequency Calibration Switch Locations

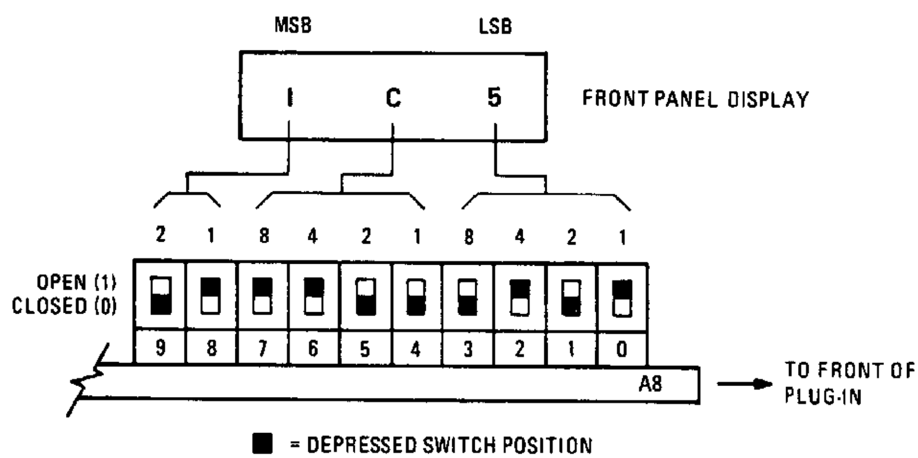


Figure 5-11. A8S1 and A8S2 Frequency Calibration Switch Configuration

5-18. YO RETRACE COMPENSATION

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A8

DESCRIPTION:

During sweep retrace and at each bandswitch point, the YO frequency is forced to the required beginning frequency of the next band by the retrace compensation circuit. This circuit is adjusted to maximize the YO frequency settling time before the next band is swept. An external Frequency Meter is set to the YO frequency for the start of the next band. The width of the Frequency Meter pip corresponds to the length of time the YO has settled at the correct start frequency.

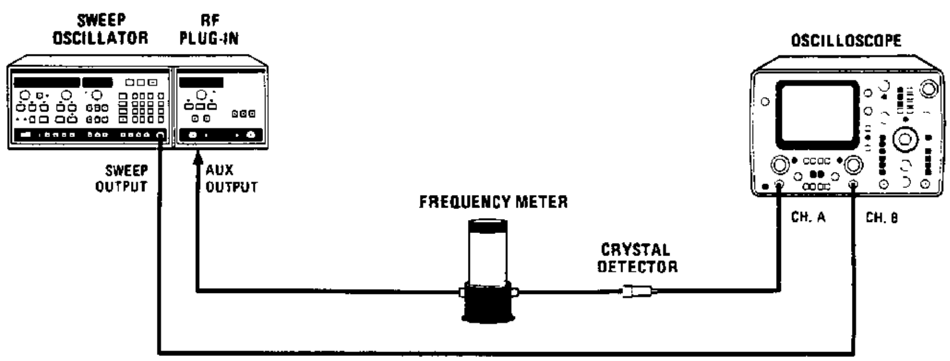


Figure 5-12. YO Retrace Compensation Test Setup

EQUIPMENT:

Oscilloscope .... HP 1740A
Crystal Detector .... HP 8470B
Frequency Meter (3.7 to 12.4 GHz) .... HP 537A
Frequency Meter (0.96 to 4.2 GHz) .... HP 536A
Sweep Oscillator .... HP 8350A/B

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position. Refer to Table 5-6.

1. Connect the equipment as shown in Figure 5-12 with the Oscilloscope connected through the Detector and the HP 536A Frequency Meter to the Model 83592C rear-panel AUX OUTPUT. On the Model 8350A/B, press **[INSTR PRESET]**, **[RF BLANK]**. Allow the equipment to warm up for one hour.

5-18. YO RETRACE COMPENSATION (Cont'd)

2. Set the Oscilloscope controls as follows:

Channel B	DC
Channel B Sensitivity	2 V/DIV
Horiz. Sweep	5 ms/DIV
Delayed Sweep	0.5 ms/DIV
Display	CHOP
Trigger	B
Sweep Mode	MAIN

3. Adjust the vertical sensitivity of Channel A on the Oscilloscope to bring the trace to center screen.

4. Set the HP 536A Frequency Meter to 3.5 GHz.

5. Use the delayed sweep vernier to set the delayed part of the trace on the bandswitch point between Band 1 and Band 2 as shown in Figure 5-13.

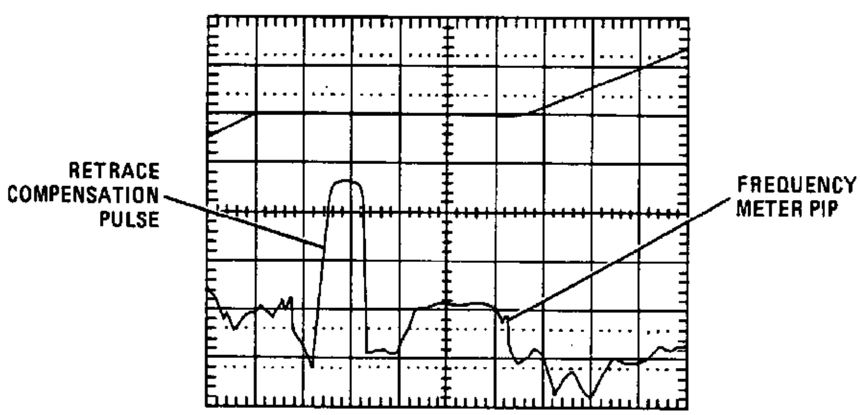


Figure 5-13. YO Retrace Compensation Pulse

6. On the Oscilloscope, switch to delayed sweep and fine-adjust the Frequency Meter to set the frequency pip near center screen.

7. Start with A8R55 (RTC COMP) fully clockwise, and adjust it for the widest and flattest pip while tracking the bandswitch frequency with the Frequency Meter. A well adjusted retrace compensation pulse is shown in Figure 5-13.

8. Select MAIN sweep on the Oscilloscope and adjust the delayed sweep vernier to move the delayed portion of the sweep to the bandswitch point between Band 2 and Band 3.

9. Replace the HP 536A Frequency Meter with the HP 537A and set it to 4.49 GHz.

5-18. YO RETRACE COMPENSATION (Cont'd)

10. On the Oscilloscope, switch to delayed sweep and fine-adjust the Frequency Meter to set the frequency pip near center screen. If the previous Band 1 to Band 2 adjustment was made properly, this bandswitch point will look the same. If it does not, repeat steps 4 through 10 for the best compromise.

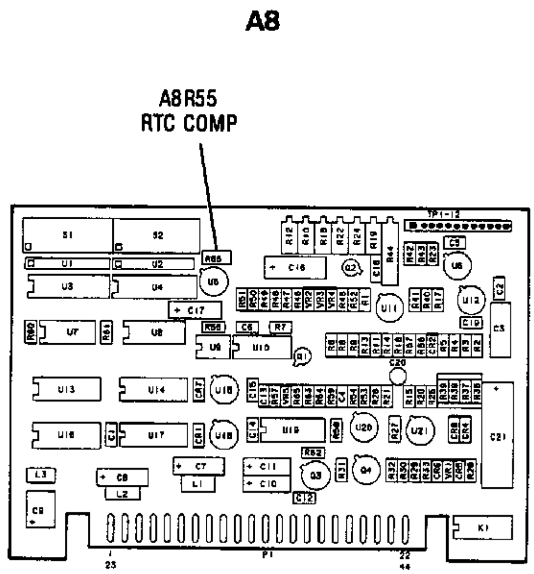


Figure 5-14. YO Retrace Compensation Adjustment Location

5-19. YO DELAY COMPENSATION

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A8

DESCRIPTION:

This circuit compensates for the delay in the RF sweep output that occurs at fast sweep speeds. An external Frequency Meter is used to generate a frequency-dependent marker which is aligned with a tuning ramp-dependent marker generated from the Model 8350A/B Mainframe. Sweep time is decreased and the delay in the YO is observed as the difference between the two marker pips.

Delay compensation adjustments are made while observing the shift between the marker pips at a sweep time of 10 milliseconds (worst case for single-band sweeps). At sweep times greater than 100 milliseconds, delay should not exceed ± 15 MHz (the difference in accuracy between CW and Swept Frequency).

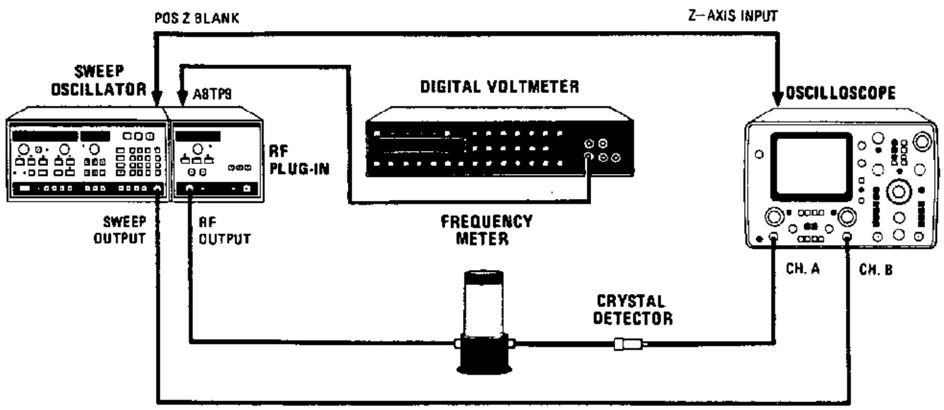


Figure 5-15. YO Delay Compensation Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3456A
Oscilloscope	HP 1740A
Frequency Meter (3.7 to 12.4 GHz)	HP 537A
Frequency Meter (12.4 to 18 GHz)	HP P532A
Crystal Detector	HP 8470B
Sweep Oscillator	HP 8350A/B

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position. Refer to Table 5-6.

5-19. YO DELAY COMPENSATION (Cont'd)

1. Connect the equipment as shown in Figure 5-15, using the HP 537A Frequency Meter. On the Model 8350A/B, press **[INSTR PRESET]** and allow the equipment to warm up for one hour.

2. Set the Oscilloscope for A vs B sweep mode to obtain a display of amplitude versus frequency.

3. On the Model 8350A/B, press **[CW]**.

4. Measure and note the voltage at A8TP9.

5. On the Model 8350A/B, press **[CF] [ΔF] [0] [MHz]**.

6. Adjust A8R18 (Z) for a DVM reading equal to the voltage noted in step 4. Remove the DVM test leads.

7. On the Model 8350A/B enter the front panel data as follows:

   [INSTR PRESET]
   [START] [6] [.] [9] [GHz]
   [STOP] [1] [3] [.] [5] [GHz]
   [SWEEP TIME] [1] [0] [ms]
   [M1] [7] [.] [2] [GHz]
   [AMPTD MKR]
   [RF BLANK]
   [SAVE] [2]

8. On the Model 8350A/B, press **[SWEEP TIME] [2] [0] [0] [ms] [SAVE] [1]**.

9. On the Model 8350A/B, press **[M2] [1] [3] [.] [2] [GHz] [SAVE] [3]**.

10. On the Model 8350A/B, press **[SWEEP TIME] [1] [0] [ms] [SAVE] [4]**.

11. On the Model 8350A/B, press **[RECALL] [1]**.

12. Expand the Oscilloscope trace at the marker by centering the marker on the screen and then setting the Oscilloscope for a magnified horizontal trace. Set the HP 537A Frequency Meter so that the peak of the pip is on the leading edge of the 7.2 GHz marker.

13. On the Model 8350A/B, press **[RECALL] [2]**.

14. Adjust A8R12 (LO) so that the peak of the HP 537A Frequency Meter pip is on the leading edge of the marker.

15. Verify that the delay is accurate by manually adjusting the sweep time from 10 ms to 200 ms. Reset A8R12 (LO) as necessary for the best compromise in overall delay setting (minimum delay per change in sweep time). The poslition of the 537A Frequency Meter pip should typically stay within ± 15 MHz as read on the Frequency Meter across the 10 ms to 200 ms range.

16. On the 8350A/B press **[RECALL] [3]**.

5-19. YO DELAY COMPENSATION (Cont'd)

17. Replace the HP 537A Frequency Meter with HP P532A and set it so that the peak of the pip is coincident with the leading edge of the 13.2 GHz marker.

18. On the Model 8350A/B, press **[RECALL] [4]**.

19. Adjust A8R10 (HI) so that the peak of the frequency Meter pip is coincident with the leading edge of the marker.

20. Verify that the delay is accurate by manually adjusting the sweep time from 10 ms to 200 ms. Reset A8R10 (HI) as necessary for the best compromise in overall delay setting (minimum delay per change in sweep time). The posiltion of the Frequency Meter pip should typically stay within ± 15 MHz as read on the HP P532A Frequency Meter across the 10 ms to 200 ms sweep speed range.

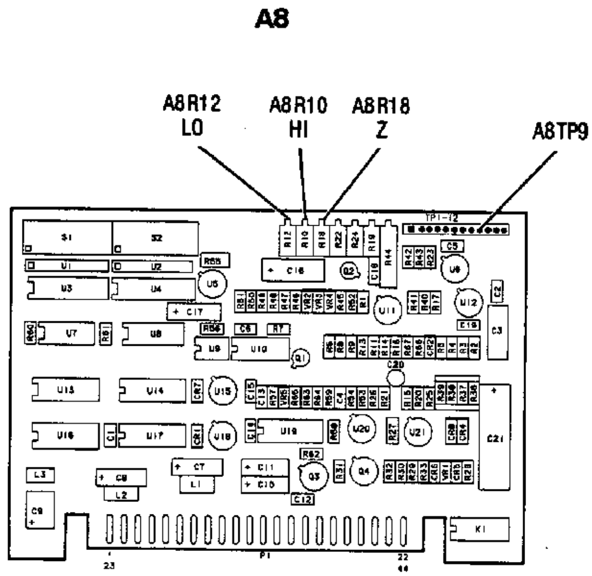


Figure 5-16. YO Delay Compensation Adjustment Locations

5-20. SLOW SPEED YTM/YTF TO YO TRACKING

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A6 and A7

DESCRIPTION:

The Model 83592C is set to Sweep Bands 1, 2 and 3 (2.3 to 20.0 GHz), and the ALC is opened by selecting the EXT ALC MODE. The FILTER PEAK control on the front panel (YTF OFFSET) is adjusted to maximize RF output. The SRB Bias for the YTM is preset and requires further adjustment according to Paragraph 5-21. Prior to this adjustment, the OFFSET and GAIN DACS for the YTM and YTF are loaded with the proper correction factors using SHIFT 92 (OFFSET) and SHIFT 93 (GAIN): the output power is peaked for each mode, and the appropriate hexadecimal correction factor is entered with the calibration switches. Once YTM/YTF to YO tracking has been performed, SRD BIAS (Paragraph 5-21) should be adjusted. If power is below specification, YTM to YO tracking (Paragraph 5-22) must be performed.

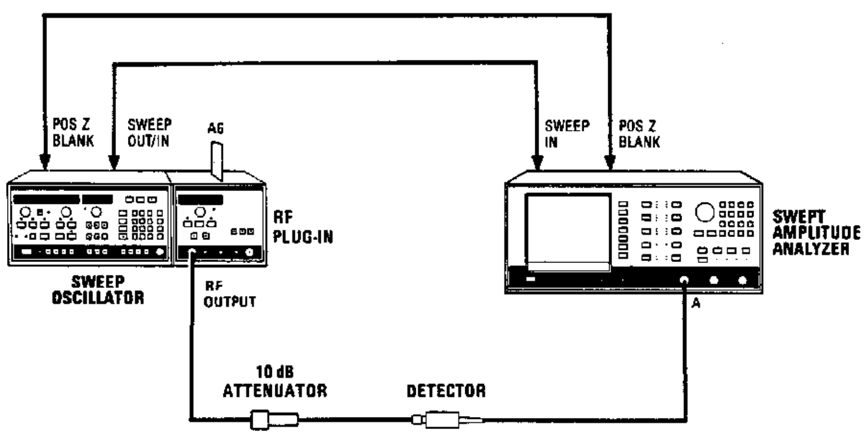


Figure 5-17. Slow Speed YTM/YTF to YO Tracking Test Setup

EQUIPMENT:

Swept Amplitude Analyzer .... HP 8756A
Detector .... HP 11664B
10 dB Attenuator.. HP 8493C-010
Sweep Oscillator... HP 8350A/B
Extender Board .... HP 08350-60031

5-20. SLOW SPEED YTM/YTF TRACKING (Cont'd)

PROCEDURE:

1. Connect the equipment as shown in Figure 5-17 with the Model 83592C A6 Sweep Control Board on tan extender. Allow the equipment to warm up for one hour.

2. On the Model 8350A/B, press **[INSTR PRESET]**, **[START]** **[2]** **[.]** **[3]** **[GHz]** **[SWEEP TIME]** **[2]** **[0]** **[0]** **[ms]**, **[⊔⊓ MOD]** . On the Model 83592C, press ALC MODE **[EXT]**. The unleveled lamp should be lit. Press **[SAVE]** **[1]**.

3. Select 5 dB/DIV display resolution on the HP 8756A and center the display. Turn off Channel 2.

4. Adjust the FILTER PEAK to maximize the lowest power point as viewed on the Model 8756A. If the output is within specification, go to paragraph 5-21. Otherwise continue on.

NOTE

This procedure requires that A3S1 be set to the factory set position. Refer to Table 5-6.

NOTE

During this adjustment, a localized drop in power may occur. This drop in power is due to the YTM being overdriven and is called squegging. Adjustment of the diode bias for Bands 2 and 3 will eliminate diode squegging. If squegging occurs in Band 2, adjust A6R68 and A6R73. If it occurs in Band 3, adjust A6R69 and A6R74.

5. Preset A6R63 (3HL) to mid-range. Refer to Figure 5-18 for adjustment locations.

6. Preset A6R78 (T) and A6R12 (C) one quarter turn from the full counterclockwise position.

7. On the Model 8350A/B, press **[SHIFT]** **[9]** **[2]** to enable the OFFSET DAC subroutine. Using the Model 83592C POWER control, peak the low portion of the trace.

8. Enter the number displayed on the Model 83592C POWER DISPLAY into A7S1 as shown in Figure 5-20. Refer to Figure 5-19 for the switch location.

9. On the Model 8350A/B, press **[SHIFT]** **[9]** **[3]** to enable the GAIN DAC subroutine. Using the Model 83592C POWER control, peak the middle and high positions of the trace.

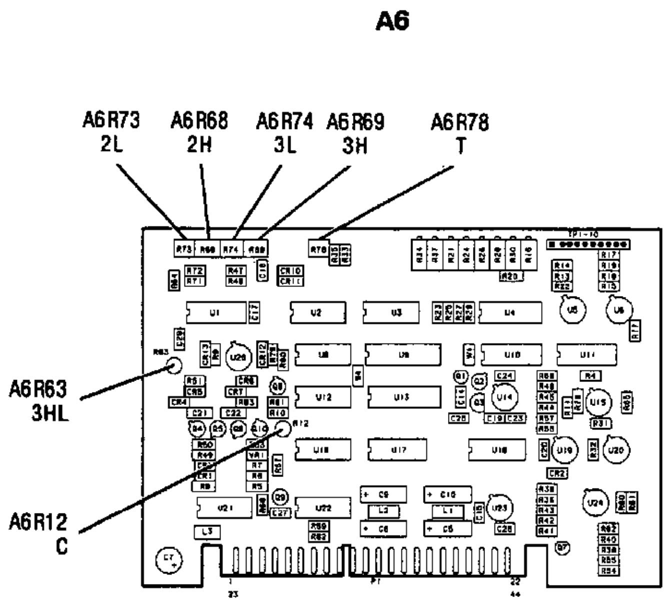
10. Enter the number displayed on the Model 83592C POWER display into A7S2 as shown in Figure 5-20. Refer to Figure 5-19 for the switch location.

11. Repeat steps 7-10 until maximum power output is obtained.

12. On the Model 8350A/B, press **[INSTR PRESET]** so that the new calibration data will be entered from the current switch settings.

13. If the output is within specification, go to STEP 15 to peak Band 1. Otherwise continue on with the YTF adjustment

5-20. SLOW SPEED YTM/YTF TO YO TRACKING (Cont'd)



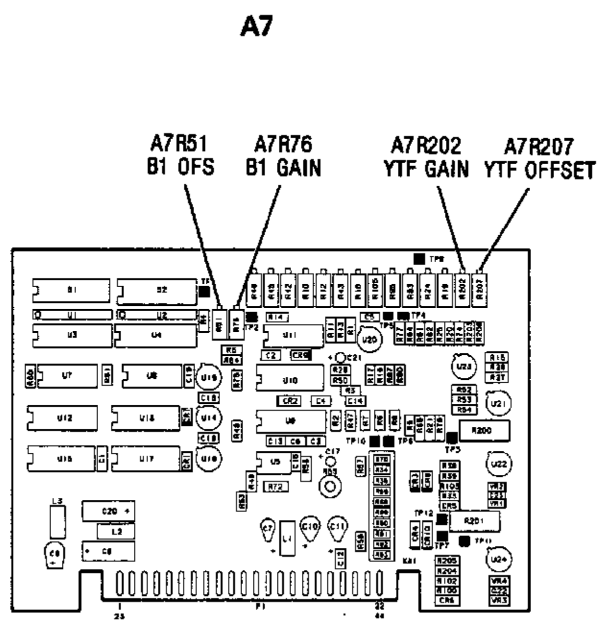


Figure 5-18. Slow Speed YTM/YTF to YO Tracking Adjustment Locations

5-20. SLOW SPEED YTM/YTF TO YO TRACKING (Cont'd)

14. On the Model 8350A/B, press **[RECALL] [1]**. On A7 adjust R207 (YTF OFFSET) to peak the lower portion of the trace.
15. On A7 adjust R202 (YTF GAIN) to peak the middle and high portions of the trace.
16. Repeat steps 14 and 15 until maximum power output is obtained.
17. If the output power is within specification, peak Band 1 as explained in the following steps. Otherwise, go to Paragraph 5-21.
18. On the Model 8350A/B, press **[STOP] [7] [GHz]**, **[⊔⊓ MOD]**. On the Model 83592C, press ALC MODE **[EXT]**.
19. Adjust A7R51 (B1 OFS) and A7R76 (B1 GAIN) to maximize the minimum power points of the Band 1 displayed trace.

5-20. SLOW SPEED YTM/YTF TO YO TRACKING (Cont'd)

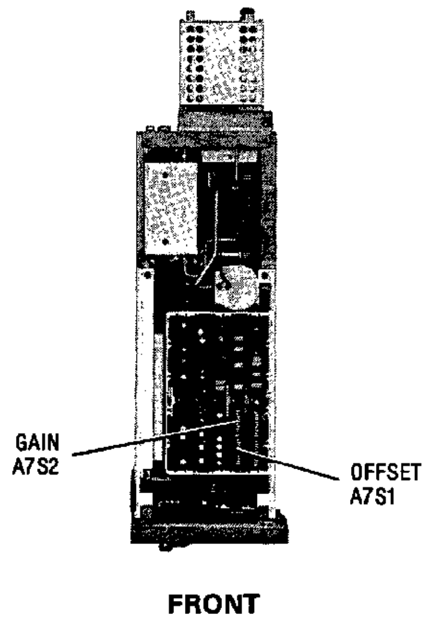


Figure 5-19. YTM/YTF to YO Tracking Calibration Switch Locations

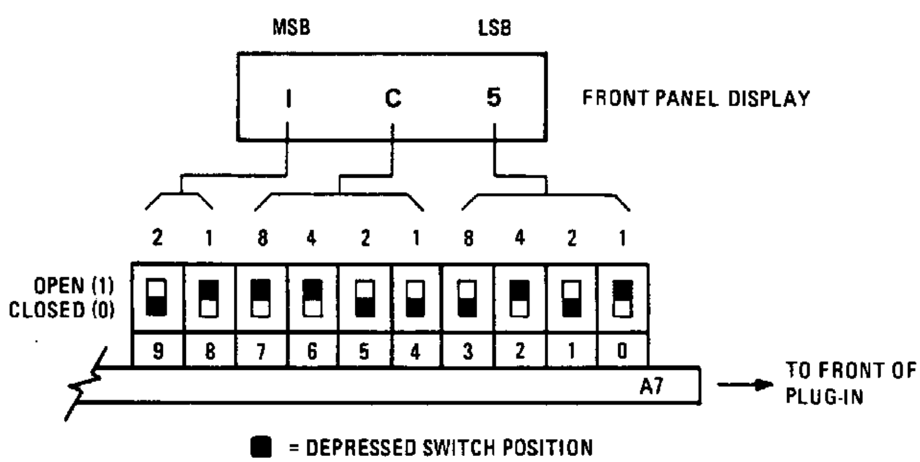


Figure 5-20. YTM/YTF to YO Tracking Calibration Switch Configuration

5-21. SRD BIAS

REFERENCE:

Performance Test: Paragraphs 4-17, 4-19
Service Sheet: A4 and A6

The High Power SRD Bias is set by peaking the HP 8756A displayed trace with A6R68 (2H) and A6R73 (2L) in Band 2, A6R69 (3H) and A6R74 (3L) in Band 3.

The Low and Mid Power SRD Bias is adjusted by inserting a voltage source through a 1 kOhm current-limiting resistor into the MOD 1 signal path in place of the A4 ALC board output. With the Model 83592C at maximum RF output power level, the voltage is increased (from a starting point of 0.6 Vdc to a maximum of 5.0 Vdc) to set the RF output to a point just above the noise level of the HP 8756A. At this point, A6R63 (3HL) is adjusted until minimum slope is obtained on an Oscilloscope display, and A6R12 (C) is adjusted to peak the power in Bands 2, and 3. The voltage from the Power Supply is decreased until the display on the HP 8756A reaches a point halfway between full RF out and the previous point. A6R78 (T) is adjusted to optimize the power at this intermediate point. The Power Supply is then removed.

EQUIPMENT:

Swept Amplitude Analyzer	HP 8756A
Detectors (2)	HP 11664B
6 dB Attenuator	HP 8493C-006
10 dB Attenuator	HP 8493C-010
20 dB Attenuator	HP 8493C-020
Directional Coupler	HP 0955-0125
Power Supply	HP 6214A
Low Pass Filter (6.8 GHz)	HP 11684A
Oscilloscope	HP 1740A
Extender Board	HP 08350-60031
Sweep Oscillator	HP 8350A/B
1 kOhm Resistor	HP 0757-0280

PROCEDURE:

NOTE

Turn the Model 8350A/B LINE power OFF when removing or installing PC boards.

NOTE

This procedure requires that A3S1 is set to the factory-set position (refer to Table 5-6).

High Power SRD Bias

1. Connect the equipment as shown in Figure 5-17 with the Model 83592C A6 Sweep Control board on an extender. With the LINE power OFF, remove the Model 83592C A4 ALC board. Connect the HP 8756A MODULATOR DRIVE output to the Model 83592C rear-panel PULSE IN connector.

2. Allow the equipment to warm up for one hour.

5-21. SRD BIAS (Cont'd)

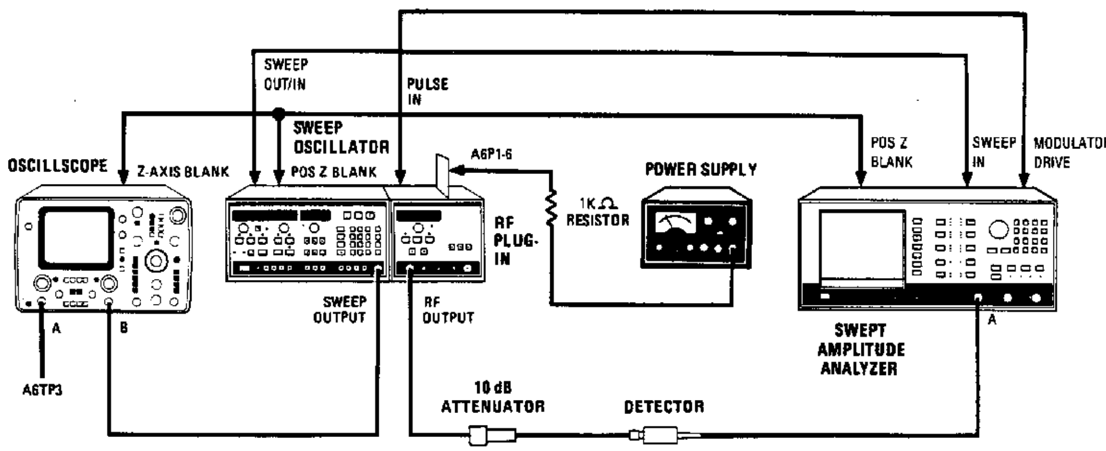


Figure 5-21. SRD Bias Adjustment Test Setup

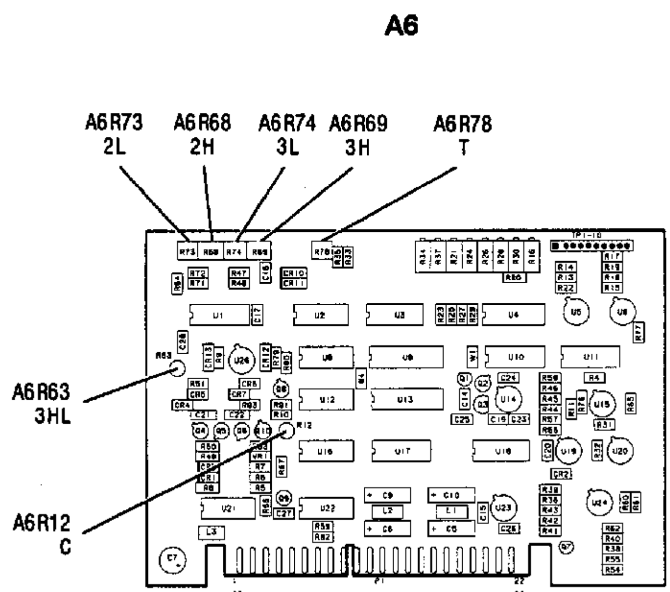


Figure 5-22. SRD Bias Adjustment Locations

5-21. SRD BIAS (Cont'd)

3. On the Model 8350A/B press **[INSTR PRESET] [START] [7] [GHz] [SWEEP TIME] [2] [0] [0] [ms]**.

4. Set the HP 8756A display resolution for 5 dB/DIV and center the display.

5. Adjust A6R73 (2L) and A6R68 (2H) until Band 2 is at maximum power across the band. A6R73 adjusts the low frequency end of Band 2 and A6R68 adjusts the high end. Refer to Figure 5-22 for adjustment locations.

6. Adjust A6R74 (3L) and A6R69 (3H) until Band 3 is at maximum power across the band. A6R74 adjusts the low frequency end of Band 3 and A6R69 adjusts the high end.

7. Repeat steps 5 and 6 in order to obtain optimum power across the display.

8. Check the YO to YTM/YTF tracking to ensure it has not changed (refer to paragraph 5-19). If retracking is necessary, adjust A6R68, R69, R70, R73, R74, and R75 as necessary to eliminate any squegging that may have occurred.

Low and Mid Power SRD Bias

9. Set up the equipment as shown in Figure 5-21, with a 1 kOhm resistor connected to A6P1-6 (reference to ground). Remove the Model 83592C A4 ALC board. Connect the HP 8756A Swept Amplitude Analyzer MODULATOR DRIVE output to the Model 83592C rear-panel PULSE IN connector.

10. Allow the equipment to warm up for one hour.

11. On the Model 8350A/B, press **[INSTR PRESET] [START] [7] [GHz] [SWEEP TIME] [2] [0] [0] [ms]**.

12. Set the HP 8756A display resolution for 10 dB/DIV and adjust the display to the top graticule. On the Oscilloscope, select A vs B, set Channel 1 to .5 V/DIV, set Channel 2 to 1 V/DIV, and DC-couple Channels 1 and 2.

13. On the HP 8756A, select the R DISPLAY and note the position of the trace. This is the noise floor of the HP 8756A. Return to the A DISPLAY.

14. Set the Power Supply voltage at .6 Vdc and increase the voltage until the lowest point of the HP 8756A display is 10 dB above the noise floor (do not exceed 5 Vdc).

15. Monitor A6TP3 with the Oscilloscope and adjust A6R63 until minimum slope (flat display) is obtained.

16. Monitor the HP 8756A display and adjust A6R12 until optimum power is obtained for Bands 2 and 3

17. Reduce the Power Supply voltage until the power displayed on the HP 8756A rises to a level approximately halfway between maximum power output (0 volts from the Power Supply) and the previous point.

18. Adjust A6R78 to optimize the power in Bands 2 and 3 at this intermediate power level.

5-22. SLOW SPEED YTM TO YO TRACKING

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A6 and A7

DESCRIPTION:

If adjustment of the front panel FILTER PEAK, correction factors for the YTM/YTF OFFSET and GAIN DACS, potentiometers for the YTF OFFSET and GAIN, and SRD BIAS does not move the output to within specification, it will be necessary to break the connection between the YTM and YTF, track the YTM to the YO, and then track the YTF to the YTM, this technique is also necessary if either the YTM or YTF is replaced. This section also includes YTM delay compensation which is necessary after the YTM is tracked to the YO.

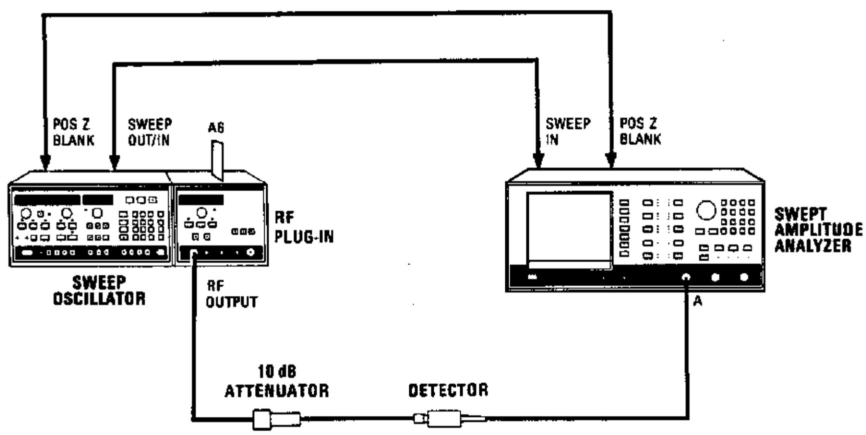


Figure 5-23. Slow Speed YTM to YO Tracking Test Setup

EQUIPMENT:

Swept Amplitude Analyzer	HP 8756A
Detector	HP 11664B
10 dB Attenuator	HP 8493C-010
Sweep Oscillator	HP 8350A/B
Extender Board	HP 08350-60031

5-22. SLOW SPEED YTM TO YO TRACKING (Cont'd)

PROCEDURE:

YTM To YO Tracking

NOTE

This procedure requires that A3S1 is set to the factory-set position. Refer to Table 5-6.

NOTE

During this adjustment, a localized drop in power may occur. This drop in power is due to the YTM being overdriven and is called squegging. If squegging occurs in Band 2, adjust A6R68 and R73 to eliminate the squegging and to maximize power across the band. If squegging occurs in Band 3, adjust A6R69 and R74.

1. Connect equipment as shown in Figure 5-23 with the Model 83592C A7 Sweep Control board on an extender. Allow the equipment to warm up for one hour.

2. On the Model 8350A/B, press **[INSTR PRESET]**, **[START]** **[2]** **[.]** **[3]** **[GHz]**, **[SWEEP TIME]** **[2]** **[0]** **[0]** **[ms]**, **[⊔⊓ MOD]**. On the Model 83592C, press ALC MODE **[EXT]**. Press **[SAVE]** **[1]**. The unleveled lamp should be lit.

3. Disconnect W34 from the YTM (refer to Figure 5-24). Connect the service extension cable 83525-20013 to the YTM. Connect the HP 11664B detector to the cable through an adapter.

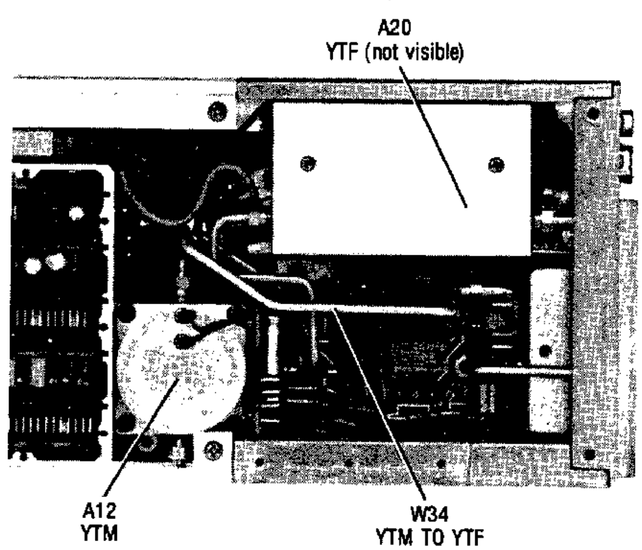


Figure 5-24. YTM/YTF Component Location Diagram

5-22. SLOW SPEED YTM TO YO TRACKING (Cont'd)

NOTE

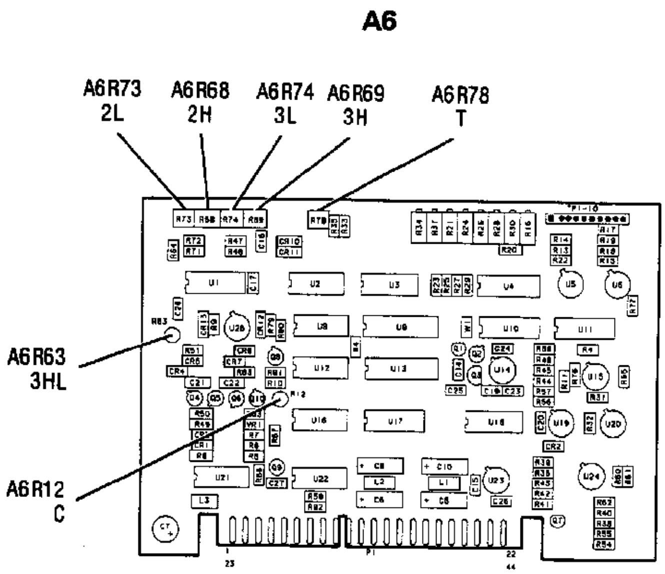
If the YTM is being replaced R200 must also be replaced. Place A7 on an extender board. Press [SHIFT] [9] [2] and set the plug-in display to 200 using the POWER control knob. Press [SHIFT] [9] [3] and set the plug-in display to 300 using the POWER CONTROL knob. Connect a 500 ohm potentiometer in series with a 40 ohm resistor, between TP3 and ground. While viewing the YTM output on the HP 8756A, adjust the 500 ohm potentiometer to obtain maximum power across the full band. Remove both resistors and measure the resistance of the series pair. Replace R200 by a ¾ watt resistor closest to this measured value. Refer to Figure 5-25 for adjustment locations.

4. Preset A6R63 (3HL) to mid range. Refer to Figure 5-25 for adjustment locations.
5. Preset A6R78 (T) and A6R12 (C) one quarter turn from the full counterclockwise position.
6. Select 5 dB/DIV display resolution on the HP 8756A and center the display.
7. On the Model 8350A/B, press **[SHIFT] [9] [2]** to enable the OFFSET DAC subroutine. Using the Model 83592C POWER control, peak the low portion of the trace. Record the "number" displayed on the Model 83592C POWER display.
8. On the Model 8350A/B, press **[SHIFT] [9] [3]** to enable the GAIN DAC subroutine. Using the Model 83592C POWER control, peak the middle and upper portions of the trace. Record the "number" displayed on the Model 83592C POWER display.
9. Repeat setps 4 to 7 until maximum power output is obtained. Enter the OFFSET DAC "number" into A7S1. Enter the GAIN DAC "number" into A7S2. Switch locations are shown in Figure 5-26. Switch configurations are shown in Figure 5-27.
10. On the Model 8350A/B, press **[INSTR PRESET]** so that the new calibration data will be entered from the current switch settings. The YTM is now tracking the YO.
11. The SRD bias should now be adjusted. Refer to section 5-21.

YTM Delay Compensation

12. YTM delay compensation will now be performed. The equipment should be connected as in Figure 5-28. Do not connect the BNC cable between the Model 8350A/B rear panel POS Z BLANK and the HP 8755 Aux C connector. Preset A7R45 (SEQ TC) fully counterclockwise. Refer to Figure 5-25 for adjustment locations.
13. On the Model 8350A/B and Model 83592C, press **[INSTR PRESET] [⊔⊓ MOD]** ALC MODE **[EXT] [SAVE] [1] [SWEEP TIME] [0] [.] [5] [s] [SAVE] [2]**.
14. Press **[RECALL] [1]**. Adjust A7R45 (SEQ TC) for the highest power with the best defined (brightest) bandswitch points between Band 2 and Band 3.
15. Connect a BNC cable from the Model 8350A/B rear panel POS Z BLANK connector to the HP 8755 rear panel AUX C connector.
16. Adjust A7R43 (SEQ LO) for maximum power at the beginning of Band 2.

5-22. SLOW SPEED YTM TO YO TRACKING (Cont'd)



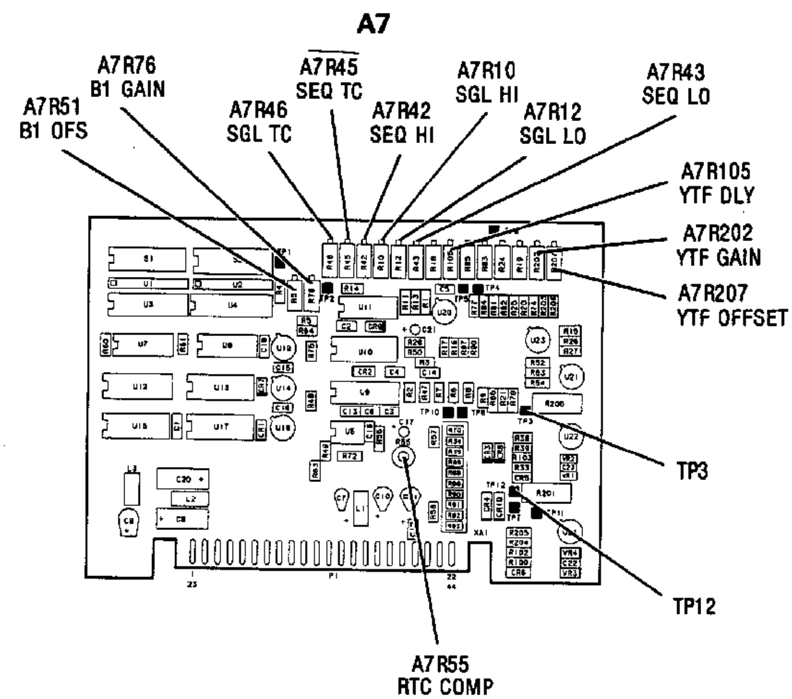


Figure 5-25. Slow Speed YTM to YO Tracking Adjustment and Test Point Locations

5-22. SLOW SPEED YTM TO YO TRACKING (Cont'd)

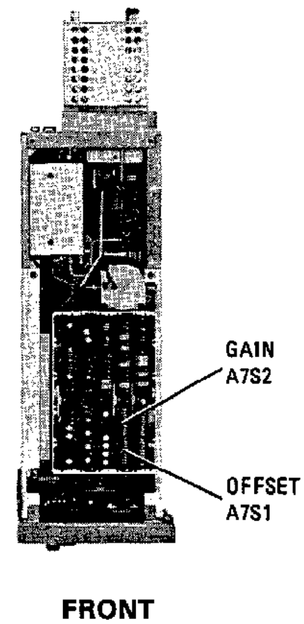


Figure 5-26. YTM to YO Tracking Calibration Switch Locations

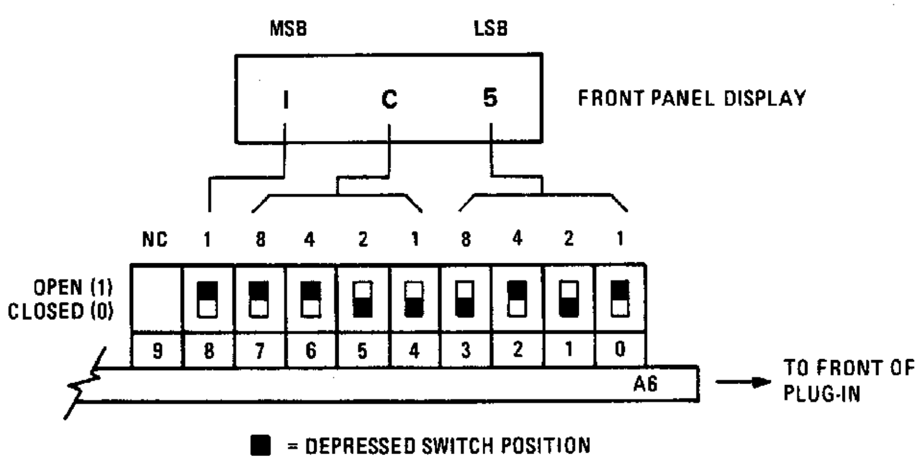


Figure 5-27. YTM to YO Tracking Calibration Switch Configuration

5-22. SLOW SPEED YTM TO YO TRACKING (Cont'd)

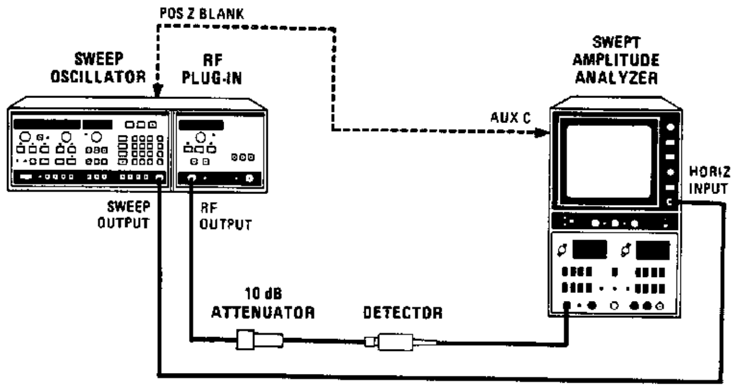


Figure 5-28. YTM Delay Compensation Adjustment Test Setup

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detector	HP 11664B
10 dB Attenuator	HP 8493C-010
Sweep Oscillator	HP 8350A/B

17. Adjust A7R42 (SEQ HI) for maximum power at the end of Band 3.

18. On the Model 8350A/B, iterate between **[RECALL] [1]** and **[RECALL][2]** while readjusting A7R42 (SEQ HI) and A7R43 (SEQ LO) as necessary to minimize power level changes.

19. On the Model 8350A/B, press **[START] [7] [.] [1] [GHz]**, **[SWEEP TIME] [3] [0] [ms]**.

20. Adjust A7R55 (RTC COMP) for maximum power in Band 2.

21. Vary the Model 8350A/B START FREQUENCY control from 10 MHz to 13 GHz to check for power variations. Readjust A7R42 (SEQ HI), A7R43 (SEQ LO), and A7R55 (RTC COMP) as necessary to minimize any droop in power (particularly near 20 GHz). The worst case droop should not exceed 1 dB as the START frequency is varied. If this cannot be met, repeat the Slow Speed YTM/YTF to YO Tracking Adjustments (paragraph 5-20).

