CI-~~0649~~ 0693

REF 8505A VOLUME I

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

A CALIBRATION/SERVICE PROCEDURE (CSP) CONTAINS DETAIL NECESSARY FOR EXPERIENCED CALIBRATION TECHNICIANS TO PERFORM A CALIBRATION PROCESS. IT ASSUMES FAMILIARITY WITH THE MEASUREMENT STANDARDS, SUPPORT EQUIPMENT, TEST INSTRUMENT (TI), GENERAL METROLOGY TECHNIQUES, TERMINOLOGY & DEFINITIONS, AND CURRENT LABORATORY POLICY.

THE PERFORMANCE SPECIFICATIONS LISTED IN SECTION 1 ARE NOT NECESSARILY THE MANUFACTURERS PUBLISHED SPECIFICATIONS. PERFORMANCE SPECIFICATIONS ARE BASED ON THE USER'S REQUIREMENTS, TI CAPABILITIES, AND THE CAPABILITIES OF THE MEASUREMENT STANDARDS.

NORMAL CALIBRATION ENVIRONMENT UNLESS OTHERWISE DEFINED IN SECTION 1:
TEMPERATURE 25 ±4°C RELATIVE HUMIDITY 45 ±40%

TI ENVIRONMENT RANGE OPERATION REQUIREMENTS: TEMP: 0 °C TO 50 °C, RH NOT SPECIFIED
OPERATION REQUIREMENTS ARE THOSE ENVIRONMENTAL CONDITIONS REQUIRING CONTROL OR SPECIAL REQUIREMENTS WHICH MUST BE MET TO OBTAIN PERFORMANCE WITHIN THE SPECIFICATION LIMITS CONTAINED IN SECTION 1 OF THE CSP.

TI WARM-UP PERIOD REQUIREMENTS: 1 HR. 0 MIN.

SEE SHEET 1-1 FOR REVISION STATUS.

REV STATUS OF SHEETS	REV																						
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

CONTRACT NO.	
PREP	D.K. NAEVE 3-2-83
CHK	D.K. NAEVE 3-2-83
APVD	G.P. FLUHARTY 3-2-83
REVD	W.H. SHEKA 3-2-83

ROCKWELL INTERNATIONAL CORPORATION
COLLINS DIVISIONS
DALLAS, TEX 75207 NEWPORT BEACH, CALIF 92663 CEDAR RAPIDS, IA 52406

CALIBRATION/SERVICE PROCEDURE

HEWLETT-PACKARD 8505A
NETWORK ANALYZER AND
8501A STORAGE NORMALIZER

METRIC

SIZE	FSCM	DWG NO.	REV LTR
A	13499	597-0724-500	

SCALE | SHEET 1 OF 59

DWG NO. 597-0724-500 SH. 1-1

REV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
SHEET	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	1-1					
REV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SHEET	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42

REV STATUS OF SHEETS																						
REV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19			

ROCKWELL INTERNATIONAL CORPORATION
COLLINS GROUPS
DALLAS, TEX 75207 NEWPORT BEACH, CALIF 92663 CEDAR RAPIDS, IA 52406

PREP	SIZE A	FSCM 13499	DWG NO. 597-0724-500	REV LTR --
CHK	SCALE		SHEET 1-1	

INTRODUCTION

THIS PROCEDURE DESCRIBES THE CALIBRATION OF THE HEWLETT-PACKARD 8505A NETWORK ANALYZER AND THE HEWLETT-PACKARD 8501A STORAGE NORMALIZER. THE 8505A OPERATES OVER A FREQUENCY RANGE OF 500 kHz TO 1.3 GHz. THE 8505A IS A COMPLETE RESPONSE SYSTEM WHICH MEASURES COMPLEX IMPEDANCE, TRANSFER FUNCTIONS, AND GROUP DELAY OF COAXIAL COMPONENTS AND SEMICONDUCTORS. THE 8501A WHEN USED WITH THE 8505A PROVIDES DIGITAL STORAGE, CRT ANNOTATION OF MAJOR CONTROL SETTINGS, NORMALIZATION OF SIGNALS, DIGITAL AVERAGING OF SIGNALS AND MAGNIFICATION OF THE DISPLAY.

THE PROCEDURE DOCUMENTED HEREIN WAS EXTRACTED FROM THE HEWLETT-PACKARD OPERATING AND SERVICE MANUALS FOR THE 8505A AND THE 8501A. THE PROCEDURE HAS BEEN MODIFIED AS REQUIRED TO REFLECT CURRENT COLLINS EQUIPMENT SPECIFICATION REQUIREMENTS, CALIBRATION AVAILABILITY AND MEASUREMENT PRACTICES.

INDEX

NOTE

THE 8501A ONLY REQUIRES A FUNCTIONAL TEST WITH THE 8505A WITH WHICH IT IS USED. FOR CALIBRATION PURPOSES IT IS CONSIDERED PART OF THE 8505A AND ASSIGNED A ZERO CALIBRATION INTERVAL.

Table A1-1. 8505A Network Analyzer Performance Specifications (1 of 3)

SOURCE

FREQUENCY CHARACTERISTICS

Frequency Range: 500 kHz to 1.3 GHz in three ranges; 500 kHz to 13 MHz, 500 kHz to 130 MHz and 500 kHz to 1.3 GHz.

Swept Frequency Accuracy: ±1% of range for linear sweep.

CW Frequency Accuracy: ±2 counts ±time-base accuracy.

Frequency Stability: better than ±0.01% of reading ±0.01% of frequency range over 10 minutes after warm up.

FREQUENCY COUNTER CHARACTERISTICS

Frequency counter measurements are made at any one of five continuously variable marker positions without interrupting the swept RF signal.

Accuracy:
Counter: ±2 counts ±time-base accuracy.

Marker Frequency: ±0.002% of scan width ±counter accuracy.

Time Base Accuracy: ±5 ppm ±1 ppm/°C ±3 ppm/90 days

OUTPUT CHARACTERISTICS

Power:
Range: +10 dBm to −72 dBm.

Accuracy:
Attenuator: ±1.5 dB over 70 dB range.

Vernier: ±1 dB

Levelling: ±0.5 dB from 500 kHz to 1.3 GHz.

Impedance: 50Ω; ≥16 dB return loss at −10 dBm output level (<1.38 SWR). **(Not Checked)**

Spectral Purity
Residual FM:

Frequency Range (MHz)	0.5 to 13	0.5 to 130	0.5 to 1300
Residual FM (Hz rms)	<20.2 Hz	<220 Hz	<2.4 kHz
Measurement Bandwidth	<20 Hz-3 kHz	<20 Hz-3 kHz	<20 Hz-15 kHz

Harmonics: >25 dB below main signal at +10 dBm output level. Typically >40 dB below main signal at −12 dB setting of vernier.

Sub-harmonics and Spurious Signals: Below −50 dBm at +10 dBm output level.

RECEIVER

FREQUENCY RANGE
500 kHz to 1.3 GHz.

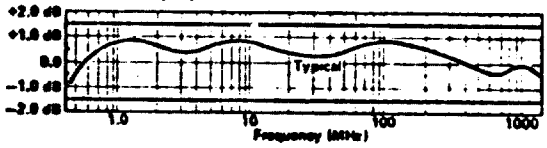
INPUT CHARACTERISTICS
Input Channels: Three channels (R, A, and B) with 100 dB dynamic range.

Maximum Input Level (Selectable): −10 dBm or −30 dBm input level.

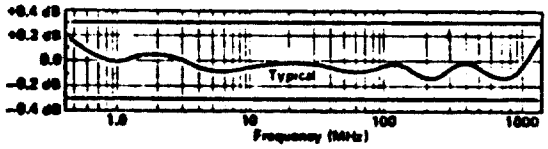
Noise (10 kHz BW): −110 dBm from 10 to 1300 MHz; −100 dBm from 2 to 10 MHz; −95 dBm from 0.5 to 2 MHz. Typically, −120 dBm using the −30 dBm input level position and 1 kHz BW.

Impedance: 50Ω: ≥20 dB return loss (<1.22 SWR). Typically >26 dB return loss (<1.11 SWR). (Checked from 5 MHz to 1300 MHz)

MAGNITUDE CHARACTERISTICS
Frequency Response:
Absolute (A, B, R): ±1.5 dB.



Ratio (A/R, B/R): ±0.3 dB from 0.5 MHz to 1.3 GHz.



Dynamic Accuracy:
± 0.01 dB/dB from −20 to −40 dBm.
± 0.2 dB from −10 to −50 dBm.
± 0.5 dB from −50 to −70 dBm.
± 1.0 dB from −70 to −90 dBm.
± 2.0 dB from −90 to −100 dBm.
± 4.0 dB from −100 to −110 dBm.

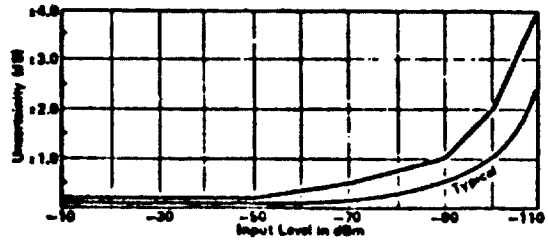
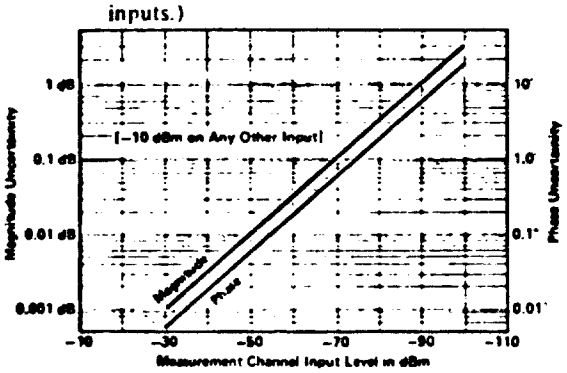


Table A1-1. 8505A Network Analyzer Performance Specifications (2 of 3)

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



Reference Offset:
Range: ±199.9 dB.
Accuracy: ±0.03 dB ±0.003 dB/dB of offset.

Resolution:
Marker Measurement: 0.01 dB over any <10 dB range; 0.1 dB for ≥10 dB range.

CRT Display: 0.1 dB to 20 dB/division in 1, 2, 5 sequence.

Crosstalk: See amplitude crosstalk specifications.

Reference Offset:
Range: ±1700 degrees.

Accuracy: ±0.3° ±0.5% of offset.

Resolution:
Marker Measurement: 0.1° over <100° range and 1° for ≥100° range.

CRT Display: 1° to 180° per division in 8 steps.

POLAR CHARACTERISTICS

Frequency Response, Dynamic Response, Reference Offset and Marker Measurement specifications are the same as magnitude and phase characteristics.

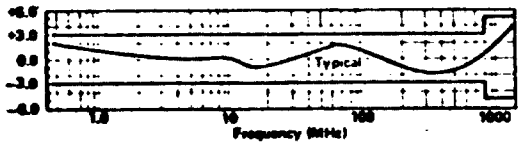
CRT Display Accuracy: Actual value is within less than a 3 mm circle of the displayed value.

Tracking Between dB Offset Controls and Polar Full switch positions: ≤0.2 dB.

CRT Display Resolution: Magnitude graticules at 20% of full scale spacing; phase graticules at 10° increments around unit circle.

PHASE CHARACTERISTICS

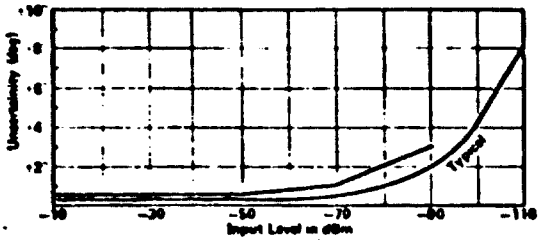
Frequency Response: ±3° from 500 kHz to 750 MHz. ±5° from 750 MHz to 1.3 GHz.



Range: ±180°.

Accuracy: ±0.01°/degree for ±170°
±0.01°/degree ±0.5° for ±180°

Dynamic Accuracy (in 10 kHz Bandwidth):
±0.02°/dB from −20 to −40 dBm.
±0.5° from −10 to −50 dBm.
±1° from −50 to −70 dBm.
±3° from −70 to −90 dBm.



DELAY CHARACTERISTICS

Frequency Response: ±1 ns from 500 kHz to 1.3 GHz

Delay Accuracy[3]: ±3% of reading ±3 units. (Units = 1 nsec for 0.5 to 1300 MHz range, 10 nsec for 0.5 to 130 MHz range, and 100 nsec for 0.5 to 13 MHz range.) **(Checked at 700 MHz only)**

Range, Resolution and Aperture[2]

Frequency Range (MHz)	0.5 to 13	0.5 to 130	0.5 to 1300
Range	0 to 80 μs	0 to 8 μs	0 to 800 ns
Resolution			
CRT:	100 ns	10 ns	1 ns
Marker:	100 ns	10 ns	1 ns
Marker over limited Range:	10 ns (<1 μs)	1 ns (≤ 100 ns)	0.1 ns (≤ 10 ns)
Aperture[2]	7 kHz	20 kHz	200 kHz

Reference Offset:
Range: ±1999 units.

Accuracy: ±0.3 units ±0.3% of offset.

Table A1-1. 8505A Network Analyzer Performance Specifications (3 of 3)

ELECTRICAL LENGTH/REF. PLANE EXTENSION CHARACTERISTICS

Calibrated Electrical Length: Range and Resolution:[3]

Frequency Range (MHz)		0.5 to 13	0.5 to 130	0.5 to 1300
Range	x1	±19.9 m	±1.99 m	±19.9 cm
	x10	±100 m	±10 m	±1 m
Resolution	x1	10 cm	1 cm	0.1 cm
	x10	1 m	10 cm	1 cm

[1] ±3 Units may be calibrated out.
[2] Typical measurement Aperture using linear FM modulation technique.
[3] Vernier provides continuous adjustment of electrical length.

Accuracy: ±3% of reading ±1% of range.

Resolution: 10°

Vernier Range: Continuously variable over >10° range.

Accuracy: ±3% of reading ±10°/scan.

Phase Compensation Linearity: < ±0.2% of phase slope inserted.

Dimensions: 426 mm wide, 279 mm high, 553 mm deep (16-3/4 in. x 11 in. x 21-3/4 in.).

Weight:
Net, 36 kg (86 lb)
Shipping, 48 kg (106 lb)

Table A1-2. Supplemental Characteristics (1 of 2)

SOURCE

Swept Frequency Resolution: (Verniers provide continuous frequency adjustment.)

Frequency Range (MHz)	0.5 to 13	0.5 to 130	0.5 to 1300
Start/Stop	10 kHz	100 kHz	1 MHz
CW ±ΔF	10 kHz 1 kHz	100 kHz 10 kHz	1 MHz 100 kHz
CW	100 Hz	1 kHz	10 kHz

Frequency Counter Resolution: (Least Significant digit)

Frequency Range (MHz)	0.5 to 13	0.5 to 130	0.5 to 1300
10 ms Sweep Time	10 kHz	100 kHz	1 MHz
100 ms Sweep Time	1 kHz	10 kHz	100 kHz
>1 second Sweep Time	100 Hz	1 kHz	10 kHz

Typical CW Noise (SSB in 1 Hz BW):

Frequency Range (MHz)	0.5 to 13	0.5 to 130	0.5 to 1300
dB below carrier	70	85	100
Frequency offset from carrier	1 kHz	10 kHz	150 kHz

SOURCE
General Characteristics:

Sweep Modes: Linear Full, Log Full, Start/Stop 1, Start/Stop 2, Alternate, CW ±ΔF, and CW.

Sweep Times: 10 ms to 100 seconds in decade ranges with vernier adjustment or manual sweep using vernier.

Trigger Modes: Auto, line sync., single scan or external sync. up to 50 kHz rate with ≥2 Vpp and ≥1 μs trigger signal.

RF Output Connector: Type N Female.

Table A1-2. Supplemental Characteristics (2 of 2)

RECEIVER

Input Damage Level: +20 dBm or ≥50 Vdc.

Full Scale Polar Magnitude Range: 1 to 0.01 in a 1, 0.5, 0.2 sequence.

