TECHNICAL MANUAL

OPERATOR'S MANUAL

MICROWAVE LINK ANALYZER SYSTEM

INCLUDING

T-1353 /V) 1/U (HP MODEL 3710A)
(NSN 6625-00-520-4992) R-2049 (V) 1/U (HP 3702B)
(NSN 6625-00-520-5023) DT-542/U (HP 3703B);
PL-1394/U (HP 3705A) (NSN 6625-00-520-5055);
HP-3715A AND PL-1405 (V) 1/U (HP 3716A)
(NSN 6625-00-520-5059)

HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1979

WARNING

115. **Volts** AC **and 100 Volts DC are used in this instrument. Some of the maintenance and servicing operations described herein are performed with power supplied to the instrument while protective covers are removed. Exercise extreme care when performing these operations. Line voltage is always present on terminals including the power input connector, fuse holder, power switch, etc. In addition, when the instrument is on, energy available at many points may result in personal injury or death when contacted.**

WARNING

This instrument is supplied with a three-wire power cable. The center third wire is intended to connect the instrument chassis to earth ground when used with a properly wired, three-conductor outlet. Refer to section II for details of power connection. Improperly grounded equipment configurations may result in hazardous potentials between the chassis of two or more instruments or earth ground.

Technical Manual
No. 11-6625-2917-10

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC *27 August 1979*

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REPORTING OF ERRORS

You can improve this manual by recommending improvements using DA Form 2028-2 located in the back of the manual. Simply tear out the self-addressed form, fill it out as shown on the sample, fold it where shown, and drop it in the mail.

If there are no blank DA Forms 2028-2 in the back of your manual, use the standard DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to the Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703.

In either case a reply will be furnished direct to you.

This manual is an authentication of the manufacturer's commercial literature which, through usage, has been found to cover the data required to operate and maintain this equipment. Since the manual was not prepared in accordance with military specifications, the format has not been structured to consider levels of maintenance.

SYSTEM SERVICE MANUAL CONTENT

Section I	**contains General Information on the MLA. Included is a general introduction and a complete table of specifications.**
Section II	**contains information on inspection, preparation and storage.**
Section III	**contains information on back-to-back performance checks and troubleshooting. This enables a malfunction in the MLA System to be isolated to one instrument. Reference is given to a General Service Sheet and Test Point (TP) within that instrument.**
Section IV	**contains information on performance checks of the individual instruments. Should any of the instruments fail to meet the standards required, then refer to the ADJUSTMENT PROCEDURES in the instrument Service Manual.**
Block Diagrams	**The fold-outs at the rear of this manual contain block diagrams of the Transmitter and Receiver, including plug-ins.**

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SECTION 0

INSTRUCTION

0-1. Scope

This manual describes the Microwave Link Analyzer System (MLA) (figure 1-1) and provides operational instructions. It also contains installation instructions and back-to-back performance checks and certain operator troubleshooting procedures.

0-2. Indexes of Publications.

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

0-3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all levels of maintenance are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A and DSAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33A/AFR 75-18/MCO P4610.19B and DSAR 4500.15.

0-4. Reporting of Equipment Improvement Recommendations (EIR).

EIR's will be prepared using DA Form 2407, Maintenance Request. Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System. EIR's should be mailed directly to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished directly to you.

0-5. Administrative Storage.

Administrative storage of equipment issued to and used by Army activities shall be in accordance with TM 740-90-1.

0-6. Destruction of Army Electronics Materiel.

Destruction of Army electronics materiel to prevent enemy use shall be in accordancae with TM 750-244-2.

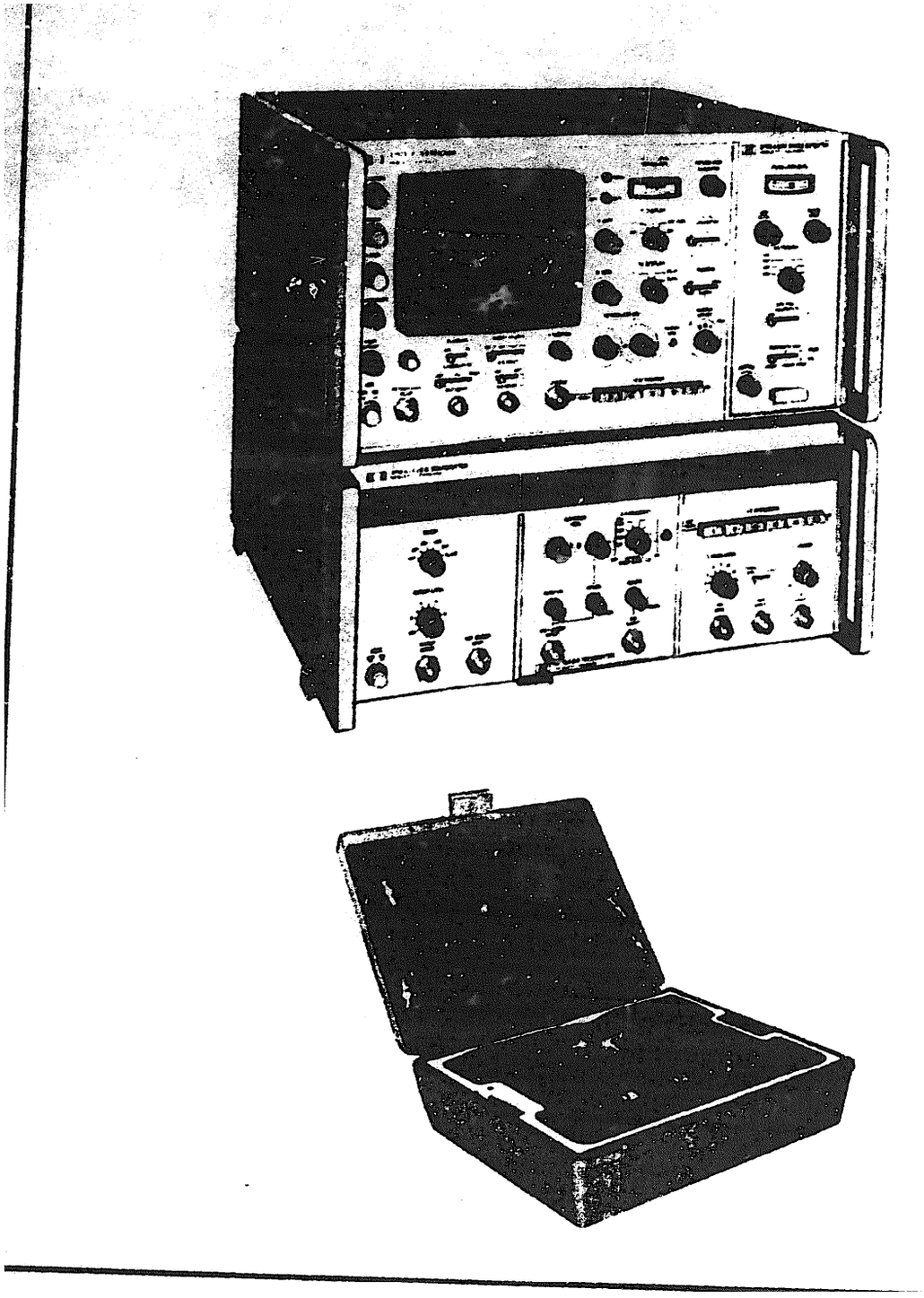


Figure 1-1 Microwave Link Analyzer System

SECTION I

INTRODUCTION

1-1. GENERAL

1-2 The *hp* Microwave Link Analyzer (MLA) is a combined Baseband (BB) and Intermediate Frequency (IF) analyzer. Designed to satisfy international measurement requirements, the MLA permits rapid tuning and equalization of satellite and terrestrial radio relay links for realization of their full traffic potential.

1-3. The MLA allows the various forms of distortion occurring in a link to be identified, measured and localized to BB and IF devices and BB/IF combination devices (eg, modulators and/or demodulators). From these measurements, it is also possible to deduce the Radio Frequency (RF) performance of the link. RF measurements however can be made directly with the aid of the *hp* Model 3730A Down Converter.

1-4. The MLA consists of a **3710A IF/BB Transmitter,** with a Transmitter plug-in, and a **3702B IF/BB Receiver,** with a Receiver plug-in.

The plug-ins available for the MLA are:

3715A BB Transmitter, providing BB test-tones of 83.333, 250 and 500kHz.

3716A BB Transmitter, providing BB test-tones of 83.333, 250 and 500kHz and, in addition, high frequency test-tones of 2.4, 4.43, 5.6 and 8.2MHz.

3703B Group Delay Detector, allowing group delay distortion measurements to be made on BB test-tones of 83.333, 250 and 500kHz.

3705A Differential Phase Detector, allowing group delay distortion measurements to be made on BB test-tones of 83.333, 250 and 500kHz, and differential phase measurements to be made on the high frequency test-tones of 2.4, 4.43, 5.6 and 8.2MHz.

Optional frequencies to those above are listed on Page 1-2.

1-5. Inclusion of high frequency BB test signals, corresponding to the upper BB frequency of the link, permits the detection of amplitude to phase modulation conversion effects. Optimization of the link differential gain and phase performance using these frequencies will achieve closer agreement with white noise loading tests.

1-6. Independent operation of the transmit and receive portions of the transmit and receive portions of the MLA allow between station (multihop-) measurements as well as in-station measurement.

1-7. Measurements made at the distant end of a between station test can be observed at the local end by a 'slave' facility involving two MLA's and the return path of the link. The measurement slaved back is immune from the characteristics of the return path.