22. On the Model 8350A/B and Model 83592C, press **[INSTR PRESET]**, **[⊔⊓ MOD]**, ALC MODE **[EXT]**.

23. Repeatedly press SWEEP TRIGGER **[SINGLE]** while watching the displayed power level. Readjust A7R42 (SEQ HI) and A7R43 (SEQ LO) as necessary to minimize the power level difference between a 30 ms SINGLE sweep and a 30 ms INT sweep.

5-22. SLOW SPEED YTM TO YO TRACKING (Cont'd)

24. On the Model 8350A/B and Model 83592C, press **[INSTR PRESET]**, **[⊔⊓ MOD]**, **[START] [6] [.] [9] [GHz]**, **[STOP] [1] [3] [.] [5] [GHz]**, ALC MODE **[EXT]**, **[SAVE] [3]**.

25. Preset A7R46 (SGL TC) fully counterclockwise.

26. While continuously changing the SWEEP TIME control for a sweep speed from 30 ms to 100 ms, adjust A7R12 (SGL LO) to maximize power at the low end of Band 2. In the same manner, adjust A7R10 (SGL HI) to maximize the power at the high end of Band 2. Then adjust A7R46 (SGL TC) to maximize the power at the extreme start of the band.

27. On the Model 8350A/B, press **[START] [1] [3] [.] [4] [GHz]**, **[STOP] [2] [0] [GHz]**, **[SAVE] [4]**. Vary the sweep speed as in Step 26 and note any drop in power. If the change is greater than 1 dB, make slight adjustments to A7R10 (SGL HI) and A7R12 (SGL LO). This completes the YTM Delay Compensation adjustment.

28. Remove Service Cable 83525-20013 from the YTM and reconnect W34 to the YTM.

YTF To YTM Tracking

29. Connect equipment as shown in Figure 5-23. On the Model 83592C, set the FILTER PEAK control to mid-range. On the Model 8350A/B, press **[RECALL] [1]**.

NOTE

If the YTF is being replaced, R201 must also be replaced. Place A7 in an extender board. Center potentiometers R202 and R207. Remove R201 and connect a 500 ohm potentiometer with a 40 ohm resistor, between TP12 and ground. While viewing the YTF output on the HP 8756A, adjust the 500 ohm potentiometer to obtain maximum power across the full band. Remove both resistors and measure the resistance of the series pair. Replace R201 by a ¾ watt resistor closest to this measured value. Refer to Figure 5-25 for adjustment locations.

30. On A7 adjust R207 (YTF OFFSET) to peak the low portion of the trace.

31. On A7 adjust R202 (YTF GAIN) to peak the middle and upper portions of the trace.

32. Repeat steps 30 and 31 until maximum power output is obtained. The YTF is now tracking the YTM, and both of these should be tracking the YO.

33. On the Model 8350A/B, press **[STOP] [7] [GHz]**, **[⊔⊓ MOD]**. On the Model 83592C, press ALC MODE **[EXT]**.

34. Adjust A7R51 (B1 OFS) and A7R76 (B1 GAIN) to maximize the minimum power points of the Band 1 displayed trace.

YTF Delay Compensation

35. Reconnect equipment as shown in Figure 5-28. Connect the BNC cable from the Model 8350A/B POS Z BLANK to the HP 8755 AUX C Connector.

5-22. SLOW SPEED YTM TO YO TRACKING (Cont'd)

36. On the Model 8350A/B press **[RECALL] [1]**. While continuously changing the SWEEP TIME control from 30 to 100 ms, adjust A7R105 to maximum power over the swept range. If power variation over the swept range is greater than 1 dB, continue on.

37. On the Model 8350A/B press **[RECALL] [3]**. While continuously varying the SWEEP TIME control for a sweep speed from 30 ms to 100 ms, adjust A7R12 (SGL LO) to maximize power at the low end of Band 2. In the same manner, adjust A7R10 (SGL HI) to maximize the power at the high end of Band 2. Then adjust A7R46 (SGL TC) to maximize the power at the extreme start of the band.

38. On the Model 8350A/B, press **[RECALL] [4]**. Vary the sweep speed as in step 37 and note any drop in power. If the change is greater than 1 dB, make slight adjustments to A7R10 (SGL HI) and A7R12 (SGL LO).

39. On the Model 8350A/B press **[RECALL] [1]**. While continuously changing the SWEEP TIME control from 30 to 100 ms, adjust A7R105 to maximize power over the swept range. If the power variation is greater than 1 dB, repeat steps 37, 38 and 39.

5-23. YTM/YTF DELAY COMPENSATION

Performance Test: Paragraph 4-14
Service Sheet: A7

DESCRIPTION:

The YTM/YTF Delay Compensation circuit is adjusted to optimize YTM/YTF to YO tracking over varying sweep rates. Adjustments are provided for sequential sweeps (multiband) and single band sweeps.

NOTE

If Paragraph 5-22 was performed, this paragraph is unnecessary.

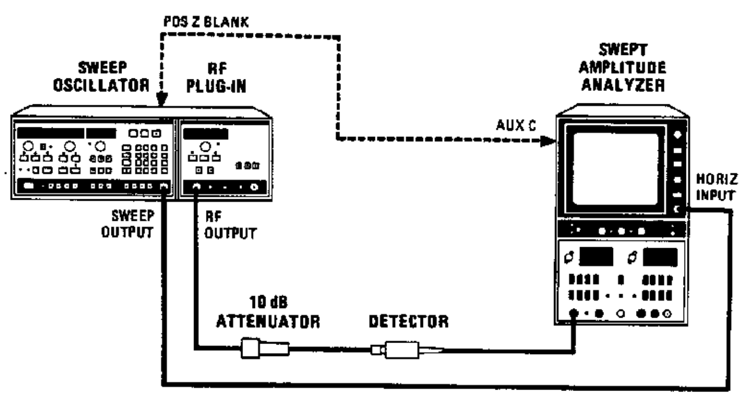


Figure 5-29. YTM Delay Compensation Adjustment Test Setup

EQUIPMENT:

Swept Amplitude Analyzer .... HP 8755
Display Main Frame .... HP 182T
Detector .... HP 11664B
10 dB Attenuator .... HP 8493C-010
Sweep Oscillator .... HP 8350A/B

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position. Refer to Table 5-6.

1. Connect the equipment as shown in Figure 5-29. Do not connect the BNC cable between the Model 8350A/B rear-panel POS Z BLANK and the 182T AUX C connector yet. Preset A7R45 (SEQ TC) fully counterclockwise. Refer to Figure 5-30 for adjustment locations. Allow the equipment to warm up for one hour.

5-23. YTM/YTF DELAY COMPENSATION (Cont'd)

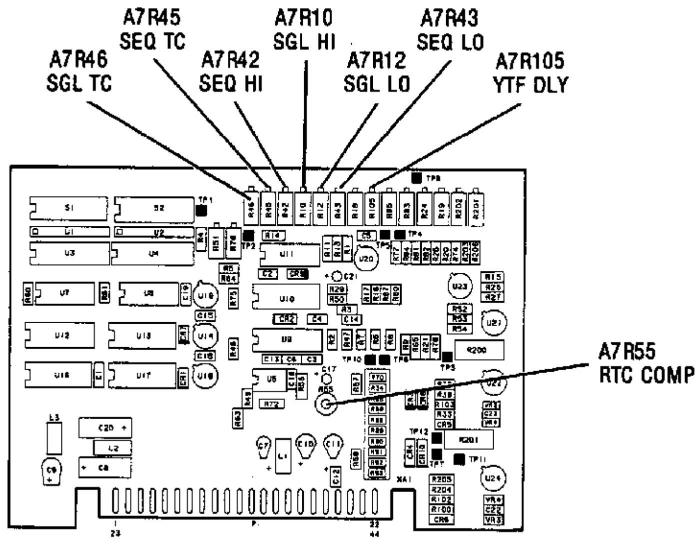


Figure 5-30. YTM/YTF Delay Compensation Adjustment Locations

2. On the Model 8350A/B and Model 83592C, press **[INSTR PRESET] [⊔⊓ MOD] [EXT ALC MODE] [SAVE] [1] [SWEEP TIME] [0] [.] [5] [s] [SAVE] [2]**.
3. Press **[RECALL] [1]**. Adjust A7R45 (SEQ TC) for the highest power with the best defined (brightest) bandswitch points between Band 2 and Band 3.
4. Connect a BNC cable from the Model 8350A/B rear-panel POS Z BLANK connector to the 182T Display Mainframe rear-panel AUX C connector.
5. Adjust A7R43 (SEQ LO) for maximum power at the beginning of Band 2.
6. Adjust A7R42 (SEQ HI) for maximum power at the end of Band 3.
7. On the Model 8350A/B, iterate between **[RECALL] [1]** and **[RECALL] [2]** while readjusting A7R42 (SEQ HI) and A7R43 (SEQ LO) as necessary to minimize power level changes.
8. On the Model 8350A/B, press **[START] [7] [.] [1] [GHz] [SWEEP TIME] [3] [0] [ms]**.
9. Adjust A7R55 (RTC COMP) for maximum power in Band 2.
10. Vary the Model 8350A/B START FREQUENCY control from 10 MHz to 13 GHz to check for power variations. Readjust A7R42 (SEQ HI), A7R43 (SEQ LO), and A7R55 (RTC COMP) as necessary to minimize any droop in power (particularly near 20.0 GHz). The worst case droop should not exceed 0.1 dB as the START frequency is varied. If this cannot be met, repeat the Slow Speed YTM/YTF to YO Tracking Adjustments (paragraph 5-20).

5-23. YTM/YTF DELAY COMPENSATION (Cont'd)

11. On the Model 8350A/B and Model 83592C, press **[INSTR PRESET]** **[⊔⊓ MOD]** ALC MODE **[EXT]**.

12. Repeatedly press **[SINGLE]** SWEEP TRIGGER while watching the displayed power level. Readjust A7R42 (SEQ HI) and A7R43 (SEQ LO) as necessary to minimize the power level difference between a 30 ms **[SINGLE]** sweep and a 30 ms **[INT]** sweep.

13. On the Model 8350A/B and Model 83592C, press **[INSTR PRESET]** **[⊔⊓ MOD]** **[START]** **[6]** **[.]** **[9]** **[GHz]** **[STOP]** **[1]** **[3]** **[.]** **[5]** **[GHz]** ALC MODE **[EXT]**.

14. Preset A7R46 (SGL TC) fully counterclockwise.

15. While continuously changing the SWEEP **[TIME]** control for a sweep speed from 30 ms to 100 ms, adjust A7R12 (SGL LO) to maximize power at the low end of Band 2. In the same manner, adjust A7R10 (SGL HI) to maximize the power at the high end of Band 2. Then adjust A7R46 (SGL TC) to maximize the power at the extreme start of the band.

16. On the Model 8350A/B, press **[START]** **[1]** **[3]** **[.]** **[4]** **[GHz]** **[STOP]** **[2]** **[0]** **[GHz]**. Vary the sweep speed as in step 15 and note any drop in power. If the change is greater than 0.5 dB, make slight adjustments to A7R10 (SGL HI) and A7R12 (SGL LO).

17. On the 8350A/B press **[RECALL]** **[1]**, **[START]** **[2]** **[.]** **[3]** **[GHz]**. While continuously changing the SWEEP TIME control from 30 to 100 ms, adjust A7R105 to maximize power over the swept range. If the power variation is greater than 1 dB repeat steps 15, 16, and 17.

5-24. BAND OVERLAP

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A6

DESCRIPTION:

The Model 83592C is set to sweep across each bandswitch point. A Frequency Meter is set to the bandswitch frequency and the gain of the Variable Gain Amplifier on the A6 Sweep Control assembly is adjusted for a smooth frequency transition between bands.

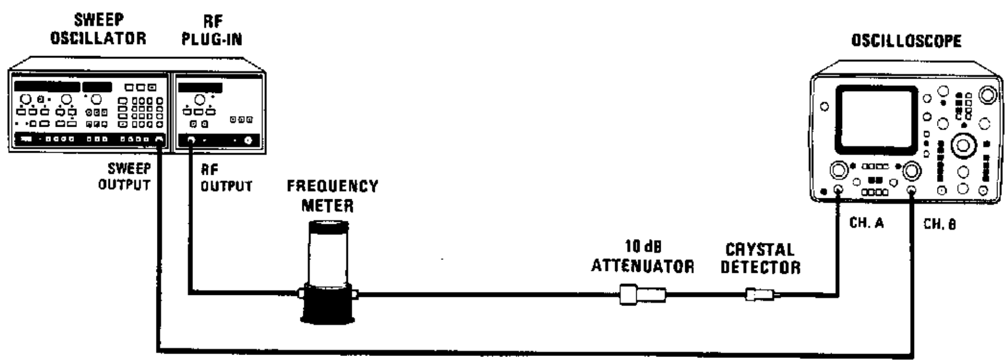


Figure 5-31. Band Overlap Adjustment Test Setup

EQUIPMENT:

Oscilloscope	HP 1740A
Frequency Meter (0.96–4.2 GHz)	HP 536A
Frequency Meter (3.7–12.4 GHz)	HP 537A
Frequency Meter (12.4–18 GHz)	HP P532A
Frequency Meter (18–20.0 GHz)	HP K532A
10 dB Attenuator	HP 8491B Option 010
Crystal Detector	HP 8470B
Sweep Oscillator	HP 8350A/B

PROCEDURE:

NOTE

This procedure requires that A3S1 be set to the factory-set position. Refer to Table 5-6.

1. Connect the equipment as shown in Figure 5-31 with the HP 536A Frequency Meter in the test setup. Allow the equipment to warm up for one hour.
2. On the Model 8350A/B, press **[INSTR PRESET] [CF] [2] [.] [3] [5] [GHz] [ΔF] [1] [5] [0] [MHz]**.
3. Set the Oscilloscope for A vs B display mode to display amplitude versus frequency. Center the display on the screen.
4. Set the HP 536A Frequency Meter to 2.35 GHz.
5. Center the bandswitch point on the display using the Model 8350A/B FREQUENCY control.

5-24. BAND OVERLAP (Cont'd)

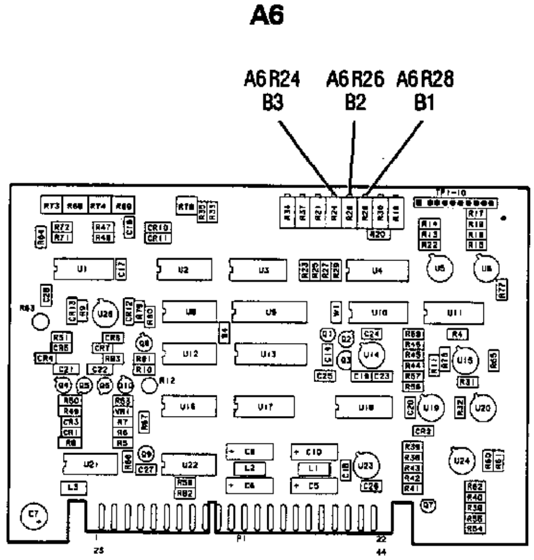


Figure 5-32. Band Overlap Adjustment Locations

6. Adjust the Frequency Meter to put the left half of the pip on the left side of the bandswitch point.
7. Adjust A6R28 (B1) to bring the right side pip over to the bandswitch point so that the right half of this pip mates with the left half of the other as shown in Figure 5-33. Refer to Figure 5-32 for the adjustment location. The pip should be undisturbed as it moves through the bandswitch point.
8. Replace the HP 536A Frequency Meter with the HP 537A and set it to 6.95 GHz.
9. On the Model 8350A/B, press **[CF] [6] [.] [9] [5] [GHz]**.
10. Repeat steps 5 through 7 but, this time, adjust A6R26 (B2) in step 7.
11. Replace the HP537A Frequency Meter with the HP P532A and set it to 13.45 GHz.
12. On the Model 8350A/B, press **[CF] [1] [3] [.] [4] [5] [GHz]**.
13. Repeat steps 5 through 7 but, this time, adjust A6R24 (B3) in step 7.

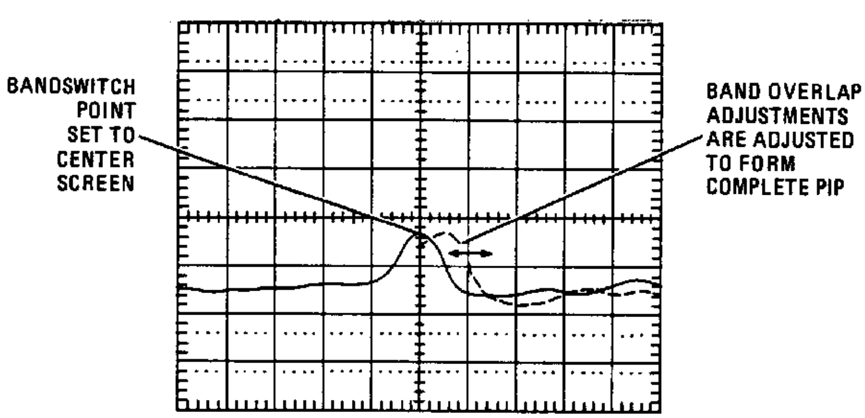


Figure 5-33. Band Overlap Adjustment Waveform

5-25. FREQUENCY REFERENCE 1V/GHz OUTPUT

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A2

DESCRIPTION:

The frequency reference rear-panel output is adjusted for 1 volt per GHz. Example: 1 GHz = 1 volt; 2 GHz = 2 volts, etc.

EQUIPMENT:

Digital Voltmeter .... HP 3456A
Sweep Oscillator.. HP 8350A/B

PROCEDURE:

NOTE

Frequency Accuracy and YTM/YTF Tracking must be adjusted correctly before the 1V/GHz frequency reference output is adjusted.

1. Connect the equipment with the DVM connected to the rear-panel 1V/GHz frequency reference connector, J4. Allow the equipment to warm up for one hour.

Bands 1 through 3

2. Adjust A2R4 (OFFSET) to the center of its mechanical range. Refer to Figure 5-34 for the adjustment location.
3. On the Model 8350A/B, press **[CW] [8] [GHz]**.
4. Adjust A2R4 (OFFSET) for a DVM reading of 8.000 ± 0.005 Vdc.
5. On the Model 8350A/B, press **[CW] [1] [5] [GHz]**.
6. Adjust A2R1 (GAIN) for a DVM reading of 15.000 ± 0.005 Vdc.
7. Repeat steps 2 through 6 until there is no change.

Band 0

8. Adjust A2R6 (BAND 0 OFFSET) to the center of its mechanical range.
9. On the Model 8350A/B, press **[CW] [1] [0] [MHz]**.
10. Adjust A2R6 (BAND 0 OFFSET) for a DVM reading of 0.010 ± 0.005 Vdc.
11. On the Model 8350A/B, press **[CW] [2] [GHz]**.
12. Adjust A2R23 (BAND 0 GAIN) for a DVM reading of 2.000 ± 0.005 Vdc.
13. Repeat steps 8 through 12 until there is no change.

5-25. FREQUENCY REFERENCE 1V/GHz OUTPUT (Cont'd)

A2

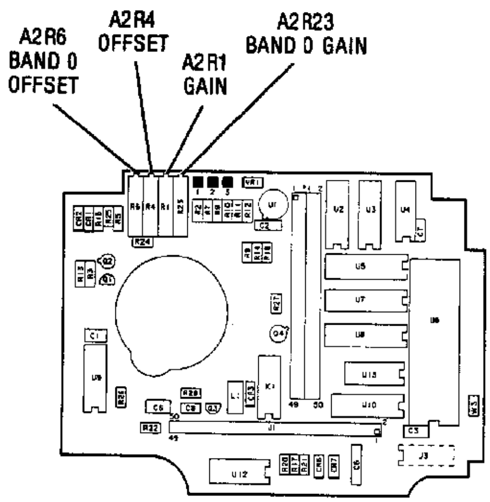


Figure 5-34. Frequency Reference Adjustment Locations

5-26. ALC ADJUSTMENT

NOTE

Complete adjustment of the ALC leveling loop requires several procedures to be performed in the order prescribed from paragraphs 5-26 through 5-29. Deviation from this routine may cause improper leveling and/or power variation problems.

REFERENCE:

Performance Test: Paragraph 4-14
Service Sheet: A4

DESCRIPTION:

Adjustments compensate for DC offsets in the detected RF path and the Main ALC Amplifier. Power is roughly calibrated and low band flatness is optimized.

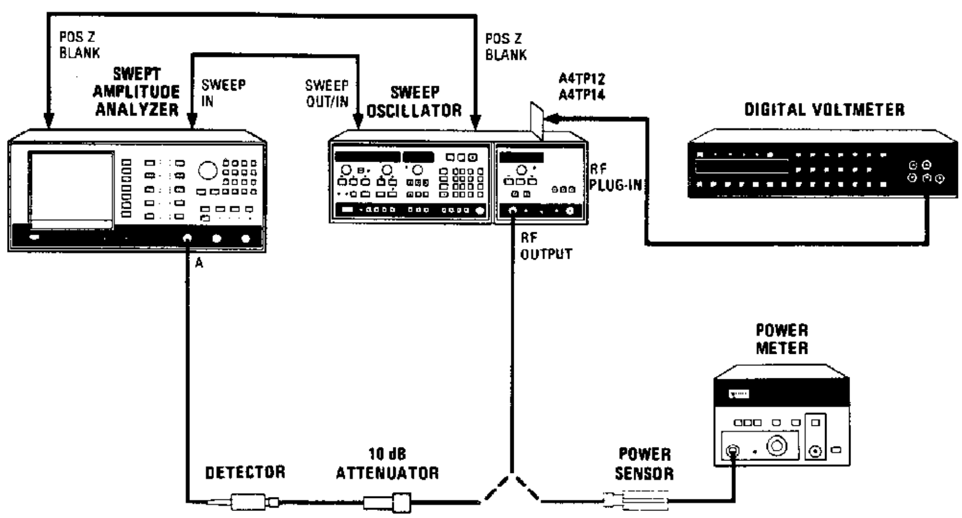


Figure 5-35. ALC Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3456A
Power Meter	HP 436A
Thermistor Mount	HP 8485A
Swept Amplitude Analyzer	HP 8756A
Detector	HP 11664B
Extender Board	HP 08350-60031
10 dB Attenuator	HP 8493C-010
Sweep Oscillator	HP 8350A/B

5-26. ALC ADJUSTMENT (Cont'd)

PROCEDURE:

NOTE

Turn AC power OFF when removing or installing PC boards.

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6), and that the Model 8350A/B Sweep Oscillator 27.8 kHz squarewave modulation is selected.

1. Remove the A5 FM Driver board. Put the A4 assembly on an extender board. Sweep the full range of the Plug-In at any leveled power. Preset the following adjustments as indicated:

   A4R47 (OFS 1) .... Midrange
   A4R56 (OFS 2) .... Midrange
   A4R59 (OFS 3) .... Midrange
   A4R67 (OFS 4) .... Midrange
   A4R11 (GAIN) .... Midrange
   A4R2 (0 HI) .... Fully CW
   A4R3 (1 HI) .... Fully CW
   A4R4 (BIAS) .... Midrange
   A4R1 (SLP) .... Midrange

2. Float the ground on the Digital Voltmeter and measure the voltage between A4TP12 and A4TP14. Refer to Figure 5-36 for adjustment locations. Adjust A4R47 (OFS 1) for 0.000 ± 0.001 Vdc.

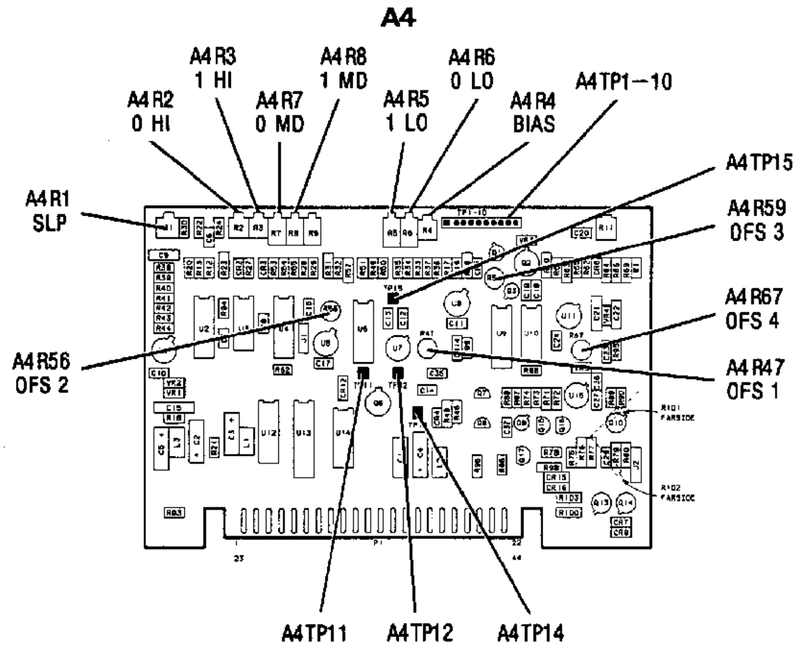


Figure 5-36. ALC Adjustment Locations

5-26. ALC ADJUSTMENT (Cont'd)

3. Attach a jumper from A4TP11 to ground. Connect the DVM to A4TP5 (reference to ground) and adjust A4R56 (OFS 2) for a DVM reading of 0.000 ± 0.001 Vdc. Remove the jumper.

4. Connect the DVM between A4TP12 and A4TP15 (floating ground). Adjust A4R59 (OFS 3) for a DVM reading of 0.000 ± 0.001 Vdc.

5. On the Model 8350A/B, press **[CW]** and ensure that the power is leveled (Model 83592C UNLEVELED light off). Connect the DVM to A4TP7 and adjust A4R67 (OFS 4) for a DVM reading of 0.000 ± 0.001 Vdc.

6. On the Model 8350A/B, press **[CW] [5] [0] [MHz]**. Turn OFF the Model 83592C **[RF]** power. Connect the DVM to A4TP10 (ground to P1 pin 42) and adjust A4R4 (BIAS) for a DVM reading of 0.000 ± 0.001 Vdc. Turn ON the Model 83592C **[RF]** power.

7. Set the Model 8350A/B LINE power to OFF. Remove the A4 assembly from the extender board and reinsert the A4 assembly directly into the instrument. Set the Model 8350A/B LINE power to ON and press **[CW] [5] [0] [MHz]**. Connect the Power Meter to the Model 83592C RF OUTPUT.

8. Set the Model 83592C for a POWER reading of −3 dBm. Adjust A4R6 (0 LO) for an RF output power at the Model 83592C connector of −3 ± 0.1 dBm.

9. Set the Model 83592C for a POWER reading of +7 dBm. Adjust A4R7 (0 MD) for an RF output power at the Model 83592C connector of +7 ± 0.1 dBm.

10. Iterate between steps 8 and 9 until both low and midpower ranges are calibrated and no readjustment is necessary.

11. Set the Model 83592C for a POWER reading of +10 dBm. Adjust A4R2 (0 HI) for an RF output power at the Model 83592C connector of +10 ± 0.1 dBm.

12. Disconnect the Power Meter and monitor the RF output with the HP 8756A Swept Amplitude Analyzer. Press Model 8350A/B **[INSTR PRESET]** to sweep the full range of the Plug-In. Press Model 8350A/B [⊔⊓MOD] for compatibility with the HP 8756A. Set the Model 83592C for a POWER reading of −3 dBm. Press **[RF BLANK] [SAVE] [1]**.

13. Adjust A4R1 (SLP) for best overall flatness from 10 MHz to 2.4 GHz as observed on the HP 8756A.

14. Adjust A4R5 (1 LO) for best continuity at the bandswitch point at 2.2 GHz.

15. Set the Model 83592C for a POWER reading of −5 dBm. On the Model 8350A/B, press **[SAVE] [2]**. Adjust A4R8 (1 MD) for best continuity at the bandswitch point.

16. Set the Model 83592C for a POWER reading of 0 dBm. On the Model 8350A/B, press **[SAVE] [3]**. Adjust A4R3 (1 HI) for best trace continuity at the bandswitch point.

17. Iterate between steps 14, 15, and 16 using **[RECALL] [1]**, **[2]**, and **[3]** until trace continuity at all three power settings is achieved.

18. Reinstall the A5 FM board assembly.

5-27. ALC INTERNAL LEVELED FLATNESS

NOTE

Complete adjustment of the ALC leveling loop requires several procedures to be performed in the order prescribed from paragraphs 5-26 through 5-29. Deviation from this routine may cause improper leveling and/or power variation problems.

REFERENCE:

Performance Test: Paragraph 4-14
Service Sheet: A5

DESCRIPTION:

Four parallel circuits on the A5 assembly provide adjustments for ALC flatness. BP1 through BP4 and SL1 through SL4 determine the slope of the flatness compensation signal input to the A4 ALC assembly. Breakpoint potentiometers (BP1—4) determine the frequency at which the corresponding slope potentiometers (SL1—4) begin to affect power output leveling.

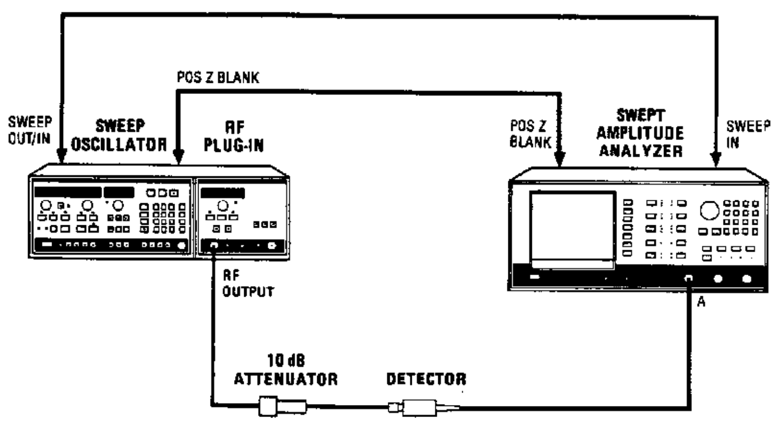


Figure 5-37. Internal Leveling Adjustment Test Setup

EQUIPMENT:

Swept Amplitude Analyzer .... HP 8756A
Detector .... HP 11664B
10 dB Attenuator.. HP 8493C-010
Sweep Oscillator.. HP 8350A/B

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position (Table 5-6), and that the Model 8350A/B Sweep Oscillator 27.8 kHz squarewave modulation is selected.

5-27. ALC INTERNAL LEVELED FLATNESS (Cont'd)

1. Connect the equipment as shown in Figure 5-37 with the HP 8756A Swept Amplitude Analyzer monitoring the RF OUTPUT through the 10 dB Attenuator. On the Model 8350A/B, press **[INSTR PRESET]** [⊔⊓ **MOD]**. Allow the equipment to warm up for one hour.

NOTE

The following step negates any power variation compensation by effectively removing the ALC power variation adjustments from the leveling circuitry. This step may be omitted if the RF power variation approaches the specified limits.

2. Adjust all breakpoint potentiometers fully clockwise to effectively remove the circuit from the ALC leveling loop. These potentiometers are A5R34 (BP1), A5R36 (BP2), A5R38 (BP3), and A5R40 (BP4). Refer to Figure 5-38 for adjustment locations.

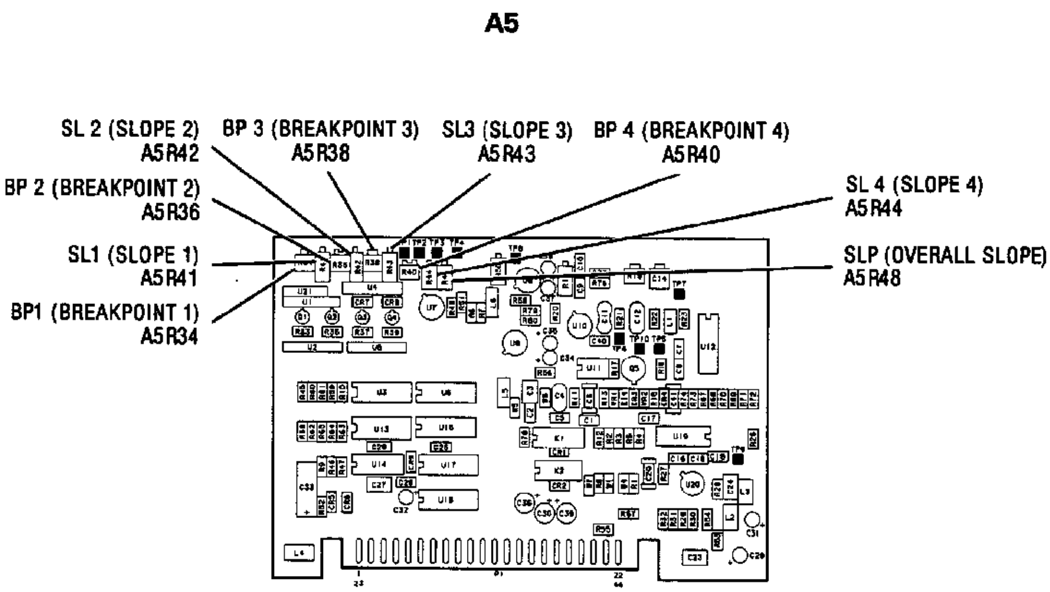


Figure 5-38. Internal Leveling Adjustment Locations

3. Adjust A5R48 (SLP) for best overall flatness.

4. Set breakpoint adjustments A5R34, A5R36, A5R38, and A5R40 (BP1–4) and slope adjustments A5R41 through A5R44 (SL1–4) for best overall flatness. (BP1 and SL1 are interdependent adjustments, as are BP2 and SL2, etc.) The breakpoint potentiometers determine the frequency points at which the slope adjustments will take effect. These are observed as pivot points on the CRT trace.

5-28. POWER METER LEVELING CALIBRATION

NOTE

Complete adjustment of the ALC leveling loop for Power Meter leveling requires several procedures to be performed in the order prescribed from paragraphs 5-26 through 5-29. Deviation from this routine may cause improper leveling and/or power variation problems.

REFERENCE:

Performance Test: Paragraph 4-14
Service Sheet: A4

DESCRIPTION:

Power Meter leveling gain potentiometer A4R9 (PM) calibrates the ALC loop gain to full-scale deflection of the leveling Meter.

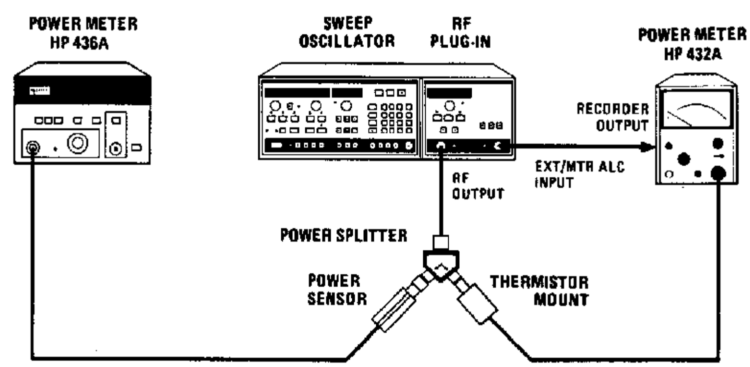


Figure 5-39. Power Meter Leveling Adjustment Setup

EQUIPMENT:

Power Meters	HP 432A and HP 436A
Thermistor Mount	HP 8478A
Power Sensor	HP 8485A
Power Splitter	HP 11667A
Sweep Oscillator	HP 8350A/B

PROCEDURE:

1. Connect the equipment as shown in Figure 5-39. On the Model 8350A/B, press **[INSTR PRESET] [CW]** and select a frequency at midband. Set the RF power level to −2 dBm, as indicated on the Model 83592C POWER display. Allow the equipment to warm up for one hour.

5-28. POWER METER LEVELING CALIBRATION (Cont'd)

A4

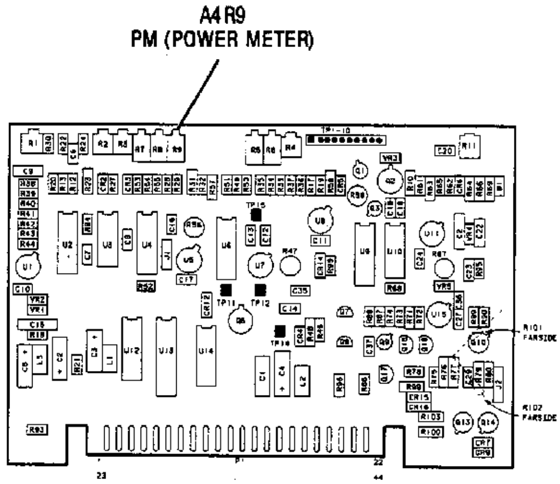


Figure 5-40. Power Meter Leveling Adjustment Location

2. Select the 0 dB range on the HP 432A Power Meter. Both meters should read approximately −8 dBm. Note the insertion loss through the Power Splitter (typically 6 dB).

3. On the Model 83592C, press **[MTR]** and adjust the **[EXT CAL]** control to reset the HP 432A to the power level measured in step 2.

4. Increase the Model 83592C power level until the HP 432A Power Meter reaches full scale deflection (Model 83592C RF output equals approximately +4 dBm). Adjust A4R9 (PM) until the HP 436A Power Meter indication is equal to the Model 83592C POWER display minus the Power Splitter insertion loss noted in step 2 (approximately 6 dB). Refer to Figure 5-40 for the adjustment location.

5. Alternately set the Model 83592C POWER to −2 dBm (and adjust the Model 83592C **[EXT CAL]** control) then set the 83595A POWER to +6 dBm (and adjust A4R9(PM) control) to obtain the best compromise where further adjustment of each is unnecessary.

5-29. ALC GAIN ADJUSTMENT

NOTE

Complete adjustment of the ALC leveling loop requires several procedures to be performed in the order prescribed from paragraphs 5-26 to 5-29. Deviation from this routine may cause improper leveling and/or power variation problems.

REFERENCE:

Performance Tests: Paragraphs 4-14, 4-19, and 4-21
Service Sheet: A4

DESCRIPTION:

A4R11 (GAIN) in the input leg of A4U11 adjusts the gain of the main ALC Amplifier on the A4 assembly. A4R11 (GAIN) is adjusted for maximum possible gain without oscillations.

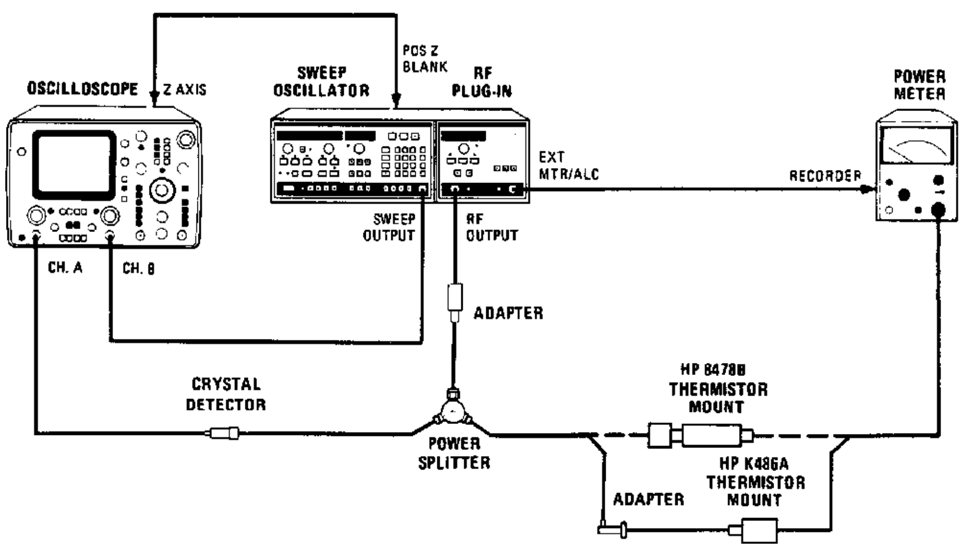


Figure 5-41. ALC Gain Adjustment Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A/B
Oscilloscope	HP 1740A
Crystal Detector	HP 8473C
Power Meter	HP 432A
Thermistor Mount (0.01 to 18 GHz)	HP 8478B
Thermistor Mount (18 to 20.0 GHz)	HP K486A
Waveguide to APC 3.5(f) Adapter (18 to 20.0 GHz)	HP K281C
Power Splitter	Weinschel Model 1579A

5-29. ALC GAIN ADJUSTMENT (Cont'd)

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position.

1. Connect the equipment as shown in Figure 5-41 with the HP 8478B Thermistor Mount connected to the Power Splitter. Preset A4R11 (GAIN) fully counterclockwise. Refer to Figure 5-42 for the adjustment location. Allow the equipment to warm up for one hour.

A4

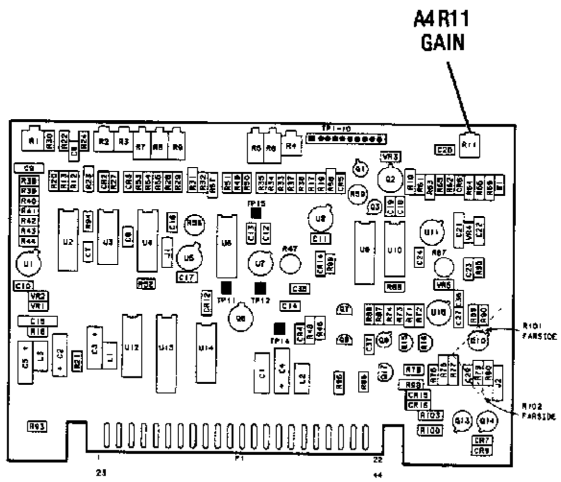


Figure 5-42. ALC Gain Adjustment Location

2. On the Model 8350A/B, press **[INSTR PRESET] [STOP] [1] [8] [.] [0] [GHz] [SWEEP TIME] [1] [0] [0] [s]**.

3. On the Oscilloscope, select A vs B mode to display a plot of amplitude versus frequency. Set the Channel A vertical sensitivity for 0.01 V/DIV and AC coupling. Set the Channel B vertical sensitivity for 1 V/DIV and DC coupling. Adjust the horizontal position and vertical position controls for a stable display at mid screen.

4. On the Model 8350A/B, press **[CW]**.

5. Set the Power Meter RANGE switch to +5 dBm. Note the Power Meter needle position.

6. On the Model 83592C, press **[MTR]** ALC MODE.

5-29. ALC GAIN ADJUSTMENT (Cont'd)

7. If necessary, adjust the output power with the Model 83592C front panel EXT CAL control to position the Power Meter needle to the same reading as noted in step 5. Then decrease the Power Meter RANGE switch by three 5 dB steps to −10 dB. This attenuates the output power by 15 dB which causes the Model 83592C output power to be near the low end of its power range (approximately −5 dBm).

8. On the Model 8350A/B, press **[START]**.

9. Observe the trace dot as it sweeps across the CRT. Adjust A4R11 (GAIN) clockwise, increasing the gain of the ALC loop, until the trace dot begins to oscillate. Then reduce the gain slightly to eliminate the oscillations so that a sharp trace dot is obtained.

10. Set the Model 83592C to maximum leveled RF output power by returning the Power Meter RANGE switch to the +5 dB position. Observe the trace through the entire sweep to ensure that no oscillations occur. If oscillations do occur, reduce the gain slightly by turning A4R11 (GAIN) counterclockwise.

11. On the Model 8350A/B, press **[INSTR PRESET] [STOP] [1] [8] [.] [0] [GHz]** to reset the Model 83592C to internal leveling.

12. Adjust the Oscilloscope Channel A vertical sensitivity to place the internally leveled sweep trace at center screen. If oscillations are present, further reduce the ALC loop gain by adjusting A4R11 (GAIN) counterclockwise.

13. Reduce the Model 83592C RF output power by rotating the Model 83592C POWER control until the 83595A POWER display reads −5 dBm. Observe a full sweep. If oscillations occur, reduce the gain further by adjusting A4R11 (GAIN) counterclockwise.

14. Reconnect the equipment with the HP K486A Thermistor Mount and the Adapter connected to the Power Splitter as shown in Figure 5-41.

15. On the Model 8350A/B, press **[INSTR PRESET] [START] [1] [7] [.] [5] [GHz] [STOP] [2] [0] [GHz] [SWEEP TIME] [1] [0] [0] [s]**.

16. On the Oscilloscope, adjust the horizontal position and vertical position controls for a stable display at mid screen.

17. On the Model 8350A/B, press **[CW]**.

18. Set the Power Meter RANGE switch to +5 dBm. Note the Power Meter needle position.

19. On the Model 83592C, press **[MTR]** ALC MODE.

20. If necessary, adjust the output power with the Model 83592C front panel EXT CAL control to position the Power Meter needle to the same reading as noted in step 18. Then decrease the Power Meter RANGE switch by three 5 dB steps to −10 dB. This attenuates the output power by 15 dB which causes the Model 83592C output power to be near the low end of its power range (approximately −5 dBm).

21. On the Model 8350A/B, press **[START]**.

22. Observe the trace dot as it sweeps across the CRT. If oscillations occur, reduce the gain by adjusting A4R11 (GAIN) counterclockwise.

5-29. ALC GAIN ADJUSTMENT (Cont'd)

23. Set the Model 83592C to maximum leveled RF output power by returning the Power Meter RANGE switch to the +5 dB position. Observe the trace through the entire sweep to ensure that no oscillations occur with the Model 83592C at maximum power. If oscillations do occur, further reduce the gain slightly by turning A4R11 (GAIN) counterclockwise.

24. On the Model 8350A/B, press **[INSTR PRESET] [START] [1] [7] [.] [5] [GHz]** to reset the Model 83592C to internal leveling.

25. Adjust the Oscilloscope Channel A vertical sensitivity to place the internally leveled sweep trace at center screen. If oscillations are present, further reduce the ALC loop gain by adjusting A4R11 (GAIN) counterclockwise.

26. Reduce the Model 83592C RF output power by rotating the Model 83592C POWER control until the Model 83592C POWER display reads −5 dBm. Observe a full sweep. If oscillations occur, reduce the gain further by adjusting A4R11 (GAIN) counterclockwise.

5-30. POWER SWEEP

REFERENCE:

Performance Test: Paragraph 4-14
Service Sheet: A5

DESCRIPTION:

A 10 dB/sweep POWER SWEEP mode is selected and the resultant is displayed on the 8756A Swept Amplitude Analyzer. The output of the Power Sweep circuit is adjusted for the correct sweep.