Electrical Length Linearity: $\Delta\phi = 0.5\% \times 1.2f$ (MHz) x l (meters)

Linear Phase Substitution (degrees/scan):

Range: ±1700° per scan with 0° offset.

$$\frac{\pm 1.4 \text{ km}}{\text{scan width (MHz)}} \text{ or } \frac{\pm 4.7\ \mu\text{sec}}{\text{scan width (MHz)}}$$

Magnitude Offset

Typical Maximum Offset between −10 and −30 dBm Input Level Position: ±0.2 dB (excluding dynamic accuracy).

Typical Maximum Offset between 10 kHz and 1 kHz BW Positions: ±0.2 dB (exluding dynamic accuracy).

Phase Offset

Typical Maximum Offset between −10V and −30 dBm Input Level Position: ≤± 2.0° (excluding dynamic accuracy).

Typical Maximum Offset between 10 kHz and 1 kHz BW Position: ≤± 5° (excluding dynamic accuracy).

General Characteristics:

RF Input Connectors: Type N Female.

CRT Reference Position: Reference lines for Channel 1, Channel 2, and beam center (in Polar) may be independently set to any position on the CRT Display.

General Characteristics (Cont'd)

Display Bandwidth: Selectable IF bandwidths of 10 kHz and 1 kHz. A video filter position is also provided.

CRT Background Illumination: Illumination control provided for CRT photography.

CRT Overlays: Smith Charts (3.16, 1, 0.5, 0.2, 0.1 full scale), Log Charts (10 MHz, 100 MHz and 1000 MHz). HP Part No. 08505-60154.

CRT Camera Adaptor: Hewlett-Packard 197A Option 006 camera is a direct fit. Camera bezel adaptor model 10375A is required to convert the standard 197A camera to fit the 8505A display.

Auxiliary Outputs:

Channel 1 and 2 Outputs: 0.25 V/display division with 2 kΩ source impedance.

Sweep Output: 0.25 V/display division with 2 kΩ source impedance.

Pen Lift: DC coupled, 200 mA current sink.

Power Requirements: 100, 120, 220, or 240 Vac +5% −10%, 50 to 60 Hz, approximately 275 watts. (Total for Signal Processor and Source/Converter-Frequency Control units.)

A1-42. TEST SETS AND ACCESSORIES AVAILABLE

A1-43. Test sets and accessories available for use with the 8505A are listed with their specifications in Table A1-3.

A1-44. RECOMMENDED TEST EQUIPMENT

A1-45. Equipment recommended for testing and troubleshooting the 8505A Network Analyzer is listed in Table A1-4. Other equipment may be substituted for the equipment listed, providing it meets or exceeds the critical specifications indicated in the table.

Table A1-4. Recommended Test Equipment (1 of 3)

Instrument	Recommended Model	Critical Specifications	Use*
Electronic Counter	EIP 545	Freq Range: 400 kHz to 5.52 GHz Accuracy: ±1 count Sensitivity: −5 dBm	P,A,T
Power Meter and Sensor	HP 435A/8482A/8484A or HP 436A/8482A/8484A	Freq Range: 500 kHz to 1300 MHz Power Range: +20 to −60 dBm Accuracy: ±0.5 dB at 1300 MHz	P,A,T
Spectrum Analyzer	HP 8568A	Freq Range: 500 kHz to 5.5 GHz Impedance: 50 ohms Dynamic Range: 60 dB Frequency identification capability Residual FM: <5 Hz	P,A,T
Oscilloscope	HP 180C/1801A/1820A/1804A	Vertical Bandwidth: 20 MHz minimum Vertical Sensitivity: 5 mV/Div Horizontal Sweep Rate: 1 μs/Div Channels: 4 (with 1804A plug-in)	A,T
Digital Voltmeter, AC/DC	HP 3490A	AC Range: 0 to 300V, 50 to 400 Hz DC Range: 0 to 200V Accuracy: ±5% Resolution: to 5 digits	A,T
Function Generator	HP 3312A	Output: +1V p-p square wave, 10 kHz and 100 kHz Adjustable DC offset.	A
~~Spectrum Analyzer~~	~~HP 8568A*~~	~~Freq Range: to 1300 mHz~~ ~~Residual FM: <3 Hz peak-to-peak~~	~~P~~
AM-FM Signal Generator	HP 8640A/B*	Frequency: 5 – 500 MHz Residual FM: < 5 Hz	P
Modulation Analyzer	HP 8901A	Frequency Range: 7 MHz to 1.3 GHz Frequency Modulation Accuracy: ±5% of reading ±1 digit, 20 Hz to 20 kHz rates Residual FM: <5 Hz PK to 13 MHz <20 Hz PK to 1300 MHz	P

*If a Model HP 8568A Spectrum Analyzer is not available to make Spectral Purity tests, an alternate procedure may be used using an 8640A/B, 5210A, etc.

Table A1-4. Recommended Test Equipment (2 of 3)

Recommended Model	Instrument	Critical Specifications	Use*
3-Way Power Splitter	HP 11850A	Impedance: 50 ohms Freq Range: 500 kHz to 1.3 GHz Connectors: Type N, female Freq Response: Input to output ≤±0.2 dB	P,A,T
VSWR Bridge	Wiltron 60G50	Freq Range: 5 MHz to 1300 MHz Directivity: 40 dB Input Impedance: 50 Ω	P,T
Matched Type N Coaxial Cables (3 required)	HP 11851A	50-ohm double-shielded coaxial cables 61 cm (24 inches) long, phase matched to 2° at 1300 MHz	P,A,T
50-Ohm Termination (3 required)	GR 900-W50 or HP 908A	Freq Range: 500 kHz to 1.3 GHz Impedance: 50 ohms Connector: Type N, male SWR: < 1.4	P,A
10 dB Attenuator	WEC 1A-10	Attenuation: 10 dB ±0.5 dB SWR: < 1.3	P,T
20 dB Atten. (2 required)	WEC 1A-20	Attenuation: 20 dB ±0.5 dB SWR: <1.3	
50-Ohm Feed-through Termination	Tektronix 011-0049-01	Connector: BNC	P
GR to N Male Adapter	GR 900QNP		P
BNC to Type N Adapter (2 required)	HP 1250-0780	Impedance: 50 ohms	P
12-Pin (Dual 6 -Pin) Extender Board	HP 08505-60109		A,T
Calibrated Step Attenuator	HP 355D	Attenuation: 0 to 120 dB in 10 dB steps ~~Standards lab calibrated at 20 MHz~~ Connectors: BNC	P
AC Probe	HP 1121A	No substitution	A
Coaxial Step Attenuator	WEC 60S/60A	Attenuation: 0 to 60 dB in 10 dB increments SWR: 1.5 Connectors: Type N, male Accuracy of provided data: ±(0.02 dB + 0.01 dB/10 dB step) at 30 MHz	P, A

Table A1-4. Recommended Test Equipment (3 of 3)

Instrument	Recommended Model	Critical Specifications	Use*
8505 Delay Line	Collins Constructed 597-0721-565	Delay: 105 ns nominal Data provided within 1 ns	P
30-Pin (Dual 15-Pin) Extender Board (2 required)	HP 08505-60041		A,T
36-Pin (Dual 18-Pin) Extender Board (3 required)	HP 08505-60042		A,T
50-Pin (Dual 25-Pin) Extender Board	HP 08505-60108		A,T
Type N Right Angle Adapter	HP 1250-0176		P
Type N Male-to-Male Adapter	HP 1250-0778	Impedance: 50 ohm	P
Type N Female-to-Female Adapter	HP 1250-0777	Impedance: 50 ohm	P
Service Interconnect Cable 61 cm (24 inches)	HP 08505-60202		T
Signature Analyzer	HP 5004A	No Substitute	T
Logic Pulser	HP 546A	No Substitute	T
Logic Probe	HP 545A	No Substitute	T
16-Pin IC Clip-on Connector (6 required)	HP 1400-0734	Any IC Clip	T

* P = Performance Test; A = Adjustment; T = Troubleshooting

CHAPTER A
MODEL 8505A NETWORK ANALYZER

SECTION IV
PERFORMANCE TEST

A4-1. INTRODUCTION

A4-2. The procedures in this section test the electrical performance of the instrument using the specifications of Table A1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is included in Paragraphs A3-1 through A3-10.

A4-3. The performance test procedures should be performed in the sequence given. If a test measurement is slightly out of tolerance, go to Section V and perform the appropriate adjustment procedures. If a function fails to operate, go to Section VI Troubleshooting to find which major assembly has failed, then to the appropriate assembly section to troubleshoot to the printed circuit or assembly that has the trouble.

A4-4. EQUIPMENT REQUIRED

A4-5. Equipment required for the performance tests is listed in the Recommended Test Equipment in Table A1-4. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model.

A4-6. TEST RECORD

A4-7. Results of the performance tests may be tabulated on the Test Record at the end of the procedures. The Test Record lists all of the tested specifications and their acceptable limits. Test results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after repairs or adjustments.

PERFORMANCE TESTS

A4-8. FREQUENCY RANGE AND ACCURACY TEST

NOTE
Allow one hour warm-up time before making the Performance Tests or Adjustments.

SPECIFICATIONS:

CW Mode Accuracy: ± 2 counts of LSD ± time-base accuracy*
Swept Frequency Accuracy: ±1% of range for linear sweep

Counter Accuracy: ±2 counts ± time-base accuracy*

*Time-base Accuracy = 5 ppm ±1 ppm/°C ±3 ppm/90 days.

PERFORMANCE TESTS

A4-8. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

DESCRIPTION:

The 8505A built-in frequency counter calibration is checked against a known good electronic counter by monitoring the CW RF signal. In CW ±ΔF mode, the FREQUENCY READOUT is compared to the counter readout. If necessary, the CW RF signal is adjusted to match the FREQUENCY readout. This calibrates the digital FREQUENCY readout to the actual RF OUTPUT signal being read on the built-in counter. The START/STOP sweep signal frequency is measured using an external counter to monitor the frequencies with both START and STOP frequencies the same.

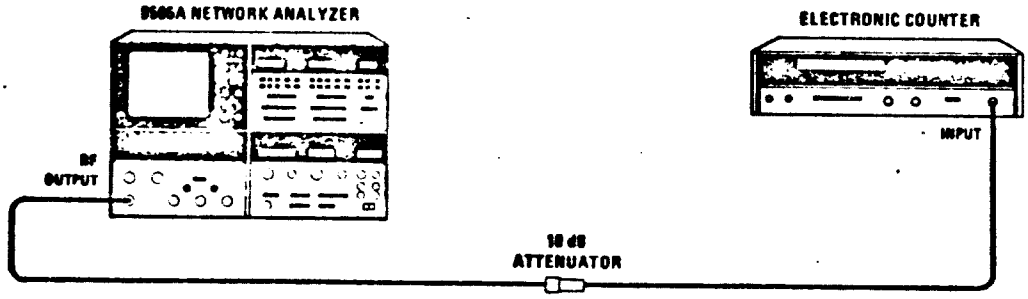


Figure A4-1. Frequency Accuracy Test Setup

EQUIPMENT:

Electronic Counter	~~HP 5340A~~	EIP 545
10 dB Attenuator	~~HP 8491B Option 010~~	WEC 1A-10

PROCEDURE:

COUNTER ACCURACY

a. Set 8505A controls as follows:

On A1 Source/Converter

OUTPUT LEVEL dBm	−10
OUTPUT LEVEL VERNIER	0

On A2 Frequency Control:

RANGE MHz	.5 — 1300
MODE	LIN EXPAND
WIDTH	CW
SCAN TIME SEC	10 — 1
VERNIER SCAN TIME	Clockwise
TRIGGER	AUTO
MARKERS	1

b. Connect equipment as shown in Figure A4-1 and set external counter resolution to 100 Hz.

PERFORMANCE TESTS

A4-8. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

c. Set CW FREQUENCY control and VERNIER control for 10.000 MHz indication on external Electronic Counter. The 8505A CW FREQUENCY digital display should indicate 0010.00 MHz ±0.02 MHz. (If the indication is not within tolerance, the built-in counter is malfunctioning; go to Troubleshooting in Chapter C.

FREQUENCY CALIBRATION

d. Set A2 Frequency Control WIDTH switch to CW ±ΔF.

e. Set CW FREQUENCY to 10 MHz and set CW FREQUENCY VERNIER to 0.

f. Set ±ΔF FREQUENCY to 000.0, and set ±ΔF FREQUENCY VERNIER to 0.

g. Remove the front-panel window of A2 Frequency Control (Figure A4-2).

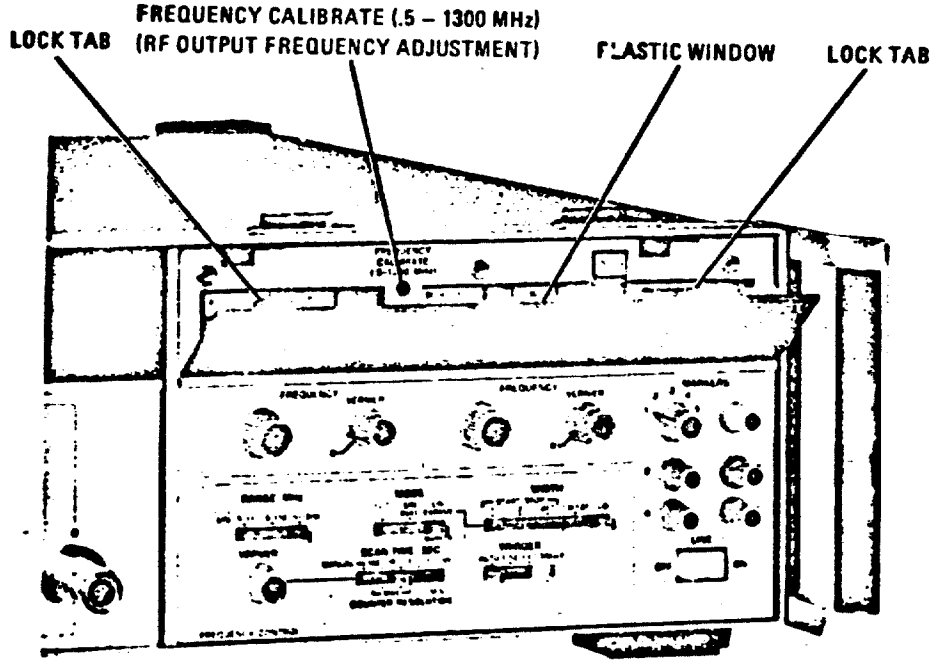


Figure A4-2. Frequency Control Front-Panel Window Removal

PERFORMANCE TESTS

A4-8. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

h. Adjust FREQUENCY CALIBRATE (.5— 1300 MHz) screwdriver adjustment in the middle of exposed subpanel so the FREQ COUNTER MHz reads 10.00 MHz plus or minus 2 counts of least significant digit (LSD).

i. Reinstall the window.

SWEPT FREQUENCY ACCURACY

j. At A2 Frequency Control, set RANGE MHz switch to .5 — 1300, MODE switch to LIN EXPAND, WIDTH switch to START/STOP 1, and SCAN TIME SEC switch to 1 — .1. Set A2 Frequency Control RANGE MHz switch and START and STOP frequency as listed in the table below and read the frequency on the external Electronic Counter.

RANGE MHz Switch Set At A2 Frequency Control	START and STOP FREQUENCY Digital Readout Set At A2 Frequency Control	Frequency Indicated on External Electronic Counter
.5 - 1300	1300. MHz	1300 MHz ± 13 MHz
.5 - 130	130.0 MHz	130.0 MHz ± 1.3 MHz
.5 - 13	13.00 MHz	13.00 MHz ± 0.13 MHz
.5 - 1300	0700. MHz	700 MHz ± 13 MHz
.5 - 130	070.0 MHz	70.00 MHz ± 1.3 MHz
.5 - 13	07.00 MHz	7.00 MHz ± 0.13 MHz
.5 - 1300	0010. MHz	10.0 MHz +13, —9 MHz
.5 - 130	001.0 MHz	1.00 MHz +1.3, —0.9 MHz
.5 - 13	01.00 MHz	1.00 MHz ± 0.13 MHz

PERFORMANCE TESTS

A4-9. CW FREQUENCY STABILITY TEST

SPECIFICATION:

Frequency Stability over 10 Minute period after one hour initial warmup: better than ±0.01% of reading ±0.01% of frequency range.

DESCRIPTION:

The frequency of the RF output signal is indicated on an external Electronic Counter over a period of 10 minutes (after an initial warmup period of one hour).