1-8. Measurements are made throughout the IF swept spectrum of 45 to 95MHz (including demodulation of BB frequencies up to 5.6MHz) and at one of seven discrete BB frequencies within the range 83.333kHz to 8.2MHz.

1-9. External modulation facilities on the MLA allow compatibility with a wide range of test equipment.

1-10. SYSTEM FEATURES

a. Combined IF and BB test set for covering the IF (45 to 95MHz) and BB (83.3kHz to 8.2MHz) frequency spectrum of 1800 Channel and Colour TV Radio Relay Links. Demodulation of BB frequencies up to 5.6MHz.

b. Sweep width automatically compensated during high frequency test-tone operation to ensure that the sidetones occur within the test bandwidth.

c. The AM INPUT allows external signals from 500kHz to 10MHz to be amplitude modulated onto the IF OUTPUT signal, and AM suppression measurements to be made on limiters.

d. IF amplitude flatness of ±0.05dB from 45 to 95MHz. IF frequency stability of ±100kHz. IF frequency markers of 70MHz, 2MHz 'comb' and sliding symmetrical pair.

e. Inbuilt CRT display for ease of use, minimizing interconnections and more importantly eliminating ground loop problems which may occur In terminal stations. Dual display of interdependent link parameters. Constant X-axis deflection independent of sweep width changes.

f. Comsat/lntelsat requirements met by optionally available sweep frequency and measurement bandwidth? appropriate to satellite link signal: noise conditions.

1-11. OPTIONS

The MLA has a number at optional irequencies to meet individual customer requirements. Table 1-1 lists the combinations of BB frequencies, and Table 1-2 the Sweep frequencies available, along with the option number for each instrument.

Table 1-1 BB Frequency Options

BB Frequencies	Options			
	3716A	3715A	3705A	3703B
83.333, 250, 500kHz		STD		STD
83.333, 250, 500kHz & 2.4, 4.43, 5.6, 8.2MHz	STD		STD	
92.593, 277.778, 555.556kHz		009		009
92.593, 277.778, 555.556kHz & 2.4, 3.58, 5.6, 8.2MHz	010		010	
92.593, 277.778, 555.556kHz & 2.4, 3.58, 4.43, 8.2MHz	011		011	
92.593, 277.778, 555.556kHz & 2.4, 4.43, 5.6, 8.2MHz	012		012	
83.333, 250, 500kHz & 2.4, 3.58, 5.6, 8.2MHz	013		013	
83.333, 250, 500kHz & 2.4, 3.5, 5.6, 8.2MHz	014		014	
83.333, 250, 500kHz & 2.4, 4.5, 5.6, 8.2MHz	016		016	
83.333, 250, 500kHz & 2.4, 3.58, 4.43, 8.2MHz	018		018	
83.333, 250, 500kHz & 2.4, 3.58, 4.43, 5.6MHz	019		019	

Table 1-2 Sweep Frequency Options

Sweep Frequencies	Options		
	3710A	3702B	3705A
70Hz	STD	STD	
50Hz Internal	006	STD	
100Hz Internal	007	STD	
*18Hz in addition to 70Hz internal (with associated bandwidths of 90 & 100Hz)	015	STD	015

***The only BB frequency** options available with Option 015 are Options 0l0 **and** 011

Table 1-3 Connector Options

Connectors	Options			
	3710A	3716A	3715A	3702B
BNC	STD	STD	STD	STD
Siemens Large	002	002	002	002
Siemens Small	003	003	003	003
Commercial equivalent of WECO 477B (with 75/124Ω bal on mainframe)	004	004	004	004

Option 017: The IF LEVEL is voltage instead of power referenced. A detected level of the IF signal prior to the IF ATTENUATOR is provided on the Transmitter rear panel. A switch is added to the Receiver rear panel to allow the Y1 and Y2 displays to be inverted and a 40dB attenuator pad included in the accessory kit allows an IF level down to -91dBm to be obtained.

1-12. TERMINOLOGY AND ABBREVIATIONS

1-13 The terms and abbreviations used in the MLA Service manuals are defined below:

a. **MLA.** Microwave Link Analyzer.

b. **Transmitter.** 3710A IF/BB Transmitter.

c. **Receiver.** 3702B IF/BB Receiver.

d. **RF.** Radio Frequency. The frequency of radio transmission in a microwave communications link.

e. **IF.** Intermediate Frequency, 45 to 95MHz. The IF band of interest, when the IF centre frequency is centred on 70MHz (CCIR recommended).

f. **BB.** Baseband. The total multiplexed information to be modulated onto or demodulated from the IF carrier. The bandwidth depends upon the information to be carried. The term BB used by *hp* refers to a single test-tone.

g. **SLAVE.** For Slave Operation, two complete MLA systems are necessary: one system at the local end, and the other at the remote or measurement end of the link. The SLAVE facility allows the remote 'master' receiver display to be monitored by the local 'slave' receiver.

h. **Modulation Index.** The ratio of the peak deviation to the modulating frequency, ie, Modulation Index = $\Delta f/fm$.

i. **Bessel Zero.** An FM signal consists of a carrier and a number of pairs of significant sidebands. As the Modulating Index varies, the amplitudes of the carrier and pairs of sidebands vary and for certain modulation indices the amplitude of the carrier or pairs of sidebands become zero. This null condition is known as a 'Bessel Zero'. A Modulation Index of 2.4048 and a modulating frequency of 83.333kHz will produce a Bessel Zero (carrier null only) when the deviation is 141kHz rms (ie, 200kHz pk-pk). A Bessel Zero is also referred to as a Crossby Null.

Table 1-4 3710A IF/BB Transmitter Specifications

Sweep

Frequency:
INTernal mode: 70Hz ±3Hz.
LINE mode: Locked to line frequency.
Option mode: As for INT (Opt. 015 not fitted).
EXTernal mode: See EXT SWEEP INPUT.

Sweep Output:
Level: 0 to 25V pk-pk min into 10K ohm.
Harmonics: >45dB below fundamental.

Ext. Sweep Input:
Frequency: 18 to 100Hz.
Input Level: 4V pk-pk maintains system calibration ±20%.
Impedance: >7k ohm.

IF

Frequency:
Scale: 45 to 95MHz ±0.5MHz.
Stability: ±100kHz/5hr period, after 1/2hr warm-up period (at 70MHz).

Deviation:

±5% 100kHz to 500kHz
Scale: 0.5 to 500kHz
±12% 10kHz to 100kHz

Sweep Width:

±2MHz INT and LINE sweep
Scale: 0 to 50MHz
±20% EXT sweep (4V pk-pk input)

Reduce: Lamp lights when outside 45 to 95MHz range by 3MHz ±1MHz.
Auto Reduction (3710A only): When BB frequency is greater than 500kHz, the Sweep Width reduces by 2 x BB FREQUENCY ±10%

IF Output
Power: Reference level of +10dBm ±0.5dB (IF VERNIER at 0).
IF VERNIER: Not less than ±1dB.
IF ATTENUATOR: 0 to 61dB in 1dB steps.
Attenuator accuracy: ±0.1dB or ±1% whichever is greatest.
Harmonics: >28dB below fundamental.
Impedance: 75 ohm.
Return Loss: 55 to 85MHz, better than 30dB
45 to 95MHz, better than 28dB

Aux Output

IF Level:
Level: Not less than -10dBm.
Impedance: 75 ohm.
Return Loss: >20dB.

70MHz Xtal:
Frequency: 70MHz ±5kHz.
Power: +10dBm ±0.5dB.
Harmonics: >28dB below fundamental.
Impedance: 75 ohm.
Return Loss: >26dB.

AM Input

Frequency: 500kHz to 10MHz.
Input Level: 0dBm.
Modulation depth: 0 to 15%.
Dial Accuracy: ±15% of setting.

Impedance Converter (OPT 004)

Can be used for BB + SWEEP OUTPUT or BB OUTPUT

Input Impedance:	75 ohm unbalanced	
Output Impedance:	124 ohm balanced	
Frequency Range:	18Hz to 100Hz 80kHz to 10MHz	
Conversion:	18Hz to 100Hz,	1:1 Voltage Conversion ±0.5dB
	80kHz to 10MHz,	1:1 Power Conversion ±0.5dB
Balance:	18Hz to 100Hz	1%
	80kHz to 1MHz	1%
	1MHz to 10MHz	3%

Table 1-5 3715A/3716A BB Transmitter Specifications

Sweep

BB + Sweep Output

*Level:	3716A	0 to 5.5V pk-pk (min) x K at BB frequencies of 500kHz and less.
	3716A	0 to 5.5V pk-pk (min) x W at BB frequencies of 2.4MHz and above.
	3715A	0 to 5.5V pk-pk (min) x K

Harmonics: >40dB below fundamental
Output Impedance: 75Ω nominal.

Baseband

Frequency
83.333, 250, 500kHz } ±2Hz or ±5ppm whichever is greatest
2.4, 4.43, 5.6, 8.2MHz (3716A only) }
EXT (3715A only): refer to EXT BB INPUT.

BB Output
Level: +10dBm ±0.5dB reduced by not less than 1dB by VERNIER control.
Harmonics: >38dB below fundamental.
Impedance: 75 ohm.
Return Loss: Better than 30dB.

BB + Sweep Output
Level: 0 to -49dBm in 1dB steps determined by BB POWER control. VERNIER control gives a continuous variation of not less than 1dB. } ±0.5dB at 0dBm, ±1dB at other levels
Harmonics: >38dB below fundamental.
Impedance: 75 ohm.
Return Loss: Better than 30dB.

Ext BB Input (3716A only)
Frequency: 80kHz to 10MHz.
Level: -10dBm maintains calibration ±10%.
Impedance: 75 ohm.
Return Loss: Better than 30dB.