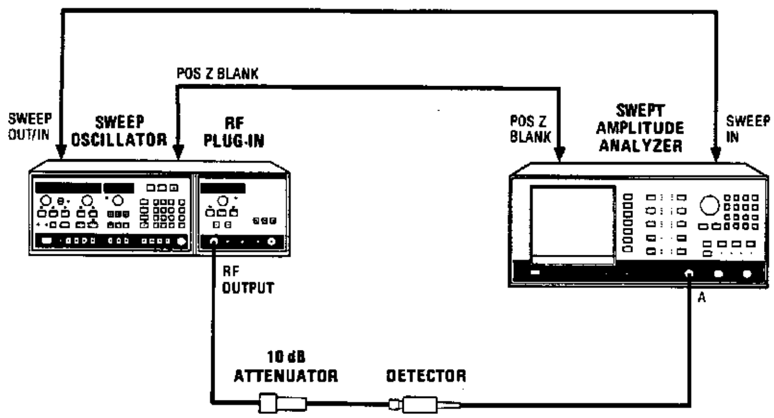


Figure 5-43. Power Sweep Test Setup

EQUIPMENT:

Swept Amplitude Analyzer . . . . HP 8756A
Detector . . . . HP 11664B
10 dB Attenuator. . . . . HP 8491B Option 010
Sweep Oscillator . . . . HP 8350A/B

PROCEDURE:

NOTE

ALC gain adjustments (paragraph 5-29) must be checked before the power sweep adjustment is made.

NOTE

This procedure requires that A3S1 is set to the factory-set position (Table 5-6), and that the Model 8350A/B Sweep Oscillator 27.8 kHz squarewave modulation is selected.

5-30. POWER SWEEP (Cont'd)

1. Connect the equipment as shown in Figure 5-43. On the Model 8350A/B, press **[INSTR PRESET] [⊔⊓ MOD]**. Allow the equipment to warm up for one hour.
2. On the Model 8350A/B, press **[SHIFT] [CW]**.
3. On the Model 83592C, press **[POWER LEVEL]**. Then on the Model 8350A/B, press **[0] [dBm]**.
4. On the 83592C, press **[POWER SWEEP]**. Then on the Model 8350A/B, press **[1] [0] [dB]**.
5. While observing the Model 8756A display of the RF output, adjust A5R50 (PWSP) for a power level change of 10 dB across the display (10 dB/sweep). Refer to Figure 5-44 for the adjustment location.

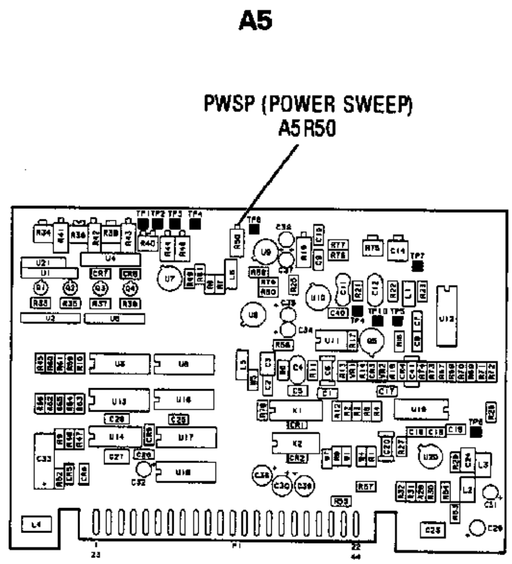


Figure 5-44. Power Sweep Adjustment Location

5-31. FM DRIVER

REFERENCE:

Performance Test: Paragraph 4-20
Service Sheet: A5

DESCRIPTION:

The FM Driver high frequency offset is adjusted for a zero volt drive with no FM modulation applied. A Delay-Line Discriminator is used to detect and display FM modulation on an Oscilloscope. Adjustments are made for best overall frequency response from DC to 10 MHz. Compliance to a supplemental characteristic of ±3 dB FM flatness is checked between DC and 2 MHz.

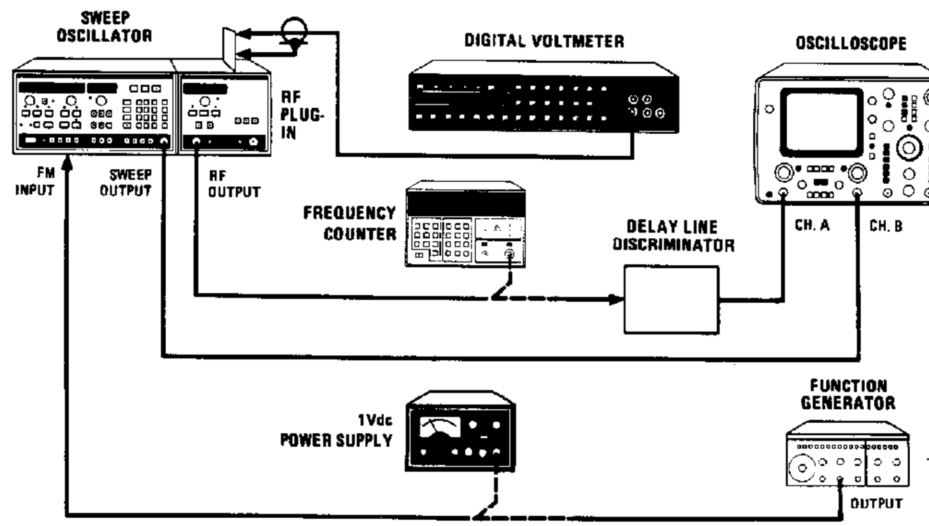


Figure 5-45. Test Setup for FM Driver Adjustments

EQUIPMENT:

Digital Voltmeter (DVM)	HP 3456A
Oscilloscope	HP 1740A
Function Generator	HP 3312A
Delay-Line Discriminator	See Figure 1-3
Frequency Counter	HP 5343A
DC Power Supply	HP 6214A
Sweep Oscillator	HP 8350A/B

PROCEDURE:

NOTE

Turn AC power OFF when removing or installing PC boards.

5-31. FM DRIVER (Cont'd)

NOTE

This procedure requires that A3S1 is set to the factory-set position (refer to Table 5-6).

FM Offset

1. Connect the equipment as shown in Figure 5-45. Connect the Frequency Counter to the Model 83592C RF OUTPUT connector. Do not connect the Power Supply or Function Generator to the Model 8350A/B rear-panel FM INPUT connector yet. Allow the equipment to warm up for one hour.

2. Connect the DVM between A5 pin 21 and A5TP7 (HIGH FREQ FM RET). Refer to Figure 5-46 for adjustment procedure locations. Adjust A5R19 (FM OFFSET) for a DVM reading of 0.000±0.001 Vdc.

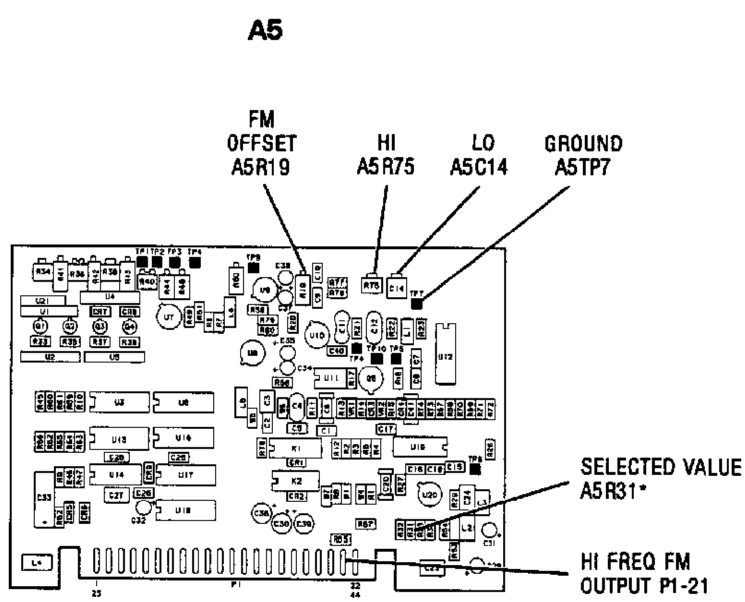


Figure 5-46. Location of A5 FM Driver Adjustments

3. Disconnect the DVM and set the equipment controls as follows:

HP 8350A/B SWEEP OSCILLATOR

CW FREQUENCY .... 3 GHz
FREQUENCY Sweep Mode .... Press **[SHIFT] [CW]** (swept CW)
CW VERNIER .... ON
SWEEP TRIGGER .... INT
RF BLANK .... OFF

5-31. FM DRIVER (Cont'd)

Model 83592C RF PLUG-IN

POWER LEVEL .... +10 dBm
CW FILTER .... OFF
ALC MODE .... INT

Set the configuration switch A3S1 on the Digital Interface board (Table 5-6) as follows:

Switch Number	1	2	3	4	5	6	7	8
Position	0	X	X	0	0	0	*	0

Positions: 1=Open; 0=Closed; X=Don't care
* "0" if no Option 002; "1" if Option 002 installed.

NOTE

The A3S1 switch positions select the Model 83592C code, maximum RF power at power-up, −20 MHz/V FM sensitivity, cross-over coupled FM modulation (AC coupled), and Option 002 code (if installed).

HP 3312A FUNCTION GENERATOR

RANGE .... 1 MHz
FREQUENCY .... 10 (10 MHz)
FUNCTION .... Sine Wave
Amplitude .... Set output for 100 mV p-p as displayed on Oscilloscope with 50 Ohm input

HP 1740A OSCILLOSCOPE

MODE .... A vs B
CHANNEL A .... 50 Ohms
CHANNEL A V/DIV .... 0.02 (CAL)
CHANNEL B INPUT .... DC
CHANNEL B V/DIV 1

Frequency Response

4. Connect the Frequency Counter to the Model 83592C RF OUTPUT. Connect +1 Vdc from the Power Supply to the Model 8350A/B rear-panel FM INPUT. A shift in frequency of approximately −20 MHz should occur on the Frequency Counter when +1 Vdc is applied. (This shows correct FM modulation sensitivity.) Connect the Delay-Line Discriminator to the Model 83592C RF OUTPUT and connect the Function Generator to the Model 8350A/B rear-panel FM INPUT connector.

5-31. FM DRIVER (Cont'd)

5. Adjust the Model 8350A/B CW FREQUENCY and CW VERNIER for a waveform at the center of the Oscilloscope CRT. Adjust the Oscilloscope Channel A CAL control for a trace 4 divisions high centered on the CRT.

6. Manually sweep the Function Generator frequency from DC to 100 kHz. Select resistor A5R31 so that the amplitude of the waveforms at Function Generator frequencies of 100 Hz and 100 kHz are the same ± 0.2 divisions on the CRT. Refer to Figure 5-46 for the location of A5R31. Refer to Table 5-3 for the allowable range of values for A5R31.

7. Manually sweep the Function Generator frequency from DC to 10 MHz. Adjust A5C14 (LO) and A5R75 (HI) controls to obtain the most constant overall response from DC to 10 MHz. Repeat this step several times.

8. Check that the ±3 dB FM flatness supplemental characteristic is met between DC and 2 MHz as follows. Manually sweep the Function Generator frequency between DC and 2 MHz. On the Oscilloscope, note the maximum and minimum response points as shown in Figure 5-47. The maximum point (+3 dB) can be as high as 5.6 divisions, and the minimum point (−3 dB) can be as low as 2.8 divisions.

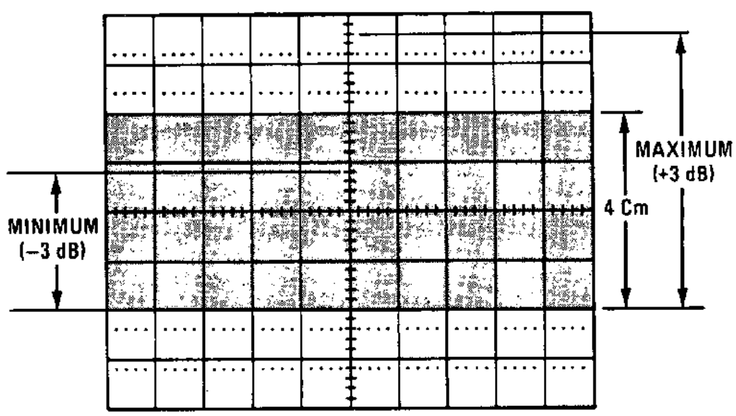


Figure 5-47. FM Flatness Tolerance, DC to 2 MHz

9. If the FM flatness supplemental characteristic in step 8 above is not met, repeat steps 6 and 7 and make compromise adjustments in the DC to 2 MHz range to meet the requirements.

10. Reset configuration switch A3S1 as indicated in Table 5-6.

VI Replaceable Parts

MANUAL IDENTIFICATION

HP Model Number: HP 83592C
Manual Part Number: 83592-90038
Date Printed: December 1983

UPDATES through CHANGE 18

Incorporate all UPDATES first, then make all changes appropriate for your instrument (see the preceding Serial Prefix reference table).

MANUAL CHANGES SUPPLEMENT

HP 83592C RF Plug-in

NOTE

Manual Change Supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically order the latest edition of this supplement. Copies are available through any HP office. When ordering copies, quote the supplement part number from the bottom of this page, or the model number and print date from the title page of the manual.

MANUAL IDENTIFICATION

Manual Part Number: 83592-90038
Date Printed: December 1983

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

TO USE THIS SUPPLEMENT: Make all changes applicable to the serial prefix or number of your instrument as indicated in the following reference table.

Note that there may be more than one Title Page and/or Parts Cross-Reference Table included in this supplement. The last change(s) applicable to your instrument will contain the most current information for these specific pages.

■ = NEW ITEM, CHANGED ITEM

HP Part Number 83592-91100 (For HP Internal Use Only)
Part of HP Part Number 83592-90100
Microfiche Part Number 83592-90101

DECEMBER 1990

Printed in U.S.A.

HEWLETT PACKARD

■ = NEW ITEM

HP 83592C

Serial Prefix or Number	Make Manual Changes
2348A	1, 20, 25
2412A	1-5, 20, 25
2429A	1-6, 20, 25
2451A	1-7, 20, 25
2506A	1-8, 20, 25
2520A	3-9, 20, 25
2532A	3-10, 20, 25
2542A	3-11, 20, 25
2602A	3-12, 20, 25
2621A	3-13, 20, 25
2644A	3-14, 20, 25
2702A	3-15, 20, 25
2718A	3-5, 7-16, 20, 25
2726A	3-5, 7-17, 20, 25
2726A00581	3-5, 7-18, 20, 25
2809A, 2815A	3-5, 7-18, 20, 25
2836A	3-5, 7-18, 20, 21, 25
2846A	3-5, 7-18, 20-22, 25
2911A	3-5, 7-18, 20-23, 25
3010A	3-5, 7-18, 20-25
■ 3050A	3-5, 7-18, 20-25

■ = NEW ITEM

Numbered Changes Index (1 of 2)

Serial Prefix Number	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2348A	1	A6	83592-60119	Replaceable Parts Service
2412A	2 and 3 and 4 and 5	A6 N/A A4 A3	N/A N/A 83592-60077 83525-60080	General Information Operation Performance Tests Adjustments Replaceable Parts Service
2429A	6	A3	N/A	Replaceable Parts
2451A	7	A7	N/A	Replaceable Parts
2506A	8	N/A	N/A	None
2520A	9	A6	83592-60107	Replaceable Parts Service
2532A	10	N/A	N/A	None
2542A	11	Mechanical Parts	N/A	Replaceable Parts
2602A	12	A2	83592-60122	General Information Installation Operation Adjustments Replaceable Parts Service
2621A	13	A8	83595-60070	Adjustments Replaceable Parts Service
2644A	14	A4	83592-60132	Replaceable Parts Service
2702A	15	N/A	N/A	None
2718A	16	A3	N/A	None
2726A	17	A4 83592-60077 A4 83592-60132	N/A	Replaceable Parts
2726A00581	18	Mechanical Parts	N/A	Replaceable Parts
2809A, 2815A	19	N/A	N/A	None
N/A	20	N/A	N/A	Performance Tests

■ = NEW ITEM

Numbered Changes Index (2 of 2)

Serial Prefix Number	Change Number	Assemblies Affected	New Assembly Part Number	Manual Sections Affected
2336A	21	A2 A10	83592-60142 83595-60081	Replaceable Parts Service
2846A	22	A8	N/A	Replaceable Parts Service
2911A	23	A8	83595-60089	Replaceable Parts Service
3010A	24	A1	83592-60147	Replaceable Parts Service
■ 3050A	25	A14A1	5086-7559 5086-6559	Replaceable Parts Service

UPDATES

Operating Information Supplement, title page:
In the lower right-hand corner of the page, change the print date to December 1983.

Page 1-1:
After paragraph 1-8 add the following:

Manufacturer's Declaration

NOTE

This is to certify that this product meets the radio frequency interference requirements of Directive FTZ 1046/1984. The German Bundespost has been notified that this equipment was put into circulation and has been granted the right to check the product type for compliance with these requirements.

Note: If test and measurement equipment is operated with unshielded cables and/or used for measurements on open set-ups, the user must insure that under these operating conditions, the radio frequency interference limits are met at the border of his premises.

Model **83592C**

NOTE

Hiermit wird bescheinigt, dass dieses Gerät/System in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes/Systems angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Zusatzinformation für Mess- und Testgeräte:

Werden Mess- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Messaufbauten verwendet, so ist vom Betreiber sicherzustellen, dass die Funk-Entstörbestimmungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

Pages 5-2 to 5-4:
Under **Adjustment Paragraph** change the paragraph numbering as follows:
5-23 to 5-24
5-24 to 5-25
5-25 to 5-26
5-26 to5-27
5-27 to 5-28
5-28 to 5-29
5-29 to 5-30
5-30 to 5-31

Page 5-28, Paragraph 5-20:
Replace Paragraph 5-20 with **5-20. SLOW SWEEP SYTM/YTF TO YO TRACKING** contained in this document.

Page 5-33, Paragraph 5-21:
Replace Paragraph 5-21 with **5-21. SRD BIAS** contained in this document.

Page 5-53:
Add Paragraph **5-26A. POWER CALIBRATION** contained in this document.

Page 5-58, Paragraph 5-29:
Replace Paragraph 5-29 with **5-29. ALC GAIN ADJUSTMENT** contained in this document.

UPDATES (Cont'd)

Page 6-2, Paragraph 6-17:

Add the following after paragraph 6-17:

Two Year Warranty and Restored Exchange Parts

The microcircuit parts listed in Table 6.0 are provided with either a two-year warranty from the date of purchase and/or a restored exchange parts program.

A two-year warranty applies to both an original component and to one that is purchased as a replacement part either new or restored through the support life of the instrument. The restored exchange parts program allows a defective component to be exchanged for a factory-restored part which provides a substantial reduction in replacement cost. In addition, if the original component is covered by a two-year warranty, the exchanged component will also have a two-year warranty from the date of purchase. Table 6-0 below identifies the components within the instrument that have a two-year warranty as well as those that are available as restored exchange parts.

Table 6-0. Two-Year Warranty and Restored Exchange Parts

Reference Designation	Description	Two-Year Warranty	Restored Exchange Part
A11	RF Switch	Yes	No
A12	Switched YTM	Yes	Yes
A13	YIG Oscillator	Yes	Yes
A14	Hi-Band Power Amp	Yes	Yes
A16	Mod/Splitter	Yes	Yes
A17	Lo-Band Power Amp	Yes	Yes
A18	Modulator Mixer	Yes	Yes
A20	Tuned Filter/YTF	Yes	Yes
DC1	Detector	Yes	No

Page 6-2, Table 6-1:

Change A12 New Part Number to 83592-60108, Rebuilt Part Number to 83592-60109, Description to Switched YTM Kit.

Change A13 New Part Number to 83592-60096, Rebuilt Part Number to 83592-60097, Description to YO 2.3 to 7.0 GHz Kit.

Change A14, New Part Number to 5086-7405, Rebuilt Part Number to 5086-6405; Description POWER AMP 2.3 to 7.0 GHz.

Add A19, New Part Number 83595-60019, Rebuilt Part Number 83595-60079, Description 55 dB Attenuator.

Change A20 New Part Number to 83592-60120, Rebuilt Part Number to 83592-60121, Description to Switched YTF Kit.

Page 6-14, Table 6-3:

Change A1RPG1 to HP and Mfr. Part Number 0960-0683, CD 3 (recommended replacement).

Page 6-15, Table 6-3:

Change A2U9 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).

Page 6-16, Table 6-3:

Change A3 to HP and Mfr. Part Number 83525-60080, CD 6, DIGITAL INTERFACE ASSEMBLY (does not include A3U1 and A3U2).

Change A3U1 and A3U2 to A3U1/A3U2 (not separately replaceable), HP and Mfr. Part Number 83592-60102, CD 4, EPROM Replacement Kit (recommended replacement).

Change A3U5 to HP and Mfr. Part Number 1820-3093, CD 8 (recommended replacement).

Add A3XU1 and A3XU2, HP and Mfr. Part Number 1200-0541 CD 1, SOCKET-IC 24-CONT DIP-SLDR (recommended replacement).

UPDATES (Cont'd)

Page 6-24, Table 6-3:

Change A6U10 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).
Change A6U11 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).

Page 6-27, Table 6-3:

Change A7U19 to HP and Mfr. Part Number 1826-1349, CD 5 (recommended replacement).
Delete A8C24.

Page 6-30, Table 6-3:

Change A11C2 to HP and Mfr. Part Number 0180-3549, CD 0 (recommended replacement).
Change **A12** to HP and Mfr. Part Number **83592-60108**, CD **0**, **SWITCHED YIG TUNED MULTIPLIER KIT**.
Change A12 to HP and Mfr. Part Number 83592-60109, CD 1, EXCHANGE 83592-60108 SWITCHED YTM KIT.

Page 6-31, Table 6-3:

Change **A13** to HP and Mfr. Part Number **83592-60096**, Cd **5**, **OSCILLATOR 2.3 — 7.0 GHz KIT**.
Change A13 to HP and Mfr. Part Number 83592-60097, CD 6, EXCHANGE 83592-60096 OSC. KIT.

Page 6-32, Table 6-3:

Change **A20** to HP and Mfr. Part Number **83592-60120**, CD **6**, **YTF REPLACEMENT KIT** (recommended replacement).
Change A20 to HP and Mfr. Part Number 83592-60121, CD 7, YTF EXCHANGE REPLACEMENT KIT (recommended replacement).

Page 6-33, Table 6-3:

Change MP3 to HP and Mfr. Part Number 83522-20028, CD 5.
Change MP35 to HP and Mfr. Part Number 83592-00027, CD 6 (recommended replacement).

Page 6-34, Table 6-3:

Change MP41 to HP and Mfr. Part Number 83592-00026, CD 5 (recommended replacement).
Under **MISCELLANEOUS PARTS** change the Part Number of the Type-N connector to HP and Mfr. Part Number 5061-5386, CD 0 (recommended replacement).
Under **OPT. 002** add the following item:
A19 HP and Mfr. Part Number 83595-60079, CD 7, EXCHANGE ATTENUATOR 55DB OPT 002 ONLY).
Under **OPTION 002**, next to the description for W31, add "(Delete STD W1)."
Under **OPTION 004**, next to the description for W32, add "(Delete STD W1)."
Change HP and Mfr. Part Number of W32 to 83592-20093.
Under **OPT. 002 and 004**:
Change A19 from 83592-60019 to 83595-60019, CD 5.
Add A19 HP and Mfr. Part Number 83595-60079, CD 7, EXCHANGE ATTENUATOR 55DB (OPT 002 ONLY).
Under **OPTION 002 and 004**, next to the description for W31, add "(Delete STD W1)."
Change HP and Mfr. Part Number of W33 to 83592-20094.
Delete the line beginning with W32.

Page 6-35/6-36, Table 6-3:

Under **HARDWARE LOCATIONS**, add the following:
14, 86290-00024, CD 4, Qty 2, Spring-Component Clip, 28480, 86290, 86290-00024.
15, 0570-0112, CD 4, Qty 4, Screw-Mach 0-80, .188-IN-LG, FIL-HD-SLT, 28480, 0570-0112.

Page 6-19, Table 6-3:

Change A4U1 to HP and Mfr. Part Number 1826-1058.
Change A4U2 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).
Change A4U9 to HP and Mfr. Part Number 1826-1186, CD 8 (recommended replacement).

UPDATES (Cont'd)

Page 8-105/8-106, Figure 8-63:
Delete A8C24.

Page 8-105/8-106, Figure 8-71:
Delete A8C24.

5-20. SLOW SWEEP SYTM TO YO TRACKING (UPDATES)

REFERENCE:

Performance Test: Paragraph 4-13
Service Sheet: A6 and A7

DESCRIPTION:

To obtain optimum output power, the Switched Yittrium-Iron-Garnet tuned multiplier (SYTM) passband peaking should track the output of the Yittrium-Iron-Garnet Oscillator (YO). The 83592C is set to sweep Bands 2 and 3 (7 to 20 GHz), and the Automatic Leveling Control (ALC) loop is opened by selecting the External (EXT) ALC MODE. The Step Recovery Diode (SRD) Bias for the SYTM is preset and will be adjusted in Paragraph 5-21. Special calibration modes are used for this procedure (SHIFT 92 for OFFSET and SHIFT 93 for GAIN of the frequency sweep). The output power is peaked for each calibration mode, and the appropriate calibration constant is entered into the calibration switches. A7S1 stores the OFFSET constant, and A7S2 stores the GAIN constant.

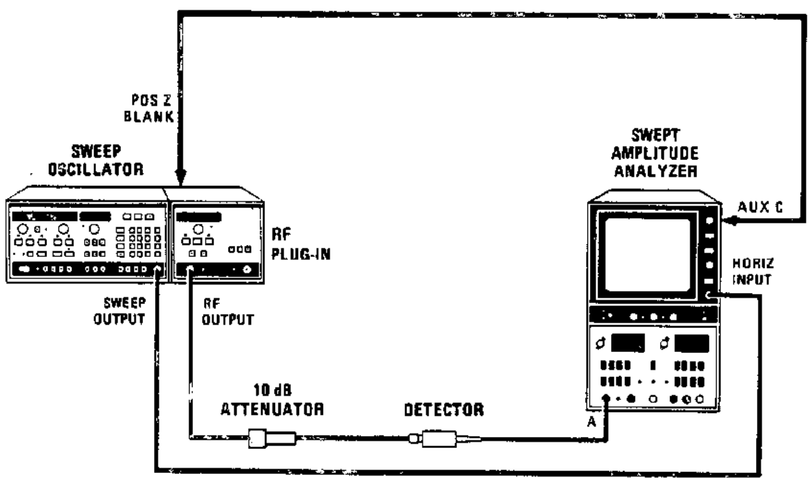


Figure 5-17. Slow Sweep SYTM to YO Tracking Test Setup

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detector	HP 11664B
10 dB Attenuator	Weinschel Model M9-10
Sweep Oscillator	HP 8350A/B

5-20. SLOW SWEEP SYTM/YTF TO YO TRACKING (UPDATES) (Cont'd)

PROCEDURE:

NOTE

This procedure requires that A3S1 is set to the factory-set position. Refer to Table 5-6.

NOTE

During this adjustment, a localized drop in power may occur. This drop in power is due to the SRD being over biased and is called squegging. If squegging occurs in Band 2, adjust A6R68 and R73 to eliminate the squegging and to maximize power across the band. If squegging occurs in Band 3, adjust A6R69 and R74.

1. Connect the equipment as shown in Figure 5-17. Allow the equipment to warm up for one hour.
2. On the 8350A/B, press **[INSTR PRESET] [START] [7] [GHz] [SWEEP TIME] [2] [0] [0] [ms] [⊔⊓ MOD]**. On the 83592C press **[EXT ALC MODE]**. The unleveled lamp light should be lit.
3. Preset A6R78 (T) one quarter turn from full clockwise position.
4. Select 5 dB/DIV display resolution on the 8755C and center the display.
5. Adjust the FILTER PEAK to maximize the lowest power point as viewed on the Model 8755C. If the output is within specification, go to paragraph 5-21. Otherwise continue on.
6. On the 8350A/B, press **[SHIFT] [9] [2]** to enable the SYTM OFFSET DAC subroutine. Using the 83592C POWER control, peak the power in the beginning of Band 2.
7. On the 8350A/B, press **[SHIFT] [9] [3]** to enable the GAIN DAC sub-routine. Using the 83592C POWER control, peak the power at the end of Band 3. Maximum peaking occurs when the power at the high end of Band 3 has been optimized without the power in other bands dropping out.
8. Iterate between steps 5 and 6. SHIFT 92/93 are interactive so the adjustments must be alternated until the best compromise is found.
9. Press **[SHIFT] [9] [2]**. Set A7S1 to the Hex-code on the plug-in display. Press **[SHIFT] [9] [3]**. Set A7S2 to the Hex-code on the plug-in display.
10. Press **[INSTR PRESET]** on the 8350A/B so that the new calibration data will be entered from the current switch settings.
11. On the 8350A/B, press **[STOP] [7] [GHz] [⊔⊓ MOD] [SWEEP TIME] [4] [0] [0] [ms]**. On the 83592C, press **[EXT ALC MODE]**.
12. If the output is within specification, go to step 16 to peak Band 1. Otherwise continue on with the YTF adjustment.
13. On the 8350A/B, press **[RECALL] [1]**. On A7 adjust R207 (YTF OFFSET) to peak the low end of band 2.
14. On A7 adjust R202 (YTF GAIN) to peak the high end of band 2 and the low end of band 3.

5-20. SLOW SWEEP SYTM/YTF TO YO TRACKING (UPDATES) (Cont'd)

15. Repeat steps 13 and 14 until maximum power output is obtained.
16. If the output power is within specification, peak band 1 as explained in the following steps. Otherwise, go to Paragraph 5-21.
17. On the 8350A/B, press **[STOP] [7] [GHz] [⊔⊓ MOD]**. On the 83592C, press ALC MODE **[EXT]**.
18. Adjust A7R51 (B1 OFS) and A7R76 (B1 GAIN) to maximize the minimum power points of the band 1 displayed trace.

5-21. SRD BIAS (UPDATES)

REFERENCE:

Performance Test: Paragraphs 4-17, 4-19
Service Sheet A4 and A6

DESCRIPTION:

The High Power SRD Bias is set by peaking the 8755C displayed trace with A6R68 (2H) and A6R73 (2L) in Band 2, A6R69 (3H) and A6R74 (3L) in Band 3.

The Low and Mid Power SRD Bias is adjusted by inserting a voltage through a 511 ohm current-limiting resistor to directly bias the Modulator/Splitter. With the 83592C at maximum RF output, the power supply voltage is increased (minimum voltage 0.5 Vdc, maximum voltage 5.0 Vdc) to set the RF output power just above the 8755C noise floor. Then A6R63 (3HL) is adjusted until minimum slope is obtained on the oscilloscope display. The voltage from the power supply is decreased until the lowest part of the trace, on the 8755C display, is 10 dB above the noise floor. Then A6R12 (C) is adjusted to peak the power in Bands 2 and 3. The power supply is then removed.

EQUIPMENT:

Swept Amplitude Analyzer	HP 8755C
Display Mainframe	HP 182T
Detectors (2)	HP 11664A
6 dB Attenuator	HP Weinschel Model M9-6
10 dB Attenuator	HP Weinschel Model M9-10
20 dB Attenuator	HP Weinschel Model M9-20
Directional Coupler	HP 0955-0125
Power Supply	HP 6214A
Oscilloscope	HP 1740A
Extender Board	HP 08350-60031
Sweep Oscillator	HP 8350A/B
511 ohm Resistor	HP 0757-0416

PROCEDURE:

NOTE

Turn the 8350A/B LINE power OFF when removing or installing PC boards.

This procedure requires that A3S1 is set to the factory-set position (refer to Table 5-6).

High Power SRD Bias

1. Connect the equipment as shown in Figure 5-21 with the 83592C A6 Sweep Control board on an extender. Do not connect the power supply. With the LINE power OFF, remove the 83592C A4 ALC board. Connect the 8755C MODULATOR DRIVE output to the 83592C rear panel PULSE IN connector.

2. Allow the equipment to warm up for one hour.

3. On the 8350A/B press **[INSTR PRESET] [START] [6] [.] [9] [GHz] [STOP] [1] [3] [.] [5] [GHz] [SWEEP TIME] [4] [0] [0] [ms]**. On the 83592C select the **[EXT ALC MODE]**.

5-21. SRD BIAS (UPDATES) (Cont'd)

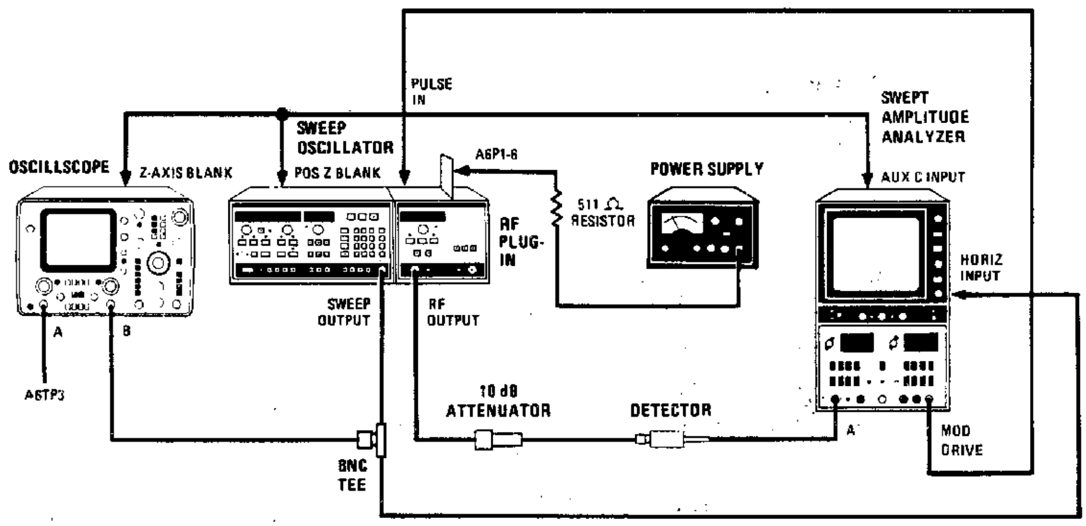


Figure 5-21. SRD Bias Adjustment Setup

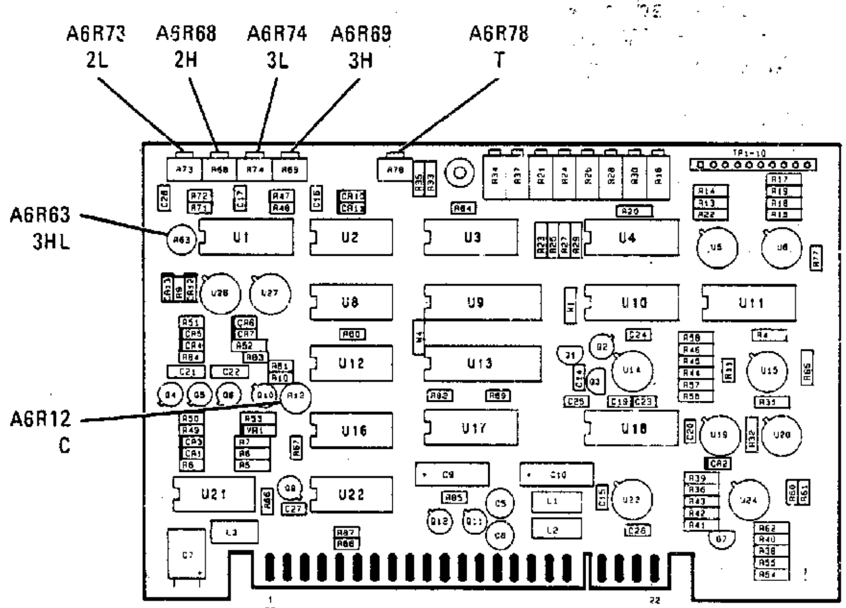


Figure 5-22. SRD Bias Adjustment Locations

5-21. SRD BIAS (UPDATES) (Cont'd)

4. Set the 8755C display resolution for 5 dB/DIV and center the display.
5. Set up a zero volt reference on the ocilloscope.

NOTE

BEFORE beginning each adjustment, preset the potentiometer to the point where one side of the trace on the oscilloscope display is below zero volts. Adjustment locations labeled 2L and 3L set the left side of the displayed trace. Adjustment locations labeled 2H and 3H set the right side of the displayed trace. DO NOT preset more than one potentiometer at a time.

6. Observe the 8755C display, adjust A6R73 (2L) to peak the power at the low end of Band 2 without the power squegging. Then adjust A6R78 (2H) to peak the rest of the band. Iterate between (2L) and (2H) to peak the power across the band without any squegging.
7. On the 8350A/B press **[START] [1] [3] [.] [4] [GHz] [STOP] [2] [0] [GHz]**. Adjust A6R74 (3L) for the low end of Band 3 and A6R69 (3H) for the rest of the band to peak the power without squegging.
8. Check the SYTM/YTF to YO tracking to ensure it has not changed (refer to Paragraph 5-20). If retracking is necessary, repeat the steps above to eliminate any squegging that may have occured.

Low and Mid Power SRD Bias

CAUTION

The voltage connected to A6P1-6 is to bias the Modulator/Splitter directly. If A6P1-7 (+10Vdc supply) is shorted to A6P1-6, the Modulator/Splitter will be damaged.

9. Set up the equipment as shown in Figure 5-21, with a 511 ohm resistor connected to A6P1-6 (reference to ground). Remove the 83592C A4 ALC board. Connect the 8755C Swept Amplitude Analyzer MODULATOR DRIVE output to the 83592C rear-panel PULSE IN connector.
10. Allow the equipment to warm up for one hour.
11. On the 8350A/B, press **[INSTR PRESET] [SWEEP TIME] [2] [0] [0] [ms] [START] [7] [GHZ]**. Set the power on the 83592C to 20dB.
12. Set the 8755C display resolution for 10 dB/DIV and adjust the display to the top graticule. On the 1740A Oscilloscope, select A vs B, set Channel A to .5 B/DIV, set Channel B to 1 V/DIV, and DC-couple Channels A and B.
13. Set the 6214A voltage to .5 Vdc. Increase the voltage until the highest power point is 10 dB above the noise floor (**DO NOT EXCEED 5 Vdc**).
14. Monitor A6TP3 with the oscilloscope and adjust A6R63 until minimum slope (flat display) is obtained.
15. Decrease the 6214A voltage until the power at the lowest point between 6.9 and 20 GHz is 10 dB above the noise floor.

5-21. SRD BIAS (UPDATES) (Cont'd)

16. Set A6R12 (C) to a centered position and then adjust to peak the power between 6.9 and 20 GHz. Using the voltage source, keep the RF power at or near 10dB above the noise floor, then repeak A6R12 (C). If the power of the sweep drops at any frequency, maximum peaking has been exceeded.

17. Repeat step 14 to verify baseline flatness, readjust A6R63 as needed.

Threshold

NOTE

For this adjustment to be accurate, the attenuator must be in the 0.0dB step. (Opt 002 only)

18. On the 8350A/B press **[INSTR PRESET]**. Set the power level on the 83592C to −5dB.

19. Observe the 8755C with a 1dB/DIV reference. Preset A6R78 (T) clockwise then adjust A6R78 (T) counter-clockwise until squegging and/or oscillations are eliminated.

20. Observe the 8755C trace, increase power slowly to maximum specified power out. If squegging or oscillations reoccur, readjust A6R78 (T) in small increments. If excessive adjustment of A6R78 (T) is required, the SRD bias may be misadjusted.

5-26A. POWER CALIBRATION (UPDATES)

NOTE

Complete adjustment of the ALC leveling loop requires several procedures to be performed in the order prescribed from paragraphs 5-26 through 5-29. Deviation from this routine may cause improper leveling and/or power variation problems.

REFERENCE:

Performance Test: Paragraph 4-14
Service Sheet: A4

DESCRIPTION:

Power is calibrated on a power meter at three over the leveled power range: −5, +3, and +10 dBm.

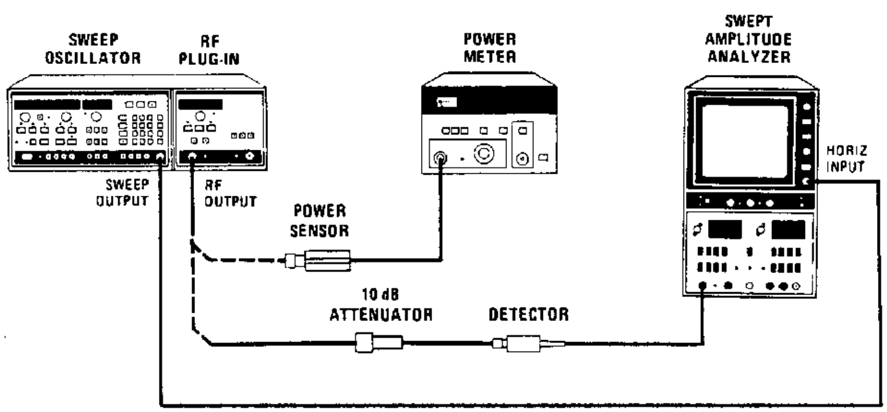


Figure 5-36a. Power Calibration Test Setup

EQUIPMENT:

Swept Amplitude Analyzer .... HP 8755C
Detector .... HP 11664A
Sweep Oscillator .... HP 8350A/B
Power Meter .... HP 436A
Power Sensor .... HP 8481A
10 dB Attenuator .... HP Weinschel Model M9-10

5-26A. POWER CALIBRATION (UPDATES) (Cont'd)

PROCEDURE:

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6). If the following steps result in A4R13 and A4R9 being adjusted near the stops, connect DVM low to A4TP12 (floating ground) and DVM high to A4TP9. Adjust A4R78 for −0.2mV + 0.01mV.

BEFORE proceeding with the power calibration, the instrument MUST be warmed up for 30 minutes minimum with cover ON in order to stabilize the power.

1. Connect power meter to RF output.
2. On the 8350A/B press **[INSTR PRESET]** then **[⊔⊓ MOD] [CW] [5] [0] [MHz]**. Set the plug-in for a front panel display of −5 dB.
3. Press **[SAVE] [1]** on the 8350A/B.
4. Select a CW frequency of 2.2 GHz and press **[SAVE] [2]**.
5. Set the plug-in for a power setting of +3 dB and press **[SAVE] [5]**.
6. Press **[CW] [5] [0] [SAVE] [4]**.
7. Set the plug-in for a power setting of +10 dB and press **[SAVE] [7]**.
8. Press **[CW] [2] [.] [2] [SAVE] [8]**.
9. Adjust A4R1 (0 SLOPE) to get the same but opposite difference between (50 MHz and 2.2 GHz at −5 dB) and (50 MHz and 2.2 Ghz at +10 dB). See Figure 5-36b.

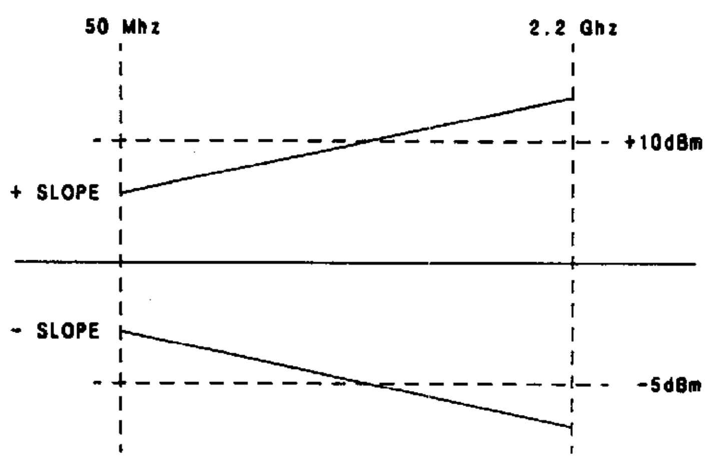


Figure 5-36b. 0 SLOPE Adjustment

5-26A. POWER CALIBRATION (UPDATES) (Cont'd)

10. Adjust A4R13 (0 LO) for equal but opposite deviations from −5 dB at 50 MHz and 2.2 GHz.
11. Adjust A4R9 (0 MID) for equal but opposite deviations from +3 dB at 50 MHz and 2.2 GHz.
12. Adjust A4R7 (0 HI) for equal but opposite deviations from +10 dB at 50 MHz and 2.2 GHz.
13. Connect the 8755C to the 83592C RF output. On the 8350A/B press **[INSTR PRESET] [START] [2] [.] [3] [GHz] [STOP] [7] [GHz] [⊔⊓ MOD]**. Observing the 8755C, locate the frequency which is the mid point of Band 1 power variation, and set CW to that frequency.
14. Connect the power meter to the 83592C RF output. Set the plug-in for a front panel display of −5 dB and adjust A4R12 (1LO) for a power meter reading of −5 dB.
15. Set the 83592C for a front panel display of +3 dB and adjust A4R10 (1MD) for a power meter reading of +3 dB.
16. Set the 83592C for a front panel display of +10 dB and adjust A4R8 (1HI) for a power meter reading of +10 dB.
17. Repeat steps 2 through 15 until no further adjustment is necessary.

A4

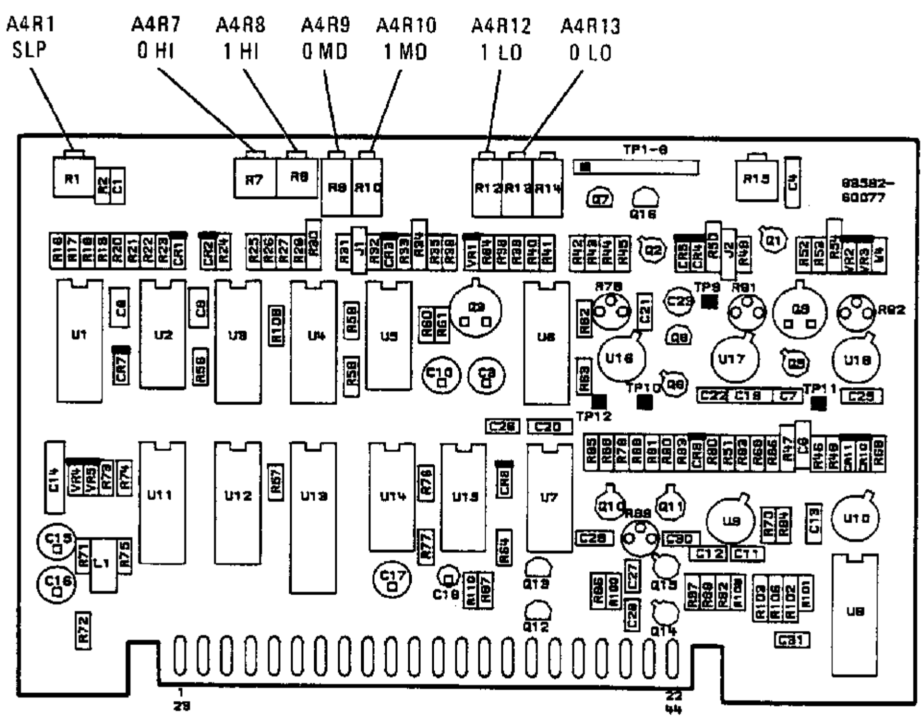


Figure 5-36c. Power Calibration Adjustment Locations

5-29. ALC GAIN ADJUSTMENT (UPDATES)

NOTE

Complete adjustment of the leveling loop requires several procedures to be performed in the order prescribed, from Paragraph 5-26 through 5-29. Deviation from this routine may cause improper leveling and/or flatness problems.