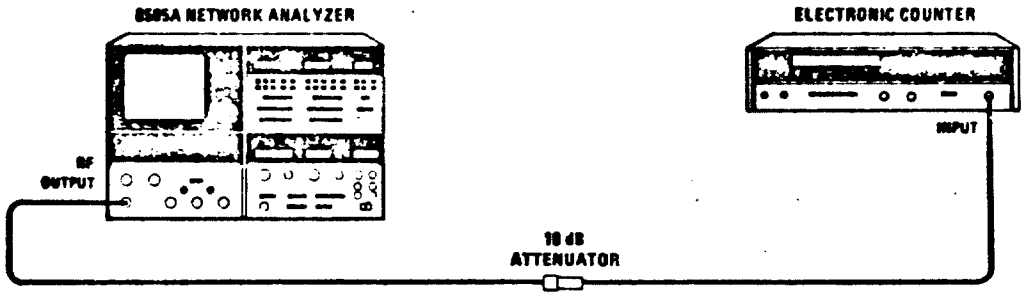


Figure A4-3. Frequency Stability Test Setup

EQUIPMENT:

Electronic Counter	~~HP 5340A~~	EIP 545
10 dB Attenuator	~~HP 8491B Option 010~~	WEC 1A-10

PROCEDURE:

a. Set 8505A controls as follows:

On A1 Source/Converter:
OUTPUT LEVEL dBm ..... −10

On A2 Frequency Control:
RANGE MHz ..... .5 — 13
MODE ..... LIN EXPAND
WIDTH ..... CW
CW FREQUENCY MHz and VERNIER 10.000

b. Connect equipment as shown in Figure A4-3.

c. Allow one hour warmup for the 8505A temperature to stabilize. If the instrument has been operating more than one hour, wait three minutes for frequency to stabilize, then proceed with the test.

d. Record frequency indicated by external electronic counter. Allow 10 minutes of operation then record electronic counter indication again. The second reading should be within ±2.3 kHz of the first reading.

PERFORMANCE TESTS

A4-10. POWER OUTPUT LEVELING TEST AND ABSOLUTE POWER CALIBRATION

SPECIFICATION:

Output Leveling: ±0.5 dB from 0.5 to 1300 MHz
Output Level Vernier Accuracy: ±1 dB

DESCRIPTION:

The power output is monitored on a power meter while the frequency band is tuned manually. The highest and lowest power spots are noted and the total difference must be less than the specification. The output level vernier is adjusted through its range and the change in power level is read on the power meter.

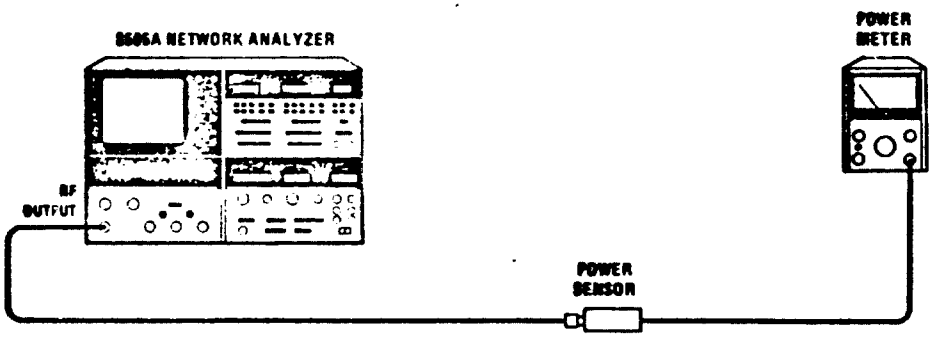


Figure A4-4. Output Leveling Test Setup

EQUIPMENT:

Power Meter	HP 435A
Power Sensor	HP 8482A

PROCEDURES:

a. Set 8505A controls as follows:

On A1 Source/Converter:

OUTPUT LEVEL dBm	0 dBm
OUTPUT LEVEL Vernier	0 dB

On A2 Frequency Control:

RANGE MHz	0.5 – 1300
MODE	LIN FULL
WIDTH	START/STOP 1
SCAN TIME SEC	MANUAL

b. Connect equipment as shown in Figure A4-4.

PERFORMANCE TESTS

A4-10. POWER OUTPUT LEVELING TEST AND ABSOLUTE POWER CALIBRATION (Cont'd)

POWER LEVELING

NOTE

If excessive variation occurs at the low or high end of the band, check the high and low end frequencies with a counter to be sure frequency is within the 0.5 to 1300 MHz band.

c. While watching the power meter, turn the MANUAL sweep control from fully counterclockwise to clockwise position. The total variation between the highest power and the lowest power indication across the band should be ≤1 dB (or ±0.5 dB).

OUTPUT LEVEL VERNIER

d. On A1 Source/Converter, set OUTPUT LEVEL dBm to +10 dBm and VERNIER to 0.

On A2 Frequency Control, set:

MODE ..... LIN EXPAND
WIDTH ..... CW
CW FREQUENCY ..... 30.0 MHz

The power meter should indicate +10 dBm ±1 dB ± tolerance of power meter used. Set OUTPUT LEVEL dBm VERNIER to −12 dB and power meter should indicate −2 dBm ± 1 dBm ± tolerance of the power meter. (If slightly out of tolerance, go to Paragraph A5-14 for adjustment.)

A4-11. POWER OUTPUT RANGE TEST

SPECIFICATIONS:

Power Output Range: +10 dBm to −72 dBm
Attenuator Accuracy: ±1.5 dB over the 70 dB range.

DESCRIPTION:

The power output and attenuator accuracy is measured by substitution, using an external step attenuator.

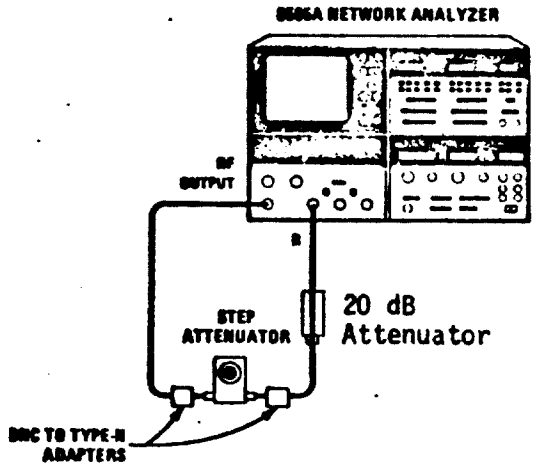


Figure A4-5. Power Output Range Test Setup

PERFORMANCE TESTS

A4-11. POWER OUTPUT RANGE TEST (Cont'd)

EQUIPMENT:

0 – 60 dB Step Attenuator (calibrated at 30 MHz)	~~HP 355D Opt. H89~~ WEC 60A/60S
Type-N female to BNC male adapter (2 required)	HP 1250-0077
20 dB Coaxial Attenuator	WEC 1A-20

PROCEDURES:

a. Set 8505A controls as follows:

On A1 Source/Converter:

OUTPUT LEVEL dBm	+10 dBm
OUTPUT LEVEL VERNIER	0 dB
INPUT LEVEL dBm MAX	–10 dBm

On A2 Frequency Control:

RANGE MHz	0.5 – 130
MODE	LIN EXPAND
WIDTH	CW±ΔF
SCAN TIME SEC	0.1 – .01
CW FREQUENCY MHz	30.0 MHz
±ΔF FREQUENCY	00.00 MHz
MARKERS	1
Markers 1	Center of CRT

On A3 Signal Processor:

Channel 1:

INPUT	R
MODE	MAG
SCALE/Div	1 dB/DIV

Channel 2:

MODE	OFF

CRT Display:

BW (Bandwidth)	10 kHz
VIDEO FILTER	On (in)

b. Connect equipment as shown in Figure A4-5. Set external step attenuator to 60 dB.

c. On Signal Processor CRT Display, press REF LINE POSN and adjust CH 1 up-down control to place the trace on the center line; press REF LINE POSN pushbutton again for normal operation.

d. Press Channel 1 DISPLAY MKR, then ZRO to place CRT trace on the center graticule line.

e. Step the OUTPUT LEVEL dBm switch to each 10 dB step between +10 dBm and –40 dBm and step the external step attenuator as listed in the following table. The step-to-step accuracy should be within ±1.5 major divisions of the center line (i.e., ±1.5 dB) ± calibration correction of the external attenuator at each step.

f. Note deviation from center line at -40 dBm. Remove 20 dB attenuator. Set step attenuator to 30 dB. Reset output level of network analyzer so that trace is at position noted at -40 dBm. The output level vernier and the REF OFFSET pushbuttons may have to be used to reset the trace to the level noted at -40 dBm. Continue with step e. at -50 and -60 dBm.

PERFORMANCE TESTS

A4-11. POWER OUTPUT RANGE TEST (Cont'd)

OUTPUT LEVEL dBm SETTING	EXTERNAL STEP ATTENUATOR SETTING	
+10 dBm	~~80 dB~~ 60 dB	
0 dBm	~~70 dB~~ 50 dB	
−10 dBm	~~60 dB~~ 40 dB	
−20 dBm	~~50 dB~~ 30 dB	
−30 dBm	~~40 dB~~ 20 dB	
−40 dBm	~~30 dB~~ 20 dB	Remove 20 dB Atten.
−50 dBm	20 dB	Reset Atten. to 30 dB.
−60 dBm	10 dB	

Note: External step attenuator settings are the total of the 1 dB and 10 dB steps.

A4-12. MAGNITUDE REFERENCE OFFSET AND MARKER ACCURACY TEST

SPECIFICATION:

Magnitude Reference Offset:
Range: ±199.9 dB
Accuracy: ±0.03 dB ±0.003 dB/dB of offset.

DESCRIPTION:

The trace is zeroed on the center reference line, then the trace is offset by ±190 dB. The resultant position of the trace is read on the marker.

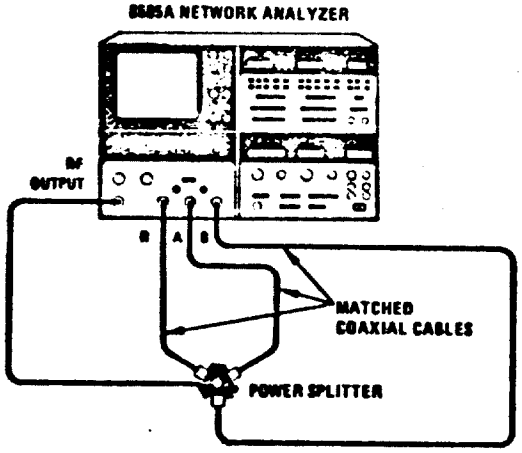


Figure A4-6. Marker Accuracy Test Setup

EQUIPMENT:

Three-Way Power Splitter ..... HP 11850A
Matched Cable Kit. ..... HP 11851A

PERFORMANCE TESTS

A4-12. MAGNITUDE REFERENCE OFFSET AND MARKER ACCURACY TEST (Cont'd)

PROCEDURE:

RECTANGULAR MARKER ZERO

a. Connect equipment as shown in Figure A4-6.

b. On 8505A, set the controls as follows:

On A1 Source/Converter:
- OUTPUT LEVEL dBm ..... −10 dBm
- OUTPUT LEVEL VERNIER ..... 0 dB
- INPUT LEVEL dBm MAX ..... −10 dBm

On A2 Frequency Control:
- RANGE MHz ..... 0.5 − 130
- MODE ..... LIN EXPAND
- WIDTH ..... CW ±ΔF
- CW FREQUENCY ..... 30.0 MHz
- ±ΔF FREQUENCY 00.0
- MARKERS 1
- Marker 1 ..... Marker at Center Screen

On A3 Signal Processor:

Channel 1:
- INPUT ..... A/R
- MODE ..... MAG
- SCALE/DIV ..... 0.1 dB/DIV

Channel 2:
- MODE ..... OFF

Electrical Length:
- MODE ..... OFF

CRT Display Section:
- BANDWIDTH (BW) ..... 10 kHz
- VIDEO FILTER ..... On (in)

Press REF LINE POSN, adjust CH1 up-down control to place the reference line at the center of the CRT, then press REF LINE POSN again for normal operation.

c. Press Channel 1 DISPLAY MKR pushbutton, then press and hold ZRO pushbutton approximately 10 seconds until the trace settles on center graticule line. The Channel 1 marker readout should indicate 0.00 dB ± 0.01 dB.

POLAR MARKER ZERO

d. Set Channel 1 MODE switch to POLAR MAG. Set SCALE/DIV to POLAR 1. On CRT Display panel, press BEAM CENTER pushbutton. Adjust up-down and left-right controls to center polar dot at center of CRT graticule. Press BEAM CENTER again for normal operation.

PERFORMANCE TESTS

A4-12. MAGNITUDE REFERENCE OFFSET AND MARKER ACCURACY TEST (Cont'd)

e. Press Channel 1 DISPLAY MKR, then ZRO pushbuttons. The dot (and marker) should be displayed within ±3 mm of the outside circle on CRT graticule.

f. Set Channel 1 MODE switch to POLAR PHASE. Press DISPLAY ZRO pushbutton. The dot trace (and marker) should be at 0 degrees ±1 degree on CRT graticule.

MARKER ACCURACY

g. Set 8505A controls as follows:

Channel 1:
INPUT ..... A/R
MODE ..... MAG
SCALE/DIV ..... 20 dB/DIV

Channel 2:
MODE ..... OFF

h. On Channel 1, press DISPLAY MKR, then ZRO pushbuttons to place the trace on the center line of CRT.

i. Press Channel 1 DISPLAY REF, then press REF OFFSET pushbuttons to offset the trace by +190.0 dB as indicated on the digital readout.

j. Press Channel 1 DISPLAY MKR and the digital readout should be −190.0 dB ±0.6 dB.

k. Press Channel 1 DISPLAY ZRO pushbutton to place the CRT trace on the center line.

l. Press Channel 1 DISPLAY REF, then press REF OFFSET pushbuttons to offset the trace by −190.0 dB as indicated on the digital readout.

m. Press Channel 1 DISPLAY MKR and the digital readout should be +190.0 dB ±0.6 dB.

A4-13. RECEIVER NOISE FLOOR

SPECIFICATION:

Noise floor in 10 kHz Bandwidth: − 95 dBm (0.5 to 2 MHz)
− 100 dBm (2 to 10 MHz)
− 110 dBm (10 to 1300 MHz)

DESCRIPTION:

The noise floor is measured by offsetting the reference −95 dB (0.5 to 2 MHz), −100 dB (2 to 10 MHz), and −110 dB (10 to 1300 MHz). Each signal at the three input ports is compared with the −95 dBm, −100 dBm, or −110 dBm reference line to verify that the noise floor is below −95 dBm, −100 dBm, or −110 dBm.

PERFORMANCE TESTS

A4-13. RECEIVER NOISE FLOOR (Cont'd)

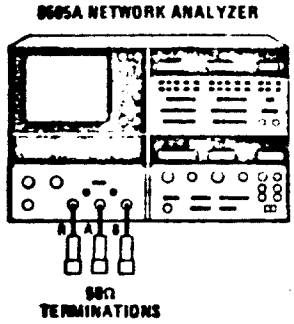


Figure A4-7. Noise Floor Test Setup

EQUIPMENT:

50 Ohm Termination (3 required) ..... ~~HP 909A Option 012~~ GR900W50 or HP 908A

PROCEDURE:

a. Connect equipment as shown in Figure A4-7.

b. Set 8505A Controls as follows:

On A1 Source/Converter:
- OUTPUT LEVEL dBm ..... −60 dBm
- OUTPUT LEVEL VERNIER ..... 0 dB
- INPUT LEVEL dBm MAX ..... −30 dBm

On A2 Frequency Control:
- RANGE MHz ..... 0.5 — 13
- MODE ..... LIN EXPAND
- WIDTH ..... START/STOP 1
- START FREQUENCY ..... 00.50 MHz
- STOP FREQUENCY ..... 02.00 MHz
- MARKERS 1
- Marker 1 ..... Center of CRT
- SCAN TIME SEC ..... 10 — 1
- SCAN TIME Vernier ..... Fully Clockwise
- TRIGGER ..... AUTO

On A3 Signal Processor:

Channel 1:
- INPUT ..... R
- MODE ..... MAG
- SCALE/DIV ..... 10 dB/DIV

Channel 2:
- MODE ..... OFF

PERFORMANCE TESTS

A4-13. RECEIVER NOISE FLOOR (Cont'd)

CRT Display:
BANDWIDTH kHz ..... 10 kHz
VIDEO FILTER ..... On (in)

NOISE FLOOR FROM 0.5 to 2 MHz

c. On Signal Processor Display, press REF LINE POSN pushbutton, then adjust CH 1 up-down control to place the CRT reference trace on the center graticule line. Press REF LINE POSN pushbutton again for normal operation.

d. At Channel 1, press DISPLAY REF, then CLR pushbutton until REL light goes out (if it was lit). Set INPUT switch to A, repeat above procedures then set INPUT switch to B and repeat above procedures. Return Channel 1 INPUT switch to R position.

e. At Channel 1, press REF OFFSET pushbuttons to obtain −95 dB offset. The CRT trace should be below the center graticule line. This shows the noise floor below −95 dBm.

f. Set Channel 1 INPUT switch to "A". The CRT trace should be below the center graticule line.

g. Set Channel 1 INPUT switch to "B". The CRT trace should be below the center graticule line.