Reduce BB Frequency (3716A only)
When the BB frequency is greater than 500kHz the lamp lights if SWEEP WIDTH control is set to less than 4 x BB FREQUENCY ±10%.

*3716A: At BB frequencies of 500kHz and less, K is determined by 3710A SWEEP WIDTH and 3716A SWEEP CAL controls.

At BB frequencies of 2.4MHz and above, W is determined by 3710A SWEEP WIDTH and 3716A SWEEP CAL and BB FREQUENCY controls.

3715A: K is determined by 3710A SWEEP WIDTH and 3715A SWEEP CAL controls.

$$K = \frac{\text{IF Sweep Width (in MHz)}}{50} \qquad W = \frac{\text{IF Sweep Width (in MHz)} - 2 \times \text{BB Freq (in MHz)}}{50}$$

Table 1-6 3702B IF/BB Receiver Specifications

Y1 DISPLAY

Switch	Meter	Calibration
REF	IF	None
IF*	IF	0.1, 0.3 or 1.0dB
BB*	BB*	1, 3 or 10%
RET LOSS*	RET LOSS*	Uses Return Loss attenuator
EXT*	–	50mV or 10% of input

*Not with Y2 DISPLAY in SPECTRUM

Y2 DISPLAY

Switch	Calibration
SPECTRUM	None
IF	0.1, 0.3 or 1.0dB
DELAY	From 3703B/3705A
SLAVE	Adopts remote display calibration

IF CHARACTERISTICS

IF INPUT
Frequency Range: 70 ±25MHz.
AFC Capture Range: 70 ±3MHz.
AFC Hold-In Range: 70 ±25MHz
Input Power Range: +21dBm to -10dBm. 31dB IF LEVEL attenuator compensates for power levels greater than -10dBm.
Power Measurement Accuracy: ±0.5dB.
Input Impedance: 75 ohm.
Return Loss: >30dB (55 to 85MHz; >28dB (45 to 95MHz)
Calibration Magnitudes: 0.1, 0.3, 1.0dB ±10%.
Flatness: ±0.05dB up to +5dBm; ±0.1dB from +5 to +21dBm back-to-back System Check, 45 to 95MHz.

Frequency Markers
Centre Marker: 70MHz ±100kHz.
Sliding Markers: 0 to 25MHz, offset.
Offset Dial Accuracy: ±1MHz.
Marker Comb: 2MHz ±100kHz.

Demodulator
Frequency Range: 80kHz to 5.6MHz.
Deviation Range: 10 to 500kHz rms.

Spectrum
Use IF INPUT, AFC inoperative.
Centre Frequency: 70MHz.
Scan Width: ±0.5 to ±9MHz.
Crystal Marker: 70MHz ±5kHz.
Nulling Sensitivity: Detects ±0.1dB change in modulation index at a Bessel Zero.

Return Loss
NOTE: Return Loss requires frequency replica at IF INPUT to lock AFC.
Input Power Range: -22dBm to -50dBm.
Flatness: 1dB 70 ±25MHz
Input Impedance: 75 ohm..
Return Loss: >28dB.

BB CHARACTERISTICS

BB INPUT 75 ohm (OPT 004: addition of 124 ohm bal)
Frequency Range: 80kHz to 10MHz, Sweep 18 to 100Hz.
Input Range: BB Power -49 to -10dBm. Sweep Voltage 600mV to 10V pk-pk, for a 10cm ±5mm trace deflection.
Measurement Accuracy: BB Power ±0.5dB.
Input Impedance: 75 ohm unbalanced Return Loss >26dB. (124 ohm bal for OPT 004).

Calibration
Calibration Magnitudes: 1, 3, 10%.
Accuracy: ±10%.
Display Bandwidth: 1, 5kHz.

DISPLAY CHARACTERISTICS

CRT
Post accelerator, 6kV accelerating potential; aluminized P2 phosphor; safety glass faceplate. 8 x 10 div parallax free internal graticule.

Horizontal Deflection

Sweep Source
INT IF: Recovered from swept IF INPUT.
EXT: From EXT SWEEP INPUT.
EXT BB+: Recovered from BB INPUT if signal also includes sweep.
EXT BB-: Same as EXT BB+ but reversed sweep direction.

Ext Sweep Input
Amplitude: 600mV to 10V pk-pk maximum.
Frequency Range: 18 to 100Hz sinusoidal.
Input Impedance: 5k ohm nominal.

AGC
Displayed sweep width remains constant to within 5mm for 3 to 50MHz IF Sweep Width and 600mV to 10V pk-pk applied to BB INPUT or EXT SWEEP INPUT.

Vertical Deflection
Y1 and Y2 controlled by respective DISPLAY switches (see Y1 DISPLAY and Y2 DISPLAY specifications).

Ext Input (Y1)
Function: Operates as a conventional oscilloscope input.
Frequency Range: dc to 12kHz (3dB).
Maximum Input: 0.5V pk-pk
DC Offset Range: ±2V maximum.
Calibration: 50mV ±5%.
10% ±1% of input.
Input Impedance: 10k ohm nominal.
Sensitivity: 0.5mV/cm.

Slave
Permits the measurement made by a remote 3702B to be reproduced locally with virtual immunity from the link return path characteristics.

Slave Output
Level: 50 ±10mV/cm of Y1 or Y2 trace with frequency markers added.
Output Impedance: 2k ohm nominal.

Table 1-7 3703B/3705A Receiver Plug-in Specifications

	3703B Group Delay Detector	3705A Differential Phase Detector
INPUT		
IF Frequencies	83.333kHz, 250 & 500kHz	83.333, 250 and 500kHz 2.4, 4.43, 5.6 and 8.2MHz (for Optional frequencies see para. 1-11)
PHASE DETECTOR		
Capture Range	±5 Hz [OPT 009 ±15Hz]	±5Hz at 83.333, 250 and 500kHz [OPT 010/011/012 ±15Hz] ±5ppm at 2.4, 4.43, 5.6 and 8.2MHz
CALIBRATION	1,3 and 10 ns	1, 3 and 10ns at 83.333, 250 & 500kHz 1°, 10° & 20% radian at 2.4, 4.43, 5.6 & 8.2MHz.
Accuracy	±10%	±10%
MEASUREMENT BANDWIDTH	1, 5 and 10kHz ±10%	1, 5 and 10kHz ±10%
DYNAMIC RANGE	>200 ns	>200ns at 83.333, 250 & 500kHz >18° or 31.4% radian at 2.4, 4.43, 5.6 and 8.2 MHz
OUTPUT	The output, internally connected to the 3702B, is a voltage proportional to the instantaneous value of group delay or differential phase variations	

Table 1-8 System Specifications

GENERAL

		3710A	3715A	3716A	3702B	3703B	3705A
POWER SUPPLY:	Voltage Frequency Power	115, or 230V ±10% 48 to 66Hz 100VA maximum	From 3710A		115, or 230V ±10% 48 to 66Hz 100VA	From 3702B	
TEMPERATURES:	Operating Storage	0° to 50°C (32° to 122°F) -40° to 65°C (-40° to 149°F)					
WEIGHTS: *with plug-in	Net Shipping	35lb (16kg) *58lb (26kg)	3.5lb (1.5kg) 10lb (4.5kg)	4.25lb (2kg) 11lb (5kg)	46lb (21kg) *80lb (36kg)	3lb (1.4kg) 9lb (4kg)	3.25lb (1.5kg) 10lb (4.5kg)
DIMENSIONS	Width Height Depth	16.75in (425mm) 6.75in (172mm) 18in (457mm)	5in (127mm) 4.7in (120mm) 14in (356mm)		16.75in (425mm) 8.5in (216mm) 18in (457mm)	3.6in (92mm) 8.25in (210mm) 10.5in (267mm)	

Table 1-8 System Specifications (continued)

FIXED FREQUENCY

Measurement	Range		Accuracy	Frequency Band
	Maximum	Minimum		
* IF Power IF Gain IF Loss	+21dBm +72dB 20dB	-10dBm 0dB 0dB	±0.5dB ±1dB ±1dB	45 to 95MHz
* BB Power BB Gain BB Loss	-10dBm 39dB 59dB	-49dBm 0dB 0dB	±0.5 ±1dB ±1dB	†50kHz to 10MHz
Modulator Sensitivity	141kHz RMS/-49dBm	141kHz RMS/0dBm		70 ±3MHz (at IF OUTPUT)
	Using 83.3kHz BB frequency and first Bessel Zero (2.405). Accuracy 1kHz.			
Demodulator Sensitivity	-10dBm/x kHz RMS x can be anywhere in the range 10 to 500kHz RMS	-49dBm/ x kHz RMS		45 to 95MHz (at IF INPUT)
	Using calibrated deviation control and measuring BB power output from demodulator.			

†Requires removal of 3705A/3703B to avoid built in LP filter at BB Frequencies other than indicated on 3705A/3703B.