REFERENCE:

Performance test: 8350A/B Paragraph 4-14.
Service Sheet: A4

DESCRIPTION:

A4R15 in the input leg of A4U9 adjusts the gain of the Main ALC Amplifier. A4R15 is adjusted for maximum possible gain without producing oscillations.

EQUIPMENT

Function Generator .... HP 3312A
Oscilloscope .... HP 1740A
Detector .... HP 8473C
10 dB Attenuator .... HP 8491A Option 010

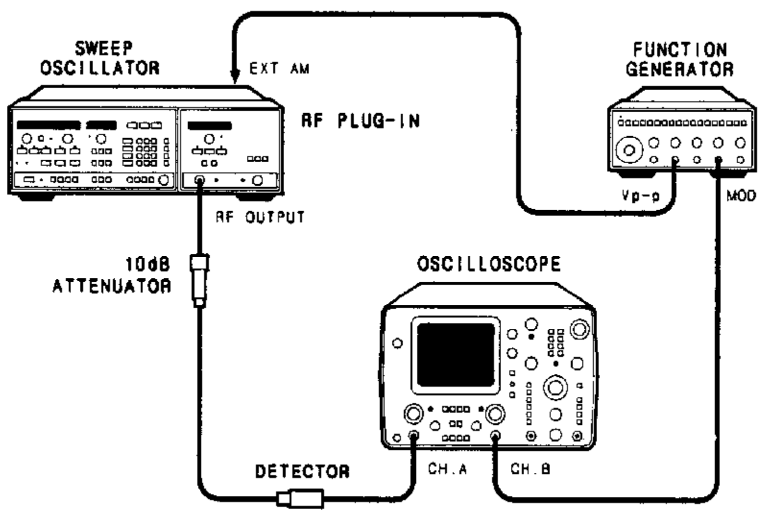


Figure 5-41. ALC Gain Adjustment Test Setup

5-29. ALC GAIN ADJUSTMENT (UPDATES) (Cont'd)

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6).

A4

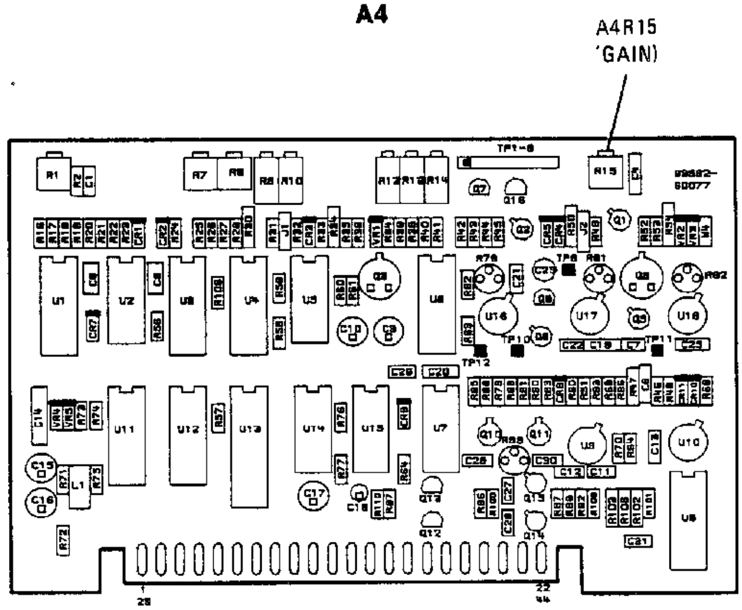


Figure 5-42. ALC Gain Adjustment Location

PROCEDURE:

1. Connect Vp-p output on HP 3312A to 1740 CHANNEL A INPUT.
2. Set instrument controls as follows:

8350A/B SWEEP OSCILLATOR

START .... 10 MHz
STOP .... 20 GHz
SWEEP MODE .... MANUAL

83592C RF PLUG-IN

POWER LEVEL .... −2 dB
ALC .... INT

3312A FUNCTION GENERATOR

MODULATION .... SWP
MODULATION RANGE Hz (KNOB) 0
VERNIER 0
FUNCTION .... [~]
RANGE Hz (BUTTON) 100K
FREQUENCY 5
AMPLITUDE 1
VERNIER 1

5-29. ALC GAIN ADJUSTMENT (UPDATES) (Cont'd)

1740A OSCILLOSCOPE

MODE	MAIN
CHANNEL A INPUT	AC
CHANNEL A V/DIV	½V
CHANNEL B INPUT	DC
CHANNEL B V/DIV	1V
DISPLAY	A

3. Adjust 1740A vertical and horizontal position knobs for waveform at the center of oscilloscope CRT. Adjust START knob, below SWP button, for 10 kHz as displayed on oscilloscope. Turn MODULATION RANGE Hz to 100 and VERNIER to 10K.
4. Connect equipment as shown in Figure 5-41.
5. On 1740A select A vs B MODE and set CHANNEL A to .005/DIV.
6. Adjust the far left side of the signal for 2 divisions pk-pk by using the CAL on the CHANNEL A knob.
7. While monitoring CHANNEL A, manually sweep the entire plug-in frequency range and adjust the ALC "GAIN" (A4R15) for 4 divisions of peaking at the plug-in frequency where the highest gain peaking occurs. (See Figure 5-42a)

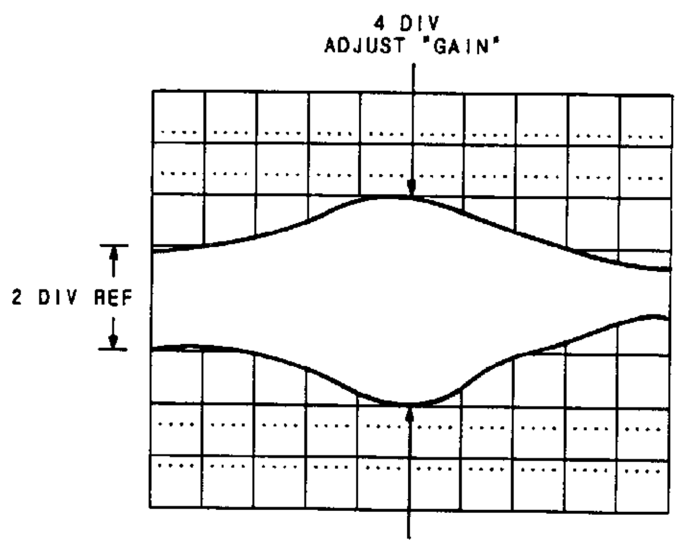


Figure 5-42a. ALC Gain Adjusted Correctly (Worst Case)

CHANGE 1

This change modifies the A6 Sweep Control Board

Page 6-22, Table 6-3:
Change the A6 Sweep Control Assembly HP and Mfr. Part Number to: 83592-60119, CD 3, (recommended replacement).

Page 6-24, Table 6-3:
Delete A6R76.
Change A6R77 to HP and Mfr. Part Number 0698-7277, CD 6, RESISTOR 51.1 K.

Page 8-83/84, Figure 8-44 (A6 Component Locations):
Delete R76.

Page 8-83/84, Figure 8-49 (A6 Schematic):
Change the SWEEP CONTROL Part Number to: 83592-60119.
Change the SERIAL PREFIX in the bottom left-hand corner to 2348A.
In block I SRD AND PIN DIODE BIAS:
Delete R76.
Change the value of R77 to 51.1 K.

CHANGE 2 (Supersedes CHANGE 1)

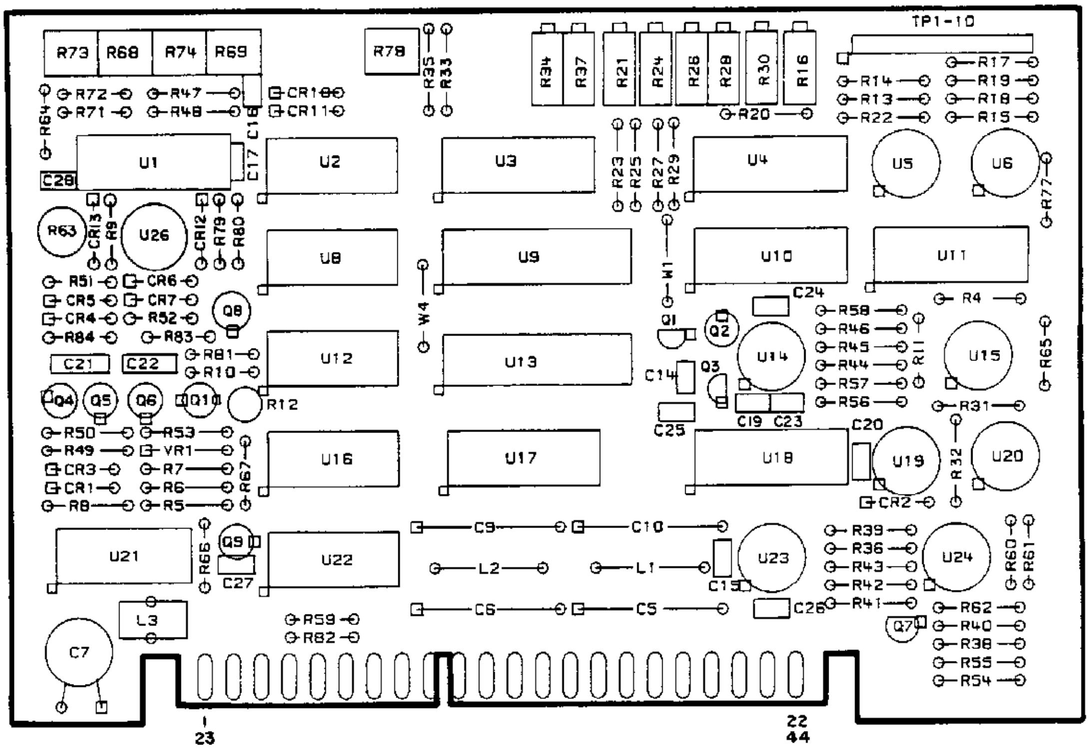
This change incorporates a new A6 Sweep Control Board.

Page 6-22, Table 6-3:
Change the HP and Mfr. Part Number of the A6 Sweep Control Board to: 83592-60119.

Page 6-23, Table 6-3:
Change A6R14 to: 0698-3447, CD 4, RESISTOR 422 1% .125W F TC=0±100, 03292, CT4-1/8-TO-422R-F.
Change A6R51 to 0698-7212, CD 9, RESISTOR 100 1% .05W F TC=0±100, 28480, 0698-7212.

Page 8-83/84, Figure 8-44 (A6 Component Locations):
Replace Figure 8-44 with Figure 8-44 (CHANGE 2) in this change sheet.

Page 8-83/84, Figure 8-49 (A6 Schematic):
Change the A6 SWEEP CONTROL part number in the top left-hand corner of the A6 Schematic to 83592-60119.
Change the SERIAL PREFIX in the bottom left-hand corner of the page to 2412A.
In block I SRD AND PIN DIODE BIAS:
Change the value of R14 to 422.



HP P/N 83592-60119

Figure 8-44. A6 Sweep Control Component Locations (CHANGE 2)

CHANGE 3

Change not applicable.

CHANGE 4

This change introduces a new ALC board. It is now possible to power meter level the plug-in with the HP 436A and HP 438A as well as the HP 432A.

Page 1-4, Table 1-1, Note 9:

Replace with the following: "Use the HP 432A/B/C, HP 436A, or HP 438A power meters. Both the HP 436A and 438A must be used on the top three (least sensitive) ranges. However, the HP 438A may also be used on the fourth range by programming the response of the power meter's filter as follows: Set the HP 438A to range two, and press **[MANFILTER] [1] [ENTER]**. See the HP 438A Operating and Service Manual for further instructions. Sweep time 100 seconds for full sweep, typically greater than or equal to 5 seconds per GHz but not less than 10 seconds."

Page 1-9, Paragraph 1-42:

Replace the first sentence with the following: "The RF output can be externally leveled using HP Model 432A/B/C, 436A, or 438A power meters or negative polarity output crystal detectors."

Delete the note below the paragraph.

Page 1-11, Table 1-4:

Across from the first listed "Power Meter" under **Critical Specifications** delete: "(No substitute when used for external power meter leveling)." Under **Recommended Model** add: "HP 436A," "HP 438A."

Across from the first listed "Thermistor Sensor" under **Recommended Model** delete: "HP 8478B" and replace with: "Unit compatible with power meter being used."

Across from the second listed "Thermistor Sensor" under **Recommended Model** delete: "HP K486" and replace with: "Unit compatible with power meter being used."

Page 3-3, Figure 3-2, Number 1:

Delete: "(HP 432 only)."

Page 3-6, Paragraph 3-22:

Add the following: "For power meter leveling (**ALC MODE [MTR]**), the power meter is used in conjunction with the internal leveling loop. Low frequency variations are handled by the power meter, and high frequency variations are handled by the internal leveling loop."

Page 3-9, Figure 3-6:

Under EQUIPMENT change the Power Meter listing to: "HP 432A/B/C, 436A, 438A." Change the Thermistor Mount listing to: "Any sensor compatible with the power meter being used."

Under the **NOTE** delete: "**The HP 435 and 436 power meters will not power meter level this plug-in. Only an HP 432 may be used.**" and add: "**When using an HP 436A power meter, enable RANGE HOLD to lock power meter in one range.**"

Under PROCEDURE, numbers 1 and 5, delete all reference to "HP 432A," "HP 8478A," "HP K486A," and "HP K281C."

Page 4-2, Table 4-1:

Across from "Squarewave Symmetry" under **83592C Adjustment** add "5-28."

Page 4-9, Power Meter Leveling:

Insert "13a. External leveling is shown using the HP 432A, HP 8478B, and HP K486A. However, the HP 432A/B/C, 436A, 438A meters and compatible sensors may also be used."

CHANGE 4

This change introduces a new ALC board. It is now possible to power meter level the plug-in with the HP 436A and HP 438A as well as the HP 432A.

Page 1-4, Table 1-1, Note 9:

Replace with the following: "Use the HP 432A/B/C, HP 436A, or HP 438A power meters. Both the HP 436A and 438A must be used on the top three (least sensitive) ranges. However, the HP 438A may also be used on the fourth range by programming the response of the power meter's filter as follows: Set the HP 438A to range two, and press **[MANFILTER] [1] [ENTER]**. See the HP 438A Operating and Service Manual for further instructions. Sweep time 100 seconds for full sweep, typically greater than or equal to 5 seconds per GHz but not less than 10 seconds."

Page 1-9, Paragraph 1-42:

Replace the first sentence with the following: "The RF output can be externally leveled using HP Model 432A/B/C, 436A, or 438A power meters or negative polarity output crystal detectors."

Delete the note below the paragraph.

Page 1-11, Table 1-4:

Across from the first listed "Power Meter" under **Critical Specifications** delete: "(No substitute when used for external power meter leveling)." Under **Recommended Model** add: "HP 436A," "HP 438A."

Across from the first listed "Thermistor Sensor" under **Recommended Model** delete: "HP 8478B" and replace with: "Unit compatible with power meter being used."

Across from the second listed "Thermistor Sensor" under **Recommended Model** delete: "HP K486" and replace with: "Unit compatible with power meter being used."

Page 3-3, Figure 3-2, Number 1:

Delete: "(HP 432 only)."

Page 3-6, Paragraph 3-22:

Add the following: "For power meter leveling (**ALC MODE [MTR]**), the power meter is used in conjunction with the internal leveling loop. Low frequency variations are handled by the power meter, and high frequency variations are handled by the internal leveling loop."

Page 3-9, Figure 3-6:

Under EQUIPMENT change the Power Meter listing to: "HP 432A/B/C, 436A, 438A." Change the Thermistor Mount listing to: "Any sensor compatible with the power meter being used."

Under the **NOTE** delete: "**The HP 435 and 436 power meters will not power meter level this plug-in. Only an HP 432 may be used.**" and add: "**When using an HP 436A power meter, enable RANGE HOLD to lock power meter in one range.**"

Under PROCEDURE, numbers 1 and 5, delete all reference to "HP 432A," "HP 8478A," "HP K486A," and "HP K281C."

Page 4-2, Table 4-1:

Across from "Squarewave Symmetry" under **83592C Adjustment** add "5-28."

Page 4-9, Power Meter Leveling:

Insert "13a. External leveling is shown using the HP 432A, HP 8478B, and HP K486A. However, the HP 432A/B/C, 436A, 438A meters and compatible sensors may also be used."

CHANGE 4 (Cont'd)

Page 5-2, Table 5-1:
Change A4R2 to A4R7.
Change A4R3 to A4R8.
Change A4R4 to A4R14.
Change A4R5 to A4R12.
Change A4R6 to A4R13.
Change A4R7 to A4R9.
Change A4R8 to A4R10.
Delete the line beginning with A4R9.
Change A4R11 to A4R15. Under **Description**, change U11 to U9.
Change A4R47 to A4R81. Under **Description**, change U7-Q6 to U17-Q9.
Change A4R56 to A4R82. Under **Description**, change U5 to U18.
Change A4R59 to A4R78. Under **Description**, change U8-Q1 to U16-Q6.
Delete the line beginning with A4R67.

Page 5-5, Table 5-2:
Across from 5-27 under "**Adjustments**," delete "Power Meter Leveling Calibration" and replace with "Squarewave Symmetry Adjustment (CHANGE 4)."

Page 5-51:
Replace pages 5-51 through 5-53 with the **5-26. ALC ADJUSTMENT (CHANGE 4)** procedure in this change sheet.

Page 5-56, **POWER METER LEVELING CALIBRATION**:
Delete pages 5-56 and 5-57 and replace with **5-28. SQUAREWAVE SYMMETRY ADJUSTMENT (CHANGE 4)** procedure in this change sheet.

Pages 5-58 to 5-61: **ALC GAIN ADJUSTMENT**:
Replace all reference to A4R11 with A4R15.

Page 5-58, DESCRIPTION:
Change A4U11 to A4U9.

Page 5-58, EQUIPMENT:
Across from "Power Meter" add: "436A, and 438A."
Across from both Thermistor Mounts delete: "HP 8478A" and "HP K486," and replace with "Unit compatible with power meter being used."

Page 5-61, Paragraph 5-29:
Add the following steps:

"27. With the Model 83592C set to −5 dBm, press **[INSTR PRESET] [CW]**. Set the oscilloscope to a 10 us sweep time. If the GAIN control (A4R15) has been over adjusted, the shape of the squarewave on the oscilloscope will be distorted."

"28. Back off on A4R15 and observe the squarewave. If the shape of the squarewave improves, back off until there is no more change. If there is no change, in the shape of squarewave as A4R15 is adjusted, return it to its initial position."

Page 6-16 Table 6-3:
Replace the parts list for the A4 Assembly with **A4 Replaceable Parts (CHANGE 4)** from this change sheet.

Page 8-19, **A4 ALC Assembly**:
Add the following paragraph at the end of the A4 ALC assembly description:

"When used in the ALC MODE **[MTR]**, the A4 ALC assembly uses both the power meter and the internal leveling loop to level the power. Each loop has a separate log amplifier. The output of the "internal" log amplifier is sent through a high pass R-C filter and combined with the output of the power meter log amplifier. This composite signal represents the actual RF power. The power meter leveling loop responds to low frequency variations, while the internal loop responds to high frequency variations."

CHANGE 4 (Cont'd)

Page 8-49, **A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION:**
Replace pages 8-49 to 8-62 with the **A4 ALC CIRCUIT DESCRIPTION (CHANGE 4)** from this change sheet.

Page 8-63/8-64, Figure 8-28:
Replace Figure 8-28 with *Figure 8-28. A4 ALC Block Diagram (CHANGE 4)* from this change sheet. Note this is a fold-out page.

Page 8-63/8-64, Figure 8-29:
Replace Figure 8-29, with *Figure 8-29. A4 ALC Component Locations (CHANGE 4)* from this change sheet.

Page 8-63/8-64, Table 8-12:
Replace Table 8-12 with *Table 8-12. Leveling Control Lines (CHANGE 4)* from this change sheet.

Page 8-63/8-64, A4P1 Pin-out Table:
Replace the A4P1 Pin-out Table with *A4P1 Pin-out Table (CHANGE 4)* from this change sheet.

Page 8-63/8-64, Figure 8-32:
Under **NOTE**, change the middle paragraph to read: **"Adjustment of the EXT/MTR ALC CAL screw will affect the waveforms at TP8 and TP5. Adjust the CAL screw until the correct waveforms are obtained."**

Page 8-63/8-64, Figure 8-33:
Replace Figure 8-33 with *Figure 8-33. Open Loop Waveforms (CHANGE 4)* from this change sheet.

Page 8-63/8-64, Figure 8-34:
Replace Figure 8-34 with *Figure 8-34. A4 ALC Schematic Diagram (CHANGE 4)* from this change sheet. Note this is a fold-out page.

5-26. ALC ADJUSTMENT (CHANGE 4)

NOTE

Complete adjustment of the ALC leveling loop requires procedures to be performed in the order prescribed, from Paragraph 5-26 through 5-29. Deviation from this routine may cause improper leveling and/or power variation problems.

REFERENCE:

Performance Test: Paragraph 4-14.
Service Sheet: A4

DESCRIPTION:

Adjustments compensate for DC offsets in the detected RF path and the Main ALC Amplifier. Power is roughly calibrated and low band flatness is optimized.

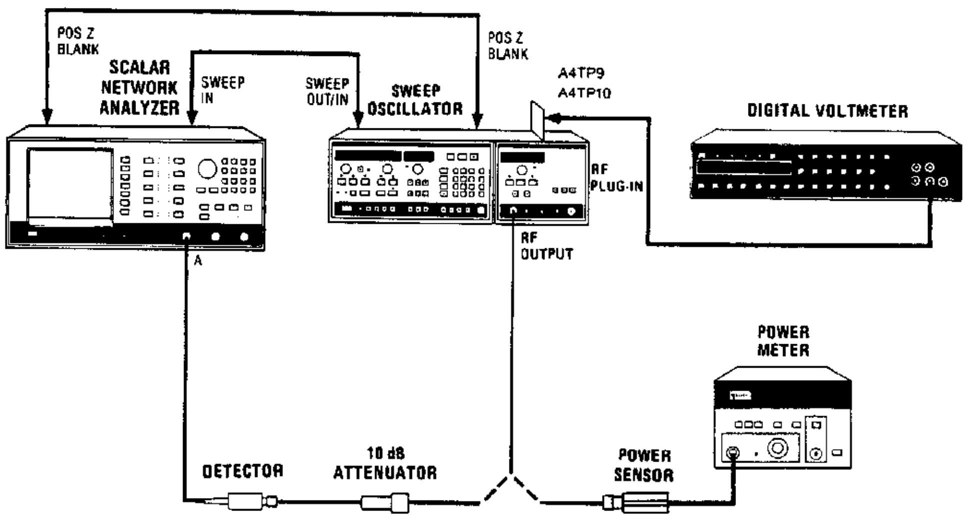


Figure 5-35. ALC Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter	HP 3455A
Power Meter	HP 436A
Thermistor Mount	HP 8485A
Scalar Network Analyzer	HP 8756A
Detector	HP 8473C
Extender Board	HP 08350-60031
10 dB Attenuator	HP 8493C-010
Sweep Oscillator	HP 8350A/B

5-26. ALC ADJUSTMENT (CHANGE 4) (Cont'd)

PROCEDURE:

NOTE

Turn AC power OFF when removing or installing PC boards.

NOTE

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6), and that the HP 8350A/B Sweep Oscillator 27.8 kHz squarewave modulation is selected.

1. Remove the A5 FM Drive board. Put the A4 assembly on an extender board. Press **[INSTR PRESET] [CW]**. Sweep the full range of the plug-in at any leveled power. Preset the following adjustments as indicated:

   A4R81 (OFS 1) .... Midrange
   A4R82 (OFS 2) .... Midrange
   A4R78 (OFS 3) .... Midrange
   A4R18 (GAIN) .... Midrange
   A4R7 (0 HI) .... Fully CW
   A4R8 (1 HI) .... Fully CW
   A4R14 (BIAS) .... Midrange
   A4R1 (SLP) .... Midrange

2. Float the ground on the Digital Voltmeter and measure the voltage between A4TP9 and A4TP10. Refer to Figure 5-36 for adjustment locations. Adjust A4R81 (OFS 1) for 0.000 ± 0.001 Vdc.

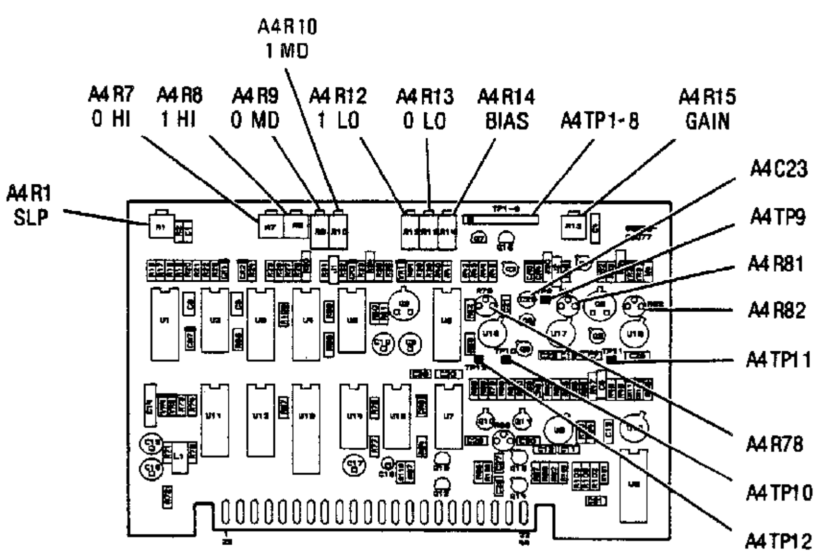


Figure 5-36. ALC Adjustment Locations

5-26. ALC ADJUSTMENT (CHANGE 4) (Cont'd)

3. Attach a jumper from A4TP11 to ground. Connect the DVM to A4TP4 (reference to ground) and adjust A4R82 (OFS 2) for a DVM reading of 0.000 ± 0.001 Vdc. Remove the jumper.

4. Connect the DVM between A4TP12 and A4TP9 (floating ground). Adjust A4R78 (OFS 3) for a DVM reading of 0.000 ± 0.001 Vdc.

5. On the HP 8350A/B, press **[CW] [5] [0] [MHz ms]**. Turn OFF the HP 83592C RF power. Connect the DVM to A4TP7 (ground to P1 pin 42) and adjust A4R14 (BIAS) for a DVM reading of 0.000 ± 0.001 Vdc. Turn ON the HP 83592C RF power.

6. Set the HP 8350A/B LINE power to OFF. Remove the A4 assembly from the extender board and reinsert the A4 assembly directly into the instrument. Set the HP 8350A/B LINE power to ON and press **[CW] [5] [0] [MHz ms]**. Connect the Power Meter to the HP 83592C RF OUTPUT.

7. Set the HP 83592C for a POWER reading of −5 dBm. Adjust A4R13 (0 LO) for an RF output power at the HP 83592C connector of −5 ± 0.1 dBm.

8. Set the HP 83592C for a POWER reading of +7 dBm. Adjust A4R9 (0 MD) for an RF output power at the HP 83592C connector of +7 ± 0.1 dBm.

9. Iterate between steps 7 and 8 until both low and midpower ranges are calibrated and no readjustment is necessary.

10. Set the HP 83592C for a POWER reading of +10 dBm. Adjust A4R7 (0 HI) for an RF output power at the HP 83592C connector of +10 ± 0.1 dBm.

11. Disconnect the Power Meter and monitor the RF output with the HP 8756A Scalar Network Analyzer. Press HP 8350A/B **[INSTR PRESET]** to sweep the full range of the plug-in. Press HP 8350A/B **[⊔⊓ MOD]** for compatibility with the HP 8756A. Set the HP 83592C for a POWER reading of −3 dBm. Press **[RF BLANK] [SAVE] [1]**.

12. Adjust A4R1 (SLP) for best overall flatness from 10 MHz to 2.4 GHz as observed on the HP 8756A.

13. Adjust A4R12 (1 LO) for best continuity at the bandswitch point at 2.4 GHz.

14. Set the HP 83592C for a POWER reading of +7 dBm. On the HP 8350A/B, press **[SAVE] [2]**. Adjust A4R10 (1 MD) for best continuity at the bandswitch point.

15. Set the HP 83592C for a POWER reading of +10 dBm. On the HP 8350A/B, press **[SAVE] [3]**. Adjust A4R8 (1 HI) for best trace continuity at the bandswitch point.

16. Iterate between steps 13, 14, and 15 using **[RECALL] [1], [2],** and **[3]** until trace continuity at all three power settings is achieved.

17. Reinstall the A5 FM board assembly.

5-28. SQUAREWAVE SYMMETRY ADJUSTMENT (CHANGE 4)

NOTE

Complete adjustment of the ALC leveling loop requires several procedures to be performed in the order prescribed from paragraphs 5-26 to 5-29. Deviation from this routine may cause improper leveling and/or power variation problems.

Turn AC power OFF when removing or installing PC boards.

This procedure assumes that A3S1 is set to the factory-set position (Table 5-6).

REFERENCE:

Performance Tests: Paragraph 4-21
Service Sheet: A4

DESCRIPTION:

C23 (SYM 1) and R99 (SYM 2) minimize overshoot of the squarewave. R92 adjusts the duty cycle of the squarewave.

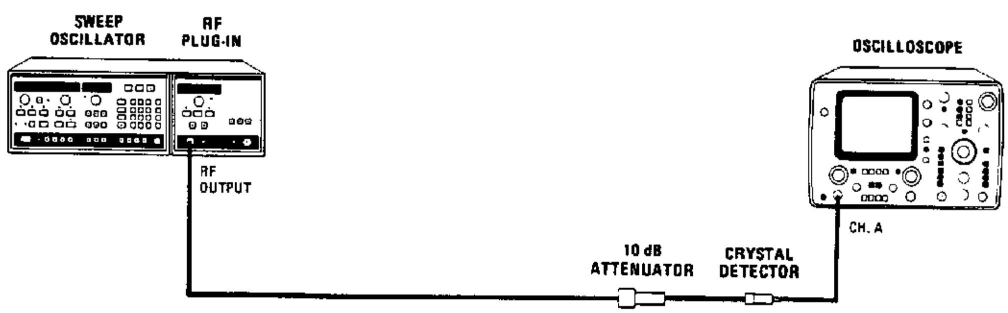


Figure 5-39. Squarewave Symmetry Adjustment Setup

EQUIPMENT:

Sweep Oscillator .... HP 8350A/B
Oscilloscope .... HP 1740A
Crystal Detector .... HP 8473C
Attenuator .... HP 8491B-010

5-28. SQUAREWAVE SYMMETRY ADJUSTMENT (CHANGE 4) (Cont'd)

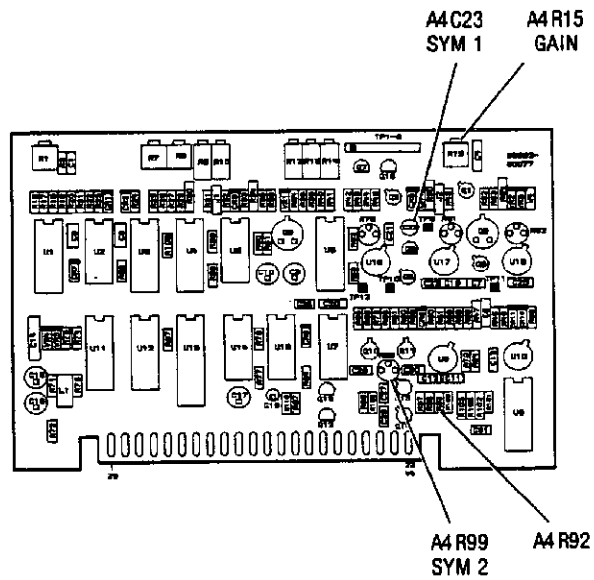


Figure 5-40a. Squarewave Symmetry Adjustment Locations

PROCEDURE:

1. Connect the equipment as shown in Figure 5-39, with A4 on an extender board. On the HP 8350A/B, press **[INSTR PRESET] [CW] [⊔⊓ MOD]**. Set the RF power level to 0 dBm and allow the equipment to warm up for one hour.

NOTE

Insure that you do not overdrive the detector as this will distort the squarewave.

2. Preset A4R15 fully counterclockwise (Figure 5-40a).
3. Press **[CW] [1] [.] [5] [GHz s]**. Alternately adjust C23 (SYM 1) and R99 (SYM 2) for the waveform shown in Figure 5-40b.
4. Press **[CW] [5] [GHz s]**. Check that the squarewave resembles that shown in Figure 5-40b. If not, adjust C23 and R99 for best squarewave while alternately checking the squarewave at 1.5 GHz.
5. Repeat step 4 for 10, 15, and 20 GHz. Optimize the shape of the squarewave over the entire range of the plug-in. Pay particular attention to the changes between band 0 and bands 1, 2, and 3. Naturally there will be slight variations at each end of the plug-in's range.
6. With the A4 board on an extender, there may be a slight "pip" on the detected signal. This will disappear when the board is mounted in the plug-in.
7. If you are unable to obtain the correct waveshape, you may need to adjust the value of R92. Replace R92 with a potentiometer having a mid range value the same as that of R92. Vary its resistance until 50% duty cycle is obtained. Remove the potentiometer and measure its value. Replace with a fixed resistor closest to the measured value.

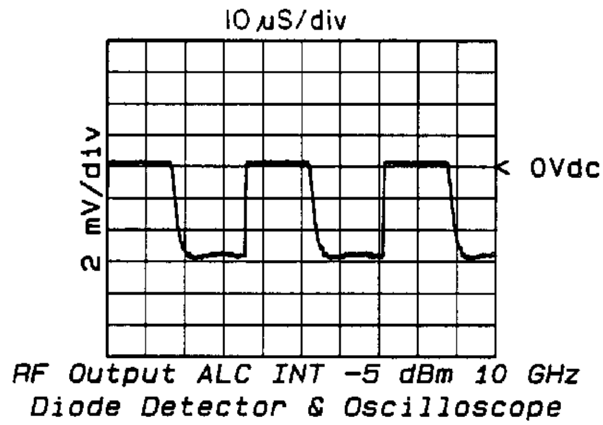


Figure 5-40b. Optimum Squarewave (CHANGE 4)

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Model 83592C Parts List (CHANGE 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4	83592--60077	2	1	BD AY -- ALC	28480	83592--60077
A4C1	0160--3879	7	4	CAPACITOR--FXD .01UF +20% 100VDC CER	28480	0160--3879
A4C3	0180--2617	1	1	CAPACITOR--FXD 6.8UF+10% 35VDC TA	25088	D6R8GS1B35K
A4C4	0160--0945	2	1	CAPACITOR--FXD 910PF +5% 100VDC MICA	28480	0160--0945
A4C6	0160--4084	8	7	CAPACITOR--FXD .1UF +20% 50VDC CER	28480	0160--4084
A4C7	0160--3874	2	2	CAPACITOR--FXD 10PF +.5PF 200VDC CER	28480	0160--3874
A4C8	0160--4084	8		CAPACITOR--FXD .1UF +20% 50VDC CER	28480	0160--4084
A4C9	0160--4084	8		CAPACITOR--FXD .1UF +20% 50VDC CER	28480	0160--4084
A4C10	0180--2697	7	4	CAPACITOR--FXD 10UF+10% 25VDC TA	28480	0180--2697
A4C11	0160--3879	7		CAPACITOR--FXD .01UF +20% 100VDC CER	28480	0160--3879
A4C12	0160--3879	7		CAPACITOR--FXD .01UF +20% 100VDC CER	28480	0160--3879
A4C13	0160--4084	8		CAPACITOR--FXD .1UF +20% 50VDC CER	28480	0160--4084
A4C14	0160--0127	2	1	CAPACITOR--FXD 1UF +20% 25VDC CER	28480	0160--0127
A4C15	0180--2697	7		CAPACITOR--FXD 10UF+10% 25VDC TA	28480	0180--2697
A4C16	0180--2697	7		CAPACITOR--FXD 10UF+10% 25VDC TA	28480	0180--2697
A4C17	0180--2697	7		CAPACITOR--FXD 10UF+10% 25VDC TA	28480	0180--2697
A4C18	0180--2661	5	1	CAPACITOR--FXD 1UF+10% 50VDC TA	25088	D1R0GS1A50K
A4C19	0160--4084	8		CAPACITOR--FXD .1UF +20% 50VDC CER	28480	0160--4084
A4C20	0160--4084	8		CAPACITOR--FXD .1UF +20% 50VDC CER	28480	0160--4084
A4C21	0160--0572	1	2	CAPACITOR--FXD 2200PF +20% 100VDC CER	28480	0160--0572
A4C22	0160--3874	2		CAPACITOR--FXD 10PF +.5PF 200VDC CER	28480	0160--3874
A4C23	0121--0448	8	1	CAPACITOR--V TRMR--CER 2.5--5PF 63V PC--MTG	28480	0121--0448
A4C25	0160--4084	8		CAPACITOR--FXD .1UF +20% 50VDC CER	28480	0160--4084
A4C26	0160--3879	7	1	CAPACITOR--FXD .01UF +20% 100VDC CER	28480	0160--3879
A4C27	0160--3878	6	1	CAPACITOR--FXD 1000PF +20% 100VDC CER	28480	0160--3878
A4C28	0160--0572	1		CAPACITOR--FXD 2200PF +20% 100VDC CER	28480	0160--0572
A4C29	0160--3873	1	2	CAPACITOR--FXD 4.7PF +.5PF 200VDC CER	28480	0160--3873
A4C30	0160--3873	1		CAPACITOR--FXD 4.7PF +.5PF 200VDC CER	28480	0160--3873
A4C31	0160--3879	7		CAPACITOR--FXD .01UF +20% 100VDC CER	28480	0160--3879
A4CR1	1901--1098	1	6	DIODE SWITCHING 1N5150 50V 200MA 4NS	28480	1901--1098
A4CR2	1901--1098	1		DIODE SWITCHING 1N415 50V 200MA 4NS	28480	1901--1098
A4CR3	1901--0535	9	4	DIODE--SM SIG SCHOTTKY	28480	1901--0535
A4CR4	1901--1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901--1098
A4CR5	1901--1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901--1098
A4CR7	1901--0535	9		DIODE--SM SIG SCHOTTKY	28480	1901--0535
A4CR8	1901--0535	9		DIODE--SM SIG SCHOTTKY	28480	1901--0535

Model 83592C Parts List (CHANGE 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4CR9	1901--0535	9		DIODE--SM SIG SCHOTTKY	28480	1901--0535
A4CR10	1901--1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901--1098
A4CR11	1901--1098	1		DIODE SWITCHING 1N4150 50V 200MA 4NS	28480	1901--1098
A4J1	1258--0124	7	2	PIN--PROGRAMING DUMPER .30 CONTACT	91506	8136--475G1
A4J2	1258--0124	7		PIN--PROGRAMING DUMPER .30 CONTACT	91506	8136--475G1
A4L1	9140--0210	1	1	INDUCTOR RF--CH--MLD 100UH 5% .166DX.385LG	28480	9140--0210
A4MP2	5040--6848	1	1	BOARD EXTR YELLOW	28480	5040--6848
A4MP3	5000--9043	6	1	PIN	28480	5000--9043
A4MP4	1251--4932	9	1	CONNECTOR--SGL CONT SKT .021--IN--BSC--SZ	91506	LSG--1AG14--1
A4Q1	1853--0007	7	1	TRANSISTOR PNP 2N3251 SI TO--18 PD=360MW	04713	2N3251
A4Q2	1854--0404	0	1	TRANSISTOR NPN SI TO--18 PD=360MW	28480	1854--0404
A4Q3	1854--0295	7	2	TRANSISTOR--DUAL NPN PD=400MW	28480	1854--0295
A4Q5	1855--0386	9	2	TRANSISTOR J--FET 2N4392 N--CHAN D--MODE	04713	2N4392
A4Q6	1855--0386	9		TRANSISTOR J--FET 2N4392 N--CHAN D--MODE	04713	2N4392
A4Q7	1855--0423	5	5	TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4Q8	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4Q9	1854--0295	7		TRANSISTOR--DUAL NPN PD=400MW	28480	1854--0295
A4Q10	1853--0316	1	2	TRANSISTOR--DUAL PNP PD=500MW	28480	1853--0316
A4Q11	1853--0316	1		TRANSISTOR--DUAL PNP PD=500MW	28480	1853--0316
A4Q12	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4Q13	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4Q14	1853--0451	5	2	TRANSISTOR PNP 2N3799 SI TO--18 PD=360MW	01295	2N3799
A4Q15	1853--0451	5		TRANSISTOR PNP 2N3799 SI TO--18 PD=360MW	01295	2N3799
A4Q16	1855--0423	5		TRANSISTOR MOSFET N--CHAN E--MODE	17856	VN10KM
A4R1	2100--2633	5	1	RESISTOR--TRMR 1K 10% C SIDE--ADJ 1--TRN	30983	ET50X102
A4R2	0698--7267	4	2	RESISTOR 19.6K 1% .05W F TC=0±100	24546	C3--1/8--T0--1962--F
A4R7	2100--2516	3	1	RESISTOR--TRMR 100K 10% C SIDE--ADJ 1--TRN	32997	3329W--1--104
A4R8	2100--2515	2	1	RESISTOR--TRMR 200K 10% C SIDE--ADJ 1--TRN	30983	ET50W204
A4R9	2100--0670	6	3	RESISTOR--TRMR 10K 10% C SIDE--ADJ 17--TRN	32997	3292X--1--103
A4R10	2100--0670	6		RESISTOR--TRMR 10K 10% C SIDE--ADJ 17--TRN	32997	3292X--1--103
A4R12	2100--3753	2	1	RESISTOR--TRMR 200K 10% C SIDE--ADJ 17--TRN	28480	2100--3753
A4R13	2100--0544	3	1	RESISTOR--TRMR 100K 10% C SIDE--ADJ 17--TRN	32997	3292X--1--104
A4R14	2100--0670	6		RESISTOR--TRMR 10K 10% C SIDE--ADJ 17--TRN	32997	3292X--1--103
A4R15	2100--2489	9	1	RESISTOR--TRMR 5K 10% C SIDE--ADJ 1--TRN	30983	ET50X502
A4R16	0698--7253	8	2	RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3--1/8--T0--5111--F
A4R17	0698--7253	8		RESISTOR 5.11K 1% .05W F TC=0±100	24546	C3--1/8--T0--5111--F
A4R18	0698--7257	2	1	RESISTOR 7.5K 1% .05W F TC=0±100	24546	C3--1/8--T0--7501--F
A4R19	0698--7263	0	2	RESISTOR 13.3K 1% .05W F TC=0±100	24546	C3--1/8--T0--1332--F
A4R20	0698--7258	3	1	RESISTOR 8.25K 1% .05W F TC=0±100	24546	C3--1/8--T0--8251--F
A4R21	0698--7261	8	3	RESISTOR 11K 1% .05W F TC=0±100	24546	C3--1/8--T0--1102--F

Model 83592C Parts List (CHANGE 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4R22	0698--7262	9	2	RESISTOR 12.1K 1% .05W F TC=0+100	24546	C3--1/8--T0--1212--F
A4R23	0698--7276	5	1	RESISTOR 46.4K 1% .05W F TC=0+100	24546	C3--1/8--T0--4642--F
A4R24	0698--7261	8		RESISTOR 11K 1% .05W F TC=0+100	24546	C3--1/8--T0--1102--F
A4R25	0698--7261	8		RESISTOR 11K 1% .05W F TC=0+100	24546	C3--1/8--T0--1102--F
A4R26	0698--7260	7	9	RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R27	0698--7231	2	1	RESISTOR 619 1% .05W F TC=0+100	24546	C3--1/8--T0--619R--F
A4R28	0698--7254	9	2	RESISTOR 5.62K 1% .05W F TC=0+100	24546	C3--1/8--T0--5621--F
A4R30	0837--0119	7	1	THERMISTOR ROD 5K--OHM TC=+.7%/C--DEG	28480	0837--0119
A4R31	0698--7279	8	1	RESISTOR 61.9K 1% .05W F TC=0+100	24546	C3--1/8--T0--6192--F
A4R32	0698--7264	1	1	RESISTOR 14.7K 1% .05W F TC=0+100	24546	C3--1/8--T0--1472--F
A4R33	0698--7248	1	2	RESISTOR 3.16K 1% .05W F TC=0+100	24546	C3--1/8--T0--3161--F
A4R34	0698--3457	6	1	RESISTOR 316K 1% .125W F TC=0+100	28480	0698--3457
A4R35	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R36	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R38	0698--7243	6	6	RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4R39	0698--7282	3	1	RESISTOR 82.5K 1% .05W F TC=0+100	24546	C3--1/8--T0--8252--F
A4R40*	0698--7288	9	1	RESISTOR 147K 1% .05W F TC=0+100	24546	C3--1/8--T0--1473--F
A4R41	0698--7284	5	1	RESISTOR 100K 1% .05W F TC=0+100	24546	C3--1/8--T0--1003--F
A4R42	0698--7256	1	4	RESISTOR 6.81K 1% .05W F TC=0+100	24546	C3--1/8--T0--6811--F
A4R43	0698--7270	9	2	RESISTOR 26.1K 1% .05W F TC=0+100	24546	C3--1/8--T0--2612--F
A4R44	0698--7233	4	1	RESISTOR 750 1% .05W F TC=0+100	24546	C3--1/8--T0--750R--F
A4R45	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4R46	0698--7234	5	2	RESISTOR 825 1% .05W F TC=0+100	24546	C3--1/8--T0--825R--F
A4R47	0837--0085	6	1	THERMISTOR ROD 680--OHM TC=+.7%/C--DEG	28480	0837--0085
A4R48	0698--7238	9	1	RESISTOR 1.21K 1% .05W F TC=0+100	24546	C3--1/8--T0--1211--F
A4R49	0698--7205	0	3	RESISTOR 51.1 1% .05W F TC=0+100	24546	C3--1/8--T0--51R1--F
A4R50	0757--0399	5	1	RESISTOR 82.5 1% .125W F TC=0+100	24546	C4--1/8--T0--82R5--F
A4R51	0698--7236	7	1	RESISTOR 1K 1% .05W F TC=0+100	24546	C3--1/8--T0--1001--F
A4R52	0698--7229	8	2	RESISTOR 511 1% .05W F TC=0+100	24546	C3--1/8--T0--511R--F
A4R53	0698--7232	3	2	RESISTOR 681 1% .05W F TC=0+100	24546	C3--1/8--T0--681R--F
A4R54	0698--3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+100	24546	C4--1/8--T0--2871--F
A4R56	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R57	0698--7248	1		RESISTOR 3.16K 1% .05W F TC=0+100	24546	C3--1/8--T0--3161--F
A4R58	0698--7256	1		RESISTOR 6.81K 1% .05W F TC=0+100	24546	C3--1/8--T0--6811--F
A4R59	0698--7229	8		RESISTOR 511 1% .05W F TC=0+100	24546	C3--1/8--T0--511R--F
A4R60	0698--7247	0	2	RESISTOR 2.87K 1% .05W F TC=0+100	24546	C3--1/8--T0--2871--F
A4R61	0698--7219	6	1	RESISTOR 196 1% .05W F TC=0+100	24546	C3--1/8--T0--196R--F
A4R62	0698--7212	9	3	RESISTOR 100 1% .05W F TC=0+100	24546	C3--1/8--T0--100R--F
A4R63	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4R64	0698--7256	1		RESISTOR 6.81K 1% .05W F TC=0+100	24546	C3--1/8--T0--6811--F
A4R68	0698--7222	1	1	RESISTOR 261 1% .05W F TC=0+100	24546	C3--1/8--T0--261R--F
A4R69	0698--7277	6	1	RESISTOR 51.1K 1% .05W F TC=0+100	24546	C3--1/8--T0--5112--F