NOISE FLOOR FROM 2 TO 10 MHz

h. Set START frequency to 02.00 MHz and STOP frequency to 10.00 MHz. At Channel 1, press DISPLAY REF, then REF OFFSET pushbuttons to obtain −100 dB offset. The CRT trace should be below the center gratidule line. This shows the noise floor below −100 dBm.

i. Set Channel 1 INPUT switch to "A". The CRT trace should be below the center graticule line.

j. Set Channel 1 INPUT switch to "R". The CRT trace should be below the center graticule line.

NOISE FLOOR FROM 10 TO 1300 MHz

k. Set RANGE switch to .5 − 1300 MHz. Set START frequency to 0010 MHz and STOP frequency to 1300 MHz. At Channel 1, press DISPLAY REF, then REF OFFSET pushbuttons to obtain −110 dB offset. The CRT trace should be below the center graticule line. This shows the noise floor below −110 dBm.

l. Set Channel 1 INPUT switch to "A". The CRT trace should be below the center graticule line.

m. Set Channel 1 INPUT switch to "B". The CRT trace should be below the center graticule line.

A4-14. CROSSTALK ISOLATION

SPECIFICATION:

Crosstalk Error Limits: >100 dB isolation between inputs.

PERFORMANCE TESTS

A4-14. CROSSTALK ISOLATION (Cont'd)

DESCRIPTION:

A signal of −10 dBm is applied to the "R" Channel inputs. The "A" and "B" Channels are terminated and the channel signal is displayed on the CRT display. The displayed signal of Channel "A" should be 100 dB below the −10 dBm level of the "R" port showing isolation between ports. The other ports are checked in the same manner.

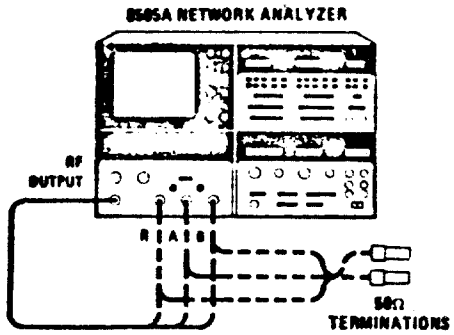


Figure A4-8. Crosstalk Isolation Test Setup

EQUIPMENT:

50 Ohm Termination (2 required) ..... ~~HP 909A Option 012~~ GR 900W50 or HP 908A

PROCEDURE:

NOTE

It is possible to verify the 100 dB crosstalk specifications only over the 10–1300 MHz range where the noise level is below −110 dBm.

a. **Set 8505A Controls as follows:**

On A1 Source/Converter:

OUTPUT LEVEL dBm ..... −10 dBm
OUTPUT LEVEL VERNIER ..... 0 dB
INPUT LEVEL dBm MAX ..... −10 dBm

On A2 Frequency Control:

RANGE MHz ..... 0.5 – 1300
MODE ..... LIN EXPAND
WIDTH ..... START/STOP 2
START FREQUENCY ..... 0010 MHz
STOP FREQUENCY ..... 1300 MHz
MARKERS 1
Marker 1 ..... Midscreen
SCAN TIME SEC ..... 10 – 1
SCAN TIME VERNIER ..... Fully Clockwise
TRIGGER ..... AUTO

PERFORMANCE TESTS

A4-14. CROSSTALK ISOLATION (Cont'd)

On A3 Signal Processor:
Channel 1:
INPUT ..... A
MODE ..... MAG
SCALE/DIV ..... 10 dB/DIV

Channel 2:
MODE ..... OFF

CRT Display:
BANDWIDTH kHz ..... 10 kHz
VIDEO FILTER ..... Off (out)

b. Connect equipment as shown in Figure A4-8 with the RF output cable connected to "R" port and "A" and "B" ports terminated with 50-ohm loads.

c. At Channel 1, press CLR pushbutton until REL light goes out (if it was lit). Set INPUT switch to A, repeat above procedure, then set INPUT switch to B and repeat above procedure. Return Channel 1 INPUT switch to A position.

d. At Channel 1, press DISPLAY REF, then REF OFFSET pushbuttons to obtain −110 dB offset. The CRT trace should be below the center graticule line for 100 dB of isolation.

e. Set Channel 1 INPUT switch to "B" and the CRT trace should be below the center graticule line.

f. Change setup by moving 50-ohm loads to port "R" and "B" and connect cable to port "A". Set Channel 1 INPUT switch to "R" and the CRT trace should be below the center graticule line.

g. Set Channel 1 INPUT switch to "B" and the CRT trace should be below the center graticule line.

h. Change setup by moving 50-ohm loads to ports "R" and "A" and connect cable to port "B". Set Channel 1 INPUT switch to "R" and the CRT trace should be below the center graticule line.

i. Set Channel 1 INPUT switch to "A" and the CRT trace should be below the center graticule iine.

A4-15. MAGNITUDE, PHASE, AND GROUP DELAY FREQUENCY RESPONSE

SPECIFICATION:

Absolute Magnitude Frequency Response: ≤±1.5 dB

Magnitude Tracking Frequency Response: ≤±0.3 dB

Phase Frequency Response: ≤±3° from 0.5 to 750 MHz
≤±5° from 750 to 1300 MHz

Group Delay: ±1 ns from 0.5 to 1300 MHz.

DESCRIPTION:

The receiver magnitude frequency response is tested by applying the RF OUTPUT first directly to the three individual ports. If the indication is slightly out of specifications, the RF OUTPUT is sent through a power splitter to one of the INPUT ports and to a power meter. The common mode power variations due to the source as indicated on the power meter is subtracted from the variations on the CRT trace, giving a resultant variation due only to the receiver and display section.

PERFORMANCE TESTS

A4-15. MAGNITUDE, PHASE, AND GROUP DELAY FREQUENCY RESPONSE (Cont'd)

The receiver frequency response in ratio measurement mode may be read directly from the CRT display since all common mode variations due to the source are cancelled.

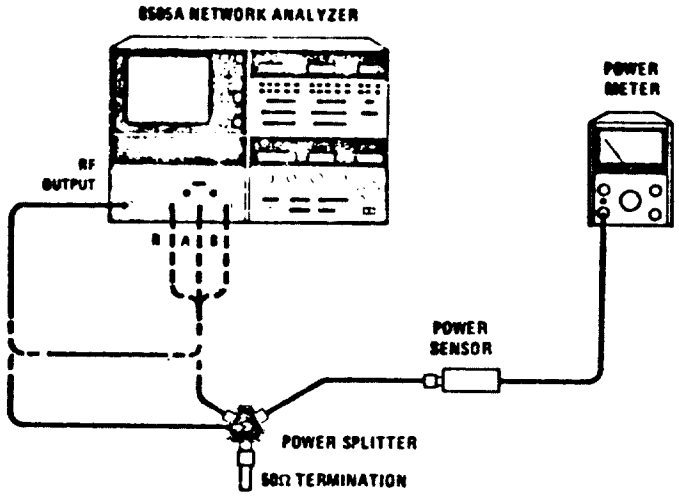


Figure A4-9. Absolute Magnitude Frequency Response Test Setup

EQUIPMENT:

Power Meter	HP 435A
Power Sensor	HP 8482A
Three-way Power Splitter	HP 11850A
50-Ohm Termination	~~HP 909A Option 012~~ GR 900W50

PROCEDURE:

ABSOLUTE MAGNITUDE FREQUENCY RESPONSE

a. On 8505A, set the controls as follows:

On A1 Source/Converter:

OUTPUT LEVEL dBm	−10 dB
OUTPUT LEVEL VERNIER	−10 dB
INPUT LEVEL dBm MAX	−10

On A2 Frequency Control:

RANGE MHz	0.5 − 1300
MODE	LIN FULL
WIDTH	START/STOP 1
SCAN TIME SEC	1 − 0.1
SCAN TIME VERNIER	Fully Counterclockwise

NOTE

It may be necessary to make slight adjustment at 0.50 MHz of Frequency Calibrate pot behind FREQUENCY CONTROL front panel. (See paragraph A4-8.)

MARKERS	1
Marker 1	Midrange

PERFORMANCE TESTS

A4-15. MAGNITUDE, PHASE, AND GROUP DELAY FREQUENCY RESPONSE (Cont'd)

On A3 Signal Processor:
Channel 1:
INPUT ..... R
MODE ..... MAG
SCALE/DIV ..... 0.5 dB/DIV

Channel 2:
MODE ..... OFF

CRT Display:
REF LINE POSN ..... Center Graticule Line
BW ..... 10 kHz On (in)
VIDEO FILTER ..... Off (out)

b. Connect equipment as shown in Figure 4-9 with "R" INPUT cable connected directly to RF OUTPUT connector.

c. Press DISPLAY CLR, MKR, then ZRO pushbuttons. Observe the highest and lowest point on the CRT trace between 0.5 and 1300 MHz. They should not be greater than 3 dB difference. If the CRT trace is out of tolerance, go to step d and cancel the effect of the RF source variations to see if the receiver section is actually within tolerance. If the CRT trace is within tolerance, go to step h and check "A" input port. If "A" port has been checked, go to step i and check "B" input port.

d. Connect equipment as shown in Figure A4-9, with RF OUTPUT to center of Power Splitter and one leg of power splitter to port "R" and the other leg to Power Sensor and Power Meter.

e. Set Marker 1 to the point on CRT trace that is maximum. Note Marker reading and Power Meter reading.

f. Set Marker 1 to the point on CRT trace that is minimum. Adjust OUTPUT LEVEL VERNIER and step attenuator to set Power Meter to the same indication noted in step e.

g. Subtract the Marker indication noted in step e from the displayed marker reading. The difference should be <3 dB.

h. Disconnect RF Cable from "R" INPUT and connect to "A" INPUT. Set Signal Processor Channel 1 INPUT switch to A. Repeat preceding step c and observe the power level variations for "A" INPUT.

i. Disconnect RF Cable from "A" INPUT and connect to "B" INPUT. Set Signal Processor Channel 1 INPUT switch to B. Repeat preceding step c and observe the power level variations for "B" INPUT.

RATIO MEASUREMENT MAGNITUDE FREQUENCY RESPONSE

j. Connect equipment as shown in Figure A4-10 with the power splitter connected to "R", "A", and "B" inputs and Power Meter disconnected from setup.

k. On A2 Frequency Control, set RANGE MHz switch to 0.5 — 1300 MHz position, set MODE to LIN FULL, WIDTH to START/STOP 1, SCAN TIME SEC to 1 — .1, and TRIGGER to AUTO. Set MARKER switch to 1 position and Marker 1 control to approximately 640 MHz.

l. On A3 Signal Processor, set CHANNEL 1 INPUT switch to A/R, set MODE to MAG, and set SCALE/DIV switch to 0.1 dB position. Press DISPLAY MKR, then ZRO pushbutton.

PERFORMANCE TESTS

A4-15. MAGNITUDE, PHASE, AND GROUP DELAY FREQUENCY RESPONSE (Cont'd)

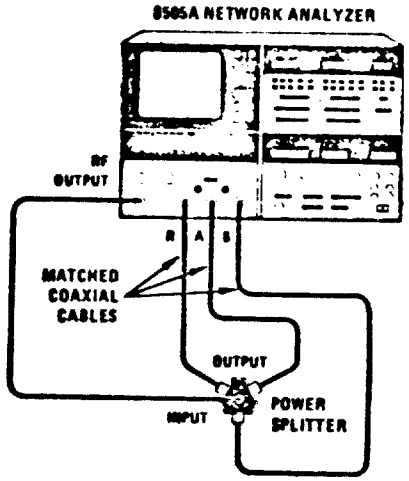


Figure A4-10. Ratio Frequency Response Test Setup

EQUIPMENT:

Three-way Power Splitter	HP 11850A
Matched Cable Kit	HP 11851A

m. On A2 Frequency Control, adjust MARKER 1 frequency control between 0.5 MHz (left end of CRT trace) and 1300 MHz (right end of CRT trace). Note the highest and lowest reading on the Signal Processor Channel 1 readout. The difference between the highest and lowest reading (peak-to-peak variation due to frequency response) should be ≤0.6 dB.

n. Set Signal Processor Channel 1 INPUT switch to B/R. Press DISPLAY MKR then ZRO pushbuttons. Repeat preceding step.

PHASE MEASUREMENT FREQUENCY RESPONSE

o. Set MODE to LIN EXPAND, WIDTH to START/STOP 1. Set START to 0000. MHz, STOP to 0750 MHz. Set Channel 1 INPUT to B/R, MODE to PHASE, and SCALE/DIV to 2 degrees.

p. Set WIDTH to START/STOP 2. Set START to 750 MHz and STOP to 1300 MHz. Return the WIDTH control to START/ STOP 1.

q. Set ELECTRICAL LENGTH INPUT to B and MODE to LENGTH X1. Press LENGTH pushbuttons to make the overall CRT trace as horizontal as possible.

r. Press Channel 1 DISPLAY MKR, then ZRO pushbutton to position the trace near the center graticule line. The maximum trace deviation from the highest point to the lowest point should be ≤6 degrees (3 divisions). If the reading is out of tolerance, the power splitter tracking may be at fault. Check the power splitter tracking as follows. Reverse the connections to the power splitter legs, then make the phase measurements again and subtract the two readings. The difference in readings is the power splitter tracking error. Correct the original phase measurements by subtracting the power splitter tracking error.

s. Set WIDTH to START/STOP 2 and repeat step r for the 750 to 1300 MHz range. The trace deviation should be ≤ 10 degrees (5 divisions).

t. Repeat steps o through s for A/R measurement except set Channel 1 INPUT switch to A/R in step o and set ELECTRICAL LENGTH INPUT switch to A in step q.

PERFORMANCE TESTS

A4-15. MAGNITUDE, PHASE, AND GROUP DELAY FREQUENCY RESPONSE (Cont'd)

GROUP DELAY FREQUENCY RESPONSE

u. On A3 Signal Processor, set Channel 1 INPUT switch to A/R, MODE switch to DLY and set SCALE/DIV switch to 1 ns. Set Frequency Control MODE switch to LIN FULL.

v. Press Electrical Length DISPLAY CLR Pushbutton. Press Channel 1 DISPLAY MKR, then ZRO pushbuttons to center CRT trace about center graticule line and zero digital readout.

w. On A2 Frequency Control, adjust MARKER 1 frequency control between 0.5 and 1300 MHz and note the highest and lowest reading on the Signal Processor Channel 1 readout. The difference between the highest and the lowest reading (peak-to-peak variation due to frequency response) should be ≤2 ns.

x. Repeat steps u through w for B/R measurements. Set all switches the same except set Channel 1 INPUT switch to B/R in step u.

A4-16. MAGNITUDE DYNAMIC ACCURACY TEST

SPECIFICATION:

Magnitude Dynamic Accuracy: ≤±0.01 dB/dB from −20 to −40 dBm
≤±0.2 dB from −10 to −50 dBm
≤±0.5 dB from −50 to −70 dBm
≤±1 dB from −70 to −90 dBm
≤±2 dB from −90 to −100 dBm
≤±4 dB from −100 to −110 dBm

DESCRIPTION:

The signal level into the receiver is adjusted by setting the external step attenuator. The signal trace is monitored on the CRT and deviation from the expected position of the trace on the graticule is noted.