*Receiver only

Table 1-8 System Specifications (continued)

SWEPT FREQUENCY

Measurement	IF Range (MHz)	Range	Maximum Sensitivity	Maximum Inherent Slope		Maximum Inherent Noise (rms)			
				BB-BB	IF-IF	BB Freq.	BB-BB at -40dBm	IF-IF	
IF Response	45 to 95	0 to ±3dB via Y1 0 to ±3dB via Y2 10 to 49dB via RETURN LOSS	0.1dB/cm	—	±0.05dB at +5dBm ±0.1dB from +5 to +21dBm ±0.5dB via RETURN LOSS		—		
BB Linearity & Differential Gain	50 to 90 45 to 95	0 to 50%	0.25%/cm	0.1%	0.2% 0.4%		—		
Group Delay	55 to 85 50 to 90 45 to 95	200ns	0.25ns/cm	0.1ns	0.4ns 0.6ns 1ns	83.3kHz 250kHz 500kHz	1.2ns 0.4ns 0.2ns	0.6ns 0.2ns 0.1ns	200kHz rms dev.
Differential Phase	55 to 85 50 to 90 45 to 95	18° 31.4% radian	0.5°/cm	0.1°	0.4°, 0.4°, 0.6° at 2.4 MHz; 0.4°, 0.6°, 0.8° >2.4 MHz	2.4MHz 4.43MHz 5.6MHz 8.2MHz	0.2° 0.2° 0.2° 0.4°	0.1° 0.1° 0.1° †	500kHz rms dev.
IF Return Loss	45 to 95	10 to 49dB (Accuracy depends on hybrid used)	1dB/cm	—	1dB		—		

NOTE: for the Receiver to lock automatically on the received signal, an IF signal within the range 70 ±3MHz is necessary.

† At 8.2MHz an external demodula or can be used for BB to IF and IF to IF measurements

SECTION II

INSTALLATION AND DESCRIPTION

2-1. INTRODUCTION

2-2. This section contains information on identification, unpacking, inspection, storage, and mechanical and electrical installation.

2-3. IDENTIFICATION

2-4. A Hewlett-Packard instrument is identified by a 10-character serial number on a plate attached to the rear panel. The title page of the manual lists the serial numbers of instruments to which it applies. If an instrument serial number does not agree with those listed on the title page, the differences will be covered by Manual Change Sheets supplied with the manual.

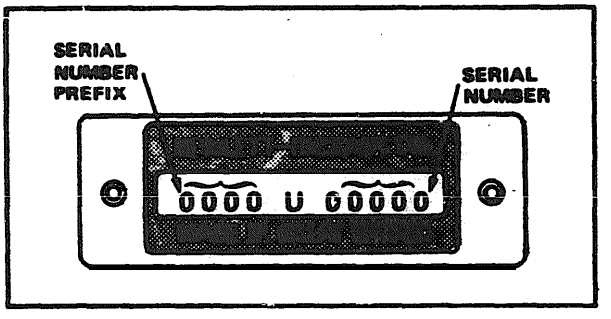


Figure 2-1 Instrument Identification

2-5. UNPACKING AND INSPECTION

2-6. Mechanical Inspection

2-7. If damage to the shipment carton is evident, ask that an agent of the carrier be present when the instrument is unpacked. Inspect the instrument for visible signs of damage (scratches, dents, broken knobs etc). Check for the presence of all furnished accessories, as listed in Table 2-l.

2-8. Electrical Inspection

2-9. After completing the Preparation for Use and the Electrical Preparation (Paragraphs 2-12 through 2-22), perform the back-to-back checks detailed in the Operating Instructions publication.

2-10. Claim for Damage

2-11. If the instrument is mechanically damaged or fails to perform to measurement accuracy, notify the carrier and the nearest Hewlett-Packard Sales and Service Office without delay. (Sales and Service Offices are listed at the back of this Manual.) Retain the shipping carton and packaging material for inspection by the carrier. The Hewlett-Packard Sales and Service Office will arrange for the repair or replacement of damaged instrument without waiting for any claim against the carrier to be settled.

2-12. PREPARATION FOR USE

2-13. Mechanical Preparation

2-14. COOLING. Cooling is assisted by a fan fitted to the rear panel of the instrument. Make sure that the filter screen is fitted and is clean. The temperature of the surrounding air must not exceed 50°C. Clearances for ventilation should be 3 to 4 inches at the side and care must be taken to ensure that other instruments do not discharge hot air near the side ventilators. The clearances provided by the plastic feet in bench stacking, and the filler strips in rack mounting, are adequate for the top and bottom cabinet surfaces.

2-15. BENCH USE. The IF/BB Transmitter and IF/BB Receiver cabinets have plastic feet which are shaped to make full width modular instruments self-aligning when stacked. The IF/BB Transmitter has a foldaway tilt stand which permits the instrument to be inclined for more convenient viewing of the control panel.

2-16. RACK MOUNTING. Rack mounting kits are available for the IF/BB Transmitter and IF/BB Receiver cabinets, and all necessary hardware and instructions are included in the kits.

2-17. Electrical Preparation

2-18. The instrument will operate on 100, 120, 220 or 240 volts RMS, + 5% to - 10%. Operating voltage is selected by a "circuit card" inserted into the line module at the rear of each instrument.

Table 2-1 Accessories

Accessories	Standard (BNC)	Option 002 (Siemens 2.5mm)	Option 003 (Siemens 1.6mm)	Option 004 (WECO)
Accessory Kit (comprising)	15550A	15550A Option 002	15550A Option 003	15550A Option 004
If Hybrid	15520A	15520A option 002	15520A Option 003	15520A (BNC only1
17dB Mismatch	15521A	15521A Option 002	15521A Option 003	l5521A (BNC only)
75ohm Termination	2x15522A	2xl5522A option002	2x15522A Option 003	2x15522A (BNC only)
48in Cable	3xl5525A (BNC/BNC)	3x15525A (Siemens/Siemens)	3x15525A (Siemens/Siemens)	3x15548A (BNC/WECO) & 2xl5551A (WECO/WECO)
Plastic Storage Box	1540-0179	1540-0179	1540-0179	1540-0179
Rack Mounting Kits	5060-0776 for the 3710A 5060-0777 for the 37028			
Extender Boards	03710-70090 for the 3710A 03710-70091 for the 3715A/3716A 5060-4403 for the 3702B			
Power Cables	a 8120-1351 (STANDARD) or 8120-1348 (USA & CANADA) or 8120-1349 (SCANDINAVIA)			

2-19. The Input Power Module is designed in such a way that the power cable connector must be removed to enable access to the mains fuse. The design also requires that the fuse has to be removed before voltage selection can be performed.

CAUTION

BEFORE CONNECTING INSTRUMENTS TO AC POWER SUPPLY BE SURE THAT THE CORRECT VOLTAGE IS SELECTED AND THAT THE LINE FUSE IS CORRECTLY RATED.

2-20. POWER CABLE. The instrument is equipped with a detachable 3-wire power cable. Proceed as follows for installation:

a. Plug the flat connector of the power cable into the Spin AC LINE jack on the rear pane? of the instrument.

Connect the power cable plug (2-blade with round earthing pin) to a suitable 3-wire power outlet. Exposed metal parts of the instrument are earthed through the round pin on the plug. If the plug does not fit the available power outlet, either. use a 3-blade to 2-blade adaptor (hp Part No. 1251-0068) or cut off the plug and fit one to suit. If the instrument is powered via an adaptor, from a 2-contact outlet, the pigtail on the adaptor should be earthed.

2-21. The power cable supplied with each instrument is varied according to the country in which it is purchased. Care should be taken when installing a new plug to comply with the regulations regarding colour coding of power cables. The two main colour codings are listed in Table 2.2.

Table 2-2 Power Cable Colour Coding

Conductor	United States	Rest of World
Line	Black	Brown
Neutral	White	Blue
Ground	Green/Yellow	Green/Yellow

2-22. WARM-UP PERIOD. The Microwave Link Analyzer is ready for operation immediately after switching on - BUT - until the temperature has stabilized it is recommended that the IF centre frequency be checked as in the Operating Instructions, under Back-to-Back Checks, before making *precise* measurements during the first thirty minutes after switch-on.

2-23. STORAGE AND SHIPMENT

2-24 if the instrument is to be shipped to Hewlett-Packard for service, repair or modification, attach a tag to the instrument identifying the owner and indicating the attention required; include the full 10-character serial number of the instrument. In any correspondence, please identify the instrument by the Model Number and the full 10-character serial number.

2-25. To protect the instruments during storage and shipment always use the best packaging methods available. The nearest Hewlett-Packard Sales and Service Office can provide material such as that used for original packaging. The following are recommended packaging methods:

a. RUBBERISED HAIR. Wrap the instrument in protective paper. Pack in a strong corrugated cardboard container (350lb/sq in bursting test) with 2-inch pads of rubberised hair placed along ail surfaces of the instrument. insert fillers between pads and container to ensure a snug fit.

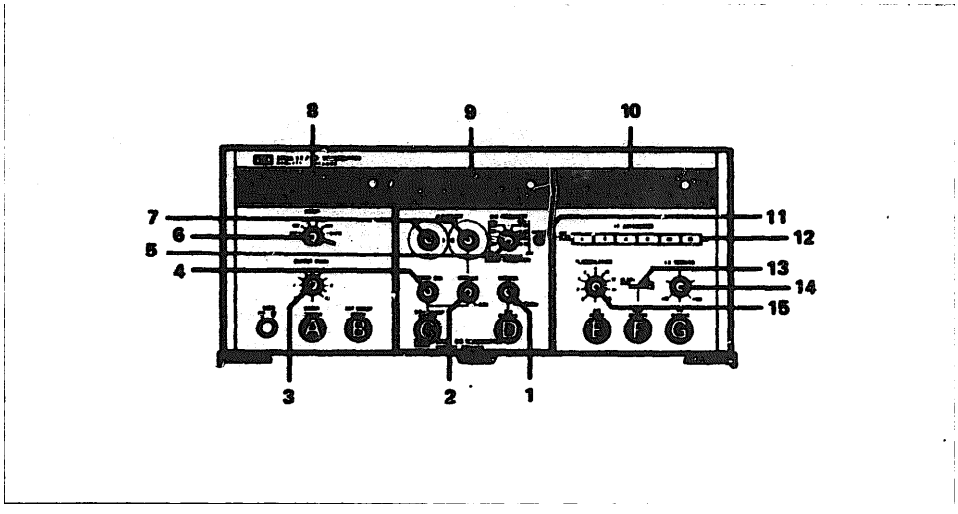
b. EXCELSIOR. Wrap the instrument in protective paper. Pack in a strong corrugated cardboard container (350lb/sq in bursting test) with a layer of excelsior about 6in thick packed firmly against all surfaces of the instrument.