Model 83592C Parts List (CHANGE 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4R70	0698--7246	9	1	RESISTOR 2.61K 1% .05W F TC=0+100	24546	C3--1/8--T0--2611--F
A4R71	0698--7268	5	1	RESISTOR 21.5K 1% .05W F TC=0+100	24546	C3--1/8--T0--2152--F
A4R72	0698--7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3--1/8--T0--100R--F
A4R73	0698--7212	9		RESISTOR 100 1% .05W F TC=0+100	24546	C3--1/8--T0--100R--F
A4R74	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4R75	0698--7274	3	1	RESISTOR 38.3K 1% .05W F TC=0+100	24546	C3--1/8--T0--3832--F
A4R76	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R77	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R78	2100--1986	9	1	RESISTOR--TRMR 1K 10% C TOP--ADJ 1--TRN	73138	82PR1K
A4R79	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R80	0698--7205	0		RESISTOR 51.1 1% .05W F TC=0+100	24546	C3--1/8--T0--51R1--F
A4R81	2100--2030	6	2	RESISTOR--TRMR 20K 10% C TOP--ADJ 1--TRN	73138	82PR20K
A4R82	2100--2030	6		RESISTOR--TRMR 20K 10% C TOP--ADJ 1--TRN	73138	82PR20K
A4R83	0698--7234	5		RESISTOR 825 1% .05W F TC=0+100	24546	C3--1/8--T0--825R--F
A4R84	0698--7232	3		RESISTOR 681 1% .05W F TC=0+100	24546	C3-1/8-T0-681R-F
A4R85	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R86	0698--7251	6	2	RESISTOR 4.22K 1% .05W F TC=0+100	24546	C3--1/8--T0--4221--F
A4R87	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4R88	0698-7264	1	2	RESISTOR 14.7K 1% .05W F TC=0±100	24546	C3-1/8-TO-1472-F
A4R89	0698--7263	0		RESISTOR 13.3K 1% .05W F TC=0+100	24546	C3--1/8--T0--1332--F
A4R90	0698-7264	1		RESISTOR 14.7K 1% .05W F TC=0±100	24546	C3-1/8-TO-1472-F
A4R91	0698--7240	3	1	RESISTOR 1.47K 1% .05W F TC=0+100	24546	C3--1/8--T0--1471--F
A4R92*	0698--7270	9		RESISTOR 26.1K 1% .05W F TC=0+100	24546	C3--1/8--T0--2612--F
A4R93	0698--7260	7		RESISTOR 10K 1% .05W F TC=0+100	24546	C3--1/8--T0--1002--F
A4R94	0698--7242	5	1	RESISTOR 1.78K 1% .05W F TC=0+100	24546	C3--1/8--T0--1781--F
A4R95	0698--7254	9		RESISTOR 5.62K 1% .05W F TC=0+100	24546	C3--1/8--T0--5621--F
A4R96	0698--7251	6		RESISTOR 4.22K 1% .05W F TC=0+100	24546	C3--1/8--T0--4221--F
A4R97	0698--7267	4		RESISTOR 19.6K 1% .05W F TC=0+100	24546	C3--1/8--T0--1962--F
A4R98	0698--7257	2	1	RESISTOR 7.5K 1% .05W F TC=0+100	28480	0698--7257
A4R99	2100--1738	9	1	RESISTOR--TRMR 10K 10% C TOP--ADJ 1--TRN	73138	82PR10K
A4R100	0698--7262	9		RESISTOR 12.1K 1% .05W F TC=0+100	24546	C3--1/8--T0--1212--F
A4R101*	0698--7256	1	4	RESISTOR 6.81K 1% .05W F TC=0+100	24546	C3--1/8--T0--6811--F
A4R102	0698--3440	7	2	RESISTOR 196 1% .125W F TC=0+100	24546	C4--1/8--T0--196R--F
A4R103	0757--0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+100	24546	C4--1/8--T0--1101--F
A4R105	0698--7205	0		RESISTOR 51.1 1% .05W F TC=0+100	24546	C3--1/8--T0--51R1--F
A4R106*	0698--3440	7	2	RESISTOR 196 1% .125W F TC=0+100	24546	C4--1/8--T0--196R--F
A4R108	0698--8827	4	1	RESISTOR 1M 1% .125W F TC=0+100	28480	0698--8827
A4R110	0698--7243	6		RESISTOR 1.96K 1% .05W F TC=0+100	24546	C3--1/8--T0--1961--F
A4TP1--8	1251--5618	0	1	CONNECTOR 8--PIN M POST TYPE	28480	1251--5618
A4TP9	0360--0535	0	4	TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP10	0360--0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION

Model 83592C Parts List (CHANGE 4)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr. Code	Mfr. Part Number
A4TP11	0360--0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4TP12	0360--0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
A4U1	1826--0417	6	3	IC SWITCH ANLG QUAD 16--DIP--C PKG	27014	LF13333D
A4U2	1826--0616	7	2	IC OP AMP PRCN QUAD 14--DIP--C PKG	06665	OP--11EY
A4U3	1826--0610	1	2	IC MULTIPLXR 4--CHAN--ANLG DUAL 16--DIP--C	06665	MUX24FQ
A4U4	1826--0417	6		IC SWITCH ANLG QUAD 16--DIP--C PKG	27014	LF13333D
A4U5	1826--0616	7		IC OP AMP PRCN QUAD 14--DIP--C PKG	06665	OP--11EY
A4U6	1826--0610	1		IC MULTIPLXR 4--CHAN--ANLG DUAL 16--DIP--C	06665	MUX24FQ
A4U7	1820--1197	9	1	IC GATE TTL LS NAND QUAD 2--INP	01295	SN74LS00N
A4U8	1826--0417	6		IC SWITCH ANLG QUAD 16--DIP--C PKG	27014	LF13333D
A4U9	1826-0319	7	2	IC OP AMP GP DUAL 14--DIP--P PKG	A3500	TBA231
A4U10	1826--0026	3	1	IC COMPARATOR PRCN TO--99 PKG	01295	LM311L
A4U11	1826--0752	2	1	IC CONV 12--B--D/A 16--DIP--C PKG	24355	AD7542BD
A4U12	1820--1216	3	1	IC DCDR TTL LS 3--TO--8--LINE 3--INP	01295	SN74LS138N
A4U13	1820--1730	6	1	IC FF TTL LS D--TYPE POS--EDGE--TRIG COM	01295	SN74LS273N
A4U14	1820--1199	1	1	IC INV TTL LS HEX 1--INP	01295	SN74LS04N
A4U15	1820--1198	0	1	IC GATE TTL LS NAND QUAD 2--INP	01295	SN74LS03N
A4U16	1826--0021	8	1	IC OP AMP GP TO--99 PKG	27014	LM310H
A4U17	1826--0447	2	1	IC OP AMP WB TO--99 PKG	27014	LF257H
A4U18	1826--0318	6		IC OP AMP GP DUAL 14--DIP--P PKG	A3500	TBA231
A4VR1	1902--0041	4	1	DIODE--ZNR 5.11V 5% DO--35 PD=.4W	28480	1902--0041
A4VR2	1902--0111	9	1	DIODE--ZNR 1N753A 6.2V 5% DO--7 PD=.4W	28480	1902--0111
A4VR3	1902--3070	5	1	DIODE--ZNR 4.22V 5% DO--35 PD=.4W	28480	1902--3070
A4VR4	1902--0049	2	2	DIODE--ZNR 6.19V 5% DO--35 PD=.4W	28480	1902--0049
A4VR5	1902--0049	2		DIODE--ZNR 6.19V 5% DO--35 PD=.4W	28480	1902--0049
A4W4	8159--0005	0	1	RESISTOR--ZERO OHMS 22 AWG LEAD DIA	28480	8159--0005

A4 AUTOMATIC LEVELING CONTROL (ALC), CIRCUIT DESCRIPTION (CHANGE 4)

The A4 Automatic Leveling Control (ALC) assembly is part of a closed loop power leveling function, designed to control the amplitude of the RF output power. The **General** section below describes loop operation, including some components external to the A4 assembly. The rest of this operational theory is devoted to detailed description of the circuits found on the A4 assembly.

General

The circuits which accomplish power control and power leveling can be divided into two categories: internal loop circuitry, and external components of the loop. Figure 8-24 illustrates this theme.

The Power Level Reference leg of the ALC establishes the desired power level. This is accomplished by pressing the plug-in **[POWER LEVEL]** pushbutton and rotating the RPG or entering the desired reference on the Model 8350A/B front panel DATA ENTRY keys. This leg of the ALC is not an interdependent part of the loop, as shown in Figure 8-24.

The Detector leg of the ALC loop samples the actual RF output power and produces a voltage proportional to RF amplitude. This voltage is converted to log scale and compared with the Power Level Reference signal. If the voltages at the summing junction are not of equal magnitude an error voltage is generated. This error voltage is amplified and converted to a current drive for the RF modulators, which vary the transmitted RF power to correct the error and achieve the desired RF power level.

Address Decoder and Control Latches A

U12 is a 3-to-8 decoder, selecting address 2C07H when it is present on the address bus. This address serves as a chip enable for octal latch U13. Information on the data bus is then latched into U13 and used throughout the A4 assembly. U14 and U15 have been added to provide the proper outputs for all 3 ALC leveling modes.

Detector Inputs and Selection Switches B

Control lines MUX A0B and MUX A1B are encoded with leveling mode and band selection information. The lines are decoded in Table 8-12. U6 decodes these control lines to select the proper detector input for the desired operating mode.

R43 and R14 BIAS adjustment offset the Band 0 internal detector so that 0 volts at TP7 corresponds to no RF power.

EXT/MTR ALC input provides external crystal leveling capability within the −10 to −200 mV range and power meter leveling capability within the 0 to +1V range. VR4 and VR5 provide protection against transients. Two Schottky diodes, CR1 and CR2, are mounted between the EXT/MTR ALC connector and the front panel casting for similar protection.

When **MTR** (power meter) leveling is selected, the power meter (HP 432A/B/C, 436A, or 438A) is used in conjunction with the internal leveling detector. U1A routes the power meter signal to a separate POWER METER LOG AMPLIFIER. The internal leveling detector is routed through U6B and the input sample and hold to the main log amplifier. The internal leveling detector compensates for the response of the power meter and prevents instability while at the same time permitting reasonable sweep times.

A4 (ALC), CIRCUIT DESCRIPTION (CHANGE 4) (Cont'd)

Sample and Hold Drivers K

Q10 and Q11 act as complementary pairs, controlling the Input Sample and Hold, and Error Sample and Hold circuits respectively. The complementary pairs improve action of the sampling FETS Q5 and Q6 by reducing the error signal passed through gate to source capacitance. The sample and hold function of the ALC loop is used in conjunction with pulse and square wave modulation. When L PULSE ENABLE is high, and either L PULSE or SQ MOD input is low, Q10A and Q11B turn on causing Q10B and Q11A to turn off, thereby initializing the HOLD mode.

The frequency of the sampling mode is dependent on the L PULSE or SQ MOD input. When the system is used with the HP 8756A Scalar Network Analyzer, the SQ MOD input is a 27.8 kHz square wave, controlling the gates of Q5 (Block I) and Q6 (Block **E**). (Refer to Model 8350A/B Operating and Service Manual, Section V, for 27.8/1 kHz Oscillator adjustment). A time delay set by R64 and C26 causes an approximate 5 µsec delay, enabling the RF signal to come to full power before releasing HOLD and thus preventing overshoot. The sample level is maintained during the OFF pulse, thus preventing saturation of the Log and Main ALC amplifiers.

The SQ MOD input is also connected to the PIN MOD 0 and PIN MOD 1 Drivers (Blocks O and N) for RF modulation when the Model 8350A/B internal squarewave modulation is used.

Input Sample and Hold E

The Input Sample and Hold function prevents the Log Amplifier from saturating during pulse and squarewave modulation.

U16 is a unity gain follower with internal feedback whick buffers the detector input. R78 compensates for the offset voltage of the operational amplifier. Q6 and C21 perform the sample and hold function. C23 is used to reduce error due to the gate to source capacitance of Q6.

Power Meter Log Amplifier F

The Power Meter Log Amplifier is used in conjunction with the Log Amplifier in **ALC MODE [MTR]**. The Power Meter Log Amplifier sets the power level and takes care of low frequency variations, while the Log Amplifier takes care of the high frequency variations.

U5B is a unity gain follower which buffers the input of R5D. Logarithmic scaling is performed by Q3A in the feedback loop of U5D. The base-emitter voltage of Q3A is exponentially related to its collector current, hence the logarithmic action of the amplifier. Q3B compensates the Log Amp over temperature. U5A is a standard non-inverting amplifier, with its gain controlled by R33 and R32. CR3 prevents oscillation in the Log Amplifier.

Log Amplifier G

The logarithmic scaling function is performed by Q9A in the feedback loop of U17. Q9A collector current is proportional to the voltage at TP10 and exponentially related to its base-emitter voltage. Therefore, Q9A emitter voltage is logarithmically related to the input voltage at TP10.

Q9B compensates the Log Amp against changes in reverse saturation current with temperature.

CR9 clamps the output of U18 to 0.6V above the input voltage to U17, preventing oscillations.

A4 (ALC), CIRCUIT DESCRIPTION (CHANGE 4) (Cont'd)

U6A decodes MUX A0B and MUX A1B (Table 8-12) to select the proper offset voltage for power calibration at the low end of the plug-in power range. In EXTernal ALC, the power level calibration is set with the front panel EXT CAL potentiometer.

U18 amplifies the logged output for comparison with the Power Level Summing Signal (Block **H**). R9 and R10 adjust the gain of U18, and calibrate midrange power levels for their respective bands.

Guarded-gate FETs Q7, Q8 and Q16 select the appropriate detector return for INTernal, EXTernal, and PM (power meter) leveling.

Power Level Reference C
Power Level Summing H

U11 is a 12-bit microprocessor-compatible digital to analog converter (DAC), which latches data in three 4-bit nibbles. The −10V REF input sets the DAC for a maximum outut (TP2) of +10V. The voltage at TP2 is the product of −10V REF and the fractional binary input of the DAC.

The voltage at TP1 is the sum of several voltages, depending on the operating mode of the plug-in. U2A sums PWR SWP/COMP and AM inputs. In addition, selected feedback resistors R7 and R8 reduce gain to compensate for detector deviation from square-law at the upper limits of the plug-in power range.

The EXT CAL input is summed through amplifier U2C. R30, in the feedback loop of U2C, provides temperature compensation for the Log Amplifier and detectors.

Error, Sample and Hold I

The Error, Sample and Hold function prevents the Main ALC Amp from saturating during pulse and square wave modulation.

U2D pin 10 is the summing junction for the Power Level Summing output, Log Amplifier output, and FREQ TRK V is a 0 to 5 volt ramp proportional to the YTM DRIVE Voltage. R1 (SLP) adjusts the overall slope of Band 0.

Under leveled power conditions, the voltage at U2D pin is zero. A non-zero voltage represents an error and forces a change in modulator current until power is again level.

U2D buffers the error voltage. Q5 and the following integrating circuit (U9) perform the sample and hold. C7 eliminates error due to the gate to source capacitance of Q5.

Log Amplifier Selector J

The Log Amplifier Selector circuit selects through path for the Log Amplifier, or combines its output with that of the Power Meter Log Amplifier (MTR). In MTR, R84 and C3 act as a high pass filter, to shape the output of the Log Amplifier, which is then combined with the Power Meter Log Amplifier output. The combination of the two prevents instability when using certain power meters.

In switch U4: A and B are open, C is closed in INT or EXT DET mode. The opposite is true in MTR mode.

A4 (ALC) CIRCUIT DESCRIPTION (CHANGE 4) (Cont'd)

Main ALC Amp L
Unleveled Signal M

Both inputs to integrator U9 are at virtual ground under leveled power conditions, allowing for immediate response to an input error voltage.

R15 optimizes the speed at which the loop responds to power level changes.

L RFB goes low during bandswitching to blank the RF power, thus preventing the loop from saturating. When Model 8350A/B RF BLANK is selected, L RFB goes low during retrace and U1D closes, pulling current through C4, forcing TP5 high and turning on the PIN modulators.

Under unleveled conditions, VR2 and VR3 will clamp the output of U9 at approximately +5 and −7 volts, preventing negative or positive saturation. When the output of U9 approaches −2 volts, comparator U10 activates the front panel LED indicating unleveled power.

U8D is not used.

Collector current in common-base transistor Q1 is exponentially related to the base-emitter voltage. PIN modulators are driven exponentially to maintain constant loop gain.

Emitter-follower Q2, CR5 and CR4 control the gain of the exponential current drive.

PIN Mod 0 Driver O
PIN Mod 1 Driver N

R101 and R105 compensate for the loss of modulator sensitivity with increasing bias current. They are factory selected to make the modulator characteristics for band 0 match the modulator characteristics for bands 1 to 4 as closely as possible.

Q15 (Block **O**) or Q14 (Block **N**) increase isolation between Band 0 and Band 1 by shutting off the modulator in the inactive band. Q12 and Q13 provide squarewave modulation and RF blanking, when selected.

R92 is factory selected to match the modulator for best square wave modulation symmetry.

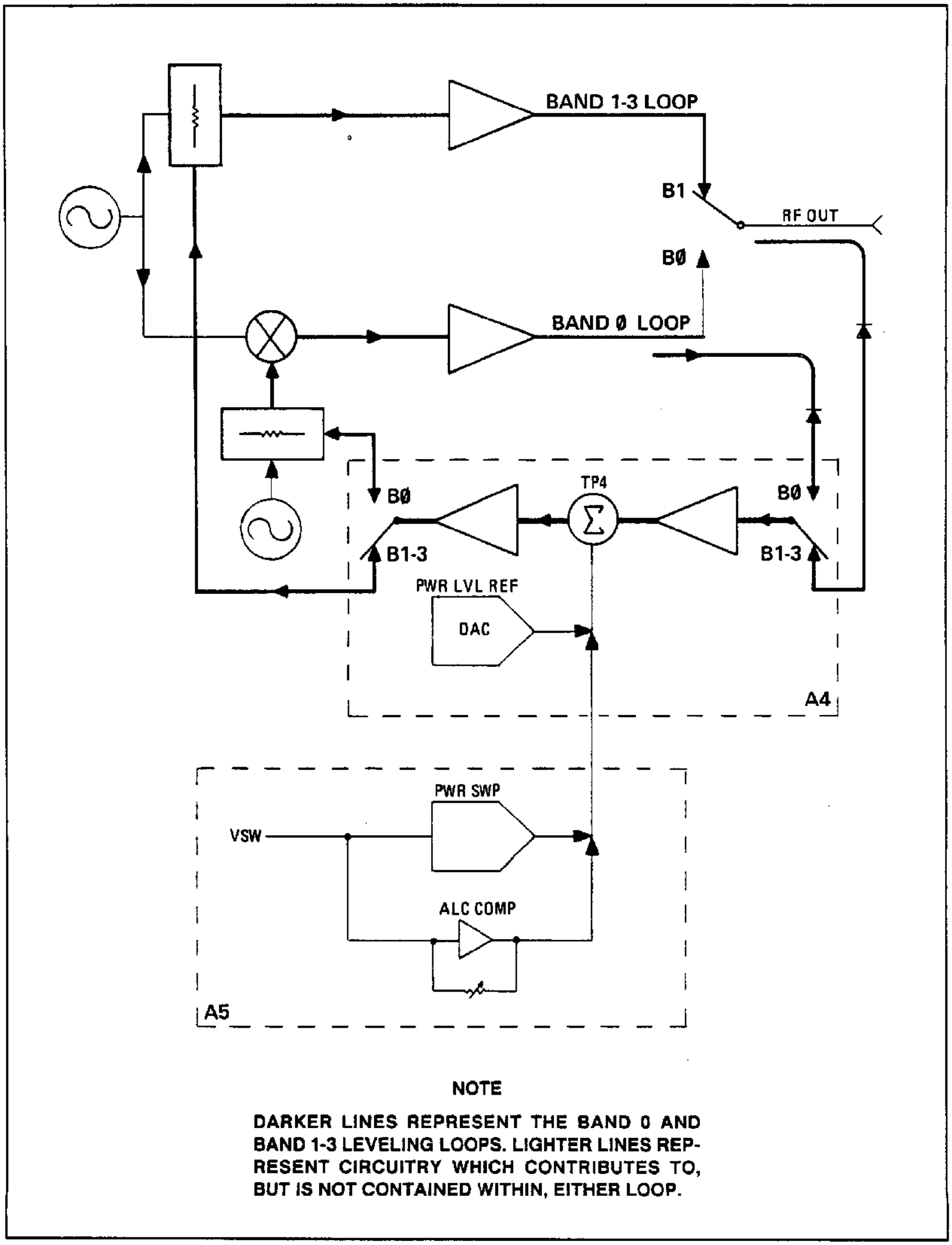


Figure 8-24. Simplified ALC Block Diagram (CHANGE 4)

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

NOTE

To ensure that Option 002 plug-ins remain in the same attenuator setting during troubleshooting, press [SHIFT] [POWER SWEEP]. This allows full ALC control without changing attenuator settings.

Since the Automatic Leveling Control (ALC) function of the Model 83592C RF Plug-In includes many individual components arranged in a highly interdependent closed loop, the scope of the A4 ALC Troubleshooting section extends well beyond the limits of the A4 assembly. Portions of the A5 FM Driver assembly, and several microcircuit components which contribute to the power leveling function, are discussed below.

The ALC loop is a complex feedback loop which monitors the RF output power and continuously corrects for any deviation from the desired power level. Because it is a closed system, it is difficult to isolate causes from effect when a problem arises. Therefore, the key to troubleshooting is to examine individual components, correlating the expected output for a particular input signal.

This troubleshooting outline is organized into two major sections: Troubleshooting Symptoms, and Troubleshooting Diagnostics. The section entitled "Symptoms" (1) characterizes possible failure modes, (2) provides some general troubleshooting hints, and (3) refers the reader to more detailed procedures found under "Diagnostics."

Troubleshooting Symptoms

The procedures outlined below help to systematically characterize the failure as quickly as possible. The following failure symptoms are discussed:

RPG/POWER DISPLAY FAILURE
UNLEVELED (LED)
FLATNESS/OSCILLATIONS (Power Dropouts)
FULL UNLEVELED POWER
NO POWER (Single Band)
NO POWER (All Bands)
POWER SWEEP/FLATNESS

Evaluating the specific failure may require an HP 432A/B/C, 436A, or 438A Power Meter or the HP 8756A Scalar Network Analyzer with the Model 11664B Detector. (However, a crystal detector with an "A vs B" oscilloscope may often be substituted.) Figure 8-25 configures a typical test setup. Initiate all tests with the **[INSTR PRESET]** condition.

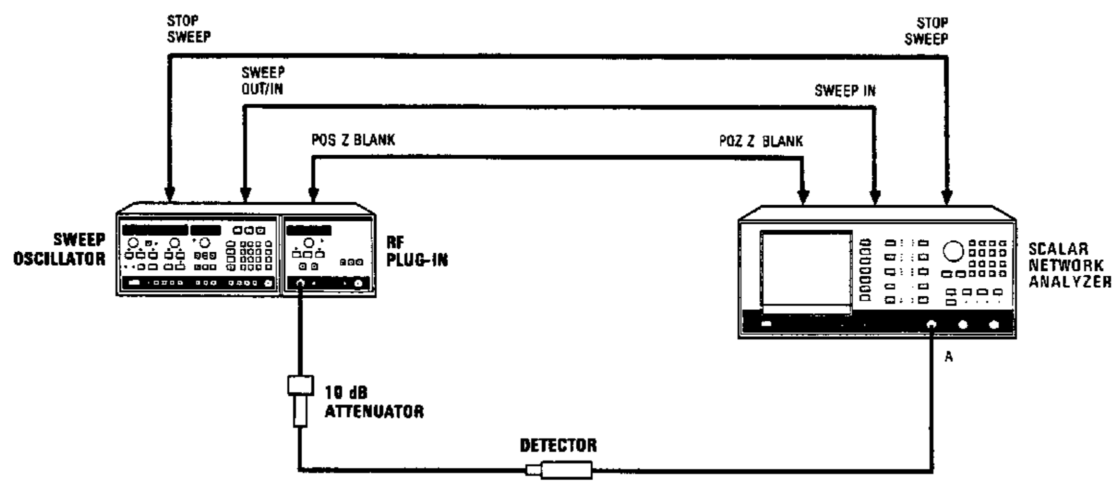


Figure 8-25. Typical ALC Troubleshooting Setup

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

RPG / POWER DISPLAY FAILURE

Check that the POWER display changes when either the RPG is rotated or data is entered via the Model 8350A/B keyboard. This verifies that the digital information is reaching the mainframe, is properly processed, and is then displayed.

- If the display is flashing rapidly or showing random patterns, refer to A1/A2 Front Panel or A3 Digital Interface Troubleshooting. If the RPG causes a change in the measured RF power level, but the POWER display remains the same, refer to A1/A2 Troubleshooting. If the RPG produces no response whatsoever, or if the front panel display is blank, refer to A1/A2 Troubleshooting, and trace the problem back to the Model 8350A/B mainframe.

UNLEVELED (LED)

If the UNLEVELED light turns on during the sweep, enter a sweep time of 20 seconds (i.e. one second per GHz). Observe the SWP light on the Model 8350A/B Sweep Oscillator, and determine at which times during the sweep the UNLEVELED light turns on.

- If the UNLEVELED light remains lit during retrace, suspect problems in the front panel annunciator drivers. Refer to A1/A2 Troubleshooting.
- If the UNLEVELED light blinks briefly at the beginning of the sweep, the heterodyned Band 0 may be sweeping through 0 Hz and causing an ALC drop-out. Check this by slowly increasing the start frequency. If the UNLEVELED light stops blinking, enter a CW frequency of 0 MHz and adjust the Model 83592C front panel FREQ CAL knob to the center of its adjustment range that keeps the UNLEVELED light on. Press **[INSTR PRESET]** and observe the UNLEVELED light. A frequency counter may be used to check frequency accuracy at 10 MHz or 50 MHz. If necessary, refer to Section V, Adjustments, in this manual, and perform the Frequency Accuracy calibration procedure.
- If the UNLEVELED light is on only during the first two seconds of the sweep (10 MHz to 2.4 GHz), the problem is in the Band 0 loop. If it is lit after the first two seconds of the sweep but prior to retrace, the problem is related to Bands 1 through 3. In either case, the Reference leg of the ALC circuitry and those components common to all bands are probably NOT at fault. Check the appropriate detector, modulator, and detector selection switch.
- If the UNLEVELED light is on during the entire forward sweep, suspect components common to all bands.

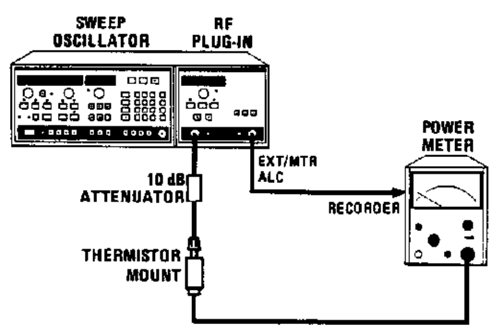


Figure 8-26. Power Meter Leveling Setup

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

- If the UNLEVELED light flashes on briefly three times during the sweep (at 2, 7, and 13.5 seconds into the trace), the problem occurs at the bandswitch points. Check for the RF blanking (L RFB) pulses during bandswitch at A4P1-29, as shown in Figure 8-30. If the signal is missing, trace the problem back through the Model 8350A/B, to the blanking request (L RFBRQ) line on the RF Plug-In A6 assembly. If L RFB is present, but A4TP5 does not clamp at greater than or equal to +4 Vdc during blanking, suspect A4U2D or A4U9.

- If the UNLEVELED light flashes briefly during the sweep, but does not imply any of the above failure modes, check power flatness. See below.

FLATNESS / OSCILLATIONS (Power Dropouts)

Monitor the RF output with the HP 8756A as shown in Figure 8-25. Optimize the output power with the front panel PEAK control.

- If the power level is constant across the sweep within approximately 5 dB, then the Plug-In may only require ALC flatness adjustments. Refer to Section V, Adjustments, in this manual, for the Internal Leveled Flatness adjustment procedure.

- If the measured power level lies between +10 and −5 dBm, but cannot be controlled via the front panel, refer to the Digital Control section under Troubleshooting Diagnostics.

- If the trace appears chopped or broken, the loop may be oscillating. Refer to Section V, Adjustments, in this manual, and perform the ALC Gain adjustment procedure.

FULL UNLEVELED POWER (One or More Bands)

If power is unleveled in Band 0 only or Bands 1-3 only, select a sweep width within the unleveled band(s). If power is unleveled in all bands, continue to sweep the plug-in's full range.

- Attempt to level the power externally using the HP 432A/B/C, 436A, or 438A Power Meter as shown in Figure 8-26. Select **MTR** leveling, and enter a 100 second sweep time. If the RF power is now leveled, the failure is most likely in the detectors or the Detector Selection Switch, A4U6. Refer to the following paragraph. If this does not prove to be the case, the problem may be in the two analog switches U3B and U6A. It may be necessary to perform the ALC adjustments in Section V of this manual.

- Check the Detector Selection Switch by entering a CW frequency within the band or leveling mode in question and trace the detector voltage through U6B. If the input to be selected does not match the output, check the MUX A0 and MUX A1 lines (see Table 8-12). Also check U12 and U13 as described under Digital Control.

- Check the voltage at TP5. If it is greater than or equal to +5 Vdc, suspect the Mod Drivers or Modulators. If it is below −2 Vdc, suspect the Detectors and Detector Leg.

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

NO POWER (Single Band Only)

If no power is detected in one band, but there is leveled power in another band, suspect the components of the RF path appropriate to the faulty band within the ALC loop.

NOTE

Turn off LINE switch before removing or installing any assembly.

With the ALC assembly removed from the plug-in, 27.8 kHz squarewave modulation from the Model 8350A/B is not available. However, the HP 8756A 27.8 kHz squarewave can be connected to the rear panel PULSE IN connector to maintain HP 8756A compatibility.

- To check the RF components, remove the A4 ALC assembly from its socket. This removes all bias from the modulators, and should allow maximum power through the RF path in all bands. If full power (at least +12 dBm from .01 to 2.4 GHz, +8 dBm from 2.4 to 18.6 GHz, and +6 dBm from 18.6 to 20 GHz) is then detected in all bands, the RF Amplifiers (A14 and A17), the Cavity Oscillator (A11), the Low Pass Filter (FL1), the DC Return (A15), the Isolator (AT1), the YTM (A12), and the YTF (A20) are verified. Suspect primarily the appropriate detector. Also inspect the appropriate modulator, as well as the A4 Mod Drivers and Detector Selection Switch.
- If the RF signal for Bands 1 through 3 is missing, check the A6 SRD and PIN Diode Bias circuit. If ths PIN diode switch bias signal is not getting through, or the B0 control line is missing, the Switched YTM will come up in the Band 0 position.

NO POWER (All Bands)

NOTE

Turn off line power before removing or installing any assembly.

- If no power is detected in any band, remove the A4 ALC assembly. This removes all bias from the modulators, and should allow full RF power to be transmitted. If there is still no power, check the rear panel AUX OUTPUT for approximately 0 dBm to verify that the A13 YIG Oscillator is providing an RF output. Refer to RF Troubleshooting for details.
- If removing the A4 assembly causes full unleveled RF power to appear, reinstall the board and check A4TP5. If less than −2 Vdc is present, verify that the voltage across R49 is zero. If A4TP5 is greater than +5 Vdc, suspect any circuitry between the Detector Selection Switch and A4TP5, particularly the Log Amp.

POWER SWEEP / FLATNESS

- If power increases smoothly with frequency, and POWER SWEEP is NOT selected, suspect problems with the A5 FM Driver assembly.

NOTE

Turn off line power before removing or installing any assembly.

Remove the A5 board from the plug-in. If the situation improves, suspect a failure on the A5 assembly.

- If the RF power is leveled within approximatley 5 dB, refer to Section V, Adjustments, in this manual, and perform the Internal Leveled Flatness adjustment procedure.

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

Troubleshooting Diagnostics

The troubleshooting information below is organized into functional areas:

DIGITAL CONTROL A
REFERENCE POWER LEVEL C H
DETECTORS / DETECTOR SELECTION SWITCH B, DC1, CR1
DETECTOR LEG E F G
MODULATOR LEG I L
MOD DRIVERS N O
MODULATORS A17, A13
SAMPLE AND HOLD E K

DIGITAL CONTROL A

Address Decoder U12 and Control Latch U13 control digital switches throughout the A4 assembly. Their operation can be confirmed by performing the Hex Data Rotation Write at address 2C07 Hex. Enter the following keystrokes:

[SHIFT] [0] [0]	Enters Hex Data command
[2] [GHz s] [0] [7]	Address location 2C07 (U13)
[M4]	Hex Data Rotation Write

- Check the outputs of U13 for the waveforms shown in Figure 8-2.
- If any output signal is missing or misplaced, check the data lines agains Figure 8-2. If no output is found, look for activity at U13 pin 11. Check for L INST1 and BA3 to pulse low, while BA0, BA1, and BA2 pulse high. If these pulses are missing, trace the problem back to A3 Digital Interface.

If the Digital Control section is working, the primary outputs of U13 are easily controlled by selecting the appropriate front panel function while in the CW sweep mode. (e.g., B1 is held high by selecting a CW frequency in Bands 1 through 3; selecting MTR leveling holds the PM line high, etc.).

REFERENCE POWER LEVEL C H

The Reference Power Level Leg produces a voltage proportional to the desired power level. This signal is a summation of the absolute power reference, AM, detector compensation, and power sweep signals.

The detector compensation and power sweep signals are generated on the A5 FM Driver assembly. If an A5 failure is suspected, refer to troubleshooting information on the A5 Service Sheet. Unless A5 is suspect, simplify A4 troubleshooting by turning off the line power and removing the A5 assembly. Although power sweep will be disabled and the power flatness will be lost, the ALC Loop should still level without the signals provided by the A5 assembly.

DAC U11 establishess the absolute power level. The −10V REF from the A6 assembly is scaled to yield from 0 Vdc (−5 dBm displayed) to the +10 Vdc (+20 dBm displayed) at TP2. (This breaks down to a voltage step of 0.40 Vdc per 1.0 dB of power over the dynamic range, or 6.00 Vdc at +10 dBm.)

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

A self-test routine is available to exercise the ALC DAC. Enter:

[SHIFT] [5] [0]

The waveform in Figure 8-31 should be seen at TP2. Note that the exercise routine for the 12-bit DAC yields a staircased waveform with 13 levels. The first step shows the maximum +10 Vdc output with all bits high. The following levels represent the voltage at TP2 with successive bits loaded high in order from the Most Significant Bit to the Least Significant Bit.

- If the waveform at TP2 is not correct, check for −10V REF, and trace any problem back to the A8 assembly. Look for activity on L INST1, BA0, and BA1. BA2 and BA3 should pulse high as each new DAC value is loaded, pulsing the CS line (U14 pin 8) low. If any of these lines, or a data line, appears dead, trace the problem back to the A3 assembly.

U2A adds PWR SWP/COMP and AM, and provides detector flatness compensation at higher power levels with CR2 and CR1. Use the EXT MTR mode to bypass these diodes while troubleshooting.

U2C adds the front panel amplitude adjustment (EXT CAL) used with external leveling. The following levels should be seen at TP1 with A5 removed and INT leveling selected: +0.3 Vdc for −5 dBm, and +7.0 Vdc for +20 dBm. An amplitude modulation (AM) signal of 1.0 V p-p at P1-4 will produce roughly 260 mV p-p at TP1. (Note that U3A, CR2, and CR1 in the feedback path around U2A change the gain depending on the band and the desired power level. This may result in a 1.0 Vdc difference between bands at +20 dBm.)

DETECTORS / DETECTOR SELECTION SWITCH B, DC1, CR1

The detectors DC1 (Band 0) and CR1 (Bands 1-3) are tested simply by checking their output voltages under full leveled power or full unleveled power conditions. The A4 assembly must be installed for troubleshooting in Band 0 as it supplies bias current to the Band 0 detector.

NOTE

The 27.8 kHz modulation signal required for HP 8756A compatibility is not available from the Model 8350A/B when the A4 assembly is removed from the plug-in, and must be supplied from the HP 8756A through one of its rear panel MODULATOR DRIVE connectors.

- If no power is measured in the suspected band, turn off the line power and remove the A4 assembly. Return power to the instrument. (If there is still no RF power, suspect components of the RF path. Refer to RF Troubleshooting.) If full unleveled RF power is obtained, apply two narrow strips of cellophane tape to the pin-edge connector at P1-19 and P1-44 to isolate the outputs of the modulator drivers from the modulators. Reinstall the A4 board. This removes bias from the modulators, allowing full RF power transmission, while providing detector bias.

- If full leveled power (+10 dBm from .01 to 2.4 GHz, +6 dBm from 2.4 to 18.6 GHz, and +4 dBm from 18.6 to 20 GHz) or full unleveled power (at least +12 dBm from .01 to 2.4 GHz, +8 dBm from 2.4 to 18.6 GHz, and +6 from 18.6 to 20 GHz) is measured, sweep only the band in question and check the voltages at the detector inputs against the values shown in Table 8-11. (Use high-impedance 10:1 probes.)

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

Table 8-11. Detector Voltages

	Full Leveled +10 dBm	Full Unleveled +20 dBm
Band 0 (A4P1-21)	−150 to −200 mV	−300 to −400 mV
Bands 1-3 (A4P1-20)	−100 to −120 mV	−200 to −600 mV

- If the detectors are working and the Detector Selection Switch is suspected, sweep only in the faulty band and monitor TP12 for the voltages seen at the selected input of U6B.
- If the EXT/MTR ALC INPUT circuits are suspected, select the desired mode and supply a test signal (low-level DC or sine wave) in the front panel BNC connector, and trace it through U6B at A4TP12.

NOTE

Remove any tape applied to edge connector pins in the previous procedure.

DETECTOR LEG E F G

The Detector Leg of the ALC loop includes components between the Detector Selection Switch and the Error Summing Amplifier U2D.

Before troubleshooting the Detector Leg, be sure the Detectors and Detector Selection Switch are working correctly. See above.

The Detector Leg can be effectively tested by using the Open Loop method of troubleshooting. This procedure utilizes the external leveling mode (**EXT**) by supplying an external DC voltage or sine wave to the EXT/MTR ALC INPUT connector. This method breaks the ALC Loop and allows waveforms to be checked against known test signals. See Figure 8-32.

MODULATOR LEG I L

The Modulator Leg includes the Error Sample & Hold and the Main ALC Amp.

U2D is a non-inverting unity-gain summing amplifier. Under leveled conditions, both U2D pin 10 and TP8 should be nearly 0.0 Vdc. Under any conditions (except during "hold"), U2D pin 10 and TP8 should be at the same voltage. If not, suspect U2D, Q5, or the Sample & Hold Driver.

U9 forms an inverting integrator. When TP8 is positive, TP5 should be at −7 Vdc. If not, suspect U1D or U9. When TP8 is negative, TP5 should be at +5 Vdc. If this is not the case, suspect U9.

- The following procedure can be used to check U2D and U9:

  1. Use a jumper to ground A4TP11.
  2. Set power for −5 dBm at any CW frequency.
  3. Press Model 83592C **[EXT]** ALC.

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

4. To check U2D, monitor U2D pin 10 and TP8 while adjusting the EXT/MTR ALC CAL screw between the extremes of its range. Both U2D pin 10 and TP8 should vary between approximately +0.5 and −0.5 Vdc.

5. Verify U9 by adjusting the CAL screw as described above and monitoring TP5. Since U9 is an integrator, TP5 should saturate and clamp (due to VR2 and VR3) at −7 Vdc and +5 Vdc, respectively. (When sweeping across a bandswitch point, RF blanking pulses will saturate TP5 at +5 Vdc regardless of input.)

6. Remove jumper from A4TP11 to ground.

Further troubleshooting of the Modulator Leg can be continued by following the Open Loop procedure outlined in Figure 8-32 and checking for the waveforms provided in Figure 8-33.

MODULATOR DRIVERS N O

The voltage-to-current conversion and current gain needed to drive the modulators is provided by Q2 and Q1 on the output of the Main ALC Amplifier. As the voltage increases at TP5 so does the current to the modulators, shunting more RF energy to ground and allowing less to pass through. Since the modulators are essentially current-controlled, the voltages measured at TP6, P1-19, and P1-44 do not vary much over a wide range of modulator attenuations.

Q2 is an emitter-follower followed by a common-base stage (Q1), with two diodes in between. Check the biases and base-emitter voltages to see if the transistors are damaged.

- To establish a bias level for the Mod Driver stages, TP5 can be forced high (+5 Vdc). Using a jumper, ground A4TP11. Press Model 8350A/B **[CW]** and select a CW frequency in the appropriate band. Select **[EXT]** ALC, and enter an RF power level of −5 dBm via front panel controls. Rotate the EXT/MTR ALC CAL knob fully counterclockwise. Verify a signal level of approximately +5 Vdc at TP5. Remove jumper from A4TP11 to ground.

R101 should be selected so that the peaking in band 0 matches the peaking in bands 1 to 3. This peaking is due to the response of the ALC loop. R92 is adjusted for 50% duty cycle of the squarewave.

- Set the HP 8350A/B to CW, SQ MOD. Connect the RF output to a crystal detector and oscilloscope. Using a function generator, drive the AM input of th HP 8350A/B with a sine wave swept in frequency from DC to 400 kHz (trigger the oscilloscope with the ramp from the function generator). The oscilloscope shows the response of the ALC loop. Vary the frequency and observe the peaking when in band 0 and in bands 1 to 3. Select R101 to match the peaking. Lower values tend to raise the gain in band 0. The minimum value is 2.7k ohms. Disconnect the function generator and press **[⊔⊓ MOD]**. While observing the squarewave on the oscilloscope, adjust R92 for 50% duty cycle.

MODULATORS

The two internal modulators for this plug-in are housed in combination microcircuit packages: A17 Modulator/Mixer (Band 0), and A16 Modulator/Splitter (Bands 1-3). Figure 8-27 provides a simplified schematic for these positive-bias, shunt-type attenuators. As more current is supplied through the modulator bias pin, the shunt diode turns on harder, sinking more RF power to ground and allowing less to reach the front panel.

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

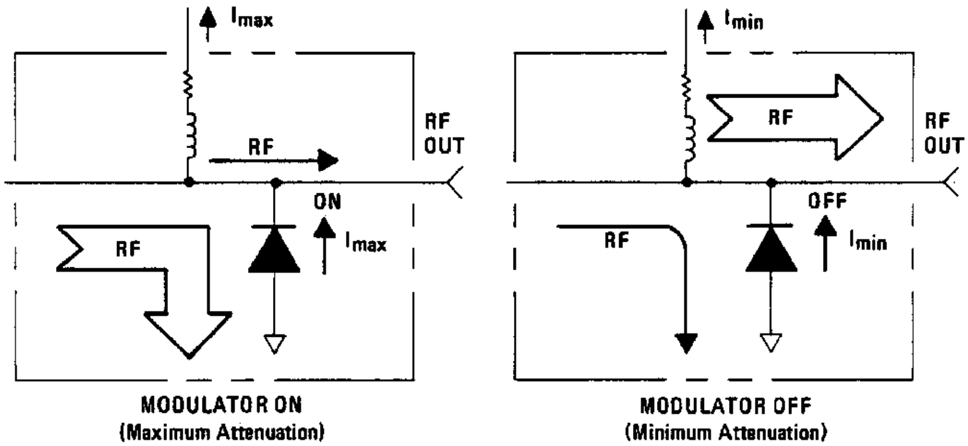


Figure 8-27. Simplified Modulator Schematic

The modulators are checked simply by noting whether the actual RF attenuation is appropriate to the modulation bias present.

NOTE

Turn off line power before removing or installing any assembly.

- If low or no RF power is observed, remove all modulator bias currents simply by removing the A4 assembly from the Motherboard. With no bias current, the RF power should pass through the modulator unhindered. If this is not the case, check the modulator diode as follows:

  1. Select Model 83592C **[EXT]** ALC. Attach a jumper from A4TP11 to ground. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully clockwise. This should result in −7 Vdc at TP5, essentially removing bias from the modulators. Measure the voltage across R49. It should be 0V. If this is not the case, isolate each modulator from its drive circuitry by applying a piece of cellophane tape to the appropriate pin edge connection: P1-44 for Band 0, or P1-19 for Bands 1-3. If the voltage across R49 now measures 0V, the modulator diode is probably shorted. If the voltage across R49 still does not measure 0V, suspect the band blanking circuitry: U8B and Q15 for Band 0, or U8C and Q14 for Bands 1-3. Remove jumper from A4TP11 to ground.

NOTE

Remove any tape applied to the pin edge connectors in the previous procedure.

- If the modulators appear to be functioning properly, check the following RF levels with a power meter or spectrum analyzer. When checking power levels internal to the RF signal path, ensure that all critical ports are terminated in 50 ohms.

  1. If power is low in all bands, check the RF level at the rear panel AUX OUTPUT connector. Refer to the RF Schematic Diagram at the end of Section VIII for the proper levels.

A4 ALC TROUBLESHOOTING (CHANGE 4) (Cont'd)

2. If power is low in Band 0 only, measure the RF levels around the A18 Modulator/Mixer. With no modulation, approximatley +13 dBm should be measured at the input of A18, with approximately −10 dBm at the output. If no output is measured, make sure the Cavity Oscillator A11 is yielding at least +8 dBm.

3. If the RF output for Bands 1-3 is low, check the RF levels around the Power Amplifier A14 with no modulation. A14 should output approximately +26 dBm with about +13 dBm at the input.