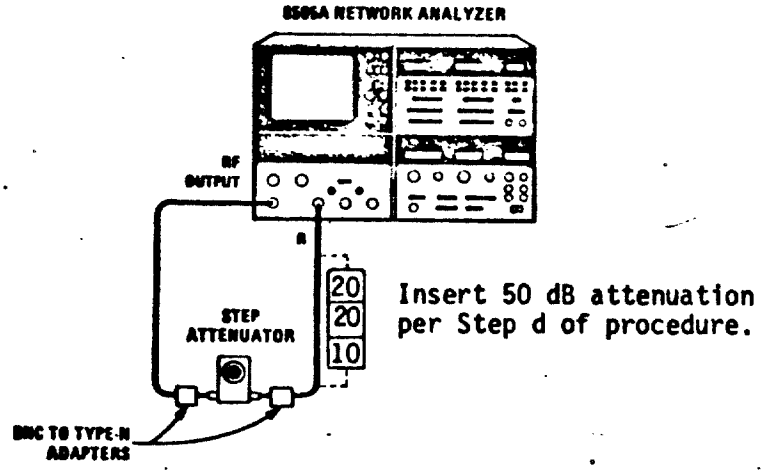


Figure A4-11. Dynamic Range Test Setup

EQUIPMENT:

	WEC 60A/60S
0 – 60 dB Step Attenuator (calibrated at 30 MHz)	~~HP 355D Opt. H89~~
Type-N female to BNC male Adapter (2 required)	HP 1250-0077
20 dB Attenuator (2 required)	WEC 1A-20
10 dB Attenuator	WEC 1A-10

PERFORMANCE TESTS

A4-16. MAGNITUDE DYNAMIC ACCURACY TEST (Cont'd)

PROCEDURE:

a. On 8505A, set the controls as follows:

On A1 Source/Converter:
- OUTPUT LEVEL dBm 0
- OUTPUT LEVEL VERNIER 0
- INPUT LEVEL dBm MAX ..... −10

On A2 Frequency Control:
- RANGE MHz ..... 0.5 − 130
- MODE ..... LIN EXPAND
- WIDTH ..... CW±ΔF
- CW FREQUENCY ..... 30.0 MHz
- ±ΔF FREQUENCY 00.0

On A3 Signal Processor:

Channel 1:
- INPUT ..... R
- MODE ..... MAG
- SCALE/DIV ..... 0.2 dB/DIV

Channel 2:
- MODE ..... OFF

Electrical Length:
- MODE ..... OFF

Display Section:
- BANDWIDTH kHz ..... 10 kHz On (in)
- REF LINE POSN ..... Reference Line to Center Graticule Line
- VIDEO FILTER ..... On (in)

b. Connect equipment as shown in Figure A4-11.

c. Connect calibrated attenuator between RF output and input "R", and set to 30 dB. Press Channel 1 DISPLAY MKR, then ZRO pushbuttons until trace settles. Press CHAN 1 DISPLAY REF pushbutton. As attenuator is stepped down, offset −10 dB/step to bring trace back to reference line within limits shown in following table. (It may be necessary to change CHAN 1 SCALE/DIV to less sensitivity settings if trace is off screen.) When step attenuator reaches 60 dB, note trace deviation from center line on CRT. Insert attenuators as shown in Figure A4-11. Set step attenuator to 10 dB. Adjust output level of network analyzer so that trace is in same position as noted above. Continue checking as in Step C.

d. Repeat step c with attenuator connected to "A" input and Channel 1 INPUT switch to "A".

e. Repeat step c with attenuator connected to "B" input and Channel 1 INPUT switch to "B".

PERFORMANCE TESTS

A4-16. MAGNITUDE DYNAMIC ACCURACY TEST (Cont'd)

External Attenuator Setting	Channel 1 REF OFFSET	OFFSET from REF LINE (Plus attenuator tolerance)
10 dB	+20.0	±0.20 dB
20 dB	+10.0 dB	±0.1 dB
30 dB	0 dB	±0.00 dB
40 dB	−10.0 dB	±0.1 dB
50 dB	− 20.0 dB	±0.2 dB
Reset Atten to 60 dB 10 dB	− 30.0 dB	±0.4 dB
10. Insert 50 dB ~~70 dB~~ 20 dB	− 40.0 dB	±0.6 dB
~~80 dB~~ 30 dB	− 50.0 dB	±0.8 dB
~~90 dB~~ 40 dB	− 60.0 dB	±1 dB
~~100 dB~~ 50 dB	− 70.0 dB	±2 dB
~~110 dB~~ 60 dB	− 80.0 dB	±4 dB

Note: External step attenuator settings are the total of the 1 dB and 10 dB steps.

A4-17. PHASE DYNAMIC RANGE

SPECIFICATION:

Phase Dynamic Accuracy (in 10 kHz Bandwidth):
±0.02 degree/dB from −20 to −40 dBm
±0.5 degree from −10 to −50 dBm
±1 degree from −50 to −70 dBm
±3 degrees from −70 to −90 dBm

DESCRIPTION:

A phase reference level is established on the CRT. Then the signal at the receiver is changed through the dynamic range of the instrument and the change in phase indication is noted.

PERFORMANCE TESTS

A4-17. PHASE DYNAMIC RANGE (Cont'd)

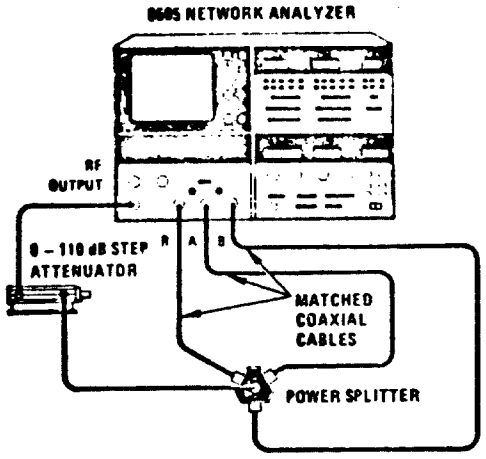


Figure A4-12. Phase Dynamic Range Test Setup

EQUIPMENT:

RF Cable Kit	HP 11851A
3-Way Power Splitter	HP 11850A
Step Attenuator, 0 — 110 dB	HP ~~8496A~~ 355D

PROCEDURE:

a. On 8505A, set controls as follows:

On A1 Source/Converter:

OUTPUT LEVEL dBm	+10 dB
OUTPUT LEVEL VERNIER	.0
INPUT LEVEL dBm MAX	–10

On A2 Frequency Control

RANGE MHz	0.5 — 130
MODE	LIN EXPAND
WIDTH	CW ±ΔF
SCAN TIME SEC	.1 — .01
CW FREQUENCY	30 MHz
±ΔF FREQUENCY	00.0
MARKERS	1
Marker 1	Center of CRT Screen

On A3 Signal Processor:
Channel 1:

INPUT	A/R
MODE	PHASE
SCALE/DIV	1 degree

PERFORMANCE TESTS

A4-17. PHASE DYNAMIC RANGE (Cont'd)

Channel 2:
MODE.....OFF

Electrical Length:
MODE.....OFF

Display Section:
BANDWIDTH kHz .....10 kHz On (in)
VIDEO FILTER .....On (in)
REF LINE POSN .....Adjust Reference Line to CRT center graticule line

b. Connect equipment as shown in Figure A4-12.

c. Set external step attenuator to 10 dB. If "R" OVERLOAD light comes on, adjust OUTPUT LEVEL VERNIER to clear overload. Press Channel 1 DISPLAY MKR, then ZRO pushbuttons to place the CRT trace on the center graticule line.

d. Step external step attenuator from 10 to 50 dB position. (This applies —50 dBm to ports "A" and "R".) The trace should be within ±0.5 degree of Reference Line.

e. Step the external attenuator from 50 to 70 dB position. (This applies —70 dBm to ports "A" and "R".) The CRT trace should be within ±1 degree of Reference Line.

f. Step the external attenuator from 70 to 90 dB position. (This applies —90 dBm to ports "A" and "R".) The CRT trace should be within ±3 degrees of Reference Line.

A4-18. PHASE REFERENCE OFFSET

SPECIFICATION:

Phase Reference Offset:

Range: ±1700 degrees
Accuracy: ±0.3° ±0.5% of offset

DESCRIPTION:

The CW phase signal is observed on the CRT. The signal is offset multiples of 360 degrees and observed if it returns to the reference line.

PERFORMANCE TESTS

A4-18. PHASE REFERENCE OFFSET (Cont'd)

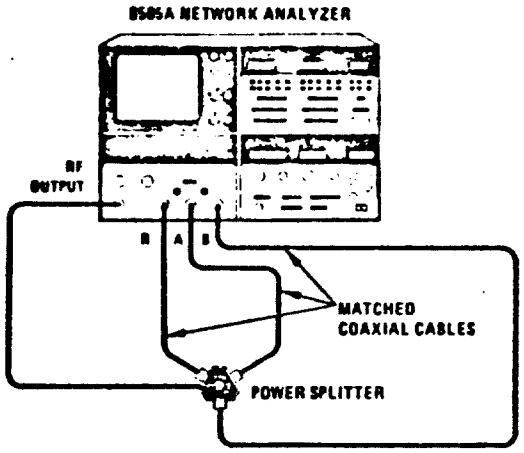


Figure A4-13. Phase Reference Offset Test Setup

EQUIPMENT:

3-Way Power Splitter	HP 11850A
Matched Type-N Coaxial Cables	HP 11851A

PROCEDURE:

a. On 8505A, set controls as follows:

On A1 Source/Converter:

OUTPUT LEVEL dBm	−10
OUTPUT LEVEL VERNIER	.0
INPUT LEVEL dBm MAX	−10

On A2 Frequency Control:

RANGE MHz	0.5 − 130
MODE	LIN EXPAND
WIDTH	CW ±ΔF
SCAN TIME SEC	.1 − .01
SCAN TIME VERNIER	Fully Clockwise
TRIGGER	AUTO
CW FREQUENCY	60 MHz
±ΔF FREQUENCY	4.5 MHz

On A3 Signal Processor:

Channel 1:

INPUT	A/R
MODE	PHASE
SCALE/DIV	1°/DIV

Channel 2:

MODE	OFF

PERFORMANCE TESTS

A4-18. PHASE REFERENCE OFFSET (Cont'd)

Electrical Length:
INPUT ..... A
MODE ..... OFF

CRT Display:
BANDWIDTH kHz 10
REF LINE POSN ..... Adjust Reference Line to center of CRT
VIDEO FILTER ..... On (in)

b. Connect equipment as shown in Figure A4-13.

c. Press Channel 1 DISPLAY MKR, then ZRO pushbuttons to place the CRT trace on the reference line. If trace is not on CRT center line, make slight adjustment with CRT Display CH 1 to place the trace directly on the center line.

d. Press Channel 1 DISPLAY REF. Press REF OFFSET pushbuttons to obtain offset shown below, then check that the phase trace is within the limits of the reference line listed below.

REF OFFSET	TRACE ACCURACY FROM CENTER LINE
±360°	≤± 2.1°
±720°	≤± 3.9°
±1080°	≤± 5.7°
±1440°	≤± 7.5°

A4-19. PHASE ACCURACY AND ELECTRICAL LENGTH TEST

SPECIFICATION:

Phase Accuracy: ±0.01 degrees/degree for ±170 degrees
±0.01 degrees/degree ±0.5 degrees for ±180 degrees.

Polar Accuracy: actual value is within less than a 3 mm circle of displayed value.

Electrical Length Accuracy: ±3% of reading ±1% of length range.

DESCRIPTION:

The hysteresis loop is observed to see that the 180 degree transition occurs at precisely +180 degrees and −180 degrees. The electrical length offset is checked by inserting two phase cycles and reading the resultant Electrical Length digital readout of 720 degrees.

PERFORMANCE TESTS

A4-19. PHASE ACCURACY AND ELECTRICAL LENGTH TEST

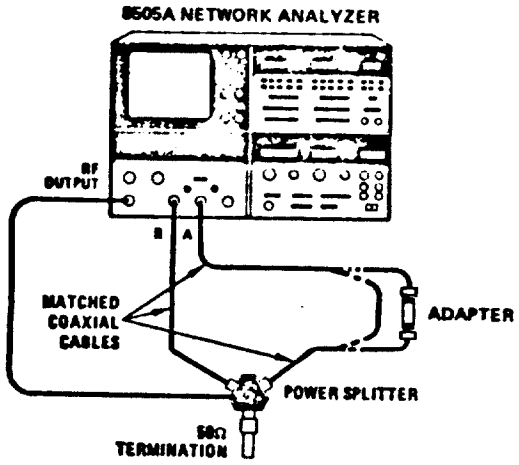


Figure A4-14. Phase Accuracy Test Setup

EQUIPMENT:

50-Ohm Termination	~~HP 909A Option 012~~	GR 900W50
Type-N Female to Type-N Female Adapter	HP 1250-0777	
3-Way Power Splitter	HP 11850A	
RF Cable Kit	HP 11851A	

PROCEDURE:

PHASE ACCURACY TEST

a. On 8505A, set the controls as follows:

On A1 Source/Converter:

OUTPUT LEVEL dBm	−10
OUTPUT LEVEL VERNIER	0
INPUT LEVEL dBm MAX	−10

On A2 Frequency Control:

RANGE MHz	0.5 − 130
MODE	LIN EXPAND
WIDTH	CW ±ΔF
CW FREQUENCY	60 MHz
±ΔF FREQUENCY	4.5 MHz
SCAN TIME SEC	.1 − .01
TRIGGER	AUTO
MARKERS	1
Marker 1	60 MHz

PERFORMANCE TESTS

A4-19. PHASE ACCURACY AND ELECTRICAL LENGTH TEST (Cont'd)

On A3 Signal Processor:
Channel 1:
INPUT ..... A/R
MODE ..... PHASE
SCALE/DIV ..... 90°/DIV

Channel 2:
MODE ..... OFF

CRT Display:
BW (Bandwidth) ..... 10 kHz
Video Filter ..... Off (out)

Electrical Length Panel:
MODE ..... OFF

b. Connect equipment as shown in Figure A4-14 with two 24-inch matched cables connected in series between Port "A" and the 3-way power splitter.

c. Offset the phase trace with the Channel 1 REF OFFSET pushbuttons to place a phase transistion to the right of midscreen as shown in Figure A4-15.

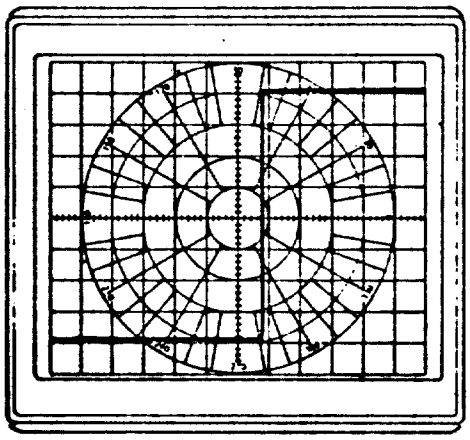


Figure A4-15. CRT Trace of Phase Transistion

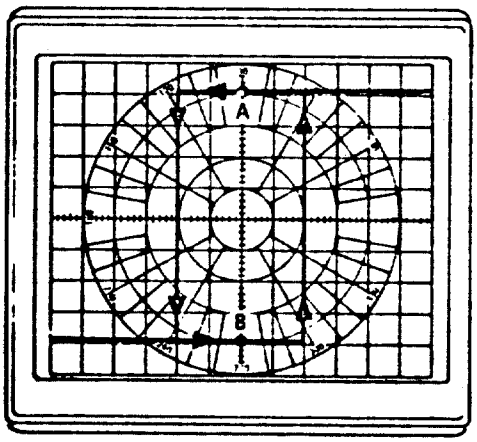


Figure A4-16. Hysteresis Loop of Phase Trace

d. Set SCAN TIME SEC to MANUAL. Sweep through the transition in both forward and reverse direction using the Manual sweep control. Note the hysteresis loop as shown in Figure A4-16.

e. Adjust both CW FREQUENCY and ±ΔF FREQUENCY to make the hysteresis loop six divisions wide and centered on the vertical center line of CRT. (See Figure A4-16.)

NOTE

If either step f or g is out of tolerance, refer to Section V for adjustment of A3A12 Phase Detector.

f. Press Channel 1 DISPLAY MKR. Center trace dot on the vertical center line at point "A" on Figure A4-16 trace. The marker readout should be +180 degrees ±2 degrees.