2-26. Conditions during storage and shipment should normally be limited as follows:

a. Minimum temperature -40°F (-40°C).

b. Maximum temperature 149°F (65°C).

2-27. CRT WARRANTY. The CRT used in the 3702B is covered by a separate warranty from the instrument. The CRT Warranty is included at the back of the 3702B Service Manual, for use in the event of CRT failure during the warranty period.



TRANSMITTER (3710A IF/BB Transmitter & 3716A BB Transmitter)

Front Panel Description

A. SWEEP OUTPUT provides a high impedance version of the sweep signal. The frequency is selected by the SWEEP switch (6) and the amplitude is determined by the OUTPUT LEVEL control (3).

B. EXT SWEEP INPUT allows application of an external sweep signal in the range 10 to 100Hz; to maintain calibration, a level of 4V pk-pk is required. The SWEEP switch (6) should be in the EXT mode.

C. BB+ SWEEP OUTPUT provides a combined BB test tone and sweep signal. The test-tone at a maximum level of OdBm, the sweep signal at a maximum amplitude of 5V pk-pk.

D. BB OUTPUT provides a BB test-tone, selected by the BB FREQUENCY switch [5], at a nominal level of +10dBm.

E. AM INPUT allows external signals in the frequency range 60kHz to 10MHz at OdBm to be amplitude modulated onto the IF OUTPUT signal. The depth of modulation is determined by the % MODULATION control [15].

F. AUX OUTPUT frequency is controlled by the AUX OUTPUT switch [13]. In the 70MHz XTAL mode, the AUX OUTPUT supplies a 70MHz crystal controlled signal at a level of +10dBm. In the IF (UNCAL) mode, the AUX OUTPUT supplies an IF signal frequency similar to the IF OUTPUT signal but at a level of not less than -10dBm.

G. IF OUTPUT supplies an IF signal swept or unswept in the range 45 to 95MHz. The IF signal has a maximum sweep width of 50MHz and can be frequency modulated with the BB test-tones selected by the BB FREQUENCY switch [5]. The output reference level is +10dBm and the output may be varied between +11dBm and -52dBm using the IF ATTENUATOR [12] and IF VERNIER control [14].

EXT BB INPUT (3715A BB Transmitter ONLY) allows use of an external BB test-tone in the range 80kHz to 10MHz. The BB FREQUENCY switch [5] must be in the EXT mode.

SLAVE INPUT (rear panel) accepts the display information from the SLAVE OUTPUT of the 3702B IF/BB Receiver. This information is used to modulate the IF OUTPUT signal which is applied to the local end via a separate 'playback' channel.

1. BB OUTPUT VERNIER varies the level of the BB OUTPUT signal by not less than 1dB.

2. BB + SWEEP OUTPUT VERNIER varies the level of the BB + SWEEP OUTPUT baseband signal by 0 to -1dB.

3. OUTPUT LEVEL control varies the amplitude of the SWEEP OUTPUT signal from 0 to 25V pk-pk.

4. SWEEP CAL control varies the amplitude of the BB + SWEEP OUTPUT sweep signal from 0 to 5V pk-pk.

5. BB FREQUENCY switch selects the baseband frequency to be applied to the BB Outputs and to be modulated onto the IF signal for the IF Outputs.

6. SWEEP switch selects the sweep frequency that will be applied to the IF Outputs, BB + SWEEP OUTPUT, or SWEEP OUTPUT.

7. BB POWER (-dBm) attenuator varies the BB signal level of the BB + SWEEP OUTPUT from 0 to -49dBm in 1dB steps.

8. SWEEP WIDTH control selects the IF frequency band to be swept from 0 to 50MHz about an IF centre frequency.

9. DEVIATION control allows the deviation of the IF carrier signal to be varied from 0.5 to 500kHz rms by the BB signal.

10. IF FREQUENCY control selects the IF centre frequency in the range 45 to 95MHz.

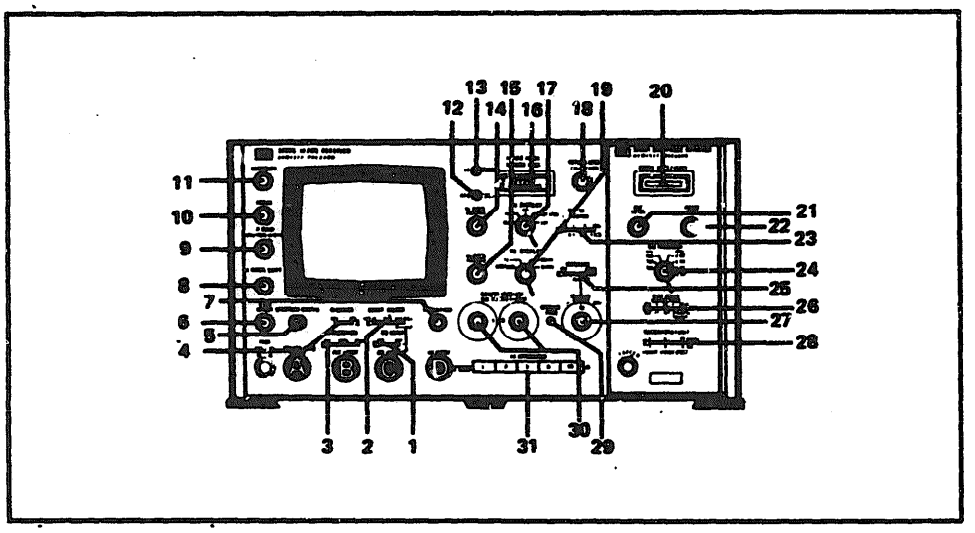
11. BB FREQUENCY REDUCE Lamp when lit, indicates that the sidebands are not being swept through the full IF range.

12. IF ATTENUATOR varies the IF output level by 0 to 61dB in 1dB steps.

13. AUX OUTPUT switch selects either a 70MHz crystal output frequency at a level of +10dBm or a frequency replica of the IF OUTPUT at a level of not less than -10dBm.

14. IF VERNIER control varies the IF OUTPUT range by ±1dB over the IF ATTENUATOR range.

15. % MODULATION control varies the depth of amplitude modulation applied to the IF OUTPUT signal.



RECEIVER (37028 IF/BB Receiver &3705A Diff Phase Detector)

Front Panel Description

A. RETURN LOSS INPUT is a high sensitivity IF input for return loss measurements and increased sensitivity IF amplitude response measurements. The IF amplitude response measurement dynamic range is up to 22dB.

B. EXT INPUT provides a dc coupled external Y-axis input to the CRT. This input has a sensitivity of 0.5mV/cm and a frequency range of 0 to 25kHz.

C. BB INPUT accepts BB signals for measurement against a base of IF frequency on the CRT. The BB signal must be *in* the range 80kHz *to* 1OMHz at a level between -10 to -49dBm. A combined BB + Sweep signal may be applied providing the BB signal is within the limits stated and the sweep signal is in the range 10 to 100Hz up to an amplitude of 5V pk-pk.

D. IF INPUT accepts swept or unswept IF signals in the range 45 to 95MHz at levels between -10 and +21dBm.

EXT SWEEP INPUT (rear panel) accepts sweep signals in the range 10 to 100Hz at amplitudes between 0.6 and 1OV pk-pk.

SLAVE OUTPUT (rear panel) provides the Y1 Y2 vertical display information to the Transmitter, during slave operation.

1. BB INPUT switch selects either the IN Ternally demodulated BB signal or an EXTernal BB signal for application to the BB amplifier, display and mater circuitry.

2. SWEEP SOURCE switch selects the source of the sweep signal for application to the horizontal deflection circuitry. To cater for negative and positive polarity modulators. the EXT BB+ and EXT BB- positions allow the low frequency and of the trace to be positioned on the left of the display.

3. CALIBRATION switch selects either an internally genefated 50mV square wave or a 10% of EXT INPUT calibration signal when the Y1 DISPLAY signal [17] is in the EXT mode.

4. BLANKING switch in the OFF position enables the forward and return traces to be phased together. In the ON position, only the forward trace is displayed.

5. SPECTRUM CENTWE control enables the spectrum marker to be positioned in the centre of the screen.

6. Y EXT OFFSET control enables the dc offset of the EXT INPUT to be varied by ±2V.

7. x POSITION control enables the trace to be positioned centrally on the screen.

8. X PHASE SHIFT control allows the recovered information to be phased with the sweep signal to ensure accurate measurements.

9. X GAIN/SPECTRUM WIDTH controls. The X GAIN control allows the width of the trace to be varied, normally adjusted to give a 10cm trace width. The SPECTRUM WIDTH control varies the width of spectrum window from 18MHz to 1 MHz.

10. FOCUS control adjusts the focus of the traces.

11. INTENSITY control adjusts the brilliance of the display.

12. AFC LOCK Lamp when lit indicates that the internal demodulator is locked to and tracking with the swept I F INPUT signal.

13. IF UNCAL Lamp when extinguished shows that the IF INPUT signal level is at the correct amplitude for calibration of CRT display.