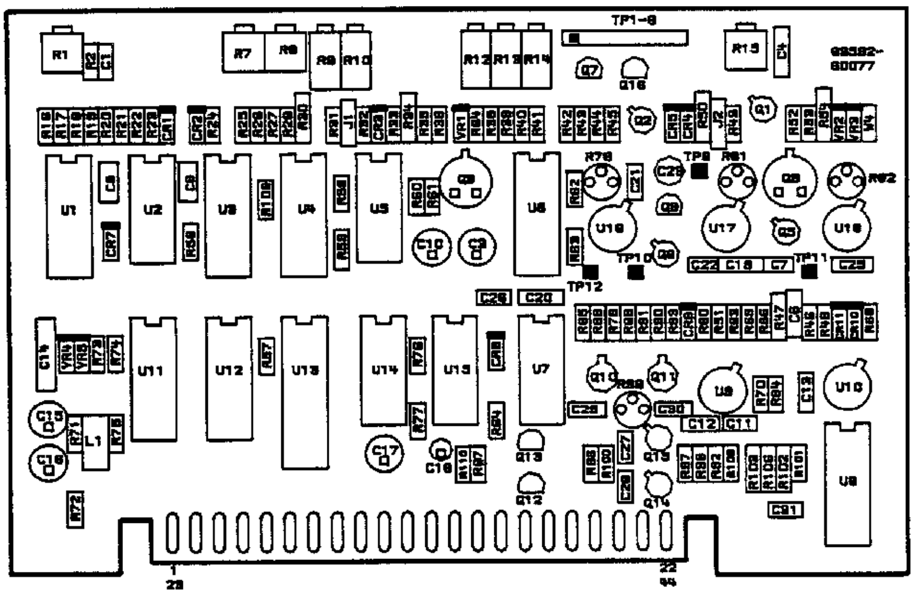
- If maximum unleveled RF power is observed, attempt to achieve maximum attenuation (minimum RF transmitted). Select Model 83592A **[EXT]** ALC. Attach a jumper from A4TP11 to ground. Enter −5 dBm RF power, and select a CW frequency in the appropriate band. Rotate the EXT/MTR ALC CAL knob fully counterclockwise. The voltage level at TP5 should be +5 Vdc. Concurrently, the voltage levels at the output of the Mod Drivers, P1-44 (Band 0) and P1-19 (Bands 1-3), should be approximately +0.6 Vdc to +0.8 Vdc.

1. If the voltages are significantly higher than this, the modulator diode is probably open.

2. Check TP6 for approximately +2.0 Vdc. The difference between the test point and the corresponding pin-edge connector gives an indication of how much current is flowing to the modulator.

SAMPLE AND HOLD E K

There are adjustments to improve the shape of the squarewave. C23 in block E and R99 in block K are used to eliminate offset in the Input Sample and Hold, and Error Sample and Hold circuits respectively. They act to effectively cancel charge passed through the gate to source capacitance of the FET. Refer to Paragraph 5-28 for the proper adjustment procedures.



HP P/N 83592-60077

Figure 8-29. A4 ALC Component Locations (CHANGE 4)

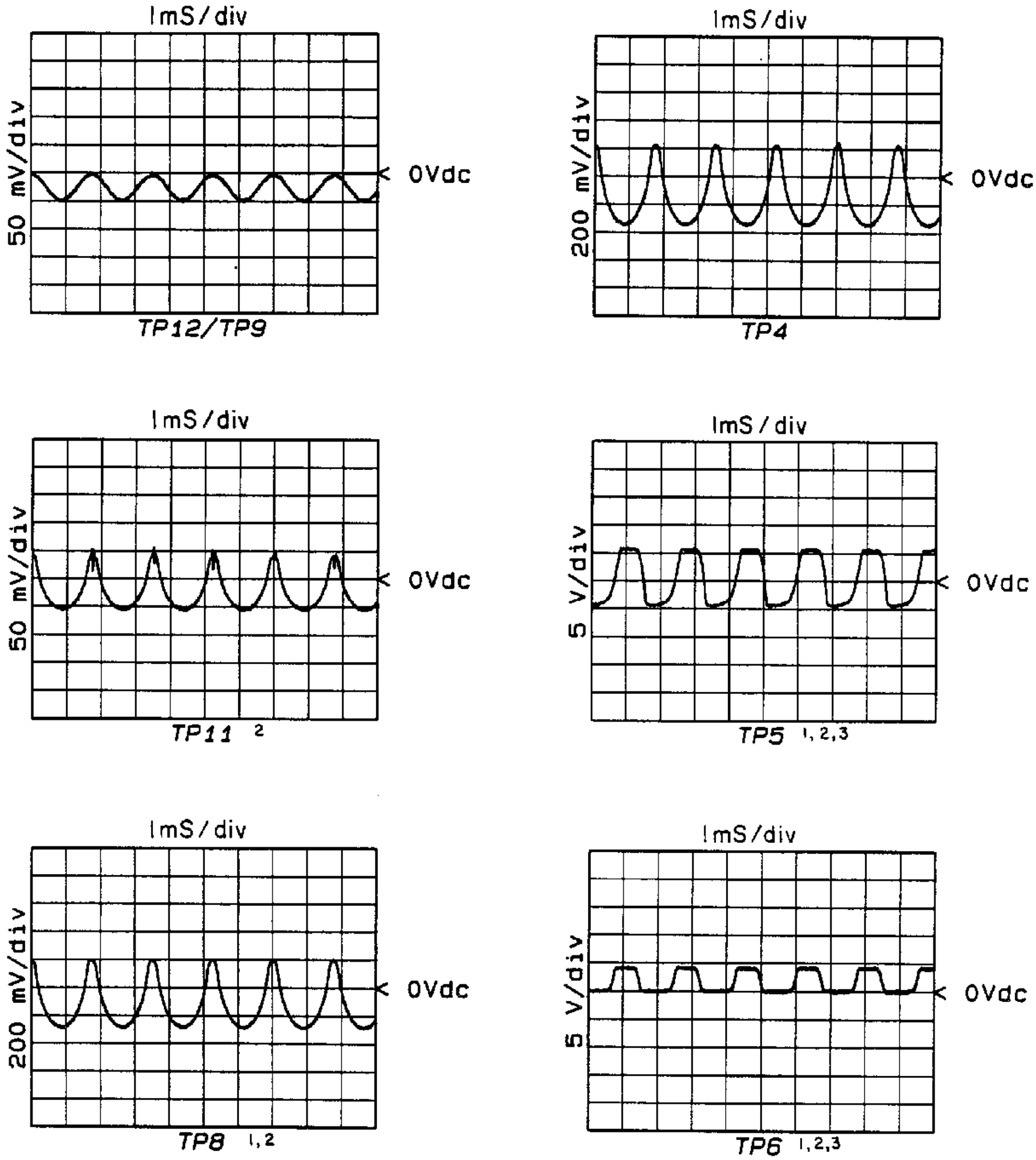
Table 8-12. Leveling Control Lines (CHANGE 4)

DATA BUS					Leveling Mode
Mux A0	Mux A1	Mux A0B	Mux A1B	PM	
H	H	H	H	L	INT 0
L	H	L	H	L	INT 1
H	L	H	L	L	EXT
L	L	H	H	H	PM 0
L	L	L	H	H	PM 1

A4P1 Pin-Out Table (CHANGE 4)

A4P1

PIN	SIGNAL	I/O	TO/FROM	FUNCTION
1	EXT DET RET	IN	J2	P
23	EXT DET	IN	J2	B
2	L UNLVL	OUT	A6P1-40, A10J1-12	M
24	EXT CAL	IN	A10J1-41	H
3	PWR REF	OUT	NOT USED	C
25			NOT USED	
4	AM	IN	P1-A4	C
26	FREQ TRK V	IN	A10J1-36	I
5	PWR SW/COMP	IN	A5P1-23	C
27	+5V	IN	A3P1-6,7	P
6			NOT USED	
28	−15V	IN	P2-28	P
7	+10V	IN	P1-8	P
29	L RFB	IN	P2-56	L, O
8	GND DIG			P
30	GND DIG			P
9	BD1	IN	A3P1-9	A, C
31	BD0	IN	A3P1-31	A, C
10	BD3	IN	A3P1-10	A, C
32	BD2	IN	A3P1-32	A, C
11	BA1	IN	A3P1-11	A, C
33	BA0	IN	A3P1-33	A, C
12	BA3	IN	A3P1-12	A, C
34	BA2	IN	A3P1-34	A, C
13	BD5	IN	A3P1-13	A
35	BD4	IN	A3P1-35	A
14	BD7	IN	A3P1-14	A
36	BD6	IN	A3P1-36	A
15	GND ANLG			P
37	GND ANLG			P
16			NOT USED	
38	+15V	IN	P2-29	P
17	−10V	IN	P1-13	P
39	−40V	IN	P1-11	P
18	L INST1	IN	A3P1-8	A, C
40	SQ MOD	IN	P2-26	K, O
19	MOD 1	OUT	A10E1	N
41	L PULSE	IN	A6P1-25	K
20	INT DET 1	IN	CR1	B
42	INT DET RET	IN	CR1	B
21	INT DET 0	IN	A10-E4	B
43	−10V REF	IN	A8P1-3	C
22	MOD DRIVE	OUT	NOT USED	L
44	MOD 0	OUT	A10J5-16	O



1. POWER: 10dBm. Offset depends on power level and **EXT/MTR ALC ``CAL''**
2. CW mode
3. Adjust **EXT/MTR ALC ``CAL''** to attain waveshape.

Figure 8-33. Open Loop Waveforms (CHANGE 4)

CHANGE 5

This change installs Revision 6 firmware.

Page 6-16, Table 6-3:

Change A3 to HP and Mfr. Part Number 83525-60080, CD 6, DIGITAL INTERFACE ASSEMBLY (does not include A3U1 and A3U2).

Change A3U1 HP and Mfr. Part Number to 83592-80025, CD 2.

Change A3U2 HP and Mfr. Part Number to 83592-80026, CD 3.

CHANGE 6

This change installs Revision 7 firmware.

Page 6-16, Table 6-3:
Change A3U1 to HP and Mfr. Part Number 83592-80038, CD 7.
Change A3U2 to HP and Mfr. Part Number 83592-80039, CD 8.

CHANGE 7

This change increases the range of the sequential-band delay compensation adjustments.

Page 6-25, Table 6-3:
Change A7R42 to HP and Mfr. Part Number 2100-0544, CD 3, RESISTOR-TRMR 100K 10%.
Change A7R43 to HP and Mfr. Part Number 2100-3611, CD 1, RESISTOR-TRMR 50K 10%.

Page 6-26, Table 6-3:
Change A7R105 to HP and Mfr. Part Number 2100-3754, CD 3, RESISTOR-TRMR 1M 10%.

CHANGE 8

Documents serial prefix change only.

CHANGE 9 (Supersedes CHANGE 2)

This change documents a modified A6 Sweep Control Assembly.

Page 6-22, Table 6-3:
Replace all the information shown for A6 with *P/O Table 6-3. Replaceable Parts (CHANGE 9) (1 of 3)* in this change sheet.

Page 6-23, Table 6-3:
Replace all the information shown for A6 with *P/O Table 6-3. Replaceable Parts (CHANGE 9) (2 of 3)* in this change sheet.

Page 6-24, Table 6-3:
Replace all the information shown for A6 with *P/O Table 6-3. Replaceable Parts (CHANGE 9) (3 of 3)* in this change sheet.

Page 8-83/84, Figure 8-44. A6 Sweep Control Component Locations:
Replace Figure 8-44 with *Figure 8-44 (CHANGE 9)* in this change sheet.

Page 8-83/84, Figure 8-49. A6 Sweep Control Schematic Diagram:
Replace Figure 8-49. with *Figure 8-49. A6 Sweep Control Schematic Diagram (CHANGE 9)* supplied in this document.

Table 6-3. Replaceable Parts (CHANGE 9) (1 of 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	83592-60107		1	BOARD ASSEMBLY-SWEEP CONTROL	28480	83592-60107
A6C1-A6C4				NOT ASSIGNED		
A6C5	0180-2617		2	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A6C6	0180-2617			CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A6C7	0180-2815		1	CAPACITOR-FXD 100UF+-20% 10VDC TA	28480	0180-2815
A6C8				NOT ASSIGNED		
A6C9	0180-0228		2	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A6C10	0180-0228			CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A6C11				NOT ASSIGNED		
A6C12				NOT ASSIGNED		
A6C13				NOT ASSIGNED		
A6C14	0160-3878		6	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C15	0160-0573		1	CAPACITOR-FXD 4700PF +-20% 100VDC CER	28480	0160-0573
A6C16	0160-3878			CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C17	0160-3878			CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C18				NOT ASSIGNED		
A6C19	0160-0575		2	CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A6C20	0160-3878			CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C21	0160-4084		2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C22	0160-4084			CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A6C23	0160-3879		2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6C24	0160-3879			CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6C25	0160-3878			CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C26	0160-3878			CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C27	0160-0575			CAPACITOR-FXD .047UF +-20% 50VDC CER	28480	0160-0575
A6C28	0160-3874		1	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A6CR1	1901-0535		3	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR2	1901-0535			DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR3	1901-0535			DIODE-SM SIG SCHOTTKY	28480	1901-0535
A6CR4	1901-0050		7	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR5	1901-0050			DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR6	1901-0050			DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR7	1901-0050			DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR8				NOT ASSIGNED		
A6CR9				NOT ASSIGNED		
A6CR10	1901-0050			DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR11	1901-0050			DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR12	1901-0050			DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR13	1901-0033		1	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A6L1	9140-0137		2	INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L2	9140-0137			INDUCTOR RF-CH-MLD 1MH 5% .2DX.45LG Q=60	28480	9140-0137
A6L3	08503-80001		1	COIL-TOROID	28480	08503-80001
A6MP2	5000-9043		1	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
A6MP3	0360-0124		1	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A6Q1	1855-0423		3	TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q2	1854-0477		2	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q3	1855-0423			TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q4	1854-0019		1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q5	1853-0405		2	TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A6Q6	1853-0405			TRANSISTOR PNP SI PD=300MW FT=850MHZ	04713	2N4209
A6Q7	1855-0423			TRANSISTOR MOSFET N-CHAN E-MODE	17856	VN10KM
A6Q8	1854-0404		1	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A6Q9	1854-0477			TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q10	1853-0281		1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A6Q11	1854-0809		2	TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A6Q12	1854-0809			TRANSISTOR NPN 2N2369A SI TO-18 PD=360MW	28480	1854-0809
A6R1				NOT ASSIGNED		
A6R2				NOT ASSIGNED		
A6R3				NOT ASSIGNED		
A6R4	0757-0466		1	RESISTOR 110K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1103-F
A6R5	0757-0280		3	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R6	0757-1094		1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A6R7	0698-3446		1	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A6R8	0698-7212		1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R9	0698-7260		6	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R10	0698-7267		1	RESISTOR 19.6K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1962-F
A6R11	0698-7283		2	RESISTOR 90.9K 1% .05W F TC=0+-100	24546	C3-1/8-T0-9092-F

See introduction to this section for ordering information. *Indicates factory selected value.

Table 6-3. Replaceable Parts (2 of 3)

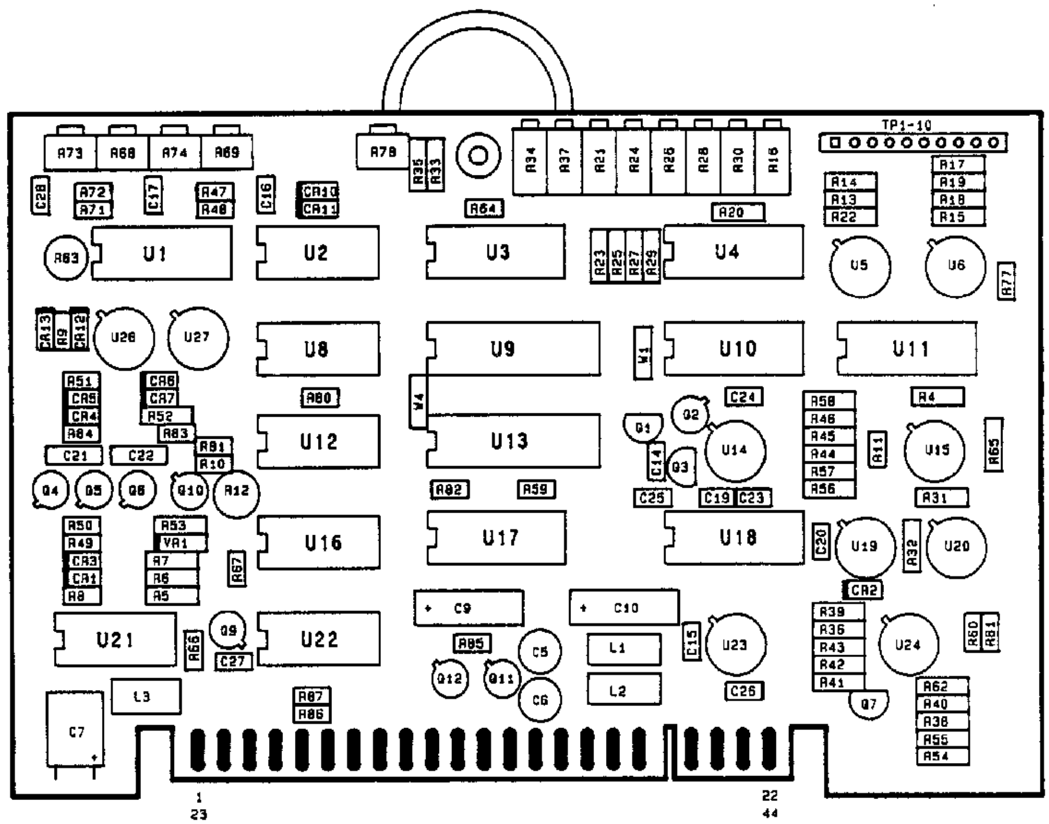
Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R12	2100-1738		1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TRN	73138	82PR10K
A6R13	0757-0442		3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R14	0757-0280			RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R15	0698-8469		8	RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R16	2100-3756		1	RESISTOR-TRMR 20 10% C SIDE-ADJ 17-TRN	28480	2100-3756
A6R17	0698-8469			RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R18	0698-8469			RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R19	0698-8469			RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R20	0699-0642		1	RESISTOR 10K .1% .1W F TC=0+-5	28480	0699-0642
A6R21	2100-3757		1	RESISTOR-TRMR 100 10% C SIDE-ADJ 17-TRN	28480	2100-3757
A6R22	0699-0831		1	RESISTOR 9.95K .1% .1W F TC=0+-5	28480	0699-0831
A6R23	0699-0830		2	RESISTOR 30.423K .1% .1W F TC=0+-5	28480	0699-0830
A6R24	2100-3732		2	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R25	0699-0830			RESISTOR 30.423K .1% .1W F TC=0+-5	28480	0699-0830
A6R26	2100-3732			RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	28480	2100-3732
A6R27	0699-0829		1	RESISTOR 42.884K .1% .1W F TC=0+-5	28480	0699-0829
A6R28	2100-0545		1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	32997	3292X-1-102
A6R29	0699-0828		1	RESISTOR 82.541K .1% .1W F TC=0+-5	28480	0699-0828
A6R30	2100-3759		1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	28480	2100-3759
A6R31	0698-8469			RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R32	0698-8469			RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R33	0698-8469			RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R34	2100-3755		1	RESISTOR-TRMR 50 10% C SIDE-ADJ 17-TRN	28480	2100-3755
A6R35	0698-8469			RESISTOR 6.99K .1% .1W F TC=0+4	28480	0698-8469
A6R36	0698-8827		3	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A6R37	2100-3750		1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	28480	2100-3750
A6R38	0698-8827			RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A6R39	0699-0154		1	RESISTOR 7.2K .1% .125W F TC=0+-25	28480	0699-0154
A6R40	0698-6867		1	RESISTOR 7.35K .25% .125W F TC=0+-50	28480	0698-6867
A6R41	0757-0442			RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R42	0698-3260		2	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A6R43	0698-3150		2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R44	0757-0442			RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6R45	0698-3260			RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A6R46	0698-3150			RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A6R47	0698-7234		2	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A6R48	0698-7234			RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A6R49	0698-7227		1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A6R50	0698-7319		1	RESISTOR 196 1% .125W F TC=0+-100	24546	C4-1/8-T0-196R-F
A6R51	0698-7212		1	RESISTOR 100 1% .05W F TC=0+-100	28480	0698-7212
A6R52	0698-0084		1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A6R53	0698-3429		1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A6R54	0698-3453		1	RESISTOR 196K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1963-F
A6R55	0698-8827			RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-8827
A6R56	0698-3159		1	RESISTOR 26.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2612-F
A6R57	0698-3266		1	RESISTOR 237K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2373-F
A6R58	0757-0280			RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R59	0698-7236		1	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A6R60	0698-7277		2	RESISTOR 51.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5112-F
A6R61	0698-7277			RESISTOR 51.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5112-F
A6R62	0757-0458		1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A6R63	2100-2030		1	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	73138	82PR20K
A6R64	0698-7260			RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R65	0757-0440			RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7501-F
A6R66	0698-7272		1	RESISTOR 31.6K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3162-F
A6R67	0698-7253		1	RESISTOR 5.11K 1% .05W F TC=0+-100	24546	C3-1/8-T0-5111-F
A6R68	2100-2516		2	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R69	2100-2516			RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	32997	3329W-1-104
A6R70				NOT ASSIGNED		
A6R71	0698-7237		1	RESISTOR 1.1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1101-F
A6R72	0698-7242		2	RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-F
A6R73	2100-2521		2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A6R74	2100-2521			RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	30983	ET50X202
A6R75				NOT ASSIGNED		
A6R76	0698-8959		1	RESISTOR 619K 1% .12W		
A6R77	0698-7278		1	RESISTOR 56.2K 1% .05W F TC =0+ −100	28480	0698-7277
A6R78	2100-2692		1	RESISTOR-TRMR 1M 20% C SIDE-ADJ 1-TRN	30983	ET50X105
A6R79	0689-7243		1	RESISTOR 1.96K 1% .05W F TC=0+-100	28480	0689-7243
A6R80*	0698-7249		1	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3481-F
A6R81	0698-7260			RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R82	0698-7243		1	RESISTOR 1.96K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1961-F
A6R83	0698-7242			RESISTOR 1.78K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1781-F
A6R84	0698-7239		1	RESISTOR 1.21K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1211-F
A6R85	0698-7260			RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R86	0698-7260			RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R87	0698-7260			RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6TP1	1251-4672		10	CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP2	1251-4672			CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP3	1251-4672			CONNECTOR 10-PIN M POST TYPE	28480	1251-4672

See introduction to this section for ordering information. *Indicates factory selected value

Table 6-3. Replaceable Parts (3 of 3)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6TP4	1251-4672			CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP5	1251-4672			CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP6	1251-4672			CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP7	1251-4672			CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP8	1251-4672			CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP9	1251-4672			CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6TP10	1251-4672			CONNECTOR 10-PIN M POST TYPE	28480	1251-4672
A6U1	1826-0720		2	IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A6U2	1820-1211		1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A6U3	1820-1196		1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A6U4	1826-0720			IC SWITCH ANLG QUAD 16-DIP-C PKG	06665	SW-02FQ
A6U5	1826-0471		5	IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U6	1826-0471			IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U7				NOT ASSIGNED		
A6U8	1820-1112		2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U9	1820-1730		1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A6U10	1826-1186		2	ANALOG SWITCH 4 SPST 16 -CERDIP	28480	1826-1186
A6U11	1826-1186			ANALOG SWITCH 4 SPST 16 -CERDIP	28480	1826-1186
A6U12	1820-1112			IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A6U13	1820-2024		1	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A6U14	1826-0026		2	IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U15	1826-0471			IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U16	1820-1246		1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS09N
A6U17	1820-1216		1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A6U18	1826-0752		1	IC CONV 12-B-D/A 16-DIP-C PKG	24355	AD7542BD
A6U19	1826-0471			IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U20	1826-0471			IC OP AMP LOW-DRIFT TO-99 PKG	28480	1826-0471
A6U21	1820-1202		1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A6U22	1820-1197		1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A6U23	1826-0026			IC COMPARATOR PRCN TO-99 PKG	01295	LM311L
A6U24	1826-0092		1	IC OP AMP GP DUAL TO-99 PKG	28480	1826-0092
A6U25				NOT ASSIGNED		
A6U26	1826-0185		1	IC OP AMP SPCL TO-99 PKG	3L585	CA3080
A6U27	1826-0915		1	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-C PKG	01295	TL071ACJG (PER HP DWG)
A6VR1	1902-3002		1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A6W1	8159-0005		2	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A6W2				NOT ASSIGNED		
A6W3				NOT ASSIGNED		
A6W4	8159-0005			RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

See introduction to this section for ordering information. *Indicates factory selected value.



HP P/N 83592-60107

Figure 8-44. A6 Sweep Control Component Locations (CHANGE 9)

CHANGE 10

Documents a serial prefix change only.

CHANGE 11

This change documents a new front dress panel, front casting, and attaching hardware.

Page 6-33, Table 6-3:

Change MP4, FRONT PANEL-DRESS to HP and Mfr. Part Number 83592-00025, CD 4.
Change MP18, CASTING-FRONT to HP and Mfr. Part Number 83592-20106, CD 4.
Change MP19, RETAINER-PUSH ON to HP and Mfr. Part Number 0510-1267, CD 6.
Change MP28, LATCH-SCREW to HP and Mfr. Part Number 83525-20069, CD 7.
Delete MP28a, SCREW SET.

CHANGE 12

This change documents a selectable FREQUENCY REFERENCE output.

Throughout the manual there are references to the 1.0 V/GHz rear panel output. Change all references to include 0.5 V/GHz. What follows are some specific areas to change.

Page 1-6, Table 1-2. (Supplemental Performance Characteristics):
Under **GENERAL CHARACTERISTICS**:
Change **Frequency Reference Output** to, selectable, 1.0 V/GHz ±PP 25 mV (0.01 to 18 GHz) or 0.5 V/GHz ±PP 25 mV (0.01 to 26.5 GHz) rear panel BNC output.

Page 1-8, paragraph 1-22:
Change to read as follows:
A rear panel 1.0 V/GHz (0.5 V/GHz) signal corresponds to the RF output frequency up to 18 GHz (26.5 GHz). This output voltage is selectable and may be used as a reference for pretuninig external equipment. The HP 8410B/8411A network analyzer utilizes the 1.0 V/GHz output for phase-locking. The HP 83554A/55A/56A millimeter-wave source module uses the 0.5 V/GHz as its frequency reference for millimeter frequency applications.

Page 3-16:
After page 3-16 add page 3-17/3-18, *Figure 3-9. A2 Frequency Reference Selection Switch* provided in this document.

Page 5-49, paragraph **5-25. FREQUENCY REFERENCE 1V/GHz OUTPUT:**
Add the following:

NOTE

The frequency reference selection switch must be set to the 1.0 V/GHz position before performing this adjustment. Refer to Figure 3-9.

Page 6-14, Table 6-3:
Change A2 to HP and Mfr. Part Number 83592-60122, CD 8.
Add A2C9 HP and Mfr. Part Number 0160-4808, CD 4, CAPACITOR-FXD CER 470 pF 100 WV.

Page 6-15, Table 6-3:
Change to the following:

Reference Designation	HP Part Number	CD	Description
A2R8	0757-0463	4	RESISTOR-FXD 82.5K 1% .125W
A2R9	0698-7251	6	RESISTOR-FXD 4.22K 1% .05W
A2R10	0698-6320	8	RESISTOR-FXD 5K 0.1% .125W
A2R11	0698-6630	3	RESISTOR-FXD 20K 0.1% .125W
A2R18	0698-3159	5	RESISTOR-FXD 26.1K 1% .125W

Add the following:

Reference Designation	HP Part Number	CD	Description
A2R27	0698-7260	7	RESISTOR-FXD 10K 1% .05W
A2R29	0698-5437	6	RESISTOR-FXD 12K 0.1% .125W
A2S1	3101-2751	1	SWITCH ROCKER 2 POSITION DIP 1A
A2VR1	1902-0041	4	DIODE-ZNR 5.11V 5% DO-35 PD=.4W

Delete A2R28.

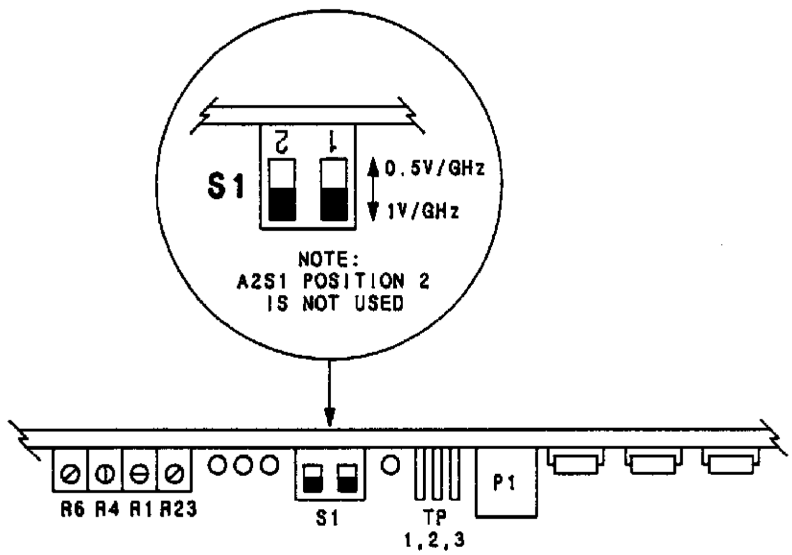
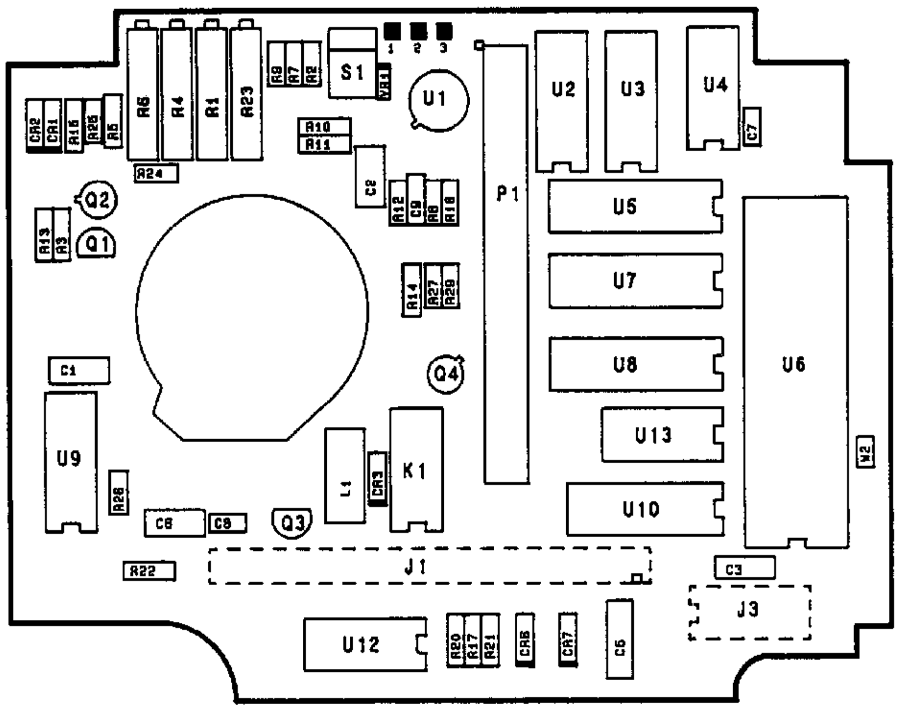


Figure 3-9. A2 Frequency Reference Selection Switch (CHANGE 12)



HP P/N 83592-60122

Figure 8-12. A2 Front Panel Interface, Component Locations (CHANGE 12)

CHANGE 13

This change documents a new YO Driver Board Assembly.

On the pages listed below, replace the figures with the new figures given.

Adjustments

Page 5-10, *Figure 5-2. −10V Reference Adjustment Location.*
Page 5-13, *Figure 5-4. Sweep Control Adjustment Location.*
Page 5-16, *Figure 5-7. YO and YTM DAC Calibration Adjustment Location.*
Page 5-24, *Figure 5-14. YO Retrace Compensation Adjustment Location.*
Page 5-27, *Figure 5-16. YO Delay Compensation Adjustment Location.*

Service

Page 8-105, *Figure 8-63. A8 YO Driver, Component Locations.*

Page 8-105, *Figure 8-71. A8 YO Driver, Schematic Diagram:*
Replace Block I YIG COIL CURRENT SOURCE with the partial schematic *P/O A8 YO Driver, Schematic Diagram (CHANGE 30)* from this document.

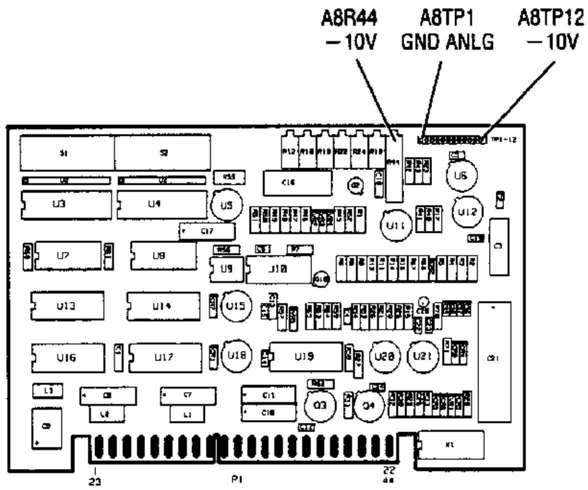
Page 6-27, Table 6-3:
Change the A8 Part No. to 83595-60070, CD 8, 83595-60070.
Add A8C22, 0160-3879, CD 7, CAPACITOR .01UF +20% 100VDC CER, 02010, SR201C103MAA.
Add A8C23, 0160-3879, CD 7, CAPACITOR .01UF +20% 100VDC CER, 02010, SR201C103MAA.
Add A8C24, 0160-3878, CD 6, CAPACITOR .001UF +20% 100VDC CER, 02010, SR201C102MAA.
Add A8C25, 0160-4801, CD 7, CAPACITOR 100 PF +5% 100VDC CER, 02010, SA101A101JAA.
Add A8CR9, 1901-0033, CD 2, DIODE-GEN PRP 180V 200MA DO-35, 00046, NDP692.

Page 6-29, Table 6-3:
Add A8R70, 0698-7220, CD 9, RESISTOR 215 1% .05W FTC=+100, 00746, CRB20.
Add A8R71, 0698-7220, CD 9, RESISTOR 215 1% .05W FTC=+100, 00746, CRB20.

Page 8-105, Figure 8-71 in the upper left hand corner:
Change the Part No. 83592-60002 to 83595-60070.

Page 8-105, Figure 8-71 in the lower left hand corner:
Change the Serial Prefix to 2621A.

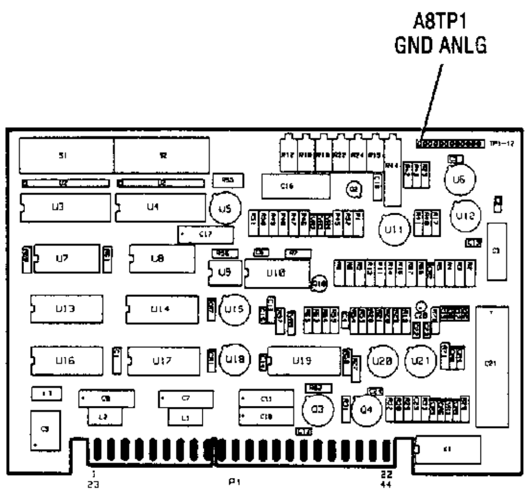
A8



HP P/N 83595-60070

Figure 5-2. −10V Reference Adjustment Location (CHANGE 13)

A8



HP P/N 83595-60070

Figure 5-4. Sweep Control Adjustment Locations (CHANGE 13)

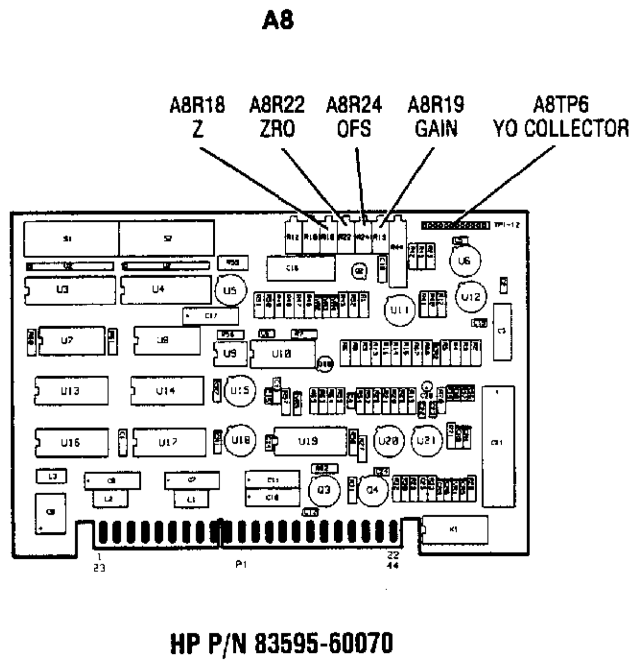


Figure 5-7. YO and YTM DAC Calibration Adjustment Locations (CHANGE 13)

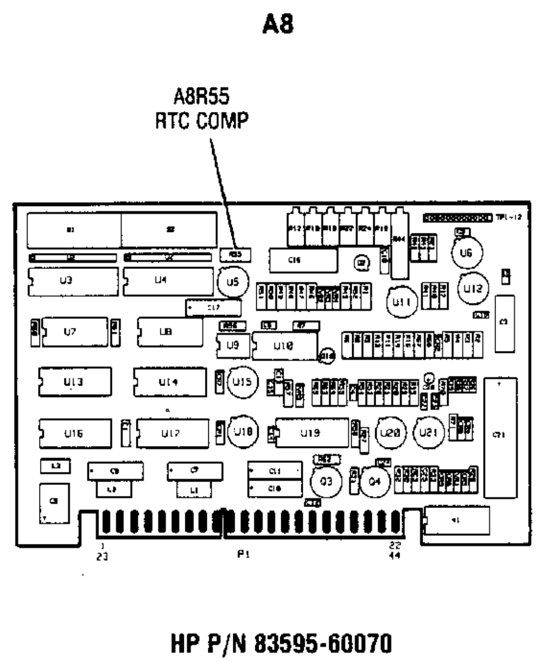
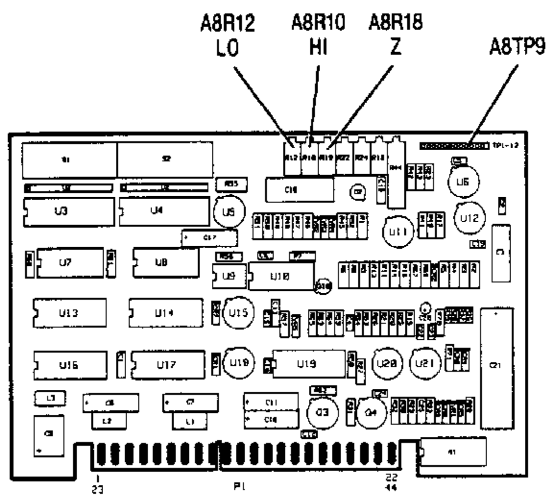


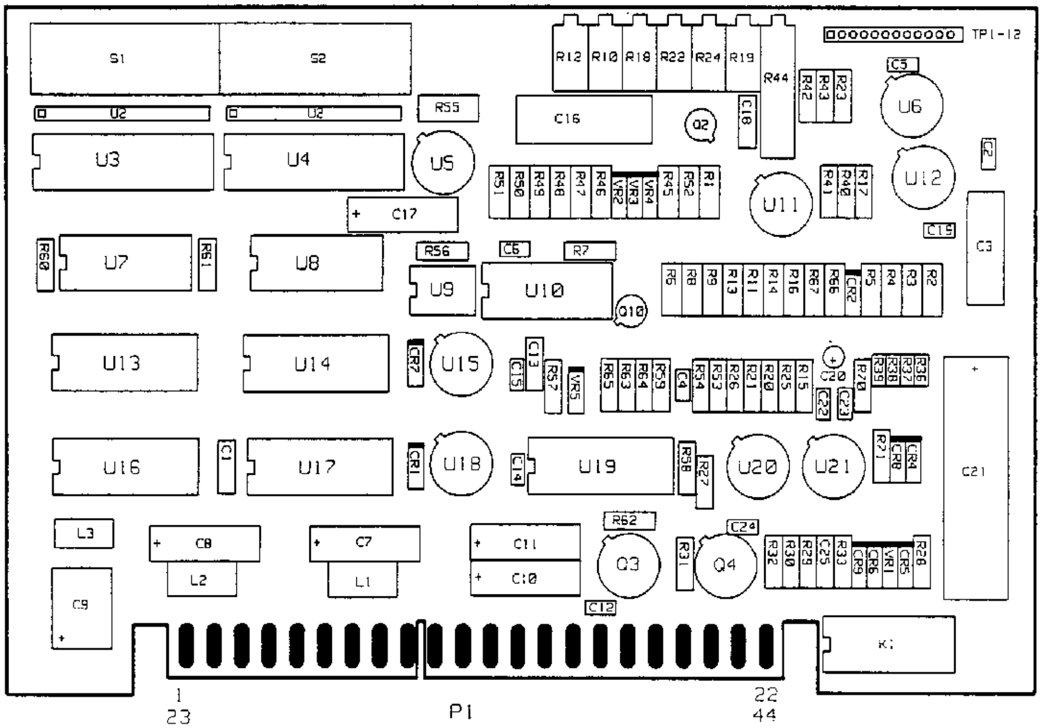
Figure 5-14. YO Retrace Compensation Adjustment Location (CHANGE 13)

A8



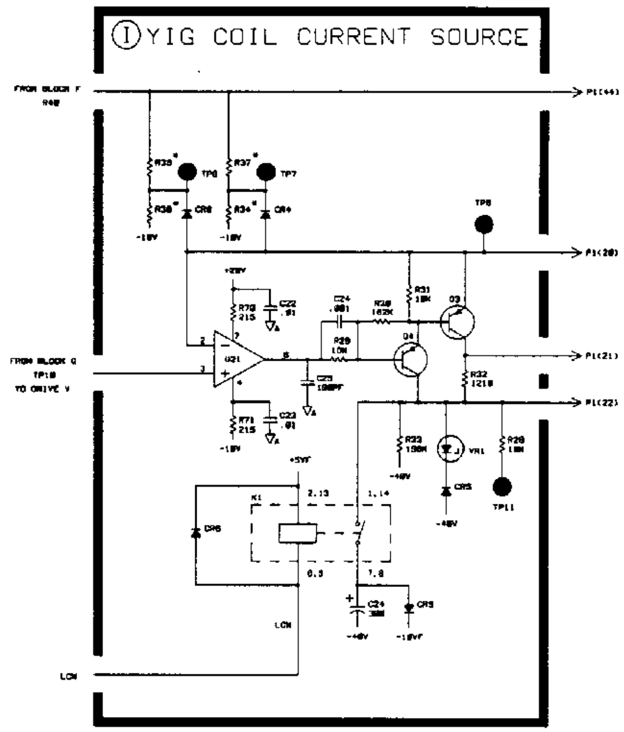
HP P/N 83595-60070

Figure 5-16. YO Delay Compensation Adjustment Location (CHANGE 13)



HP P/N 83595-60070

Figure 8-63. A8 YO Driver, Component Locations (CHANGE 13)



HP P/N 83595-60070

P/O Figure 8-71. A8 YO Driver, Schematic Diagram (CHANGE 13)

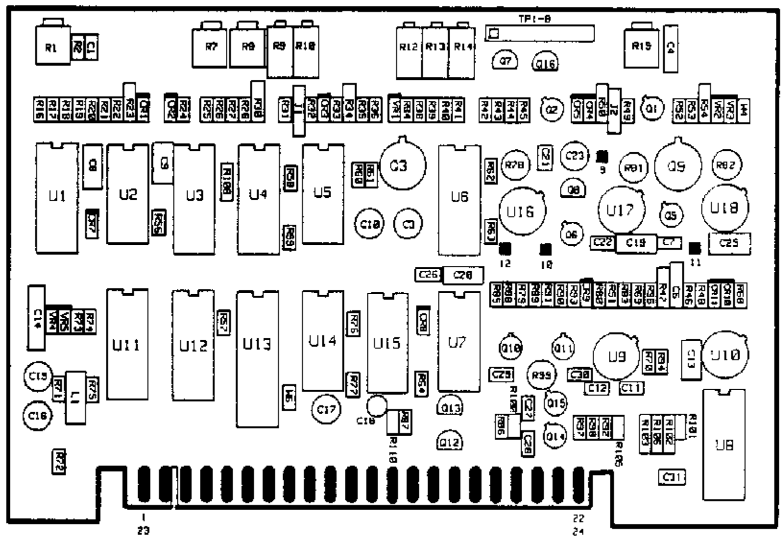
CHANGE 14

This change documents the addition of a jumper to the A4 ALC assembly, it does not change any electrical functions of the ALC. Change 4 in this document is assumed to be incorporated prior to making the changes written in this change (Change 14).

Section VI, Replaceable Parts:
Change A4 ALC assembly to HP and Mfr. Part Number 83592-60132, CD 0.
Add A4W6, HP and Mfr. Part Number 8159-0005, CD 0, RESISTOR-ZERO OHMS 22 AW6 LEAD DIA.

Page 8-63/8-64, Figure 8-29:
Replace the Component Locations Diagram with *Figure 8-29. A4 ALC, Component Locations (CHANGE 14)* provided in this document.

Page 8-63/8-64 Figure 8-34:
Add A4W6 in series with the input to U15C pin 9 located in block 0, PIN MOD 0 DRIVER.



HP P/N 83592-60132

Figure 8-29. A4 ALC Component Locations (CHANGE 14)

CHANGE 15

This change documents a serial prefix change only.

CHANGE 16

(Supersedes CHANGE 6)

This change documents a serial prefix change only.

CHANGE 17

This change documents a revision on the A4 ALC assembly to increase the speed of the sample and hold drivers.

Page 6-18, Table 6-3:
Change A4R64 to 1.96K ohms, HP part number 0698-7256, CD 1.

Page 6-19, Table 6-3:
Change A4U7 to HP part number 1820-1425, CD 6.

Page 8-63/8-64, Figure 8-34 (Block K):
Change A4R64 to 1.96K ohms.

NOTE: A4R64 and A4U7 are interactive components, therefore, they must both be changed at the same time.

▶ CHANGE 18

With this change, the latch and front casting are stronger.

Page 6-33, Table 6-3:
Change MP28, CASTING FRONT to HP and Mfr. Part Number 83592-20074, CD.
Change MP29, LATCH to HP and Mfr. Part Number 83525-20072, CD.

MANUAL IDENTIFICATION

HP Model Number: HP 83592C
Manual Part Number: 83592-90038
Date Printed: December 1983

CHANGE 19

Change 19 documents serial number prefix 2809A.

This change does not affect documentaiton.

MANUAL IDENTIFICATION

HP Model Number: HP 83592C
Manual Part Number: 83592-90038
Date Printed: December 1983

CHANGE 20

Change 20 documents updated performance tests.

INSTRUCTIONS

Replace — Replace the existing manual page(s) with the page(s) provided in this change. These page(s) supersede the existing page(s) in the manual, provided that the serial number prefix of your instrument is the same or higher than the one indicated on this page. To keep your documentation applicable to all versions of instruments, place the superseded page(s) in the MANUAL BACKDATING section of your manual.

Replace the following pages:

Title Page
1-1 through 1-6
4-1 through 4-42

HP 83592C
RF PLUG-IN
(Including Options 002 and 004)

SERIAL NUMBERS

This manual applies directly to HP 83592C RF plug-in having serial number prefix 2328A.