PERFORMANCE TESTS

A4-19. PHASE ACCURACY AND ELECTRICAL LENGTH TEST (Cont'd)

g. Center trace dot on the vertical center line at point "B" on Figure A4-16 trace. The Channel 1 marker readout should be −180 degrees ±2 degrees.

ELECTRICAL LENGTH LINE STRETCHER TEST

h. Remove extra 24-inch cable and adapter and reconnect Port "A" to the three-way power splitter through one of the matched cables.

i. On Frequency Control, set:

RANGE MHz ..... 0.5 — 1300 MHz
MODE ..... LIN EXPAND
WIDTH ..... CW ±ΔF
±ΔF FREQUENCY ..... 0 MHz
CW FREQUENCY (read on FREQ COUNTER MHz panel) ..... 1000 MHz
SCAN TIME SEC ..... 1 — .1
SCAN TIME VERNIER ..... Fully Clockwise

On Signal Processor, set:
Channel 1:

INPUT ..... A/R
MODE ..... POLAR MAG
SCALE/DIV ..... POLAR FULL

CRT Display:

BW (Bandwidth) ..... 10 kHz On (in)
VIDEO FILTER ..... Off (out)

j. At ELECTRICAL LENGTH Panel, set:

INPUT ..... A
MODE LENGTH X10
VERNIER A ..... 0 (fully counterclockwise)
DISPLAY CLR ..... Press and release

k. On Channel 1, press DISPLAY MKR, then ZRO pushbuttons. Set Channel 1 MODE switch to POLAR PHASE, then press DISPLAY ZRO. This should place the trace dot within 3 mm of the outside circle and zero degrees.

l. Press ELECTRICAL LENGTH pushbuttons to add +30 cm length. The trace dot should move around the outside circle back to 0 degrees ±10 degrees.

m. Set ELECTRICAL LENGTH MODE switch to LENGTH X1 position. Press ELECTRICAL LENGTH pushbuttons to read +15 cm. The trace dot should be at 180 degrees ±5 degrees. The same indication appearing on the CRT should appear on the Channel 1 digital readout.

LINEAR PHASE RANGE

n. Set Channel 1 MODE to PHASE and SCALE/DIV to 90 degrees. Set ELECTRICAL LENGTH MODE switch to PHASE X10 degrees/SCAN. Press Channel 1 DISPLAY REF, then CLR and press ELECTRICAL LENGTH DISPLAY CLR.

PERFORMANCE TESTS

A4-19. PHASE ACCURACY AND ELECTRICAL LENGTH TEST (Cont'd)

o. With ELECTRICAL LENGTH offset pushbuttons, put in +1800 degrees of electrical length. (The electrical length readout displays +180.) Verify that five transitions are displayed and that the linear phase display limits over approximately the last 5% of the trace or 0.6 divisions. (See Figure A4-17, Photo A.)

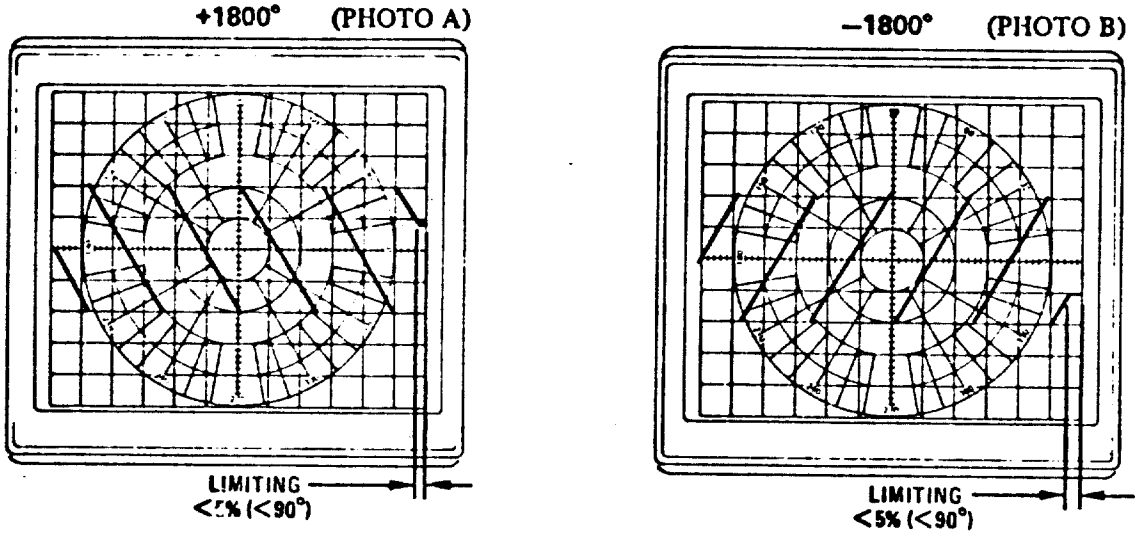


Figure A4-17. Phase Trace with Maximum Electrical Length Added

p. Reduce electrical length with LENGTH pushbuttons until the limiting section just goes off-screen. The digital readout at ELECTRICAL LENGTH panel should be ≥+173 (≥+1730 degrees).

q. With ELECTRICAL LENGTH offset pushbuttons, put in −1800 degrees of electrical length. (The electrical length readout displays −180.) Verify that five transitions are displayed and that the linear phase display limits over approximately the last 5% of the trace or 0.6 division. (See Figure A4-17, Photo B.)

r. Reduce electrical length with LENGTH pushbuttons until the limiting section just goes off-screen. The digital readout at ELECTRICAL LENGTH panel should be equal to or more negative than −173 (equal to or more negative than −1730 degrees).

LINEAR PHASE ACCURACY

s. On ELECTRICAL LENGTH panel, set MODE switch to PHASE X 10 degrees/SCAN, set VERNIER A to zero, then press DISPLAY CLR pushbutton.

t. On Channel 1, set MODE switch to PHASE. Press DISPLAY REF, then CLR pushbuttons. Press MKR, then ZRO pushbuttons. Press DISPLAY REF, then REF OFFSET pushbuttons to place −180 degrees of offset in Channel 1.

u. On ELECTRICAL LENGTH panel, press LENGTH pushbutton to obtain two complete phase cycles on the CRT screen. The ELECTRICAL LENGTH digital readout should be ±72 ±2, corresponding to ±720 degrees ±20 degrees of electrical length.

PERFORMANCE TESTS

A4-20. GROUP DELAY ACCURACY TEST

SPECIFICATIONS:

Group Delay Accuracy: ≤±3% of reading ±1 ns for 0.5 to 1300 MHz range, or ±10 ns for 0.5 to 130 MHz range, or ±100 ns for 0.5 to 13 MHz range.

DESCRIPTON:

The group delay accuracy is checked using a standard delay line to obtain a direct group delay reading.

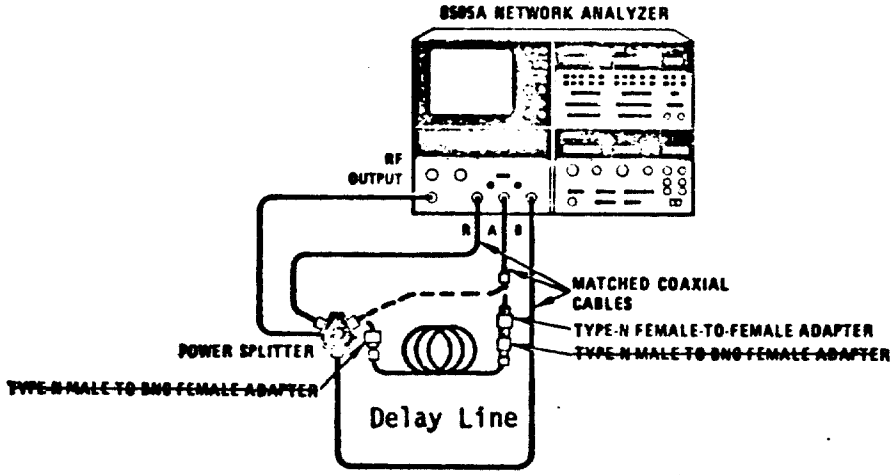


Figure A4-18. Test Setup to Measure Group Delay of Test Cable

EQUIPMENT:

	3-Way Power Splitter	HP 11850A
	Matched Type-N Coaxial Cables	HP 11851A
Delay line	~~Test Cable~~ ~~>50 feet of coaxial cable (RG 223/U or similar)~~	Collins
	~~BNC to Type-N Adapters (2 required)~~ ~~HP 1250-0780~~	597-0721-565
	Type-N female to Type-N female Adapter	HP 1250-0777

PROCEDURE:

a. ~~A coaxial cable greater than 50 feet in length is used as a standard in the group delay test. Group delay of the test cable is measured with the 8505A in phase mode as follows:~~

(1) Connect the "Test Cable" in A channel between the matched cable and the power splitter as shown in Figure A4-18.

(2) Set 8505A controls as follows:

On A1 Source/Converter:

OUTPUT LEVEL dBm	−10
OUTPUT LEVEL Vernier	0
INPUT LEVEL dBm MAX	−10

PERFORMANCE TESTS

A4-20. GROUP DELAY ACCURACY TEST ~~(Cont'd)~~

a. Connect equipment as shown in Figure A4-18 with both matched cables connected to power splitter and ~~"test cable"~~ "Delay Line" with adapters not connected in circuit.

b. On 8505A, set controls as follows:

On A1 Source/Converter:

OUTPUT LEVEL dBm	−10
OUTPUT LEVEL VERNIER	0
INPUT LEVEL dBm MAX	−10

On A2 Frequency Control:

RANGE MHz	0.5 — 1300
MODE	LIN ~~FULL~~ EXPAND
WIDTH	~~START/STOP~~ 1 CW
SCAN TIME SEC	1 — .1
SCAN TIME VERNIER	Fully clockwise
MARKERS	1
Marker 1	Midrange
TRIGGER	AUTO
Frequency	700 MHz

On A3 Signal Processor:

Channel 1

INPUT	A/R
MODE	DLY
SCALE/DIV	DELAY 1 ns*

Channel 2

MODE	OFF

Electrical Length

INPUT	A
MODE	OFF

c. Press Channel 1 DISPLAY REF pushbutton, then CLR pushbutton until REL light goes out (if it was lit). Then press MKR pushbutton.

d. Connect ~~"Test Cable"~~ "Delay Line" between adapters in the A channel. The channel 1 digital readout should indicate the group delay of the "Delay Line" ±(1 ns +3% of reading).

*SCALE/DIV is set to 1 ns to obtain 0.1 ns resolution. The CRT trace may be off screen.

PERFORMANCE TESTS

A4-21. INPUT IMPEDANCE TEST

SPECIFICATION:

Input Impedance: 50 Ohms
Return Loss: ≥20 dB (≤1.22 SWR)

DESCRIPTION:

A VSWR Bridge is used with the 8505A by initially taking a CRT reference with the bridge test port open, then connecting to port under test and checking the difference in dB from the reference.

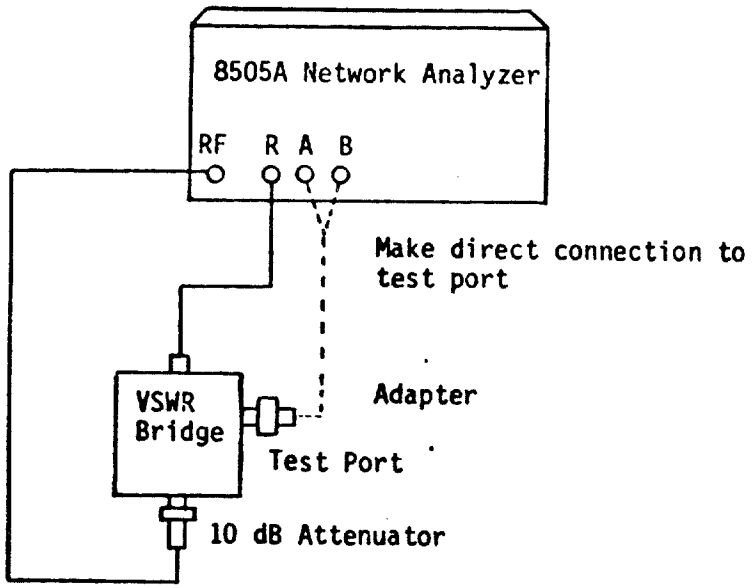


Figure A4-19 Input Impedance Test Setup

EQUIPMENT:

Matched Cable Kit. . . . . .HP 11851A
VSWR Bridge. . . . . Wiltron 60G50
GR to N Male Adapter . . . . . General Radio 900QNP
10 dB Attenuator . . . . . .WEC 1A-10

PERFORMANCE TESTS

A4-21. INPUT IMPEDANCE TEST (Cont'd)

PROCEDURE:

a. On 8505A, set controls as follows:

On A1 Source/Converter:

OUTPUT LEVEL dBm	~~−10~~	0
OUTPUT LEVEL VERNIER	0	
INPUT LEVEL dBm MAX	−10	

On A2 Frequency Control:

RANGE MHz	0.5 − 1300	
MODE	LIN ~~FUEL~~	EXPAND
WIDTH	START/STOP 1	
SCAN TIME SEC	1 − 0.1	
SCAN TIME VERNIER	Clockwise	
MARKERS	1	
Marker 1	Midscreen	
Start	5 MHz	
Stop	1300 MHz	

On A3 Signal Processor:

Channel 1:

INPUT	R
MODE	MAG
SCALE/DIV	5 dB

Channel 2:

MODE	OFF

CRT Display:

BW (Bandwidth)	10 kHz
VIDEO FILTER	Off (out)

b. Connect equipment as shown in Figure A4-19.

c. Press Channel 1 DISPLAY MKR, then ZRO pushbuttons to center trace on the CRT.

CAUTION

Use only water soluble "grease pencil" on CRT.

d. Draw a grease pencil mark over the trace on the CRT display.

e. Connect the TEST port directly to the 8505A "A" port (no coaxial cable between).

PERFORMANCE TESTS

A4-21. INPUT IMPEDANCE TEST (Cont'd)

f. Press Channel 1 DISPLAY REF pushbutton. Press Channel 1 REF OFFSET pushbuttons to obtain −20dB at digital display.

g. Compare the CRT trace to the grease pencil reference line. The CRT trace should be below the grease pencil mark for ≥20 dB of return loss (≤1.22 SWR).

h. Disconnect Test Set TEST port from "A" port and connect to "B" port Repeat step g above.

i. Remove grease pencil marks from CRT display. Disconnect Test Set TEST port from "B" port . Disconnect RF OUT port of Test Set from 8505A "R" port and connect it to "A" port. Set Channel 1 INPUT switch to A.

j. Press Channel 1 DISPLAY MKR then ZRO pushbutton to center the trace on the CRT. Draw a grease pencil mark over the trace on the CRT display.

k. Connect test port of VSWR bridge to 8505A "R" port.

l. Press Channel 1 DISPLAY REF pushbutton. Press Channel 1 REF OFFSET pushbuttons to obtain−20 dB at digital display.

m. Compare the CRT trace to the grease pencil reference line. The CRT trace should be below the grease pencil mark for ≥20 dB of return loss (≤1.22 SWR).

PERFORMANCE TESTS

A4-23. SPECTRAL PURITY TEST

SPECIFICATION:

Spectral Purity

Harmonics: ≥25 dB below main signal at +10 dBm output level

Sub-harmonic and Spurious Signals: Below −50 dBm at +10 dBm output level

Residual FM: ≤20.2 Hz rms on 0.5 - 13 MHz range in 3 kHz Bandwidth
≤220 Hz rms on 0.5 - 130 MHz range in 3 kHz Bandwidth
≤2.4 kHz rms on 0.5 - 1300 MHz range in 15 kHz Bandwidth

HARMONICS:

DESCRIPTION:

The CW RF output signal as well as harmonics and spurious signals are observed on the spectrum analyzer.