14. Y1 GAIN/POSITION controls vary the sensitivity and position respectively of the Y1 trace.

15. Y2 GAIN/POSITION controls vary the sensitivity and position respectively of the Y2 trace.

16. IF/BB LEVEL – RETURN LOSS Meter is a centre zero meter indicating the IF level, BB level or Return Loss dependent upon the setting of the Y1 DISPLAY switch [17].

17. Y1 DISPLAY switch controls the function of the Y1 trace and IF/BB LEVEL - RETURN LOSS meter [16]. The five positions of the switch are:

REF : The Y1 trace is a straight line but can still display frequency markers. The IF LEVEL meter [16] and IF ATTENUATOR [31] measure the mean IF INPUT power.

IF: The Y1 trace displays the amplitude variations of the IF INPUT signal. The IF LEVEL meter [16] and IF ATTENUATOR [31] measure the mean IF INPUT power.

BB: The Y1 trace displays BB level variations with IF frequency. The baseband signal may be internally demodulated from the IF INPUT or be applied via the BB INPUT from an external demodulator.

RET LOSS: The Y1 trace displays the return loss variations of a test item port. The RETURN LOSS meter [16] and RETURN LOSS attenuator [30] measure the return loss of the test item port in dB.

EXT: The Y1 trace displays the signal applied to the EXT INPUT to a base of frequency selected by the SWEEP SOURCE switch [2].

18. RETURN LOSS CALIBRATION control is used to set up the Receiver when making return

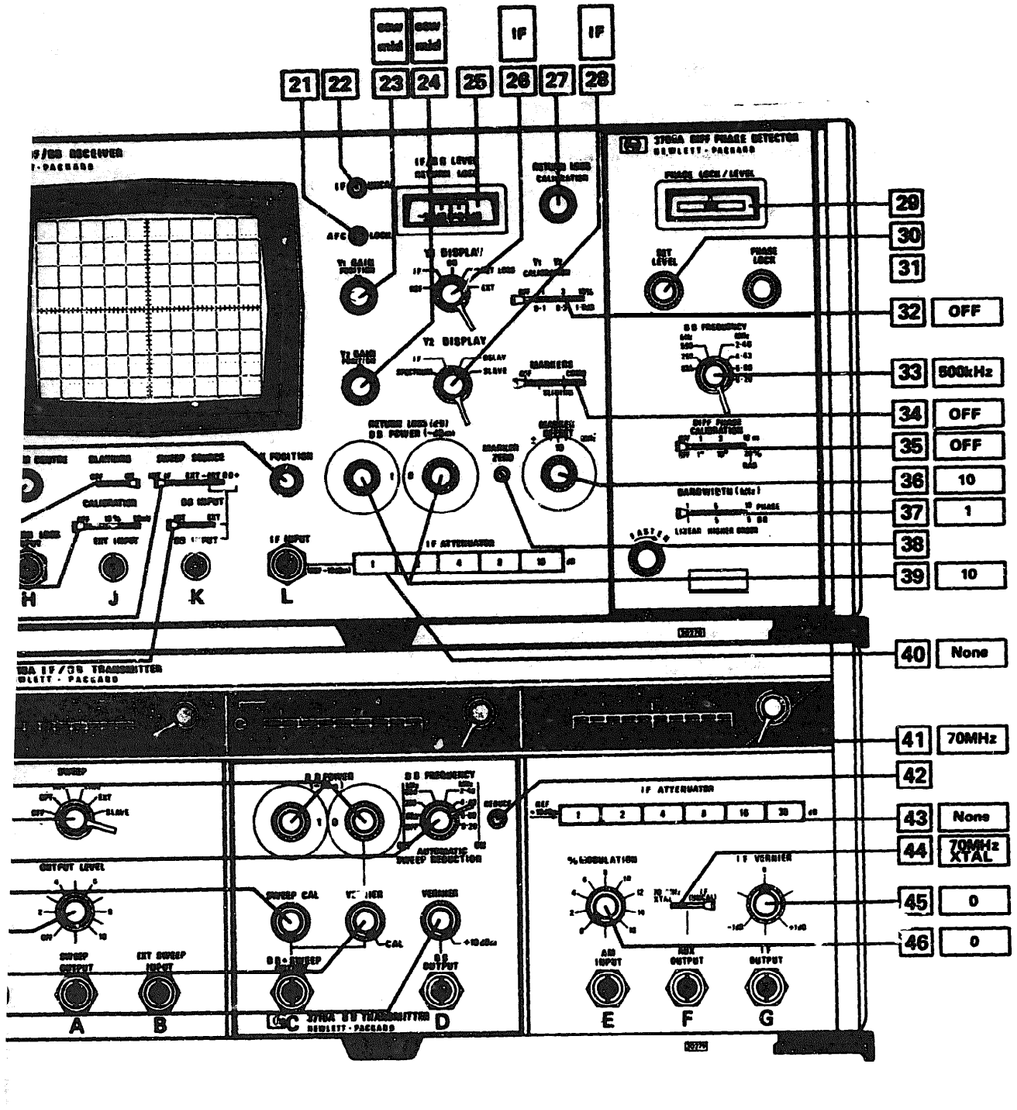


Figure 3-1 Reference Settings

3-7. 3702B PRELIMINARY SETTING-UP

Procedure	Troubleshooting
1. Set the controls to the Reference Settings indicated in Paragraphs 3-5 and 3-6.	
2. Turn the INTENSITY control [20] clockwise until two spots just appear on the screen.	**Spots do not appear; refer to 3702B General Service sheet G5.**
3. Adjust the FOCUS control [29] and if necessary the ASTIGMATISM control (rear panel) to give a sharp round spot.	**Sharp, round spot is not obtainable; refer to 3702B General Service Sheet G5.**
4. Adjust the X POSITION control [16] to centralize the spots in the centre of the screen.	**Centralization of spots is not possible; refer to 3702B General Service Sheet G5.**
5. Set the Y2 DISPLAY switch [28] **to SPECTRUM and adjust the INTENSITY control [20] to display two traces of normal brilliance. Adjust the X GAIN control [18] for a 10cm X display.** **NOTE: A marker may be displayed on the Y1 trace.**	**Faulty X display when the Y2 DISPLAY switch switched to SPECTRUM; refer to 3702B** Figure **G1-1, Test Point 1H.**
6. Check that the traces can be adjusted off the screen at the top and bottom by the Y1 POSITION [23] and Y2 POSITION [24] controls. Reset the controls to mid-position.	**Position of traces cannot be properly controller refer to 3702B General Service Sheet G5.**
7. Check that the traces are parallel to the CRT graticule lines and if necessary adjust the TRACE ALIGN control (rear panel).	**Adjustment of TRACE ALIGN control has no effect; refer to 3702B Assembly Service Sheet A6.**

3-8. SPECTRUM SETTING-UP

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5 through 3-7.***	
2. Set the SPECTRUM WIDTH control [18] fully clockwise.	
3. Adjust the SPECTRUM CENTRE control [14], if necessary, to display a marker on the Y1 trace.	Marker not present; refer to 3702B Figure G1-1, Test Point 1M.
4. Set the BLANKING switch [13] to OFF, and adjust the X-PHASE SHIFT control [17] to display two markers.	Blanking inoperative; refer to 3702B General Service Sheet G5, Test Point 5G.
5. Adjust the X PHASE SHIFT control [17] to superimpose the markers on the forward and return traces.	Markers cannot be superimposed; refer to 3702B General Service Sheet G5, Test Points 5D and 5E.
6. Adjust the SPECTRUM CENTRE control [14] to bring the marker to the centre of the screen.	Marker not adjustable to centre of screen; refer to 3702B General Service Sheet G2, Test Point 2E.
7. Turn the SPECTRUM WIDTH control [18] fully anticlockwise and repeat steps 5 and 6 if necessary.	
8. Set the BLANKING switch [13] to ON.	
9. Check that the marker remains in the centre of the screen as the SPECTRUM WIDTH control [18] is turned from fully anticlockwise to fully clockwise.	Marker does not remain in the centre of the screen; refer to 3702B Assembly Service Sheet A4.

3-9. IF FIXED FREQUENCY

3-10. IF Fixed Frequency-3710A 70MHz Crystal Output and Spectrum Marker

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. Perform the Procedures as detailed in Paragraphs 3-5 through 3-8.	
2. Set the SPECTRUM WIDTH control [18] anticlockwise and connect the 3710A AUX OUTPUT [F] to the 3702B I F INPUT [L].	
3. Insert 20dB in the 3702B IF ATTENUATOR [40] and check that the 3702B meter [25] reading is on scale.	**Meter reading not on scale, measure the 3710A AUX OUTPUT power level using the Power Meter and the 75/50Ω matching pad.** **AUX OUTPUT level +lOdBm ±0.5dB; refer to 3702B Figure G1-1, Test Point 1F. AUX OUTPUT level *not* +lOdBm ±O.5dB; refer to 3710A Assembly Service Sheet A16.** **Adjustment: 3710A Al6 R4** **3702B A5 R57**
4. Adjust the 3702B Y2 GAIN control [24] to give a birdie display of approximately 3cm on the Y2 **trace.**	**Birdie display not present, measure the 3710A AUX OUTPUT frequency using the Electronic Counter.** **Frequency 70 ±0.0075MHz; refer to 3702B Figure G1-1, Test Point 1J. Frequency not 70±0.0075MHz; refer to 3710A Assembly Service Sheet A16.**
5. **Check that the Y2 birdie coincides with the centre of the Y1 marker.**	**Y1 marker and the Y2 birdie do not coincide. Measure the 3710A. AUX, OUTPUT frequency using the Electronic Counter.** **Frequency 70±0.0075MHz; refer to 3702B Assembly Service Sheet A25. Frequency *not 70* ±0.0075MHz; refer to 3710A Assembly Service Sheet A16.**
6 . **Disconnect the cable from the 3710A AUX OUTPUT [F] and remove the attenuation from the 3702B IF ATTENUATOR [40].**	