For additional information about serial numbers, refer to INSTURMENTS COVERED BY MANUAL in Section 1.

Manual Changes Supplement Print Date: 26 JULY 1988

Change	Documents Prefix		Change	Documents Prefix		Change	Documents Prefix
1	2348A		16	2718A			
2	2412A		17	2726A			
3	2412A		18	2726A00581			
4	2412A		19	2809A			
5	2412A		20	N/A			
6	2429A						
7	2451A						
8	2506A						
9	2520A						
10	2532A						
11	2542A						
12	2602A						
13	2621A						
14	2644A						
15	2702A						

1400 FOUNTAINGROVE PARKWAY, SANTA ROSA, CA 95403 U.S.A.

MANUAL PART NO. 83592-90038
Microfiche Part Number 83592-90039

Printed: DECEMBER 1983

HEWLETT PACKARD

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of delivery. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

BP21.1

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 83592C RF Plug-In. Figure 1-1 shows the Model 83592C.

1-3. This manual is divided into eight major sections which provide the following information:

a. SECTION I, GENERAL INFORMATION, includes a brief description of the instrument, safety considerations, specifications, supplemental characteristics, instrument identification, options available, accessories available, and a list of recommended test equipment.

b. SECTION II, INSTALLATION, provides information for initial inspection, preparation for use, storage, and shipment.

c. SECTION III, OPERATION, explains the frequency resolution characteristics of the RF Plug-In in CW and swept frequency modes. Operating instructions include FM switch parameter settings, and crystal and power meter leveling instructions. A description of front and rear panel features and Plug-In error codes is also given.

d. SECTION IV, PERFORMANCE TESTS, presents procedures required to verify that performance of the RF Plug-In is in accordance with published specifications.

e. SECTION V, ADJUSTMENTS, presents procedures required to properly adjust and align the Model 83592C RF Plug-In after repair.

f. SECTION VI, REPLACEABLE PARTS, provides information required to order all parts and assemblies.

g. SECTION VII, MANUAL BACKDATING CHANGES, provides backdating information required to make this manual compatible with earlier shipment configurations.

h. SECTION VIII, SERVICE, provides an overall instrument block diagram with troubleshooting and repair procedures. Each assembly within the instrument is covered on a separate Service Sheet which contains a circuit description, schematic diagram, component location diagram, and troubleshooting information to aid in the proper maintenance of the instrument.

1-4. Supplied with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of the manual, which should be kept with the instrument for use by the instrument operator.

1-5. On the front cover of this manual is a Microfiche part number. This number may be used to order 10- by 15-centimeter (4- by 6-inch) microfilm transparencies of the manual. Each microfiche contains up to 60 photo duplicates of the manual pages. The microfiche package also includes the latest Manual Changes sheet as well as all pertinent Service Notes.

1-6. Refer any questions regarding this manual, the Manual Changes sheet, or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a worldwide listing of HP Sales/Service Offices.

1-7. SPECIFICATIONS

1-8. Listed in Table 1-1 are the specifications for the Model 83592C RF Plug-In. These specifications are the performance standards, or limits, against which the instrument may be tested. Table 1-2 lists the RF Plug-In supplemental performance characteristics. Supplemental performance characteristics are not specifications but are typical characteristics included as additional information for the user.

Manufacturer's Declaration

NOTE

This is to certify that this product meets the radio frequency interference requirements of Directive FTZ 1046/1984. The German Bundespost has been notified that this equipment was put into circulation and has been granted the right to check the product type for compliance with these requirements.

Note: If test and measurement equipment is operated with unshielded cables and/or used for measurements on open set-ups, the user must insure that under these operating conditions, the radio frequency interference limits are met at the border of his premises.

Model HP 83592C

NOTE

Hiermit wird bescheinigt, dass dieses Gerät/System in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes/Systems angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Zusatzinformation für Mess- und Testgeräte:

Werden Mess- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Messaufbauten verwendet, so ist vom Betreiber sicherzustellen, dass die Funk-Entstörbestimmungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

Table 1-1. Specifications for HP 83592C Installed in HP 8350 (1 of 2)

FREQUENCY[1]

Specification	Frequency Bands (GHz)				
	0.01 to 2.4	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**	**0.01 to 20.0**
Accuracy (25°C ± 5°C) CW Mode	±5 MHz[2]	±5 MHz	±10 MHz	±10 MHz	————
All Sweep Modes (Sweep time >100 ms)	±15 MHz[2]	±20 MHz	±25 MHz	±30 MHz	±50 MHz[2]
Frequency Markers (Sweep time ≥100 ms)	±15 MHz[2] ±.5% of sweep width	±20 MHz ±.5% of sweep width	±25 MHz ±.5% of sweep width	±30 MHz ±.5% of sweep width	±50 MHz[2] ±.5% of sweep width

POWER OUTPUT

Specification	Frequency Bands (GHz)						
	0.01 to 2.4	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 18.6**	**18.6 to 20.0**	**0.01 to 18.6**	**0.01 to 20.0**
Maximum Leveled Output Power (25°C)[3,4,5]	+10 dBm	+6 dBm	+6 dBm	+6 dBm	+4 dBm	+6 dBm	+4 dBm
With Option 002	+10 dBm	+4.5 dBm	+4 dBm	+3.5 dBm	1.5 dBm	+3.5 dBm	+1.5 dBm
Power Level Accuracy[6] (internally leveled)	<±1.5 dB	<±1.3 dB	<±1.3 dB	<±1.4 dB	1.4 dB	<±1.5 dB	<±1.5 dB
With Option 002[7] (at 0 dB attenuator step)	<±1.7 dB	<±1.5 dB	<±1.5 dB	<±1.6 dB	1.6 dB	<±1.7 dB	<±1.7 dB
Power Sweep Frequency Bands (GHz)[8] Calibrated Range[9]	>15 dB	>11 dB	>11 dB	>11 dB	>9 dB	>11 dB	>9 dB
With Option 002	>15 dB	>9.5 dB	>9 dB	>8 dB	>6 dB	>8 dB	>6 dB

POWER VARIATION (at specified Maximum Leveled Power or below)

Specification	Frequency Bands (GHz)				
	0.01 to 2.4	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**	**0.01 to 20.0**
Internally Leveled	±0.9 dB	±0.7 dB	±0.7 dB	±0.8 dB	±0.9 dB

FREQUENCY STABILITY

With 10 dB Power Level Change	±200 kHz	±200 kHz	±400 kHz	±600 kHz	±600 kHz
Residual FM, Peak (20 Hz to 15 kHz bandwidth) (CW Mode with CW Filter)	<5 kHz	<5 kHz	<7 kHz	<9 kHz	————

Spurious Signals at specified maximum leveled power	**0.01 to 1.4**	**1.4 to 2.4**	**2.4 to 3.5**	**3.5 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**	**20.0 to 26.5**
Harmonics (in dB below carrier)	>−25 dBc	>45 dBc	>−50 dBc	>−55 dBc	>−55 dBc	>−55 dBc	>−25 dBc
Non-Harmonics	>−25 dBc	>−25 dBc	>−55 dBc	>−55 dBc	>−55 dBc	>−55 dBc	>−25 dBc

Table 1-1. Specifications for HP 83592C Installed in HP 8350 (2 of 2)

MODULATION[1]

External FM

Maximum Deviations for Modulation Frequencies		
Modulation Frequencies	**Cross-Over Coupled**	**Direct Coupled**
DC to 100 Hz*	±75 MHz	±12 MHz
100 Hz to 1 MHz	±7 MHz	±7 MHz
1 MHz to 2 MHz	±5 MHz	±5 MHz
2 MHz to 10 MHz	±1 MHz	±1 MHz

*CW Filter Off

External AM
Maximum Input: 15V

Square Wave
Selectable (by internal jumper in HP 8350) to 1 kHz or 27.8 kHz square wave modulation. The 27.8 kHz modulation allows operation with an HP 8756/57A Scalar Network Analyzer.

On/Off Ratio: ≥30 dB below specified maximum leveled power

Symmetry: 40/60

Minimum Settable Power: −5 dBm
With Option 002: −60 dBm

Attenuator Accuracy (±dB referenced from the 0 dB setting):

Frequency Range GHz	Attenuator Setting (dB)										
	5	10	15	20	25	30	35	40	45	50	55
0.01 to 12.4	0.4	0.6	0.9	0.7	1.0	0.9	1.3	1.8	2.0	2.0	2.2
12.4 to 18.0	0.5	0.7	1.0	0.9	1.2	1.2	1.6	2.0	2.2	2.3	2.5
18.0 to 20.0	0.6	0.9	1.3	1.5	2.0	2.5	2.8	3.0	3.1	3.2	3.2

GENERAL SPECIFICATIONS[1]

Minimum Sweep Time (over full band): 35 ms

Minimum Sweep Time (over single band): 10 ms

Band Switch Points: internal band switch points at approximately 2.4 GHz, 7.0 GHz, and 13.5 GHz

RF Ouput Connector: type-N female

1. Unless otherwise noted, all specifications are at the RF OUTPUT connector and at 0° to 55°C.
2. Accuracy when calibrated with the FREQ CAL adjustment.
3. For temperatures greater than 25°C, maximum leveled output power typically degrades 0.1 dB/°C.
4. When RF Output is peaked with PEAK control.
5. 0.5 dB lower for Option 004.
6. Includes power level variations.
7. Attenuator switch points are every 10 dB starting at −5 dBm indicated power.
8. Power Sweep and Slope Compensation total must not exceed the specified Power Sweep calibrated range.
9. With Option 002, in power sweep or slope functions, power can exceed the attenuator step by the amount that the Power Sweep calibrated range exceeds 10 dB (i.e., if the calibrated range is 12 dB, power can exceed the attenuator step by 2 dB).

Table 1-2. Supplemental Characteristics for HP 83592C Installed in HP 8350 (1 of 2)

NOTE: Values in this table are not specifications, but are typical characteristics included for user information.

FREQUENCY CHARACTERISTICS[1]

Characteristic	Frequency Bands (GHz)				
	0.01 to 2.4	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**	**0.01 to 20.0**
Accuracy (25°C ± 5°C)					
CW Mode	±2 MHz[2]	±2 MHz	±3 MHz	±4 MHz	————
Manual Sweep	≤15 MHz	≤30 MHz	≤30 MHz	≤30 MHz	≤100 MHz
All Sweep Modes (sweep time 10 ms to 100 ms)	≤±5 MHz	≤±6 MHz	≤±8 MHz	≤±10 MHz	≤±35 MHz
Sweep Mode Linearity[3]	≤±2 MHz	≤±2 MHz	≤±4 MHz	≤±6 MHz	≤±10 MHz
Stability					
With Temperature	±200 kHz/°C	±200 kHz/°C	±400 kHz/°C	±600 kHz/°C	±600 kHz/°C
With 3:1 Load SWR	±100 kHz	±100 kHz	±200 kHz	±300 kHz	
With Time (in a 10 minute period after one hour warmup at the same frequency setting):	<±100 kHz	<±100 kHz	<±200 kHz	<±300 kHz	<±300 kHz

OUTPUT CHARACTERISTICS[1]

Power Output

Resolution (displayed): 0.1 dB

Resolution (power): ±0.01 dB

Stability with Temperature (at specified maximum leveled power): ±0.1 dB/°C

POWER VARIATION (at specified maximum leveled power or below)

Characteristic	Frequency Bands (GHz)			
	0.01 to 2.4	**2.4 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**
Externally Leveled				
Negative Crystal Detector[4] (Sweep time >100 ms)	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Power Meter[5]	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Residual AM in 100 kHz Bandwidth (in dB below carrier and at specified maximum leveled power)	≥50 dB	≥50 dB	≥50 dB	≥50 dB

Spurious Signals (in dB below carrier and at specified maximum leveled power)	**0.01 to 1.4**	**1.4 to 2.4**	**2.4 to 3.5**	**3.5 to 7.0**	**7.0 to 13.5**	**13.5 to 20.0**
Harmonics and Subharmonics	>−25 dBc	>−45 dBc	>−50 dBc	>−55 dBc	>−55 dBc	>−55 dBc
Non Harmonics	>−25 dBc	>−25 dBc	>−55 dBc	>−55 dBc	>−55 dBc	>−55 dBc
Output SWR (internally leveled)	<1.9	<1.9	<1.9	<1.9	<1.9	<1.9
With Option 002	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1

Table 1-2. Supplemental Characteristics for HP 8359C Installed in HP 8350 (2 of 2)

Impedance: 50 Ohms

Power Sweep[6]:

Accuracy (including linearity): ±1.5 dB
Resolution (displayed): 0.1 dB

Slope Compensation[6]

Linearity: typically <0.2 dB

Calibrated Range[7]: up to 5 dB/GHz; up to 15 dB for full sweep range

Resolution (displayed): 0.01 dB/GHz

MODULATION CHARACTERISTICS[1]

External AM

Frequency Response: 100 kHz
Input Impedance: 10k Ohm
Range of Amplitude Control: 15 dB
Sensitivity: 1 dB/V

Pulse In

TTL compatible: logic high=RF on, logic low=RF off
0.01 to 20.0 GHz: Squarewave modulation up to 30 kHz (absolute error for HP 8756A/8757A compatibility from 1 to 2 dB)

0.01 to 2.5 GHz:

Rise/Fall Time: typically 50 ns

Minimum Pulse Width:

Leveled: typically 5 µs
Unleveled Power level set to +20 dBm: 200 ns

2.5 to 20 GHz:

Rise/Fall Time: typically 10 ns

Minimum Pulse Width:

Leveled: typically 1 µs
Unleveled Power level set to +23 dBm: Typically 100 ns

External FM

Frequency Response (DC to 2 MHz): ±3 dB

Sensitivity (switch selectable) −20 MHz/V (FM Mode)
−6 MHz/V (Phase-Lock Mode)

Input Impedance: 2000 Ohms nominal

GENERAL CHARACTERISTICS[1]

Frequency Reference Output: selectable 1V/GHz ±25 mV (0.01 to 18 GHz) or 0.5V/GHz ±25 mV (0.01 to 20 GHz) rear panel BNC output.

NOTE: 0.5V/GHz applicable after serial prefix 2602A.

Auxiliary Output: rear panel 2.3 to 7 GHz fundamental oscillator output, nominally 0 dBm.

Weight: Net 6.0 kg (13.2 lb.); Shipping 9.2 kg (20 lb.)

1. Unless otherwise noted, all characteristics are at the RF OUTPUT connector and at 0° to 55°C.
2. Accuracy when calibrated with the FREQ CAL adjustment.
3. With respect to the SWEEP OUT voltage.
4. Excludes coupler and detector variation. Crystal detector output should be between −10 mV and −350 mV at specified maximum leveled power.
5. Use HP 432A/B/C, HP 436A, or HP 438A Power Meters. Sweep time 100 seconds, typically ≥5 seconds/GHz but not ≤10 seconds.
6. Power Sweep and Slope Compensation must not exceed the specified Power Sweep calibrated range.
7. With Option 002, in power sweep or slope functions, power can exceed the attenuator step by the amount that the Power Sweep calibrated range exceeds 10 dB (i.e., if the calibrated range is 12 dB, power can exceed the attenuator step by 2 dB).

Section 4. Performance Tests

INTRODUCTION

Use the procedures in this section to test the electrical performance of the sweep oscillator/RF plug-in combination. Use the specifications listed in Table 1-1, in GENERAL INFORMATION, as the performance standards. You do not have to access the interior of the RF plug-in to perform these tests.

NOTE: Let the sweep oscillator/RF plug-in warm up for at least one hour before you begin a performance test.

NOTE: Frequency measurements require a spectrum analyzer, rather than a frequency counter. Use the "peak search" function to read the frequency value. For information on reading frequency with a spectrum analyzer, refer to the analyzer operation manual.

EQUIPMENT REQUIRED

The equipment required to test the RF plug-in is listed in Table 1-4, in GENERAL INFORMATION. Any equipment that satisfies the critical specifications listed in the table may be substituted for the recommended model.

OPERATION VERIFICATION

To verify operation, perform the following tests:

- Frequency Range and Accuracy
- Output Amplitude

You can verify HP-IB functions using the program listed in Section IV of the *HP 8350 Operating and Service Manual*.

These tests provide reasonable assurance that the sweep oscillator and plug-in are functioning properly, and should meet the needs of an incoming inspection (80% verification).

TEST RECORD

Table 4-15 provides a tabulated index of the performance tests, their acceptable limits, and a column for recording actual measurements. Use this test record when you perform a calibration (100% verification).

RELATED ADJUSTMENTS

Table 4-1 lists the performance tests and their related adjustments (in Section 5). If the plug-in fails a performance test, the associated adjustment(s) may correct the problem.

TEST SEQUENCE

Perform the tests in the order they appear within each subsection.

CALIBRATION CYCLE

Perform the tests in this section at least once every twelve months.

Table 4-1. Performance Tests and Related Adjustments

Performance Tests	Related Adjustment
4-13. Frequency Range and Accuracy	
CW Frequency Accuracy	5-14, 5-16, 5-17
Swept Frequency Accuracy	5-15 through 5-19, 5-23
Marker Accuracy	5-14 through 5-18
4-14. Output Amplitude	
Maximum Leveled Power	
Output Power Variations	5-20 through 5-23, 5-25 through 5-28
Power Level Accuracy	5-16, 5-18 through 5-23, 5-25 through 5-28
Power Sweep	5-30
4-15. Frequency Stability	
4-16. Residual FM	
4-17. Spurious Signals	5-21
4-18. Not Used	
4-19. Not Used	
4-20. External Frequency Modulation	5-31
4-21. Square-Wave On/Off Ratio and Symmetry	5-27
4-22. Step Attenuator Accuracy (Option 002)	

4-13. Frequency Range and Accuracy Tests

Description

A spectrum analyzer is used to check both the CW and swept frequency range and accuracy of the plug-in. In swept mode the analyzer is used as a frequency meter, with its video output displayed on an oscilloscope. The oscilloscope is swept by the sweep oscillator.

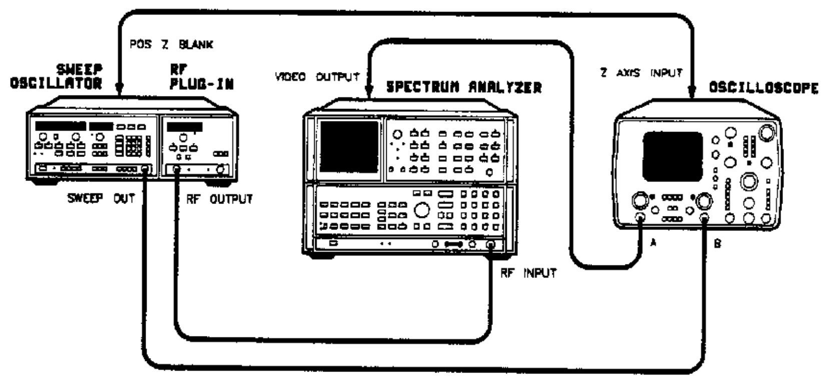


Figure 4-1. Frequency Range and Accuracy Tests Setup

Equipment

Sweep Oscillator Mainframe .... HP 8350
Spectrum Analyzer .... HP 8566B
Oscilloscope .... HP 1741A

Procedure

CW Frequency Accuracy

1. Connect the equipment as shown in Figure 4-1. Press **[INSTR PRESET]** on both the sweep oscillator and the spectrum analyzer. Allow the equipment to warm up for one hour.
2. On the sweep oscillator press **[CW] [5] [0] [MHz]**.
3. On the spectrum analyzer, press:

   [REFERENCE LEVEL] [1] [0] [dBm]
   [CENTER FREQUENCY] [5] [0] [MHz]
   [FREQUENCY SPAN] [5] [0] [MHz]

4. If necessary, adjust the FREQ CAL pot on the plug-in front panel:

   On the sweep oscillator, press **[CW] [5] [0] [MHz]**.

   The 50 MHz signal should be visible near mid-screen. If not, adjust the frequency calibration adjustment (FREQ CAL) until the signal is centered.

   Verify that the signal increases in frequency as you increase the sweep oscillator's CW frequency.

4-13. Frequency Range and Accuracy Tests (cont'd)

5. On the sweep oscillator press **[CW] [1] [0] [MHz]**.
6. On the spectrum analyzer, press:

   [CENTER FREQUENCY] [1] [0] [MHz]
   [FREQUENCY SPAN] [2] [0] [MHz]

7. Using the sweep oscillator CW knob, adjust the displayed signal on the spectrum analyzer to 10 MHz. On the test record, record the frequency displayed on the sweep oscillator as the start frequency.
8. Repeat steps 5 through 7 at 20 GHz. Record the stop frequency on the test record.
9. On the sweep oscillator, press:

   [CW] [the first frequency listed in Table 4-2] **[GHz]**

10. On the spectrum analyzer, press:

    [CENTER FREQUENCY] [the CW frequency in step 9] **[GHz]**
    [FREQUENCY SPAN] [5] [0] [MHz]
    [PEAK SEARCH]

    At the appropriate location on the test record, enter the frequency of the signal displayed on the analyzer.

11. Repeat steps 9 and 10 for all values listed in Table 4-2.

NOTE: To avoid band crossover problems, follow the sequence given for the frequencies in each band.

Table 4-2. CW Frequencies

Bands (Accuracy)			
Band 0 (±5 MHz) (GHz)	**Band 1 (±5 MHz) (GHz)**	**Band 2 (±10 MHz) (GHz)**	**Band 3 (±15 MHz) (GHz)**
1.0	4.0	10.0	17.0
2.2	2.5	7.1	14.0
	6.8	13.3	20.0

Swept Frequency Accuracy

12. On the sweep oscillator, press:

    [INSTR PRESET]
    [TIME] [.] [1] [s].

4-13. Frequency Range and Accuracy Tests (cont'd)

13. On the oscilloscope:

    Set Sweep: A vs B
    Set B Channel: 1V/div
    Adjust the horizontal width and position for a full screen display.
    Set A Channel: 0.2V/div, DC coupled
    Center the display

14. On the spectrum analyzer, press:

    [CENTER FREQUENCY] [1] [0] [MHz]
    [FREQUENCY SPAN] [0] [Hz]
    [RES BW] [resolution bandwidth value in Table 4-3] [kHz/MHz from Table 4-3]
    [VIDEO BW] [3] [MHz]

15. Adjust the spectrum analyzer center frequency until a peaked signal is just visible on the far left side of the oscilloscope display:

    a. **Lower** the analyzer center frequency until no signal is visible on the oscilloscope.
    b. Slowly **increase** the analyzer center frequency until the signal on the oscilloscope just peaks.
    c. Record the spectrum analyzer center frequency on the test record as start frequency.

16. On the spectrum analyzer, press:

    [CENTER FREQUENCY] [2] [0] [GHz]
    [RES BW] [resolution bandwidth value in Table 4-3] [kHz/MHz from Table 4-3]

17. Adjust the spectrum analyzer center frequency until a peaked signal is just visible on the far right side of the oscilloscope display:

    a. **Raise** the analyzer center frequency until no signal is visible on the oscilloscope.
    b. Slowly **decrease** the analyzer center frequency until the signal on the oscilloscope just peaks.
    c. Record the displayed analyzer center frequency value on the test record as stop frequency.

NOTE: There are other signals visible due to the instrument bands (0 through 3).

18. Repeat steps 12 through 17 for each start and stop frequency listed in Table 4-3.

Table 4-3. Swept Frequency Accuracy Frequencies and Tolerances

Band	Start/Stop (GHz)	Tolerance (MHz)	Spectrum Analyzer Resolution Bandwidth
Full Band	0.01/20.0	±50	300 kHz/3 MHz
0	0.01/2.4	±15	300 kHz/3MHz
1	2.4/7.0	±20	3 MHz
2	7.0/13.5	±25	3 MHz
3	13.5/20.0	±30	3 MHz

4-13. Frequency Range and Accuracy Tests (cont'd)

Frequency Marker Accuracy

19. On the sweep oscillator, press:

    [INSTR PRESET]
    [TIME] [.] [1] [s]
    [M1] [the first marker frequency in Table 4-4] **[GHz]**

Table 4-4. Frequency Marker Accuracy

Band	Sweep Range (GHz)	Marker Frequencies (GHz)					Tolerance (MHz)
Full Band	0.01 to 20	1	4	8	14	18	±150
0	0.01 to 2.4	1	2				±26
1	2.4 to 7.0	3.0	6.0				±43
2	7.0 to 13.5	8.0	12.0				±58
3	13.5 to 20.0	15.0	18.0				±63

20. On the oscilloscope, lower the intensity so the marker is clearly visible.

21. On the spectrum analyzer, press:

    [INSTRUMENT PRESET]
    [REFERENCE LEVEL] [1] [0] [dBm]
    [CENTER FREQUENCY] [the first marker value in Table 4-4] **[GHz]**
    [FREQUENCY SPAN] [0] [Hz]

22. Adjust the analyzer center frequency until the signal peak is centered on the marker displayed on the oscilloscope:

    a. Using the horizontal position knob, center the marker on a vertical graticule.
    bncrease the oscilloscope intensity until you can see the signal peak.
    c. Adjust the analyzer center frequency until the signal peak is centered on the same vertical graticule as the marker.

    NOTE: If the intensity is set so that the signal peak is just visible, when you center the signal peak on the marker, the signal intensity increases.

23. Record the analyzer center frequency value on the test record.

NOTE: Each marker is 0.4% of the sweep width (with a 20 GHz sweep, for example, the marker is approximately 80 MHz wide). For the best accuracy, center the signal peak within the highlighted marker width.

24. Repeat steps 19 through 23 for the remaining values listed in Table 4-4.

4-14. Output Amplitude Tests

Description

First, an oscilloscope is used to check the swept power. Then a power meter is used to check power level accuracy, maximum leveled output power, and power variations.

NOTE: Plug-in power specifications do not include inaccuracies caused by adapters.

Equipment

Sweep Oscillator Mainframe	HP 8350
Dual Channel Oscilloscope	HP 1741A
Crystal Detector	HP 8473C
Power Meter	HP 436A
Power Sensor (below 50 MHz)	HP 8481A
Power Sensor (above 50 MHz)	HP 8485A

Swept Power Measurement

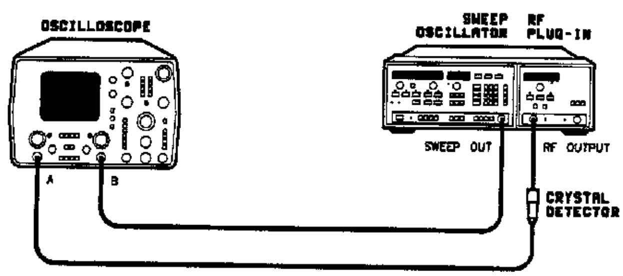


Figure 4-2. Swept Power Measurement Test Setup

Procedure

1. Connect the equipment as shown in Figure 4-2. Press **[INSTR PRESET]** on both the sweep oscillator and the spectrum analyzer. Allow the equipment to warm up for one hour.

2. On the oscilloscope, set:

Sweep:	A vs B
B channel:	1V/div
A channel:	Adjusted as necessary
Display Blanking:	ON

3. On the sweep oscillator, press:

   [INSTR PRESET]
   [STOP] [1] [8] [GHz]

4. On the plug-in, set the power level to +6 dBm (+3.5 dBm for option 002).

5. Adjust the oscilloscope for best overall visibility.
6. On the sweep oscillator:

   Vary the sweep speed from 35 ms to 1s.

   Note any oscillations or power drop-outs (pay close attention to bandswitch points).
7. On the sweep oscillator, press **[INSTR PRESET]**.
8. On the plug-in, set the power level to +4 dBm (+1.5 dBm for option 002).
9. Adjust the oscilloscope for best overall visibility.
10. On the sweep oscillator:

    Vary the sweep speed from 35 ms to 1s.

    Note any oscillations or power drop-outs (pay close attention to bandswitch points).
11. An oscillation or power drop-out can cause the instrument to fail the power level tests. If you note an oscillation or drop-out in step 6 or 10, refer to Table 4-1 for related adjustments.

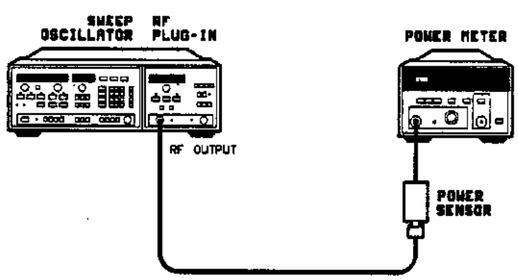


Figure 4-3. Power Level Accuracy, Maximum Leveled Output Power, and Power Variations Test Setup

Maximum Leveled Power and Variation

12. On the power meter/sensor:
    a. Set the calibration factor to 100%.
    b. Press **[dBm]**
    c. Press **[POWER REF]** (turns the reference on).
    d. Connect the power sensor to the POWER REF OUTPUT.
    e. Using the CAL ADJ, adjust the power meter to read −00.0.
    f. Press **[PWR REF]** (turns the reference off).
    g. Disconnect the power sensor from the power meter.
    h. Press **[SENSOR ZERO]**.
    i. When the power meter display reads dBm, connect the sensor to the plug-in RF output.

4-14. Output Amplitude Tests (cont'd)

13. Connect the equipment as shown in Figure 4-3, but do NOT connect the power sensor to the plug-in.

14. On the sweep oscillator, press:

    [INSTR PRESET]
    [TIME] [.] [2] [s].

On the sweep oscillator/RF plug-in:

15. Set the start/stop frequencies and power level for the first values listed in Table 4-5.

Table 4-5. RF Plug-in Frequency Range, Maximum Leveled Power, and Power Sweep Range

Frequency Range (GHz)	Maximum Leveled Power (dBm)		Power Sweep Range (dB/SWP)	
	Standard	(Option 002)	Standard	(Option 002)
0.01 to 2.4	+10.0	+10.0	15	13.5
2.4 to 7.0	+6.0	+4.5	11	9.5
7.0 to 13.5	+6.0	+3.5	11	9
13.5 to 18.6	+6.0	+3.5	11	8
18.6 to 20.0	+4.0	+1.5	9	6
0.01 to 20	+4.0	+1.5	9	6

16. Slowly increase the plug-in output power until the unleveled light comes on.

    Slowly decrease the power level until the light just goes out.

    Slowly increase the time sweep from 10 ms to 1s. If the unleveled light comes on, decrease the power level until it just goes out.

17. Press SWEEP **[MAN]** and slowly tune the FREQUENCY/TIME control across the band. If the unleveled light comes on at any point, decrease the power level until the light just goes out.

18. When the unleveled light remains out as you tune across the band, note the minimum power level. Set the manual sweep to this low power point.

19. On the power meter, adjust the calibration factor for the frequency in step 18. Record the power meter reading on the test record.

20. On the sweep oscillator/RF plug-in, reset the output power to the maximum level indicated in Table 4-5 for the current range.

4-14. Output Amplitude Tests (cont'd)

21. On the power meter, press **[dB REF]**.
22. On the sweep oscillator:

    Press SWEEP **[MAN]** and slowly tune the FREQUENCY/TIME control through the entire range. Note the maximum power variation, as measured by the power meter. This is the maximum peak-to-peak power variation.

    Divide the peak-to-peak power variation by two, and record the peak power variation on the test record card for the current frequency band.
23. On the power meter, press **[dBm]**.
24. Repeat steps 15 through 23 for each range listed in Table 4-5.

Power Level Accuracy

On the sweep oscillator/RF plug-in:

25. Press:

    [START] [the first start frequency listed in Table 4-5].
    [STOP] [the first stop frequency listed in Table 4-5].
    [POWER LEVEL] [the first power level listed in Table 4-5].
26. Press SWEEP **[MAN]** and tune the FREQUENCY/TIME control across the frequency range. Note the frequency at which the power deviates the greatest from the power level value set in step 25.

    Record the deviation on the test record for the appropriate frequency range.
27. Tune the FREQUENCY/TIME control to the frequency noted in step 26 (typically the point of greatest deviation for all power levels in this frequency range).
28. Repeat steps 26 and 27 for the remaining power levels on the test record.
29. Repeat steps 25 through 28 for the remaining frequency ranges listed in Table 4-5.

Power Sweep Range

30. On the sweep oscillator/RF plug-in, press:

    [INSTR PRESET]
    [CF] [3] [GHz]
    [POWER LEVEL] [-] [5] [dB]
    [Δf] [1] [0] [MHz]
    [MAN] [0] [MHz] (this sets the frequency at the beginning of the Δf range)
    [POWER SWEEP] [2] [5] [dB] (POWER SWEEP light on)
31. On the power meter, press **[dB REF]**.
32. On the sweep oscillator:

    Press SWEEP **[MAN]** and slowly tune the FREQUENCY/TIME control across the sweep until the unleveled light comes on (or the power meter indicates over range).

    Slowly tune the FREQUENCY/TIME control back until the unleveled light just goes out (or the power meter indicates a dB value again).
33. On the test record, record the value displayed on the power meter.

4-15. Frequency Stability Test

Description

A spectrum analyzer is used to check the frequency change caused by a 10 dB output power level change.

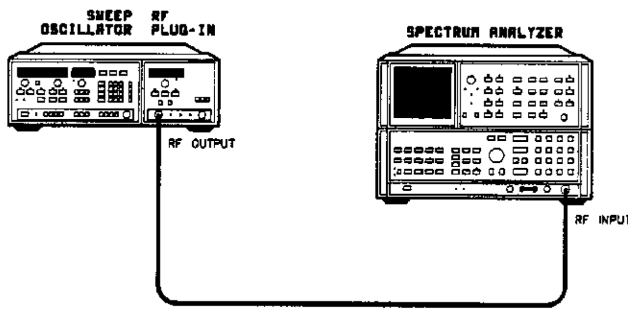


Figure 4-4. Frequency Stability Test Setup

Equipment

Sweep Oscillator Mainframe .... HP 8350
Spectrum Analyzer .... HP 8566B

Procedure

1. Connect the equipment as shown in Figure 4-4. Turn the equipment on. On the sweep oscillator and spectrum analyzer, press **[INSTR PRESET]** and allow one hour warm up.
2. On the spectrum analyzer, press:

   [REFERENCE LEVEL] [1] [0] [+dBm]
   [FREQUENCY SPAN] [1] [0] [MHz]

3. On the sweep oscillator, press:

   [CW] [The first CW value in Table 4-6]
   [POWER LEVEL] [The first power level value in Table 4-6]

   To minimize drift, wait several minutes (settling time) before continuing.

4-15. Frequency Stability Test (cont'd)

Table 4-6. CW Frequency Change with 10 dB Power Level Change

Band	CW Frequency (GHz)	Frequency Change (kHz)	Power Level (dBm)
0	2.2	±200	10
1	6.0	±200	6
2	12.0	±400	6
3*	18.0	±600	4

*The ALC range in band 3 is 9 dB.

4. On the spectrum analyzer, press:

   [CENTER FREQUENCY] [the CW frequency in step 3] **[GHz]**
   [PEAK SEARCH] [SIGNAL TRACK] (light on)
   MARKER [Δ] (signal track light goes off)

5. On the sweep oscillator/RF plug-in, press:

   [POWER LEVEL] [STEP SIZE] [1] [0] [dBm] [⬇].

6. On the spectrum analyzer:

   Press **[PEAK SEARCH]**.

   Record the absolute frequency change on the test record.

   Press MARKER **[OFF]**.

7. Repeat steps 3 through 6 for the remaining values listed in Table 4-6.

NOTE: If your measurements require greater than 10 kHz resolution on this test, in step 4, before you press MARKER [Δ], press **[FREQUENCY SPAN] [2] [MHZ]**. In step 6, after turning the marker off, press **[FREQUENCY SPAN] [1] [0] [MHZ]**.

4-16. Residual FM Test

Description

The residual FM is measured by slope-detecting the CW signal using a linear portion of a spectrum analyzer resolution bandwidth filter, in the zero-span mode.

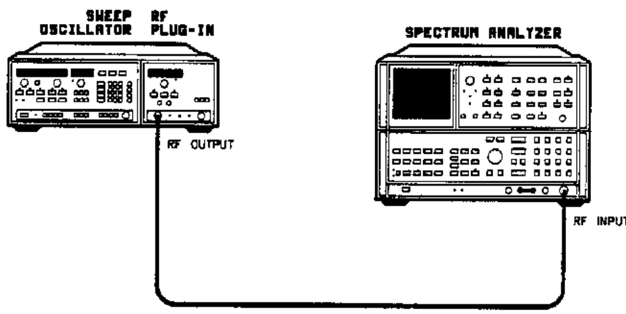


Figure 4-5. Residual FM Test Setup

Equipment

Sweep Oscillator Mainframe .... HP 8350
Spectrum Analyzer .... HP 8566B

Procedure

1. Connect the equipment as shown in Figure 4-5. Press **[INSTR PRESET]** on both the sweep oscillator and the spectrum analyzer. Allow the equipment to warm up for one hour.Allow one hour warm up time.
2. On the sweep oscillator/RF plug-in, press:

   [CW] [the first value listed in Table 4-7] **[GHz]**.

Table 4-7. Residual FM CW Frequencies

Band	CW Frequency (GHz)
0	2.2
1	6.8
2	13.3
3	20.0

4-16. Residual FM Test (cont'd)

On the spectrum analyzer:

3. Press **[CENTER FREQUENCY]** [first CW frequency listed in Table 4-7] **[GHz]**
   [REFERENCE LEVEL] [1] [0] [+dBm]
   [PEAK SEARCH] [SIGNAL TRACK] (light on)
   [FREQUENCY SPAN] [1] [MHz]
   [MKR→REF LVL]
   [RES BW] [1] [0] [0] [kHz]
   [VIDEO BW] [1] [0] [kHz]
   [SIGNAL TRACK] (light off)
   [ENTER dB/DIV] [1] [dB]
   [REFERENCE LEVEL]
4. Press **[▼]** 6 times
5. Press **[FREQUENCY SPAN] [0] [Hz]**
   [SWEEP TIME] [.] [1] [s]
   [CENTER FREQUENCY]
6. Use the RPG (rotary pulse generator) control to keep the signal centered (see Figure 4-6).

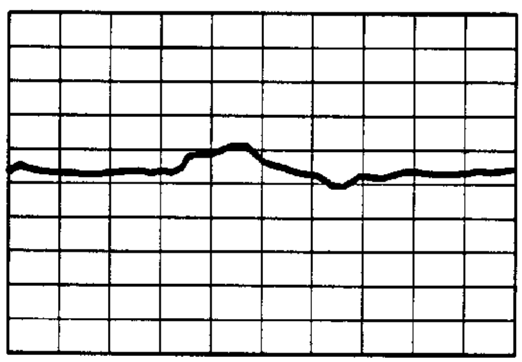


Figure 4-6. Residual FM Signal as Displayed on the Spectrum Analyzer

7. Note the maximum peak-to-peak deviation for several sweeps:

   a. Press **[VIEW]**, then **[CLEAR WRITE]** several times and note the largest peak-to-peak deviation.
   b. Press **[PEAK SEARCH]**.
   c. Using the analyzer RPG, move the marker to one peak of the deviation noted in step a.
   d. Press **[V]**.
   e. Move the cursor to the other peak of the deviation noted in step a.
   f. On the analyzer CRT, read the marker V value.

   One division =7 kHz (see NOTE below).
   Peak-to-peak deviation in kHz =(value from step f) times 7 kHz.

   Divide the peak-to-peak deviation by two. Record this peak value on the test record card.

8. Repeat steps 2 through 7 for the remaining frequencies listed in Table 4-7.

NOTE: You can check most of the remaining frequencies by simply changing both the sweep oscillator/RF plug-in CW frequency, and the spectrum analyzer center frequency, to the next test frequency. If the signal does not appear on the display, press **[CENTER FREQUENCY]** and slowly turn the analyzer RPG clock-wise/counter clock-wise until the signal is centered on the screen. If this doesn't easily bring the signal in view, repeat steps 2 through 7.

NOTE: The spectrum analyzer vertical sensitivity is nominally 7 kHz/div (see **Spectrum Analyzer Vertical Sensitivity**). To determine the maximum allowable deviation (divisions on the analyzer display), double the FM specification (peak), and divide that number by 7.

Example: Specification =5 kHz (peak)

5 X 2 =10 (peak-to-peak)

10/7 = 1.4 divisions

Spectrum Analyzer Vertical Sensitivity

You can determine the exact sensitivity of your spectrum analyzer, if necessary.

On the spectrum analyzer:

1. Connect CAL OUT to RF INPUT.
2. Press **[INSTR PRESET]**
   [FREQUENCY SPAN] [7] [0] [kHz]
   [CENTER FREQUENCY] [1] [0] [0] [.] [1] [MHz]
   [RES BW] [1] [0] [0] [kHz]
   [REFERENCE LEVEL] [1] [6] [-dBm]
   [ENTER dB/DIV] [1] [dB]
3. Adjust the frequency span and center frequency for a diagonal trace from the top left corner to the lower right corner of the CRT (see Figure 4-7).
4. Note the frequency span. Divide this number by 10. This is the FM sensitivity, which should be approximately 7 kHz/div.

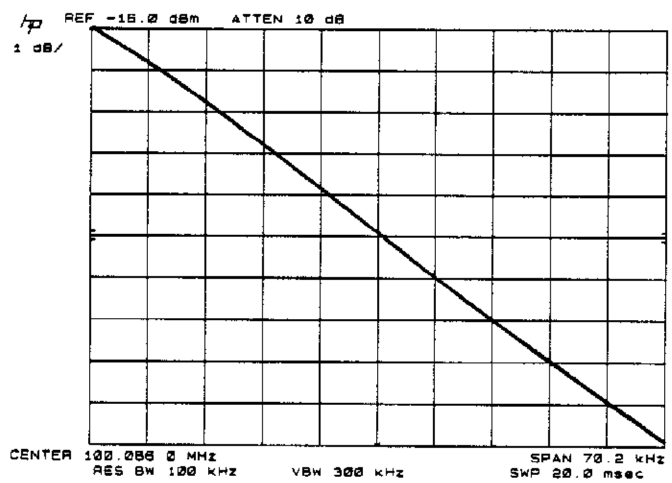


Figure 4-7. Determining Spectrum Analyzer FM Sensitivity

4-17. Spurious Signals Test

Description

The RF plug-in output signal is displayed on a spectrum analyzer to verify that harmonic and non-harmonic spurious signals are at or below the specified level.

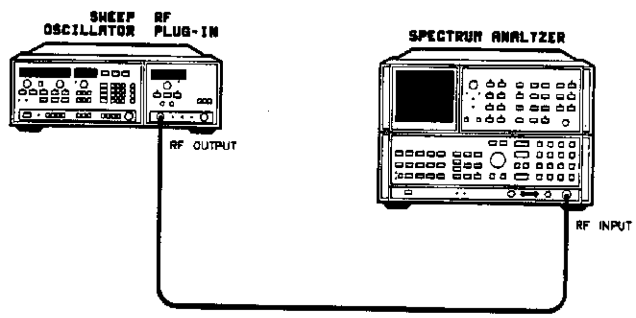


Figure 4-8. Spurious Signal Test Setup

Equipment

Sweep Oscillator Mainframe .... HP 8350
Spectrum Analyzer .... HP 8566B

Procedure

1. Connect the equipment as shown in Figure 4-8. Press **[INSTR PRESET]** on both the sweep oscillator and the spectrum analyzer. Allow the equipment to warm up for one hour.Allow one hour warm up time.

NOTE: In band 2 the fundamental oscillator frequency is multiplied by two; in band 3 it is multiplied by 3; in band 4 it is multipled by 4. Because of this, spurious signals that appear at one-half the indicated output frequency in band 2, one-third or two-thirds the output frequency in band 3, or one-fourth, one-half, or three-fourths the output frequency in band 4, are considered harmonic related signals.

NOTE: The spectrum analyzer originates some mixing products that may appear on the display.

NOTE: With the settings used in this procedure, the harmonics in this test may be below the noise floor of your spectrum analyzer.

Spur or Harmonic Amplitude Procedure

1. On the sweep oscillator, press:

   [INSTR PRESET]
   [CW] [Spur frequency from Table 4-8] **[GHz]**

4-17. Spurious Signals Test (cont'd)

Table 4-8. Spur and Fundamental Frequencies

Spur Frequency (GHz)			Fundamental Frequency (GHz)
4.0	6.0	8.0	2
5.0	15.0	20.0	10
5.0	10.0		15
6.0	12.0		18

2. On the spectrum analyzer, press:

   [INSTR PRESET]
   [REFERENCE LEVEL] [1] [0] [+dBm]
   [CENTER FREQUENCY] [Spur frequency from step 1] **[GHz]**
   [PEAK SEARCH] [SIGNAL TRACK] (light on)
   [FREQUENCY SPAN] [5] [0] [MHz]
   [SIGNAL TRACK] (light off)
   [PRESEL PEAK]
   MARKER **[Δ]**

3. On the sweep oscillator, press:

   [CW] [fundamental frequency from Table 4-8] **[GHz]**

4. On the spectrum analyzer, press:

   [PEAK SEARCH]
   [MKR→CF]
   [PRESEL PEAK]
   [VIEW]
   [PEAK SEARCH]

5. Note the amplitude dB reading displayed on the spectrum analyzer as MARKER Δ. Record this on the test record as the harmonic related value for the fundamental frequency in step 3.

6. Repeat steps 1 through 5 for the remaining spur values in Table 4-8.

NOTE: Use this procedure to determine the relative amplitude of any suspected spur or harmonic. Use the frequency of the spur as it appears on the spectrum analyzer; use the frequency of the fundamental as indicated on the sweep oscillator.

4-20. External Frequency Modulation Test

Description

As the RF output is modulated with an external sine wave (at 100 Hz, 1, 2, and 10 MHz), the FM deviation is measured on a spectrum analyzer. With 100 Hz, the FM deviation is measured by noting the frequency shift of the displayed signal. At the higher modulation frequencies, the deviation is measured using Bessel functions.

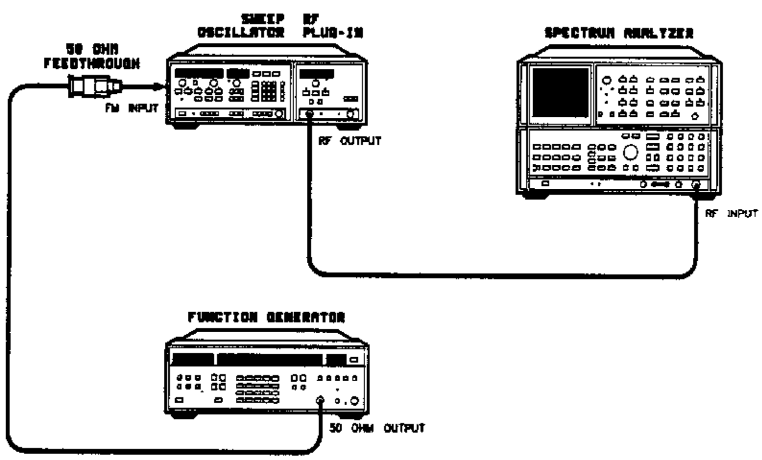


Figure 4-9. External Frequency Modulation Test Setup

Equipment

Sweep Oscillator Mainframe .... HP 8350
Spectrum Analyzer .... HP 8566B
Function Generator .... HP 3325A
50ΩFeedthrough .... HP 10100C

Procedure

1. Ensure that the RF plug-in configuration switch (A3S1) is set to −20 MHz/V, direct coupled FM (switch 6 is open; see Section 5 for details).
2. Connect the equipment as shown in Figure 4-9, but do NOT connect the function generator to the FM input yet. Turn all instruments on and allow 1 hour warm up.