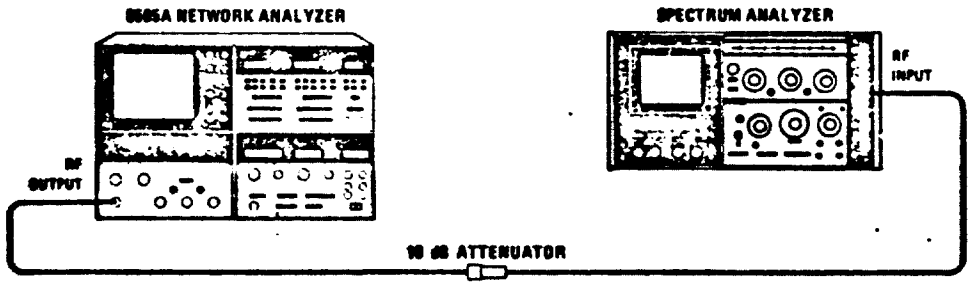


Figure A4-23. Harmonics and Spurious Signal Test Setup

EQUIPMENT:

Spectrum Analyzer	HP ~~8553B/8555A/8552B/141T~~	8568A
10 dB Attenuator	~~HP 8491A Option 010~~	WEC 1A-10

PROCEDURE:

a. Set 8505A controls as follows:

On A1 Source/Converter

OUTPUT LEVEL dBm	+10
OUTPUT LEVEL VERNIER	0

A4-23. SPECTRAL PURITY TEST (Cont'd)

On A2 Frequency Control:

RANGE MHz	.5 — 1300
MODE	LIN FULL
TRIGGER	AUTO
SCAN TIME SEC	MANUAL

b. Connect equipment as shown in Figure A4-23. Allow equipment to warm up for a minimum of one hour.

c. Slowly sweep manually through .5 — 1300 MHz range and observe harmonics and spurious signals. Identify signal in question as harmonic or non-harmonic and measure the difference in dB between this signal level and the level of the fundamental. Harmonics should be >25 dB below the fundamental (<−15 dBm). Non-harmonic spurious signals should be below −50 dBm.

NOTE

The spectrum analyzer originates some mixing harmonics that may appear on the display. If a signal is in question, increase the spectrum analyzer input attenuation by 10 dB. Note if 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.

RESIDUAL FM

DESCRIPTION:

The residual FM of the network analyzer is checked in the CW Mode with a modulation analyzer.

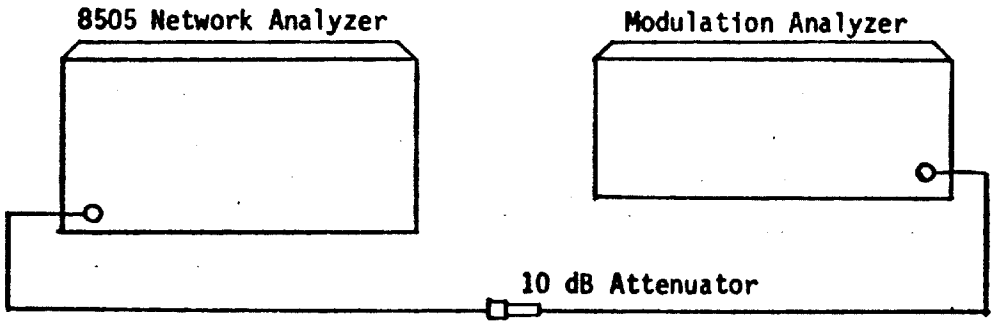


Figure A4-24

PERFORMANCE TESTS

A4-23. SPECTRAL PURITY TEST (Cont'd)

EQUIPMENT:

Modulation Analyzer	HP 8901A
Attenuator	WEC 1A-10

PROCEDURE:

a. Set controls as follows:

8505A

OUTPUT LEVEL dBm	+10
RANGE MHz	.5 - 13
MODE	LIN EXPAND
WIDTH	CW
SCAN TIME SEC	.100 - 10
CW FREQ	7.00 MHz
SCAN TIME SEC VERNIER	Fully Clockwise
TRIGGER	AUTO

8901A

MEASUREMENT	FM
LP FILTER	3 kHz
DETECTOR	AVG (rms)
HP FILTER	ALL OFF

b. Connect network analyzer RF output to modulation analyzer input thru the 10 dB attenuator.

c. The modulation analyzer should read less than 20.2 Hz rms.

d. Set network analyzer to .5 - 130 MHz range. The modulation analyzer should read $\leq$220 Hz.

e.

e. Set the network analyzer to the .5 - 1300 MHz range.

f. Set the modulation analyzer LP filter to 15 kHz. Leave all other settings as in previous steps. The modulation analyzer should read $\leq$2.4 kHz.

Table A4-2. Performance Test Records (1 of 4)

HEWLETT-PACKARD
Model 8505A Network Analyzer

Test Performed By: _____

Serial Number: _____ Date: _____

Para. No.	Description	Lower Limit	Measured Value	Upper Limit
A4-8	**Frequency Range & Accuracy Test**			
	j. START and STOP Frequency:			
	1300. MHz	1287 MHz	_____	1313. MHz
	130. MHz	128.7 MHz	_____	131.3 MHz
	13.0 MHz	12.87 MHz	_____	13.13 MHz
	0700. MHz	687 MHz	_____	713 MHz
	070.0 MHz	68.7 MHz	_____	71.3 MHz
	07.00 MHz	6.87 MHz	_____	7.13 MHz
	0010. MHz	1 MHz	_____	23 MHz
	001.0 MHz	0.1 MHz	_____	2.3 MHz
	01.00 MHz	0.87 MHz	_____	1.13 MHz
A4-9	**CW Frequency Stability Test**			
	d. Frequency Change after 10 minutes	−2.3 kHz	_____	+2.3 kHz
A4-10	**Power Output Leveling Test and Absolute Power Calibration**			
	c. Power Leveling: variation across band		_____	±0.5 dB
	d. Output Level Vernier: 0−12 dB range	−3 dBm	_____	−1 dBm
A4-11	**Power Output Range Test**			
	e. Accuracy at all settings of OUTPUT LEVEL Control		_____	±1.5 dB
A4-12	**Magnitude Reference Offset and Marker Accuracy Test**			
	c. Rectangular Marker Zero	−0.01 dB	_____	+0.01 dB
	e. Polar Marker Zero − Magnitude	−3 mm of Outside Circle	_____	+3 mm of Outside Circle
	f. Polar Marker Zero − Phase	−1 degree	_____	+1 degree
	j. Offset +190 dB & read marker	−184 dB	_____	−196 dB
	n. Offset −190 dB & read marker	+184 dB	_____	+196 dB
A4-13	**Receiver Noise Floor**			
	e. 0.5 to 2 MHz, "R" Port		_____	−95 dBm
	f. 0.5 to 2 MHz, "A" Port		_____	−95 dBm

Table A4-2. Performance Test Records (2 of 4)

Para. No.	Description	Lower Limit	Measured Value	Upper Limit
A4-13	Receiver Noise Floor (cont'd)			
	g. 0.5 to 2 MHz, "B" Port		_____	−95 dBm
	h. 2 to 10 MHz, "B" Port		_____	−100 dBm
	i. 2 to 10 MHz, "A" Port		_____	−100 dBm
	j. 2 to 10 MHz, "R" Port		_____	−100 dBm
	k. 10 to 1300 MHz, "R" Port		_____	−110 dBm
	l. 10 to 1300 MHz, "A" Port		_____	−110 dBm
	m. 10 to 1300 MHz, "B" Port		_____	−110 dBm
A4-14	Crosstalk Isolation			
	d. Crosstalk between "R" and "A" Port	100 dB	_____	
	e. Crosstalk between "R" and "B" Port	100 dB	_____	
	f. Crosstalk between "A" and "R" Port	100 dB	_____	
	g. Crosstalk between "A" and "B" Port	100 dB	_____	
	h. Crosstalk between "B" and "R" Port	100 dB	_____	
	i. Crosstalk between "B" and "A" Port	100 dB	_____	
A4-15	Magnitude, Phase and Group Delay Frequency Response			
	e. Port "R" Frequency Response		_____	3 dB
	h. Port "A" Frequency Response		_____	3 dB
	i. Port "B" Frequency Response		_____	3 dB
	m. A/R Ratio Measurement Magnitude Frequency Response		_____	0.6 dB
	n. B/R Ratio Measurement Magnitude Frequency Response		_____	0.6 dB
	r. B/R Phase Measurement Frequency Response 0.5 to 750 MHz		_____	6 degrees
	s. B/R Phase Measurement Frequency Response 750 to 1300 MHz		_____	10 degrees
	t. A/R Phase Measurement Frequency Response 0.5 to 750 MHz		_____	6 degrees
	A/R Phase Measurement Frequency Response 750 to 1300 MHz		_____	10 degrees
	w. A/R Group Delay Frequency Response		_____	2 ns
	x. B/R Group Delay Frequency Response		_____	2 ns
A4-16	Magnitude Dynamic Accuracy Test			
	e. Input "R" REF OFFSET: +20 dB	−0.2 dB	_____	+0.2 dB
	+10 dB	−0.1 dB	_____	+0.1 dB
	0 dB (Ref)	0 dB	_____	0 dB
	−10 dB	−0.1 dB	_____	+0.1 dB
	−20 dB	−0.2 dB	_____	+0.2 dB
	−30 dB	−0.4 dB	_____	+0.4 dB
	−40 dB	−0.6 dB	_____	+0.6 dB
	−50 dB	−0.8 dB	_____	+0.8 dB
	−60 dB	− 1 dB	_____	+ 1 dB
	−70 dB	− 2 dB	_____	+ 2 dB
	−80 dB	− 4 dB	_____	+ 4 dB

Table A4-2. Performance Test Records (3 of 4)

Para. No.	Description	Lower Limit	Measured Value	Upper Limit
A4-16	**Magnitude Dynamic Accuracy Test (cont'd)**			
	d. Input "A" REF OFFSET:			
	+20 dB	−0.2 dB	_____	+0.2 dB
	+10 dB	−0.1 dB	_____	+0.1 dB
	0 dB (Reference)	0 dB	_____	0 dB
	−10 dB	−0.1 dB	_____	+0.1 dB
	−20 dB	−0.2 dB	_____	+0.2 dB
	−30 dB	−0.4 dB	_____	+0.4 dB
	−40 dB	−0.6 dB	_____	+0.6 dB
	−50 dB	−0.8 dB	_____	+0.8 dB
	−60 dB	− 1 dB	_____	+ 1 dB
	−70 dB	− 2 dB	_____	+ 2 dB
	−80 dB	− 4 dB	_____	+ 4 dB
	e. Input "B" REF OFFSET:			
	+20 dB	−0.2 dB	_____	+0.2 dB
	+10 dB	−0.1 dB	_____	+0.1 dB
	0 dB (Reference)	0 dB	_____	0 dB
	−10 dB	−0.1 dB	_____	+0.1 dB
	−20 dB	−0.2 dB	_____	+0.2 dB
	−30 dB	−0.4 dB	_____	+0.4 dB
	−40 dB	−0.6 dB	_____	+0.6 dB
	−50 dB	−0.8 dB	_____	+0.8 dB
	−60 dB	− 1 dB	_____	+ 1 dB
	−70 dB	− 2 dB	_____	+ 2 dB
	−80 dB	− 4 dB	_____	+ 4 dB
A4-17	**Phase Dynamic Range**			
	d. −10 to −50 dBm Range, CRT trace tolerance from reference line	−0.5 degree	_____	+0.5 degree
	e. −50 to −70 dBm Range, CRT trace tolerance from reference line	−1 degree	_____	+1 degree
	f. −70 to −90 dBm Range, CRT trace tolerance from reference line	−3 degrees	_____	+3 degrees
A4-18	**Phase Reference Offset**			
	d. Reference Offset, CRT trace tolerance from reference line:			
	± 360 degrees	−2.1 degrees	_____	+2.1 degrees
	± 720 degrees	−3.9 degrees	_____	+3.9 degrees
	±1080 degrees	−5.7 degrees	_____	+5.7 degrees
	±1440 degrees	−7.0 degrees	_____	+7.5 degrees

Table A4-2. Performance Test Records (4 of 4)

Para. No.	Description	Lower Limit	Measured Value	Upper Limit
A4-19	**Phase Accuracy and Electrical Length Test**			
	Phase Accuracy Test:			
	f. +180 degree transistion	+182 degrees	_____	+178 degrees
	g. −180 degree transition	−182 degrees	_____	−178 degrees
	Electrical Length (Line Stretcher) Test:			
	l. 30 cm at 1000 MHz	+10 degrees	_____	−10 degrees
		(370 degrees)	_____	(350 degrees)
	m. 15 cm at 1000 MHz	185 degrees	_____	175 degrees
	Linear Phase Range:			
	p. Maximum Positive Electrical Length	+1730 degrees	_____	
	r. Maximum Negative Electrical Length	−1730 degrees	_____	
	Linear Phase Accuracy:			
	u. Length in degrees added for two phase cycles	+700 degrees	_____	+740 degrees
A4-20	Group Delay Accuracy Test	(From Calibration Data)		
	a. Group delay of Delay Line		_____	
	e. Group delay by direct measurement	(1)	_____	(2)
	(1) Lower Limit — same value as (a) above −(1 ns +3% of reading)			
	(2) Upper Limit — same value as (a) above +(1 ns +3% of reading)			
A4-21	Input Impedance Test			
	g. Return Loss of Port "A"	20 dB	_____	
	h. Return Loss of Port "B"	20 dB	_____	
	m. Return Loss of Port "R"	20 dB	_____	
~~A4-22~~	~~Source Impedance Test~~			
	~~e. SWR of RF OUTPUT port~~		_____	~~1.30 SWR~~
A4-23	Spectral Purity Test			
	e. Harmonics below fundamental at +10 dBm		_____	−15 dBm
	Non-harmonic spurious signals with fundamental at +10 dBm		_____	−50 dBm
	m. Residual FM at 7. MHz		_____	30.2 Hz rms
	q. Residual FM at 70 MHz		_____	220 Hz rms
	w. Residual FM at 700 MHz		_____	2.4 kHz rms
	~~x. Residual FM in CW mode at 500 MHz~~		_____	

8501A EQUIPMENT REQUIREMENTS

EQUIPMENT REQUIREMENTS FOR FUNCTIONAL CHECK OF THE 8501A STORAGE NORMALIZER.

ITEM	MINIMUM USE SPECIFICATIONS	CALIBRATION EQUIPMENT
2.1 NETWORK ANALYZER	COMPATIBLE WITH 8501A	HEWLETT-PACKARD 8505A
2.2 3-WAY POWER SPLITTER	IMPEDANCE: 50 OHM FREQ. RANGE: 500 kHz TO 1.3 GHz	HEWLETT-PACKARD 11850A
2.3 RF CABLE KIT (3 REQUIRED)	50 OHM COAX CABLE ≈ 24 INCHES LONG	HEWLETT-PACKARD 11851A
2.4 LO PASS FILTER	IMPEDANCE: 50 OHM CUT-OFF FREQUENCY: ≈ 380 MHz	TELONIC INDUSTRIES TLA380-4EF1

SECTION III
OPERATION AND PROGRAMMING

3-1. INTRODUCTION

3-2. This section explains the functions of the 8501A Storage-Normalizer controls, indicators, and connectors. Procedures in this section describe how to adjust the 8501A to adapt it to a network analyzer (Paragraph 3-19). Included in this section are instructions to program the 8501A with a desktop computer. If a functional test procedure is desired, go to Section IV.

3-3. OPERATING FEATURES

3-4. The 8501A Storage-Normalizer adds several significant operating capabilities to the 8505A Network Analyzer and is fully programmable through the standard HP-IB interface.

3-5. With the Normalizer and labeling connections made to the 8505A, and with the 8501A STORAGE ON pushbutton pressed, the 8501A controls the 8505A CRT display to provide the following features:

Digital Storage
Normalization
Magnification
Averaging
8505A Operating Mode Labels

3-6. Digital Storage

3-7. With the 8501A INPUT ON switch pressed, the 8501A accepts measurement data from the 8505A at a rate selected by the 8505A SCAN TIME SEC sweep speed switch. This data is digitized and stored in memory. Simultaneously, the 8501A extracts the digital data from memory, converts it to an analog signal, and sends it back to the 8505A CRT display as a flicker-free trace. This produces a crisp continuous display of the measurement trace regardless of the 8505A scan time, permitting easy adjustment of the device-under-test.

3-8. Normalization

3-9. Normalization removes a reference response characteristic from the response characteristic of the device-under-test. Frequency response variations of the 8505A and the components in the test setup are removed from the cartesian display by storing a reference trace (short, open, open/short, or through), then subtracting the stored reference trace from the device-under-test frequency response.

3-10. This is accomplished in the "Input-Memory" mode. Pressing the 8501A MEMORY STORE moves the displayed trace into reference memory. Selecting INPUT-MEMORY (–MEM) causes the reference trace to be subtracted from the current input measurement trace and the result is displayed on the 8505A CRT. This normalization process removes the need to draw calibration lines on the CRT.