3-11. IF Fixed Frequency - IF Level

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5 through 3-7.***	
2. Set the 3702B Y1 DISPLAY switch [26] to If and connect the 3710A IF OUTPUT [G] to the 3702B IF ATTENUATOR [L].	
3. Insert 10dB in the 3710A IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR [40].	
4. Check that the 3702B meter [25] reading is on scale.	Meter reading not on scale, measure the 3710A IF OUTPUT level using the Power Meter and the 75/50Ω matching pad. IF OUTPUT level 0dBm ±0.5dB; refer to 3702B Figure G1-1, Test Point 1F. IF OUTPUT level *not* 0dBm ±0.5dB; refer to 3710A General Service Sheet G3. Adjustment 3710A A1R9 3702B A5R57
5. Set the 3710A IF ATTENUATOR [43] to 11dB and check, by turning the IF VERNIER control [45] clockwise, that the 3702B meter [25] reading can be set to the same reading as that in step 4.	IF VERNIER operation incorrect; refer to 371OA Assembly Service Sheet Al.
6. Set the 3710A IF ATTENUATOR [43] to 9dB and check by turning the IF VERNIER control [45] anticlockwise that the 3702B meter [25] reading can be set to the same reading as that in step 4.	IF VERNIER operation incorrect; refer to 3710A Assembly Service Sheet Al.
7. Reset the 3710A IF ATTENUATOR [43] to 10dB and the IF VERNIER control [45] to 0.	

8. Vary the 3710A IF FREQUENCY control [41] over the range of 45 to 95MHz and check that the total variation in 3702B meter [25] reading does not exceed 1 dB. **NOTE: If necessary, the 3702B IF ATTENUATOR [40] setting may be altered by ± 1dB.**	**Meter reading variation exceeds 1dB over the range 45 to 95MHz. Measure the 3710A I F OUTPUT level using the Power Meter and the 75/50Ω matching pad, over the IF FREQUENCY range 45 to 95MHz. I F OUTPUT level variations *not* greater than 0.1dB; refer to 3702B Figure G1-1, Test Point 1F.** **I F OUTPUT level variations greater than 0.1dB; refer to 3710A General Service Sheet G3.**
9. Reset the 3710A IF FREQUENCY control [41] to 70MHz and the 3702B IF ATTENUATOR (40] to 1OdB.	
10. Set the Y1 DISPLAY switch [26] to REF and check that the 3702B meter [25] reading is the same as in 1F.	**Meter reading incorrect in REF; refer to 3702B General Service Sheet G5, and check the operation of the Y1 DISPLAY witch.**
11. Reset the Y1 DlSPLAY switch [26] to IF.	
12. Check that the IF UNCAL :p [22] lights when the 3710A IF ATTEMUATOR [43] value is increased or decreased by dB.	**The operation of the IF UNCAL lamp is incorrect; refer to 3702B Assembly Service Sheet A5.**

3-12. IF Fixed Frequency

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5 through 3-8.***	
2. ***Connect the 3710A IF OUTPUT [G] to the 3702B IF INPUT [L], insert 10dB in the 3710A IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR [40]. Check that the 3702B meter [25] reading is on scale.***	***Meter reading not on scale; refer to*** Paragraph 3-11.
3. **Adjust the 3710A IF FREQUENCY control [41] to line up the Y2 birdie with the Y1 marker.**	
4. **The 3710A IF FREQUENCY control [41] setting should be 70 ±0.5MHZ.**	**The 3710A IF FREQUENCY control setting not 70 ±0.5MHz. Measure the 371OA IF OUTPUT frequency using the Electronic Counter, with the 3710A IF FREQUENCY control set to 70MHz. Frequency 70 ±0.5MHz; refer to Paragraph 3-10. Frequency not 70 ±0.5MHz; refer to 3710A General Service Sheet G1, Test Point 1B, (DC level only) Adjustment: 3710A A11R7**

3-13. IF Fixed Frequency - Spectrum Width

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-7 through 3-8.***	
2. ***Connect the 371OA IF OUTPUT [G] to the 3702B IF INPUT [L], insert 1OdB in the 371OA IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR [40]. Check that the 3702B meter [25] reading is on scale.***	***Meter reading not on scale; refer to Paragraph 3-11.***
3. ***Adjust the 3710A IF FREQUENCY control [41] to line up the Y2 birdie with the Y1 marker and check that the 371OA IF FREQUENCY control [41] setting is 70 ±0.5MHz.***	***IF FREQUENCY control setting is not 70 ±0.5MHz,, refer to Paragraph 3-12.***
4. **Set the SPECTRUM WIDTH control [18] fully clockwise and note the IF FREQUENCY control [41] setting.**	
5. **Adjust the 3710A IF FREQUENCY control [41] to bring the Y2 birdie to the right-hand edge of the trace.**	
6. **Check that the 3710A IF FREQUENCY control [41] setting is at least 9MHz greater than noted in step 4.**	F FREQUENCY control setting is incorrect. Measure he 3710A IF OUTPUT frequency at 79MHz using he Electronic Counter. Frequency correct +0.5MHz; refer to 3702B General Service Sheet G2, Test Point 2E. Frequency incorrect; refer to 3710A General Service Sheet G1, Test Point 1B. (DC level only) **Adjustment: 3710AA11R8**
7. **Adjust the 37108 IF FREQUENCY control [41] to bring the Y2 birdie to the left-hand edge of the trace.**	

8. Check that the 3710A IF FREQUENCY control [41] setting is at least 18MHz lower than noted in step 6.

IF FREQUENCY control setting is incorrect. Measure the 3710A IF OUTPUT frequency at 61MHz using the Electronic Counter.
Frequency correct ±0.5MHz; refer to 3702B General Service Sheet G2, Test Point 2E.
Frequency incorrect; refer to 3710A General Service Sheet G1, Test Point 1B. (DC level only)
Adjustment: 3710A A11R6

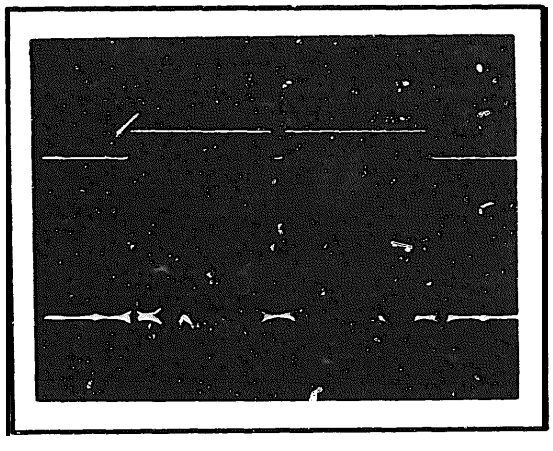
9. Reset the 3710A IF FREQUENCY control [41] to line up the Y2 birdie with the centre of the Y1 marker.

10. Set the 3715A/3716A BB FREQUENCY switch [5] to 500kHz.

11. Turn the SPECTRUM WIDTH control [18] anticlockwise, and check that the first pair of sidebands move off the screen or at least to the trace edges when the SPECTRUM WIDTH control [18] is fully anti-clockwise.

a. 500kHz sidebands not present; refer to 3710A General Service Sheet G1, Test Point 1A.
b. 500kHz sidebands do not move off the trace. Measure the 3715A/3716A BB OUTPUT frequency using the Electronic Counter.
Frequency 500kHz ±2Hz; refer to 3702B
Figure G1-1, Test Point 1J.
Frequency not 500kHz ±2Hz; refer to 3715A/3716A General Service Sheet G1.

3-14. IF Fixed Frequency - Deviation

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. Perform the procedure detailed in Paragraph 3-13.	
2. Set the 3715A/3716A BB FREQUENCY switch [5] to 83AkHz	
3. Adjust the 3702B SPECTRUM WIDTH control [18] anticlockwise, and check that the 83AkHz sidebands are displayed.	**Sidebands are not present; refer to 3710A General Service Sheet Cl, Test Point 1A.**
4. Adjust the 3710A DEVIATION control [8] clockwise until the first carrier null occurs, see waveform below.	
	