4-20. External Frequency Modulation Test (cont'd)

100 Hz Modulation

3. On the sweep oscillator/RF plug-in, press:

   [INSTR PRESET]
   [CW] [CW value from Table 4-9] **[GHz]**
   [CW FILTER] (light off)

Table 4-9. CW Frequencies for 100 Hz FM Modulation

CW Frequency (GHz)
5
10
15

4. On the spectrum analyzer, press:

   [INSTR PRESET]
   [REFERENCE LEVEL] [1] [0] [dBm]
   [PEAK SEARCH]
   [SIGNAL TRACK] (light on)
   [FREQUENCY SPAN] [5] [0] [MHz]
   [SIGNAL TRACK] (light off)
   [MAX HOLD]

   Note that the spectrum analyzer is now set to 5 MHz/div.

5. On the function generator:

   Connect the sinewave output as shown in Figure 4-9.

   Press: **[FREQ] [1] [0] [0] [Hz]**
   [AMPTD] [5] [0] [0] [mV] (this is peak-to-peak)

   Slowly increase the modulation amplitude until the deviation (displayed on the spectrum analyzer) either stops increasing, or becomes non-symmetrical about the center.

6. On the spectrum analyzer:

   a. Press [Δ]
   b. Using the RPG, move the cursor to one side of the displayed deviation.
   c. Press [Δ]
   d. Using the RPG, move the cursor to the other side of the displayed deviation.

7. Record the maximum deviation (from the CRT) on the test record.

Disconnect the function generator from the FM input.

8. Change the plug-in configuration switch (A3S1) to cross-over coupled (switch 6 closed) and press **[INSTR PRESET]**. Repeat steps 3 through 7 for all three CW frequencies in Table 4-9. Record the maximum deviation for each frequency on the test record.

4-20. External Frequency Modulation Test (cont'd)

1, 2, and 10 MHz Modulation

9. On the sweep oscillator, press:

   [CW] [CW frequency from Table 4-10] **[GHz]**

10. On the function generator, press:

    [FREQ] [function generator frequency from Table 4-10] **[MHz]**
    [AMPTD] [1] [0] [mV]

Table 4-10. CW and Function Generator Frequencies for 1, 2, and 10 MHz Frequency Modulation

CW Frequency (GHz	Function Generator Frequency (MHz)		
5	1	2	10
10	1		
15	1		

11. On the spectrum analyzer, press:

    [INSTR PRESET]
    [REFERENCE LEVEL] [1] [0] [dBm]
    [PEAK SEARCH]
    [SIGNAL TRACK] (light on)
    [FREQUENCY SPAN] [value from Table 4-11] **[MHz]**
    [RES BW] (light on, BW appropriate for frequency span)
    [SIGNAL TRACK] (light off)

Table 4-11. Spectrum Analyzer Frequency Span and Resolution Bandwidth

Modulation Frequency (MHz)	Spectrum Analyzer	
	Frequency Span (MHz)	Resolution Bandwidth (kHz)
1	4.5	30
2	4.5	30
10	30.0	100

12. On the function generator, connect the output as shown in Figure 4-9.
13. For a modulation frequency of 1 MHz, go to step 14.

    For a modulation frequency of 2 MHz, go to step 15.

    For a modulation frequency of 10 MHz, go to step 16.

4-20. External Frequency Modulation Test (cont'd)

14. **(1 MHz)** Increase the function generator output amplitude until the **first sideband** (on either side of the fundamental signal) nulls. Continue increasing the output until the first sideband nulls a **second** time (typically 700 mV p-p input signal).

    NOTE: The fundamental signal nulls twice before the first sideband reaches the second null.

    For a ±7 MHz deviation, the first sideband must null twice with a negligible (<200 kHz) frequency shift of the fundamental signal.

    For a CW frequency of 5 GHz, repeat steps 10 through 13 for the modulation frequencies of 2 and 10 MHz.

    Repeat steps 9 through 13 for the CW frequency of 15 GHz.

15. **(2 MHz)** Increase the function generator output amplitude until the **fundamental** signal nulls (typically 500 mV p-p input signal).

    For a ±5 MHz deviation, the fundamental signal must null with a negligible (<200 kHz) frequency shift.

    Repeat steps 10 through 13 for the modulation frequency of 10 MHz.

16. **(10 MHz)** Increase the function generator output amplitude until the **first** sideband is **less** than 26 dB below the unmodulated fundamental signal (typically 100 mV p-p input signal). If the two visible sidebands are unequal, use the one with the lower amplitude.

    For a ±1 MHz deviation, the sideband must be less than 26 dBc with a negligible (<200 kHz) frequency shift of the fundamental signal.

    Repeat steps 9 through 13 for the CW frequencies of 10 and 15 GHz.

4-21. Square-wave On/Off Ratio and Symmetry Test

Description

The on/off ratio is checked on the amplitude axis of a video triggered spectrum analyzer display. The symmetry is checked by calculating the on/off ratio on the frequency axis.

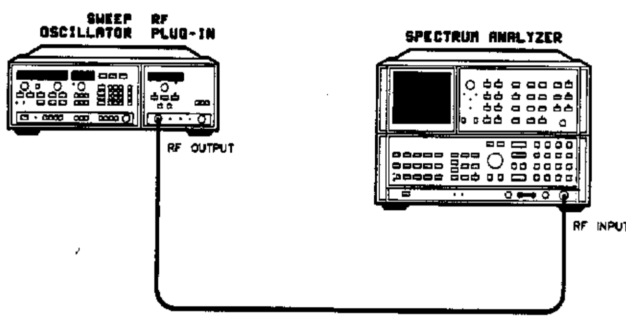


Figure 4-10. Square-Wave On/Off Ratio and Symmetry Test Setup

Equipment

Sweep Oscillator Mainframe .... HP 8350
Spectrum Analyzer .... HP 8566B

Procedure

1. Connect the equipment as shown in Figure 4-10. Press **[INSTR PRESET]** on both the sweep oscillator and the spectrum analyzer. Allow the equipment to warm up for one hour.
2. On the sweep oscillator/RF plug-in press **[CW] [5] [GHz]**
3. On the spectrum analyzer, press:

   [REFERENCE LEVEL] [1] [0] [+dBm]
   [PEAK SEARCH] [SIGNAL TRACK] (light on)
   [RES BW] (light on, 3 MHz)
   [FREQUENCY SPAN] [0] [GHz]
   [SIGNAL TRACK] (light off)
   [FREQUENCY SPAN] [0] [GHz]
   [MKR→REF LVL]

4. On the sweep oscillator, turn the square wave modulation on.
5. On the spectrum analyzer, press:

   TRIGGER: **[VIDEO]**
   For 1 kHz: **[SWEEP TIME] [.] [5] [msec]**
   For 27.8 kHz: **[SWEEP TIME] [5] [0] [μsec]**

4-21. Square-wave On/Off Ratio and Symmetry Test (cont'd)

6. On the spectrum analyzer:

   Adjust the video trigger LEVEL and intensity for a stable signal. Record the on/off ratio (peak to top of noise floor signal variation) on the test record.

   Measuring 4 dB below the peak of the ON cycle, record the ratio of the ON state to the OFF state, as the square wave symmetry on the test record.

4-22. Step Attenuator Accuracy Test (Option 002)

Description

The RF plug-in output is displayed on a spectrum analyzer, and the internal attenuator is compared (by substitution) to a calibrated step attenuator.

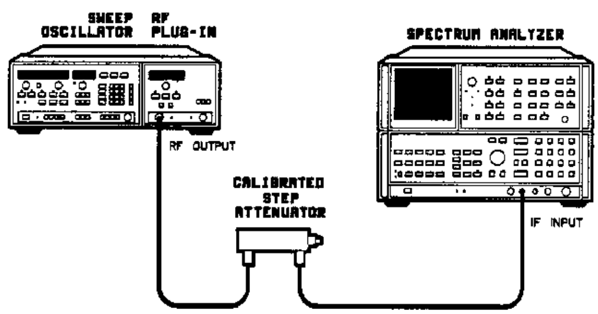


Figure 4-11. Step Attenuator Accuracy Test Setup

Equipment Required

Sweep Oscillator Mainframe	HP 8350
Spectrum Analyzer	HP 8566B
Calibrated Step Attenuator	HP 8495B Option 890

Procedure

1. Connect the equipment as shown in Figure 4-11. Press **[INSTR PRESET]** on both the sweep oscillator and the spectrum analyzer. Allow the equipment to warm up for one hour.
2. In Table 4-12, record the actual attenuation values from the reference attenuator calibration report (option 890).

4-22. Step Attenuator Accuracy Test (Option 002) (cont'd)

Table 4-12. Calibrated Attenuator Actual Attenuation Values

Attenuation Step Setting (dB)	Frequency (GHz)		
	5	15	19
55 (Reference)			
50			
45			
40			
35			
30			
25			
20			
15			
10			
5			

3. Use Tables 4-12a through 4-12c to calculate the reference attenuator error for each attenuator step:

   VRS = value at reference setting (the actual value at 70 dB).
   VSS = value at step setting (the actual value at this step setting).
   RS = reference setting (55 dB).
   SS = step setting (the ideal value at this step setting).

   Attenuation Error = (VRS − VSS) − (RS − SS)

   Example (at a step setting of 30 dB):

   From a calibration report:

   VRS = 54.55
   VSS = 30.80

   And:

   RS = 55
   SS = 30

   Attenuation Error =(54.55 − 30.80) − (55 − 30) =1.25 dB

4-22. Step Attenuator Accuracy Test (Option 002) (cont'd)

Table 4-13a. Calculating Reference Attenuator Error at 5 GHz

Reference Attenuator Step Setting (dB)	VRS (dB)	VSS (dB)		RS-SS (dB)	Error (dB)
55	-		= -	0	=
50	-		= -	5	=
45	-		= -	10	=
40	-		= -	15	=
35	-		= -	20	=
30	-		= -	25	=
25	-		= -	30	=
20	-		= -	35	=
15	-		= -	40	=
10	-		= -	45	=
5	-		= -	50	=
0	-		= -	55	=

Table 4-13b. Calculating Reference Attenuator Error at 15 GHz

Reference Attenuator Step Setting (dB)	VRS (dB)	VSS (dB)		RS-SS (dB)	Error (dB)
55	-		= -	0	=
50	-		= -	5	=
45	-		= -	10	=
40	-		= -	15	=
35	-		= -	20	=
30	-		= -	25	=
25	-		= -	30	=
20	-		= -	35	=
15	-		= -	40	=
10	-		= -	45	=
5	-		= -	50	=
0	-		= -	55	=

4-22. Step Attenuator Accuracy Test (Option 002) (cont'd)

Table 4-13c. Calculating Reference Attenuator Error at 19 GHz

Reference Attenuator Step Setting (dB)	VRS (dB)	VSS (dB)		RS-SS (dB)	Error (dB)
55	-		= -	0	=
50	-		= -	5	=
45	-		= -	10	=
40	-		= -	15	=
35	-		= -	20	=
30	-		= -	25	=
25	-		= -	30	=
20	-		= -	35	=
15	-		= -	40	=
10	-		= -	45	=
5	-		= -	50	=
0	-		= -	55	=

4. On the sweep oscillator/RF plug-in, press:

   [INSTR PRESET]
   [CW] [Frequency setting from Table 4-14] **[GHz]**
   [SHIFT] [SLOPE] (lets you independently control the internal attenuator)

5. Set the reference (calibrated) attenuator to 55 dB.

6. On the spectrum analyzer, press:

   [INSTRUMENT PRESET]
   [CENTER FREQUENCY] [Frequency setting from Table 4-14] **[GHz]**
   [FREQUENCY SPAN] [5] [0] [MHz]
   [RES BW] [1] [0] [0] [kHz]
   [PEAK SEARCH] [SIGNAL TRACK] (light on)
   [FREQUENCY SPAN] [1] [MHz]
   [SIGNAL TRACK] (light off)
   [MKR→REF LVL]
   [VIDEO BW] [1] [0] [0] [Hz]
   [ENTER dB/DIV] [2] [+dBm]

   Adjust the reference level for a centered display.

4-22. Step Attenuator Accuracy Test (Option 002) (cont'd)

Table 4-14. Step Attenuator Accuracy Test Frequency Settings

Frequency (GHz)
5
15
19

7. On the spectrum analyzer, press:

   [PEAK SEARCH] [MKR→CF] [Δ]

8. On the sweep oscillator/RF plug-in, press [▼] to increase the plug-in attenuator by 5 dB.
9. Decrease the reference attenuator by 5 dB.
10. On the spectrum analyzer:

    After the analyzer sweeps five times, note the power level variation from the 0 reference.

11. On the test record, add the attenuation error (Table 4-13) and the value from step 10. Record the sum.
12. Repeat steps 8 through 11 for the remaining attenuation steps at this frequency.
13. Repeat steps 4 through 11 for the remaining frequencies in Table 4-14.

Table 4-15. Performance Test Record (1 of 8)

HP 83592C RF PLUG-IN	Tested by__________
Serial No.__________	Date__________
Humidity*__________	Temperature*__________
(*optional)	

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-13. FREQUENCY RANGE AND ACCURACY TEST					
Frequency Range	7.	Start Frequency=10 MHz		______	10 MHz
	8.	Stop Frequency=20.0 GHz	20.0 GHz	______	
CW Frequency Accuracy	10.	CW Frequency=1.0 GHz	.995 GHz	______	1.005 GHz
		CW Frequency=2.2 GHz	2.395 GHz	______	2.405 GHz
		CW Frequency=4.0 GHz	3.995 GHz	______	4.005 GHz
		CW Frequency=2.5 GHz	2.495 GHz	______	2.505 GHz
		CW Frequency=6.8 GHz	6.7995 GHz	______	6.8005 GHz
		CW Frequency=10.0 GHz	9.99 GHz	______	10.01 GHz
		CW Frequency=7.1 GHz	7.09 GHz	______	7.11 GHz
		CW Frequency=13.3 GHz	13.29 GHz	______	13.31 GHz
		CW Frequency=17.0 GHz	16.99 GHz	______	17.01 GHz
		CW Frequency=14.0 GHz	13.99 GHz	______	14.01 GHz
		CW Frequency=20.0 GHz	19.99 GHz	______	20.01 GHz
Swept Frequency Accuracy					
Full Band	15.	Start 10 MHz ± 50 MHz	0 MHz	______	60 MHz
	17.	Stop 20 GHz ± 50 MHz	19.950 GHz	______	20.05 GHz
Band 0	15.	Start 10 MHz ± 15 MHz	0 MHz	______	25 MHz
	17.	Stop 2.4 GHz ± 15 MHz	2.385 GHz	______	2.415 GHz
Band 1	15.	Start 2.4 GHz ± 20 MHz	2.38 GHz	______	2.420 GHz
	17.	Stop 7.0 GHz ± 20 MHz	6.98 GHz	______	7.02 GHz
Band 2	15.	Start 7.0 GHz ± 25 MHz	6.975 GHz	______	7.025 GHz
	17.	Stop 13.5 GHz ± 25 MHz	13.475 GHz	______	13.525 GHz
Band 3	15.	Start 13.5 GHz ± 30 MHz	13.47 GHz	______	13.53 GHz
	17.	Stop 20.0 GHz ± 30 MHz	19.97 GHz	______	20.03 GHz

Table 4-15. Performance Test Record (2 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-13. FREQUENCY RANGE AND ACCURACY TEST (cont'd.)					
Frequency Marker Accuracy					
Full Band	23.	M1 at 1 GHz	.85 GHz	______	1.15 GHz
		M1 at 4 GHz	3.85 GHz	______	4.15 GHz
		M1 at 8 GHz	7.85 GHz	______	8.15 GHz
		M1 at 14 GHz	13.85 GHz	______	14.15 GHz
		M1 at 18 GHz	17.85 GHz	______	18.15 GHz
Band 0		M1 at 1 GHz	.974 GHz	______	1.026 GHz
		M1 at 2 GHz	1.974 GHz	______	2.026 GHz
Band 1		M1 at 3 GHz	2.957 GHz	______	3.043 GHz
		M1 at 6 GHz	5.957 GHz	______	6.043 GHz
Band 2		M1 at 8 GHz	7.942 GHz	______	8.058 GHz
		M1 at 12 GHz	11.942 GHz	______	12.058 GHz
Band 3		M1 at 15 GHz	14.937 GHz	______	15.063 GHz
		M1 at 18 GHz	17.937 GHz	______	18.063 GHz
4-14. OUTPUT AMPLITUDE TEST Standard or Option 004					
Maximum Leveled Power	19.				
0.01 to 2.4 GHz		+10 dBm	+10 dBm	______	
2.4 to 7.0 GHz		+6 dBm	+6 dBm	______	
7.0 to 13.5 GHz		+6 dBm	+6 dBm	______	
13.5 to 18.6 GHz		+6 dBm	+6 dBm	______	
18.6 to 20.0 GHz		+4 dBm	+4 dBm	______	
0.01 to 20.0 GHz		+4 dBm	+4 dBm	______	
Output Power Variation					
0.01 to 2.4 GHz	22.	+10 dBm		______	1.5 dB
2.4 to 7.0 GHz		+6 dBm		______	1.3 dB
7.0 to 13.5 GHz		+6 dBm		______	1.3 dB
13.5 to 18.6 GHz		+6 dBm		______	1.4 dB
18.6 to 20 GHz		+4 dBm		______	1.5 dB
0.01 to 20.0 GHz		+4 dBm		______	1.5 dB

Table 4-15. Performance Test Record (3 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-14. OUTPUT AMPLITUDE TEST (cont'd.)					
Power Level Accuracy					
0.01 to 2.4 GHz	26.	+10 dBm	−1.5 dB	______	+1.5 dB
		+5 dBm	−1.5 dB	______	+1.5 dB
		0 dBm	−1.5 dB	______	+1.5 dB
		−5 dBm	−1.5 dB	______	+1.5 dB
2.4 to 7.0 GHz	26.	+6 dBm	−1.3 dB	______	+1.3 dB
		+1 dBm	−1.3 dB	______	+1.3 dB
		−4 dBm	−1.3 dB	______	+1.3 dB
		−5 dBm	−1.3 dB	______	+1.3 dB
7.0 to 13.5 GHz	26.	+6 dBm	−1.3 dB	______	+1.3 dB
		+1 dBm	−1.3 dB	______	+1.3 dB
		−4 dBm	−1.3 dB	______	+1.3 dB
		−5 dBm	−1.3 dB	______	+1.3 dB
13.5 to 18.6 GHz	26.	+6 dBm	−1.4 dB	______	+1.4 dB
		+1 dBm	−1.4 dB	______	+1.4 dB
		−4 dBm	−1.4 dB	______	+1.4 dB
		−5 dBm	−1.4 dB	______	+1.4 dB
18.6 to 20 GHz	26.	+4 dBm	−1.4 dB	______	+1.4 dB
		−1 dBm	−1.4 dB	______	+1.4 dB
		−5 dBm	−1.4 dB	______	+1.4 dB
Power Sweep	33.	3 GHz	11 dB	______	
4-14. OUTPUT AMPLITUDE TEST Option 002					
Maximum Leveled Power	19.				
0.01 to 2.4 GHz		+10 dBm	+10 dBm	______	
2.4 to 7.0 GHz		+4.5 dBm	+4.5 dBm	______	
7.0 to 13.5 GHz		+4.0 dBm	+4.0 dBm	______	
13.5 to 18.6 GHz		+3.5 dBm	+3.5 dBm	______	
18.5 to 20 GHz		+1.5 dBm	+1.5 dBm	______	
0.01 to 20 GHz		+1.5 dBm	+1.5 dBm	______	
Output Power Variation					
0.01 to 2.4 GHz	22.	+10.0 dBm		______	1.7 dB
2.4 to 7.0 GHz		+4 dBm		______	1.5 dB
7.0 to 13.5 GHz		+4 dBm		______	1.5 dB
13.5 to 18.6 GHz		+3.5 dBm		______	1.6 dB
18.6 to 20 GHz		+1.5 dBm		______	1.6 dB
0.01 to 20 GHz		+1.5 dBm		______	1.7 dB

Table 4-15. Performance Test Record (4 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-14. OUTPUT AMPLITUDE TEST Option 002 (cont'd.)					
Power Level Accuracy					
0.01 to 2.4 GHz	26.	+10 dBm	−1.7 dB	______	+1.7 dB
		+5 dBm	−1.7 dB	______	+1.7 dB
		0 dBm	−1.7 dB	______	+1.7 dB
		−5 dBm	−1.7 dB	______	+1.7 dB
2.4 to 7.0 GHz	26.	+4.5 dBm	−1.5 dB	______	+1.5 dB
		−0.5 dBm	−1.5 dB	______	+1.5 dB
		−5 dBm	−1.5 dB	______	+1.5 dB
7.0 to 13.5 GHz	26.	+4.0 dBm	−1.5 dB	______	+1.5 dB
		−1.0 dBm	−1.5 dB	______	+1.5 dB
		−5.0 dBm	−1.5 dB	______	+1.5 dB
13.5 to 18.6 GHz	26.	+3.5 dBm	−1.6 dB	______	+1.6 dB
		−1.5 dBm	−1.6 dB	______	+1.6 dB
		−5.0 dBm	−1.6 dB	______	+1.6 dB
18.6 to 20 GHz	26.	1.5 dBm	−1.6 dB	______	+1.6 dB
		−3.5 dBm	−1.6 dB	______	+1.6 dB
		−5.0 dBm	−1.6 dB	______	+1.6 dB
Power Sweep	33.	3 GHz	9.5 dB	______	
4-15. FREQUENCY STABILITY TEST					
Frequency Change with 10 dB Power Level Change					
Band 0	6.	2.2 GHz		______	200 kHz
Band 1		6.0 GHz		______	200 kHz
Band 2		12.0 GHz		______	400 kHz
Band 3		18.0 GHz		______	600 kHz
4-16. RESIDUAL FM TEST	7.	CW 2.2 GHz		______	5 kHz peak
		CW 6.8 GHz		______	5 kHz peak
		CW 13.3 GHz		______	7 kHz peak
		CW 20 GHz		______	9 kHz peak

Table 4-15. Performance Test Record (5 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-17. SPURIOUS SIGNAL TEST					
Fundamental Frequency=2 GHz	5.	Spur Frequency= 4 GHz			
		Harmonic	>−45 dBc	________	
		Non-Harmonic	>−25 dBc	________	
		Spur Frequency= 6 GHz			
		Harmonic	>−45 dBc	________	
		Non-Harmonic	>−25 dBc	________	
		Spur Frequency= 8 GHz			
		Harmonic	>−45 dBc	________	
		Non-Harmonic	>−25 dBc	________	
Fundamental Frequency=10 GHz	5.	Spur Frequency= 5 GHz			
		Harmonic	>−55 dBc	________	
		Non-Harmonic	>−55 dBc	________	
		Spur Frequency= 15 GHz			
		Harmonic	>−55 dBc	________	
		Non-Harmonic	>−55 dBc	________	
		Spur Frequency= 20 GHz			
		Harmonic	>−55 dBc	________	
		Non-Harmonic	>−55 dBc	________	
Fundamental Frequency=15 GHz	5.	Spur Frequency= 5 GHz			
		Harmonic	>−55 dBc	________	
		Non-Harmonic	>−55 dBc	________	
		Spur Frequency= 10 GHz			
		Harmonic	>−55 dBc	________	
		Non-Harmonic	>−55 dBc	________	
Fundamental Frequency=18 GHz	5.	Spur Frequency= 6 GHz			
		Harmonic	>−55 dBc	________	
		Non-Harmonic	>−55 dBc	________	
		Spur Frequency= 12 GHz			
		Harmonic	>−55 dBc	________	
		Non-Harmonic	>−55 dBc	________	

Table 4-15. Performance Test Record (6 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-20. EXTERNAL FREQUENCY MODULATION TEST					
Direct Coupled	7.	100 Hz CW = 5 GHz	±12MHz	________	
Cross-over Coupled	7.	100 Hz CW = 5 GHz	±75 MHz	________	
		100 Hz CW = 10 GHz	±75 MHz	________	
		100 Hz CW = 15 GHz	±75 MHz	________	
	14.	CW = 5 GHz 1 MHz	±7 MHz	________	
	15.	CW = 5 GHz 2 MHz	±5 MHz	________	
	16.	CW = 5 GHz 10 MHz	±1 MHz	________	
	14.	CW = 10 GHz 1 MHz	±7 MHz	________	
	14.	CW = 15 GHz 1 MHz	±7 MHz	________	
4-21. SQUARE-WAVE ON/OFF RATIO AND SYMMETRY TEST					
CW at 5 GHz	6.	On/Off Ratio	>30 dB	________	
		Symmetry	40/60%	________	60/40%

Table 4-15. Performance Test Record (7 of 8)

SPECIFICATIONS TESTED Limits		Step	TEST Conditions			LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-22. STEP ATTENUATOR ACCURACY (Option 002)								
0.01 to 12.4 GHz		11.	CW frequency = 2.0 GHz					
Step Attenuator Setting	RF plug-in Output Power		Attenuator Error	+	Deviation from Reference			
55 dB	+10 dBm	10.	Ref		Ref			Ref
50 dB	5 dBm		____	+	____	−0.4 dB	____	+0.4 dB
45 dB	0 dBm		____	+	____	−0.6 dB	____	+0.6 dB
40 dB	− 5 dBm		____	+	____	−0.9 dB	____	+0.9 dB
35 dB	−10 dBm		____	+	____	−0.7 dB	____	+0.7 dB
30 dB	−15 dBm		____	+	____	−1.0 dB	____	+1.0 dB
25 dB	−20 dBm		____	+	____	−0.9 dB	____	+0.9 dB
20 dB	−25 dBm		____	+	____	−1.3 dB	____	+1.3 dB
15 dB	−30 dBm		____	+	____	−1.8 dB	____	+1.8 dB
10 dB	−35 dBm		____	+	____	−2.0 dB	____	+2.0 dB
5 dB	−40 dBm		____	+	____	−2.0 dB	____	+2.0 dB
0 dB	−45 dBm		____	+	____	−2.2 dB	____	+2.2 dB
12.4 to 18.0 GHz			CW frequency = 15.0 GHz					
Step Attenuator Setting	RF plug-in Output Power		Attenuator Error	+	Deviation from Reference			
55 dB	+3.5 dBm		Ref		Ref			Ref
50 dB	−1.5 dBm		____	+	____	−0.5 dB	____	+0.5 dB
45 dB	−6.5 dBm		____	+	____	−0.7 dB	____	+0.7 dB
40 dB	−11.5 dBm		____	+	____	−1.0 dB	____	+1.0 dB
35 dB	−16.5 dBm		____	+	____	−0.9 dB	____	+0.9 dB
30 dB	−21.5 dBm		____	+	____	−1.2 dB	____	+1.2 dB
25 dB	−26.5 dBm		____	+	____	−1.2 dB	____	+1.2 dB
20 dB	−31.5 dBm		____	+	____	−1.6 dB	____	+1.6 dB
15 dB	−36.5 dBm		____	+	____	−2.0 dB	____	+2.0 dB
10 dB	−41.5 dBm		____	+	____	−2.2 dB	____	+2.2 dB
5 dB	−46.5 dBm		____	+	____	−2.3 dB	____	+2.3 dB
0 dB	−51.5 dBm		____	+	____	−2.5 dB	____	+2.5 dB

Table 4-15. Performance Test Record (8 of 8)

SPECIFICATIONS TESTED Limits		Step	TEST Conditions			LOWER LIMIT	MEASURED VALUE	UPPER LIMIT
4-22. STEP ATTENUATOR ACCURACY (Option 002) (cont'd)								
18.0 to 20.0 GHz		11.	CW frequency = 19.0 GHz					
Step Attenuator Setting	RF plug-in Output Power		Attenuator Error	+	Deviation from Reference			
55 dB	+4 dBm	10.	Ref		Ref			Ref
50 dB	−1 dBm		_______	+	_______	−0.6 dB	_______	+0.6 dB
45 dB	−16 dBm		_______	+	_______	−0.9 dB	_______	+0.9 dB
40 dB	−11 dBm		_______	+	_______	−1.3 dB	_______	+1.3 dB
35 dB	−16 dBm		_______	+	_______	−1.5 dB	_______	+1.5 dB
30 dB	−21 dBm		_______	+	_______	−2.0 dB	_______	+2.0 dB
25 dB	−26 dBm		_______	+	_______	−2.5 dB	_______	+2.5 dB
20 dB	−31 dBm		_______	+	_______	−2.8 dB	_______	+2.8 dB
15 dB	−36 dBm		_______	+	_______	−3.0 dB	_______	+3.0 dB
10 dB	−41 dBm		_______	+	_______	−3.1 dB	_______	+3.1 dB
5 dB	−46 dBm		_______	+	_______	−3.2 dB	_______	+3.2 dB
0 dB	−51 dBm		_______	+	_______	−3.2 dB	_______	+3.2 dB

Table 4-16. Operation Verification Test Record (1 of 3)

HP 83592C RF PLUG-IN

Serial No.________________

Tested by________________

Date________________

	Specification	Pass	Fail
4-13. Frequency Range and Accuracy Test			
Frequency Range	0.01 to 20 GHz	______	______
CW Frequency Accuracy	1.0 GHz ± 5 MHz	______	______
	2.2 GHz ± 5 MHz	______	______
	4.0 GHz ± 5 MHz	______	______
	2.5 GHz ± 5 MHz	______	______
	6.8 GHz ± 5 MHz	______	______
	10 GHz ± 10 MHz	______	______
	7.1 GHz ± 10 MHz	______	______
	13.3 GHz ± 10 MHz	______	______
	17.0 GHz ± 10 MHz	______	______
	14.0 GHz ± 10 MHz	______	______
	20.0 GHz ± 10 MHz	______	______
Swept Frequency Accuracy			
Full Band	10 MHz ± 50 MHz	______	______
	20 GHz ± 50 MHz	______	______
Band 0	10 MHz ± 15 MHz	______	______
	2.4 GHz ± 15 MHz	______	______
Band 1	2.4 GHz ± 20 MHz	______	______
	7.0 GHz ± 20 MHz	______	______
Band 2	7.0 GHz ± 25 MHz	______	______
	13.5 GHz ± 25 MHz	______	______
Band 3	13.5 GHz ± 30 MHz	______	______
	20.0 GHz ± 30 MHz	______	______

Table 4-16. Operation Verification Test Record (2 of 3)

HP 83592C RF PLUG-IN		Tested by________	
Serial No.________		Date________	
	Specification	**Pass**	**Fail**
4-13. Frequency Range and Accuracy Test			
Frequency Marker Accuracy			
(Full Band) M1 at 1 GHz	±150 MHz	________	________
M1 at 4 GHz	± 150 MHz	________	________
M1 at 8 GHz	± 150 MHz	________	________
M1 at 14 GHz	± 150 MHz	________	________
M1 at 18 GHz	± 150 MHz	________	________
(Band 0) M1 at 1 GHz	±26 MHz	________	________
M1 at 2 GHz	± 26 MHz	________	________
(Band 1) M1 at 3 GHz	±43 MHz	________	________
M1 at 6 GHz	± 43 MHz	________	________
(Band 2) M1 at 8 GHz	±58 MHz	________	________
M1 at 12 GHz	± 58 MHz	________	________
(Band 3) M1 at 15 GHz	±63 MHz	________	________
M1 at 18 GHz	± 63 MHz	________	________
4-14. Output Amplitude Test*			
Maximum Leveled Power			
0.01 to 2.4 GHz	>+10 dBm	________	________
2.4 to 7.0 GHz	>+10 dBm	________	________
7.0 to 13.5 GHz	>+10 dBm	________	________
13.5 to 20 GHz	>+10 dBm	________	________
Output Power Variation			
0.01 to 2.4 GHz	± 0.9 dB	________	________
2.4 to 7.0 GHz	± 0.7 dB	________	________
7.0 to 13.5 GHz	±0.7 dB	________	________
13.5 to 20 GHz	±0.8 dB	________	________
0.01 to 20 GHz	±0.9 dB	________	________

*Specifications listed are for standard instruments. Refer to the specification tables for option 002 instruments.

Table 4-16. Operation Verification Test Record (3 of 3)

HP 83592C RF PLUG-IN			Tested by__________
Serial No.__________			Date__________
	Specification	**Pass**	**Fail**
4-14. Output Amplitude Test (cont'd.)			
Power Level Accuracy			
0.01 to 2.4 GHz			
+ 10 dBm	±1.5 dB	______	______
+ 5 dBm	±1.5 dB	______	______
− 5 dBm	±1.5 dB	______	______
2.4 to 7.0 GHz			
+ 10 dBm	± 1.3 dB	______	______
+ 5 dBm	±1.3 dB	______	______
0 dBm	±1.3 dB	______	______
− 5 dBm	±1.3 dB	______	______
7.0 to 13.5 GHz			
+ 10 dBm	± 1.3 dB	______	______
+ 5 dBm	±1.3 dB	______	______
0 dBm	±1.3 dB	______	______
− 5 dBm	±1.3 dB	______	______
13.5 to 20 GHz			
+10 dBm	±1.4 dB	______	______
+5 dBm	±1.4 dB	______	______
0 dBm	±1.4 dB	______	______
− 5 dBm	±1.4 dB	______	______
Power Sweep Range			
2.2 GHz	15 dB	______	______

MANUAL IDENTIFICATION

HP Model Number: HP 83592C
Manual Part Number: 83592-90038
Date Printed: December 1983

CHANGE 21

Change 21 documents serial number prefix 2836A.

This change documents new A2 and A10 assemblies.

INSTRUCTIONS

Replace the title page with the title page in this change packet.

Page 6-14, Table 6-3:
Change A2 to 83592-60142, CD2

Page 6-15, Table 6-3:
Change A2W3 to 0811-3587, CD5, Jumper
Add A2W4, 0811-3587, CD5, Jumper

Page 6-30, Table 6-3:
Change A10 to 83595-60081, CD1

Page 8-37/8-38:
Replace Figure 8-12 with Figure 8-12 in this change packet.
Replace Figure 8-18 with Figure 8-18 in this change packet.

HP 83592C
RF PLUG-IN
(Including Options 002 and 004)

SERIAL NUMBERS

This manual applies directly to HP 83592C RF plug-in having serial number prefix 2328A.

For additional information about serial numbers, refer to INSTURMENTS COVERED BY MANUAL in Section 1.

Manual Changes Supplement Print Date: 1 SEPT 1988

Change	Documents Prefix		Change	Documents Prefix		Change	Documents Prefix
1	2348A		16	2718A			
2	2412A		17	2726A			
3	2412A		18	2726A00581			
4	2412A		19	2809A			
5	2412A		20	N/A			
6	2429A		21	2836A			
7	2451A						
8	2506A						
9	2520A						
10	2532A						
11	2542A						
12	2602A						
13	2621A						
14	2644A						
15	2702A						

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MANUAL PART NO. 83592-90038
Microfiche Part Number 83592-90039

Printed: DECEMBER 1983

HEWLETT PACKARD

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

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This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of delivery. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

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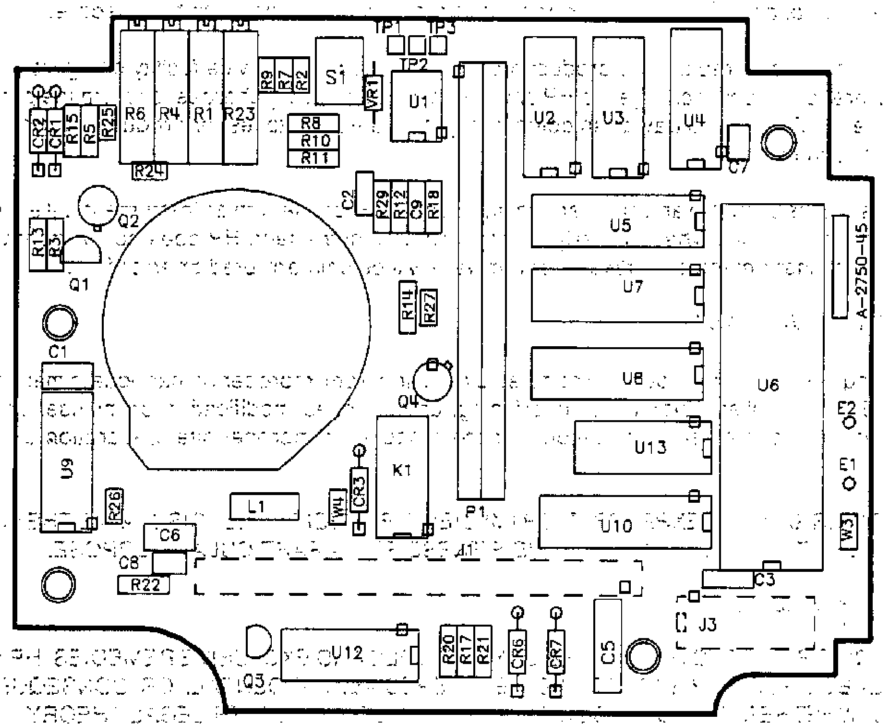
8P21.1



HP P/N 83592-60142

Figure 8-12. A2 Front Panel Interface, Component Locations (CHANGE 21)

MANUAL IDENTIFICATION

HP Model Number: HP 83592C
Manual Part Number: 83592-90038
Date Printed: December 1983

CHANGE 22

Change 22 documents serial prefix 2046A.

This change documents changes to the A8 YO driver assembly.

INSTRUCTIONS

Replace the title page with the title page in this change packet.

Page 6-27, Table 6-3:
Change A8C16 to 0160-3742, CD3, Capacitor-MPC 1.0µf 50V

Page 6-28, Table 6-3:
Change A8R49 to 0757-0465, Resistor 100K 1% 0.12W
Change A8R50 to 0757-0465, Resistor 100K 1% 0.12W
Change A8R51 to 0757-0465, Resistor 100K 1% 0.12W

Page 8-105/8-106:
Replace Figure 8-71 with Figure 8-71 in this change packet.

HP 83592C
RF PLUG-IN
(Including Options 002 and 004)

SERIAL NUMBERS

This manual applies directly to HP 83592C RF plug-in having serial number prefix 2328A.

For additional information about serial numbers, refer to INSTURMENTS COVERED BY MANUAL in Section 1.

Manual Changes Supplement Print Date: 1 NOV 1988

Change	Documents Prefix		Change	Documents Prefix		Change	Documents Prefix
1	2348A		16	2718A			
2	2412A		17	2726A			
3	2412A		18	2726A00581			
4	2412A		19	2809A			
5	2412A		20	N/A			
6	2429A		21	2836A			
7	2451A		22	2846A			
8	2506A						
9	2520A						
10	2532A						
11	2542A						
12	2602A						
13	2621A						
14	2644A						
15	2702A						

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MANUAL PART NO. 83592-90038
Microfiche Part Number 83592-90039

Printed: DECEMBER 1983

HEWLETT PACKARD

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

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BP21.1

MANUAL IDENTIFICATION

HP Model Number: HP 83592C **Manual Part Number:** 83592-90038 **Date Printed:** December 1983

CHANGE 23

Change 23 documents serial prefix 2911A.

This change documents an improvement to the A8 YO driver assembly.

INSTRUCTIONS

Replace the title page with the title page in this change packet.

Page 6-27, Table 6-3:
Change A8 to 83595-60089, CD9
Delete A8CR9.

Page 8-105/8-106:
Replace Figure 8-63 with Figure 8-63 in this change packet.
Replace Figure 8-71 with Figure 8-71 in this change packet.

HP 83592C
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SERIAL NUMBERS

This manual applies directly to HP 83592C RF plug-in having serial number prefix 2328A.

For additional information about serial numbers, refer to INSTURMENTS COVERED BY MANUAL in Section 1.

Manual Changes Supplement Print Date: 30 MARCH 1989

Change	Documents Prefix		Change	Documents Prefix		Change	Documents Prefix
1	2348A		16	2718A			
2	2412A		17	2726A			
3	2412A		18	2726A00581			
4	2412A		19	2809A, 2815A			
5	2412A		20	N/A			
6	2429A		21	2836A			
7	2451A		22	2846A			
8	2506A		23	2911A			
9	2520A						
10	2532A						
11	2542A						
12	2602A						
13	2621A						
14	2644A						
15	2702A						

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MANUAL PART NO. 83592-90038
Microfiche Part Number 83592-90039

Printed: DECEMBER 1983

HEWLETT PACKARD

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (NIST, formerly NBS), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

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For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

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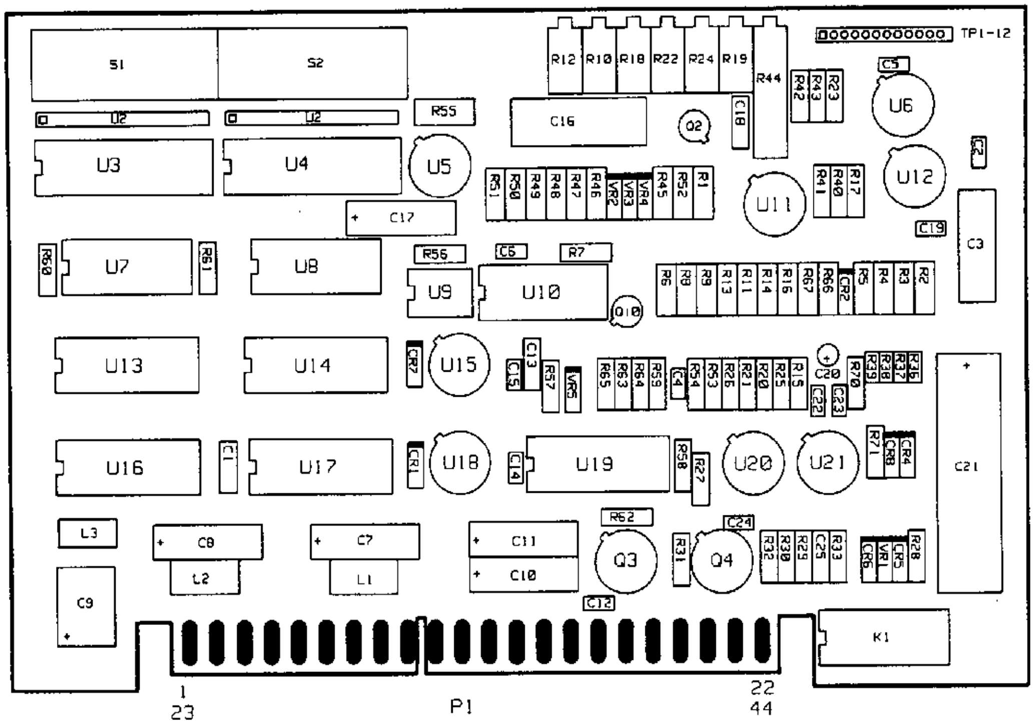
BP21.2



HP P/N 83595-60089

Figure 8-63. A8 YO Driver, Component Locations (CHANGE 23)

MANUAL IDENTIFICATION

HP Model Number: HP 83592C **Manual Part Number:** 83592-90038 **Date Printed:** December 1983

CHANGE 24

This change documents a new A1 assembly for serial prefix number 3010A. The A1 assembly was modified to improve lower level manufacturability. The capacitor was changed to one which is a preferred part.

NOTE: For serial prefixes lower than 3010A, order this new A1 assembly (HP P/N 83592-60147, CD 7) if a replacement assembly is needed. This A1 assembly is completely compatible with your instrument version. The previous assembly is no longer available.

Instructions

- Replace the existing manual title page with the title page provided with this change.
- On page 6-14:
  Change the A1 front panel board assembly to HP part number 83592-60147 CD 7.
  Change A1C2 to HP part number 0180-3831 CD 3.
- On page 6-16:
  Change A3R1 to HP part number 0757-1094 CD 9.
- On page 8-37, figure 8-18:
  Change A1 front panel part number to 83592-60147.
- On page 8-47, figure 8-23, block D:
  Change R1 value to 1470.

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SERIAL NUMBERS

This manual applies directly to HP 83592C RF plug-in having serial number prefix 2328A.

For additional information about serial numbers, refer to INSTURMENTS COVERED BY MANUAL in Section 1.

Manual Changes Supplement Print Date: APRIL 1990

Change	Documents Prefix		Change	Documents Prefix		Change	Documents Prefix
1	2348A		16	2718A			
2	2412A		17	2726A			
3	2412A		18	2726A00581			
4	2412A		19	2809A, 2815A			
5	2412A		20	N/A			
6	2429A		21	2836A			
7	2451A		22	2846A			
8	2506A		23	2911A			
9	2520A		24	3010A			
10	2532A						
11	2542A						
12	2602A						
13	2621A						
14	2644A						
15	2702A						

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MANUAL PART NO. 83592-90038
Microfiche Part Number 83592-90039

Printed: DECEMBER 1983

HEWLETT PACKARD

MANUAL IDENTIFICATION

HP Model Number: HP 83592C **Manual Part Number:** 83592-90038 **Date Printed:** December 1983

CHANGE 25

This change documents an improved A14 power amplifier bias assembly.

NOTE: For serial prefixes lower than 3050A, order this new A14 Power Amplifier if a replacement is required. The new A14 assembly is completely compatible with your instrument. The previous assembly is no longer available.

Replace the following pages with the pages provided in this change.

Title page

Make the following changes to the manual.

Page 6-31

Change A14 to HP part number 5086-7559 Power Amplifier (2.3 to 20.0 GHz) and HP part number 5086-6559 Exchange 5086-7559 Amplifier.

Delete all lower level parts to the A14A1 assembly. These parts are not separately replaceable.

Page 8-118

Delete Figure 8-74 (bias assembly is not separately replaceable)

Page 8-121

Schematic block A14 Power Amplifier has been modified. Inputs and outputs remain the same but internal circuitry has changed. A new schematic is not provided since the amplifier is not field repairable.

Schematic block A14A1 Amplifier Bias has been modified. External connections remain the same but internal circuitry has changed. A new schematic is not provided since the amplifier is not field repairable.

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SERIAL NUMBERS

This manual applies directly to HP 83592C RF plug-in having serial number prefix 2328A.

For additional information about serial numbers, refer to INSTURMENTS COVERED BY MANUAL in Section 1.

Manual Changes Supplement Print Date: DEC 1990

Change	Documents Prefix	Change	Documents Prefix	Change	Documents Prefix
1	2348A	16	2718A		
2	2412A	17	2726A		
3	2412A	18	2726A00581		
4	2412A	19	2809A, 2815A		
5	2412A	20	N/A		
6	2429A	21	2836A		
7	2451A	22	2846A		
8	2506A	23	2911A		
9	2520A	24	3010A		
10	2532A	25	3050A		
11	2542A				
12	2602A				
13	2621A				
14	2644A				
15	2702A				

MANUAL PART NO. 83592-90038
Microfiche Part Number 83592-90039

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