3-11. Magnification

3-12. Selecting MAGNIFIER switch positions X2, X5, or X10, you can increase the CRT display resolution. In the X10 position, the resolution is 0.01 dB, 0.1 degree, and 0.1 nanosecond for the cartesian display and up to 0.001 linear coefficient full scale for the polar display. When the MAGNIFIER switch is set to other than X1, the actual scale/division selected is:

$$\text{8505A SCALE/DIV} \times \frac{1}{\text{8501A MAGNIFIER}} = \text{Actual SCALE/DIV}$$

The MAGNIFIER switch selects the magnification for both display channels.

3-13. Averaging

3-14. Setting the AVERAGING switch to ON causes the data for that channel to be averaged. Averaging is accomplished by an exponential running average technique where each trace has 1/n weight, where n is the selected AVERAGING FACTOR. For example, if an averaging factor of 128 is selected, the new trace will have a weight of 1/128 to change the last trace.

3-15. The 8501A digital averaging functions similar to a video filter, eliminating random noise fluctuations from the displayed trace. This technique adds accuracy and resolution to network measurements by increasing the signal-to-noise ratio for the

measurements. This feature is useful in any measurement where noise is a problem.

3-16. 8505A Operating Mode Labels

3-17. Setting the LABELS switch to ON displays all major measurement mode settings directly on the 8505A CRT. At the top of the CRT are displayed the 8505A Channel 1 and Channel 2 INPUT, MODE, MKR value, SCALE/DIV, and if connected, the 8503A S-Parameter Test Set switching state. Along the bottom of the CRT are displayed Start/Stop, CW±ΔF, or CW frequency settings, as well as the counted MKR frequency.

3-18. This labeling capability provides a simple way to document test results for photography and makes it possible to read magnitude, phase, and group delay measured values without looking away from the CRT.

3-19. ADJUSTMENTS TO MATCH 8501A TO 8505A

3-20. The following procedure describes the adjustment necessary to match the 8501A to the 8505A Network Analyzer being used. These adjustments should be made before the system is used to make measurements.

Equipment Initial Setup

1. Connect equipment as shown in Figure 3-1.

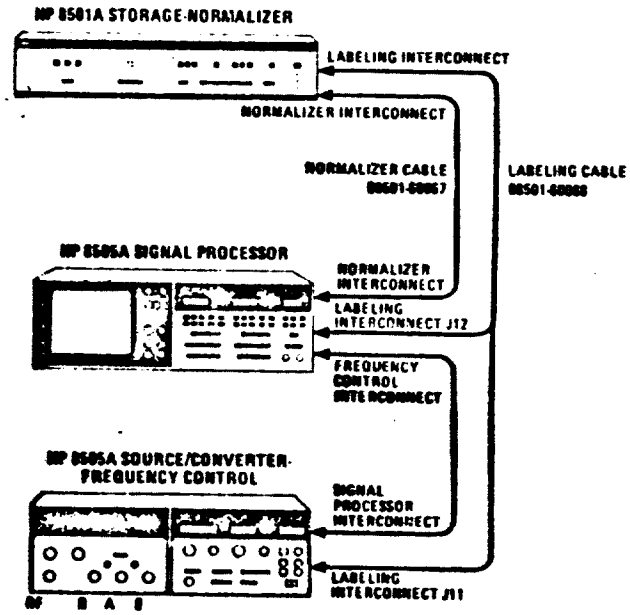


Figure 3-1. Test Setup to Make Initial Matching Adjustments

2. Set controls on the 8505A and 8501A as follows:

8501A

STORAGE ..... OFF (pressed)
MAGNIFIER X1
CHANNEL 1 INPUT ..... ON (pressed)

CHANNEL 1 AVERAGING ..... OFF
CHANNEL 2 INPUT ..... ON (pressed)
CHANNEL 2 AVERAGING ..... OFF

8505A FREQUENCY CONTROL

MODE ..... LIN EXPAND
WIDTH ..... CW ± ΔF
SCAN TIME SEC ..... .1—.01
TRIGGER ..... AUTO

8505A SIGNAL PROCESSOR
CHANNEL 1 INPUT ..... R
CHANNEL 1 MODE ..... MAG
CHANNEL 2 MODE ..... OFF
CRT Display REF LINE POSN ..... On (pressed in)
CRT Display CH 1 up-down control ..... Adjust reference line trace to center line
CRT Display X POSN ..... Center trace end dots over edge graticule lines
CRT Display TRACE ..... Adjust to align trace to horizontal line

WARNING

Any adjustment made to the instrument while its protective covers are removed must be performed ONLY by qualified maintenance service personnel who are aware of the hazards involved.

NOTE

If the ends of the trace line do not fall directly on the edge lines of the graticule, adjustment of the X-deflection amplifier in the 8505A is necessary. (See 8505A Operating and Service Manual.)

Rear Panel Channel 1 Adjustment

3. On 8501A, press STORAGE ON pushbutton. Adjust the rear panel X-OFFSET RECT control to center the reference line trace between the left and right edge of the graticule.

4. On 8501A, adjust the rear panel Y-OFFSET CH 1 control to place the reference line trace on the center graticule line.

Rear Panel Channel 2 Adjustment

5. On 8505A, set the following:

CHANNEL 1 MODE ..... OFF
CHANNEL 2 INPUT ..... R
CHANNEL 2 MODE ..... MAG

6. On 8501A, press front panel STORAGE OFF pushbutton. On the 8505A, adjust CRT Display CH 2 up-down control to place the reference line trace on the center graticule line.

7. On 8501A, press STORAGE ON pushbutton. Adjust the rear panel Y-OFFSET CH 2 control to place the reference line on the center graticule line.

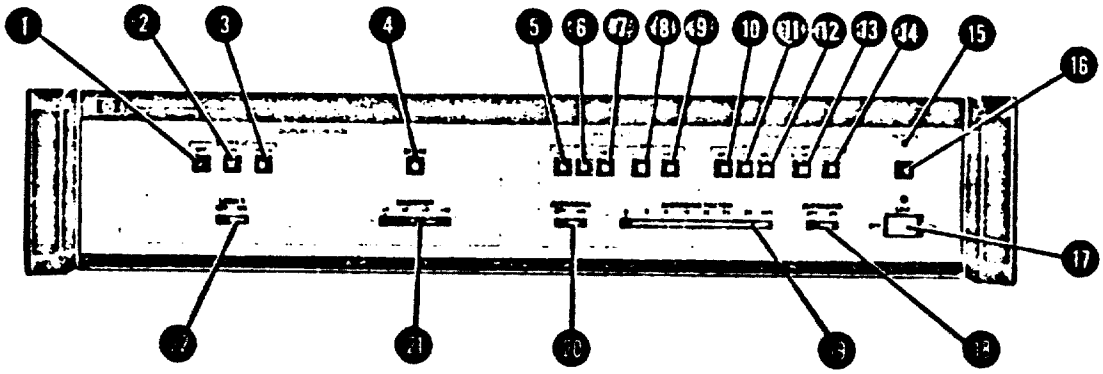
Rear Panel Polar Adjustments

8. On 8501A, press STORAGE OFF pushbutton. On 8505A, set Channel 2 INPUT to A/R, MODE to POLAR MAG, and adjust the two CRT Display BEAM CENTER POL controls to place the dot on the trace in the center of the graticule.
9. On 8501A, press STORAGE ON pushbutton. Adjust rear panel X-OFFSET POL (polar) control to place the trace dot at the center of the graticule horizontally.
10. Adjust the rear panel Y-OFFSET POL (polar) control to place the trace dot at the center of the graticule vertically.

NOTE

The 8501A is now adjusted to match the 8505A Network Analyzer and is ready to make measurements.

FRONT PANEL



1 STORAGE OFF Pushbutton. Pressing this pushbutton switches the 8501A out of the signal path, allowing a normal display without any effect from the Storage-Normalizer.

2 STORAGE ON Pushbutton. Pressing this pushbutton selects storage mode, switching the 8501A into the input signal path allowing flicker-free displays according to the mode selected by the Channel 1 and 2 INPUT switches.

3 STORAGE HOLD Pushbutton. Pressing this pushbutton holds on the CRT as a fixed trace whatever is being displayed when the pushbutton is pressed. This mode is used when photographing the CRT trace or when a stable trace is desired to inspect details of the CRT trace.

4 ERASE Pushbutton. Pressing this pushbutton erases all memory, including references.

5 CHANNEL 1 INPUT OFF Pushbutton. Pressing this pushbutton turns off the Channel 1 signal trace. The labeling on the CRT is not affected.

6 CHANNEL 1 INPUT ON Pushbutton. Pressing this pushbutton turns on the Channel 1 signal trace.

7 CHANNEL 1 INPUT — MEM (memory) Pushbutton. Pressing this pushbutton subtracts the Channel 1 reference data stored in memory from the Channel 1 input signal, and displays the resultant on the CRT. This produces a display that is normalized to the reference memory. Note: Prior to using this function, a signal must be stored with Memory STORE button.

Figure 3-2. Front Panel Controls (1 of 2)

597-0724-500
SHEET 55

PERFORMANCE TESTS

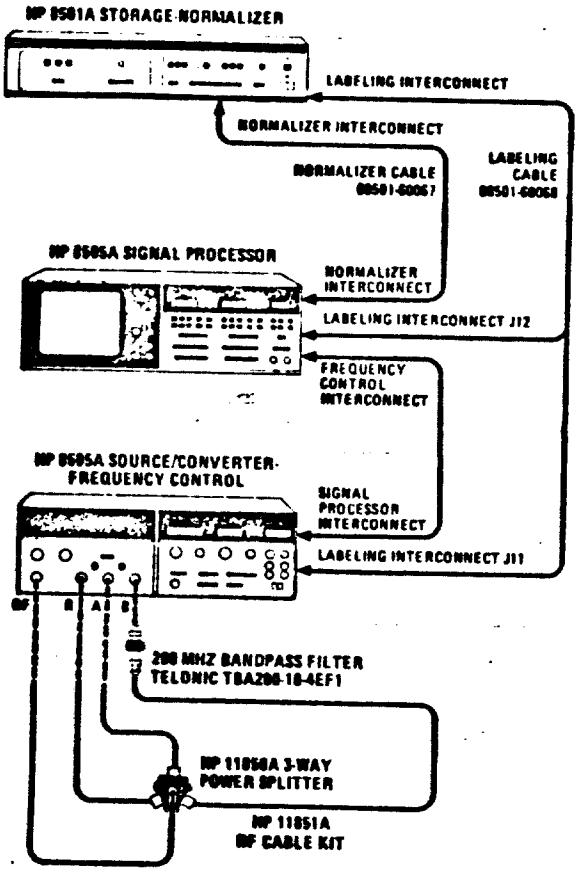


Figure 4-1. Test Setup for Manual Performance Test

PERFORMANCE TESTS

4-6. PERFORMANCE TEST WITH HP 9830A/B DESK-TOP COMPUTER (Cont'd)

Operator: Press CONT, then EXECUTE.

8505A CRT Display: A circle is drawn on CRT showing polar mode. (See Figure 4-11.)

Operator: Press CONT, then EXECUTE.

8505A CRT Display: The words "8501A Storage-Normalizer" is displayed showing text mode. (See Figure 4-12.)

4-7. MANUAL PERFORMANCE TEST

Initial Setup

1. Connect equipment as shown in Figure 4-1 except the HP-IB cables and Desk-Top Computer will not be in the test setup.

2. Make initial control settings on the 8501A and 8505A as follows:

8501A
- STORAGE ..... OFF
- LABELS ..... OFF
- ERASE ..... Press and release
- MAGNIFIER X1
- CHANNEL 1 INPUT ..... ON
- CHANNEL 1 MEMORY VIEW ..... OFF (out)
- CHANNEL 1 AVERAGING ..... OFF
- CHANNEL 2 INPUT ..... OFF
- AVERAGING FACTOR ..... .64

8505A
- SOURCE/CONVERTER
  - OUTPUT LEVEL dBm ..... –20
  - OUTPUT LEVEL dBm VERNIER 0
  - INPUT LEVEL dBm MAX ..... –10
- FREQUENCY CONTROL
  - RANGE MHz 5–1300
  - MODE ..... LIN EXPAND
  - WIDTH ..... START/STOP 1
  - SCAN TIME SEC 1–0.1
  - SCAN TIME SEC VERNIER ..... Counterclockwise
  - TRIGGER ..... AUTO
  - START FREQUENCY ..... 0180 (or freq. appropriate for filter used)
  - STOP FREQUENCY ..... 0220 (or freq. appropriate for filter used)
- SIGNAL PROCESSOR – Channel 1
  - INPUT ..... B/R
  - MODE ..... MAG
  - SCALE/DIV ..... 10 dB
- SIGNAL PROCESSOR – Channel 2
  - MODE ..... OFF

4-7. MANUAL PERFORMANCE TEST (Cont'd)

3. Press 8505A REF OFFSET to place the trace of the filter under test near the center of the CRT. With the SCAN TIME SEC sweep speed at approximately one second per sweep, note the difficulty in observing the trace. This slow sweep speed gives a more accurate and detailed measurement trace than a faster sweep speed.

Digital Storage Feature

4. On 8501A, press STORAGE ON pushbutton. The stored trace is displayed flicker-free on the CRT and is updated by a sweep each second. The CRT display shows a steady trace so the details on the trace may now be easily observed.

Normalization Feature

5. On 8501A, press CHANNEL 1 MEMORY STORE pushbutton momentarily, then release, then press INPUT — MEM (memory) pushbutton. This should display a horizontal trace and is the input signal trace minus the stored trace from memory. This trace is "normalized" to the previously stored signal.

6. Press CHANNEL 1 MEMORY VIEW and the stored trace being subtracted from the input signal is displayed on a separate trace along with the "input — memory" signal trace. (See Figure 4-5.)

Averaging Feature

7. On 8501A, press CHANNEL 1 INPUT ON and MEMORY VIEW off (out). Press STORAGE OFF pushbutton, set CHANNEL 1 AVERAGING switch to ON and AVERAGING FACTOR switch to 64. On 8505A, set Channel 1 MODE to DLY and SCALE/DIV to 10 ns. Set Source/Converter OUTPUT LEVEL to −70 dBm. Set SCAN TIME to approximately 0.01 SEC. Offset signal trace to center of CRT. The 8505A CRT trace should look similar to Figure 4-7.

8. On 8501A, press STORAGE ON, then ERASE, then wait ten seconds to allow averaging to take place on the CRT trace. The averaged trace should look like Figure 4-8. The difference between averaging and not averaging the signal may be observed by pressing first 8501A STORAGE OFF then STORAGE ON pushbuttons for comparison. Further improvement of the group delay measurement may be obtained by selecting a slower scan time on the 8505A. This allows a greater number of samples to be taken by the group delay circuits. A larger averaging factor may also be selected if averaging is to be taken over a longer period of time.

Magnifier Feature

9. Make initial settings described in steps 1 through 3 above. On 8501A, press STORAGE ON pushbutton.

10. On 8501A, set MAGNIFIER to X2, X5, and X10 position and note the CRT trace is magnified. (See Figure 4-6.)

4-7. MANUAL PERFORMANCE TEST (Cont'd)

CRT Labeling Feature

11. Make initial settings described in steps 1 through 3 above except as follows:

8501
STORAGE ..... ON
LABELS ..... ON
CHANNEL 2 INPUT ..... ON
CHANNEL 2 MEMORY VIEW ..... OFF (out)

8505A CHANNEL 2
INPUT ..... B/R
MODE ..... MAG
SCALE/DIV ..... 10 dB

12. Observe labels on the CRT (Figure 4-4). The upper left corner should contain a display similar to the following:

CH1:B/R MAG. = −0.4 dB
10 dB/DIV

This display may be interpreted as follows:

"CH1: B/R — This shows that Channel 1 has INPUT "B/R" selected.

"MAG. = — 0.4 dB" — This indicates that magnitude MODE is selected at Channel 1. Also the marker selected at the frequency counter on 8505A reads −0.4 dB on the Channel 1 trace. This value will vary depending on position of trace.

"10 dB/DIV" — This shows that the Channel 1 SCALE/DIV selected is 10 dB.

The interpretation of the Channel 2 readouts in the upper right corner of the CRT is similar to Channel 1.

The labels along the bottom of the CRT provides START, MARKER, and STOP frequencies.