5. Check that the DEVIATION control [8] setting is 141 ±7hHz. If not, set the DEVIATION control [8] to 141 kHz and starting from the fully anticlockwise positionof the DEVIATION CALIBRATION control [8] adjust it clockwise until the first carrier null occurs.	**First carrier null cannot be set at 141 kHz; refer to 3710A General Service Sheet G1, Test Point 1 A.**
6. Set the 3715A/3716A BB FREQUENCY switch [5] to 250kHz, and adjust the SPECTRUM WIDTH control [18] to display the carrier and two to four pairs of sidebands.	**25OkHz sidebards are not present; refer to 371 0A General Service Sheet G1, Test Point 1A.**

7. **Adjust the DEVIATION control [8] clockwise until the first carrier null occurs.**

8. **Check that the DEVIATION control [8] setting is 420 ±21kHz.**

First carrier null cannot be set at 420 ±21kHz; refer to 3710A General Service Sheet : I, Test Point 1A.
Adjustment: 3710A AJJR3J

9. Reset the BB FREQUENCY switch [5] to OFF and the DEVIATION control [8] to 100kHz.

NOTE: For instruments with Optional BB Frequency:
Where appropriate substitute 93A for 83A and 277A for 250
In step 5 substitute 157 ±7kHz for 141 ±7kHz
In step 8 substitute 472 ±21 kHz for 420 ±21kHz

3-15 IF Fixed Frequency - AFC Lock

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5 through 3-8.***	
2. ***Connect the 3710A IF OUTPUT [G] to the 3702B IF INPUT [L], insert 10dB in the 3710A IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR [40]. Check that the 3702B meter [25] reading is on scale.***	***Meter reading not on scale; refer to Paragraph 3-11.***
3. ***Adjust the 3710A IF FREQUENCY control [41] to line up the Y2 birdie with the Y1 marker and check that the 3710A IF FREQUENCY control [41] setting is 70 ±0.5MHz.***	***IF FREQUENCY control setting is not 70 ±0.5MHz; refer to Paragraph 3-12.***
4. **Set the Y2 DISPLAY switch [28] to IF, and check that the AFC LOCK lamp [21] is lit.**	**AFC LOCK lamp is not lit; refer to 3702B General Service Sheet G2. Adjustment: 3702B A23 R9. Refer to 3702B Local Oscillator & AFC Adjustment procedures.**
5. **Check that the AFC LOCK lamp [21] remains lit when the Y2 DISPLAY switch [28] is set to DELAY and SLAVE. Reset the Y2 DISPLAY switch [28] to IF.**	**AFC LOCK lamp does not remain lit; refer to 3702B General Service Sheet G2.**
6. **Disconnect the IF signal from the 3702B IF INPUT [L] and set the 3710A IF FREQUENCY control [41] to 67MHz.**	

7.	**Reconnect the IF signal to the 3702B IF INPUT [L] and check that the AFC LOCK lamp [21] lights.**	**AFC LOCK lamp is not lit. Measure the 3710A IF OUTPUT frequency using the Electronic Counter. Frequency correct ±O.5MHz; refer to 3702B General Service Sheet G2. Frequency incorrect; refer to 3710A General Service Sheet G1; Test Point 1B. (DC level only)**
8.	**Disconnect the IF signal from the 3702B IF INPUT [L] and set the 3710A IF FREQUENCY control [41] to 73MHz.**	
9.	**Reconnect the IF signal to the 3702B IF INPUT [L] and check that the AFC LOCK lamp [21] lights.**	**AFC LOCK lamp is not lit, Measure the 3710A IF OUTPUT frequency using the Electronic Counter. Frequency correct ±O.5MHz; refer to 3702B General Service Sheet G2. Frequency incorrect; refer to 3710A General Service Sheet G1, Test Point 1B. (DC level only)**
10.	**Vary the 3710A IF FREQUENCY control [41] over the range 45 to 95MHz, and check that the AFC LOCK lamp [21] remains lit.**	
11.	**Reset the 3710A IF FREQUENCY control [41] to 70MHz.**	

3-16. IF Fixed Frequency - IF (UNCAL) Output

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5 through 3-8.***	
2. ***Connect the 3710A IF OUTPUT [G] to the 3702B IF INPUT [L] insert 10dB in the 3710A IF ATTENUATOR [43] and 1OdB in the 3702B IF ATTENUATOR [40]. Check that the 3702B meter [25] reading is on scale.***	***Meter reading not on scale; refer*** to ***Paragraph 3-11.***
3. ***Vary the 3710A IF FREQUENCY control [41] over the range 45 to 95MHz, and check that' the 3702B meter (251 reading does not vary by more than 1dB, if necessary refer to Paragraph 3-1l step 4.***	***3702B meter reading is incorrect over the range 45 to 95MHz; refer to Paragraph 3-11.***
4. ***Reset the IF FREQUENCY control (41) to 70MHz. Adjust the 3710A IF FREQUENCY control [41] to fine up the Y2 birdie*** **with the** ***Y1 marker, and check that the 3710A IF FREQUENCY control [41] setting is 70 ±0.5MHz.***	***IF FREQUENCY control setting is not 70 ±0.5MHz; refer to Paragraph 3-12.***
5. ***Set*** the ***Y2 DISPLAY switch [28] to IF.***	
6. Disconnect the cable from the 37l0A IF OUTPUT [G] and connect it to the 3710A AUX OUTPUT [F]. 'Set the 3710A AUX OUTPUT switch [44] to IF (UNCAL).	
7. **Adjust the 3702B IF ATTENUATOR [40] to bring the 3702B meter [25] reading on scale.**	**Meter cannot be brought on scale; refer to 3710A General Service Sheet G3, Test Point 3S.**

8. Vary the 3710A IF FREQUENCY control [41] over the range 45 to 95MHz, and check that the 3702B IF ATTENUATOR [4O] can be set to bring the meter on scale.

9. Reset the 3710A IF FREQUENCY control [41] to 70MHz, and the 3702B IF ATTENUATOR [40] to 1OdB. Disconnect the cable from the 3710A AUX OUTPUT [F] and reconnect it to the 3710A IF OUTPUT [G].

Meter cannot be brought on scale; refer to 3710A General Service Sheet G3, Test Point 3S.

3-17. BASEBAND

3-18. Baseband - BB Power

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5, 3-6 and 3-7.***	
2. **Set the 3715A/3716A and 3703B/3705A BB FREQUENCY switches [5] and [33] to 83ΔkHz, the 3702B Y1 DISPLAY switch [26] to BB and the BB INPUT switch [10] to EXT. Set Y2 DISPLAY switch to IF.**	
3. **Connect the 3715A/3716A BB + SWEEP OUTPUT [C] to the 3702B BB INPUT [K].**	
4. **Check that the 3702B meter [25] reading is 0dB ±0.5dB.**	**Disconnect the cable from the 3702B BB INPUT, and connect the 3710A BB + Sweep Output to the 75Ω terminated Oscilloscope Output level is 0.245 ±.015V pk-pk; refer to 3702B Figure G1-1 Test Point 1B. Output level not 0.245 ±.015 pk-pk; refer to 3715A/3716A General Service Sheet G1.** **Adjustment:** 3716A A1R17 3702B A5R60
5. **Check that the 3702B meter [25] reading is 0dB ±0.5dB with the 3715A/3716A BB FREQUENCY switch [5] set to 250 and 500kHz.**	**Disconnect the cable from the 3702B BB INPUT, and connect the 3710A BB + Sweep Output to the 75Ω terminated Oscilloscope Output level is 0.245 ±.015V pk-pk; refer to 3702B Figure G1-1, Test Point 1B. Output level not 0.245 ±.015 pk-pk; refer to 3715A/3716A General Service Sheet G1.** **Adjustment:** 3716A adjustment procedures; BB Level to 3710A.

6.	If 3716A and 3705A plug-in units are fitted, set the 3716A and 3705A BB FREQUENCY switches [5] and [33] to 2.4MHz. Set the 3705A SET LEVEL control [30] fully clockwise and the PHASE LOCK control [31] for a steady 3705A meter [29] reading. Adjust the SET LEVEL control [30] to bring the 3705A meter [29] reading to the green band. Check that the 3702B meter [25] reading is OdB ±0.5dB.	Steady 3705A meter reading not possible; measure the frequency of the 3710A BB OUTPUT using the Electronic Counter. Frequency 2.4MHz ± 12Hz; refer to 3702B General Service Sheet G3, Test Point 3A. 3A correct; refer to 3705A manual Frequency incorrect; refer to 3716A General Service Sheet G1. 3702B meter reading not OdBm ±O.5dB; proceed as described in step 4. Adjustment: 3716A as for step 5 3702B Baseband adjustment procedures
7.	Repeat step 6 with the 3716A and 3705A BB FREQUENCY switches [5] and [33] set to 4.43, 5.6 and 8.2MH z .	As for step 6 substituting 4.43, ±22Hz, 5.6 ±28Hz and 8.2 ±41 Hz for 2.4 MHz.
8.	Reset the 3716A and 3705A BB FREQUENCY switches [5] and [33] to 83AkHz.	
9.	Set the 3702B BB POWER attenuator [39] to -11dBm and check, by turning the BB + SWEEP OUTPUT VERNIER control [2] anticlockwise, that the 3702B meter [25] can be reset to the same reading as obtained in step 4.	BB + SWEEP OUTPUT VERNIER is incorrect; refer to 3715A/3716A General Service Sheet G1. Adjustment: 3716A AIR16 Recheck step 4
10.	Reset the 3702B and 3716A BB POWER attenuators [39] and (7) to -10dBm and the BB + SWEEP OUTPUT VERNIER control [2] to CAL.	
11.	Switch the 3702B BB POWER attenuator [39] through all its positions, and check that all the positions are accurate ±ldB, using the 3715A/3716A BB POWER attenuator [7] as standard.	Disconnect the cable from the 3702B BB INPUT and connect the 3715A/3716A BB + SWEEP OUTPUT to the 75 Ω terminated RMS voltmeter. Check that the accuracy of 3715A/3716A BB POWER attenuator is ±0.5dB. 3715A/3716A BB POWER attenuator within specification; refer to 3702B Assembly Service Sheet A13. 3715A/3716A BB POWER attenuator not within specification; refer to 3715A Assembly Service Sheet A4 or 3716A Assembly Service Sheet A10.
12.	Reset the 3702B and the 3715A/3716A BB POWER attenuators [39] and [7] to -10dBm.	

3-19. Baseband - BB-BB Linearity and Differential Gain

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. Performance Paragraph 3-18.	
2. Set the 3710A SWEEP switch [6] to INT, and the 3715A,/3716A SWEEP CAL control (4) fully clockwise. Set the 3702B SWEEP SOURCE switch [11] to EXT BB+.	
3. Adjust the 3702B X GAIN control [18] to give a 10cm X display.	**10cm X display not available; set the 3715A/ 3716A BB FREQUENCY switch to OFF, and disconnect the cable from the 3702B BB INPUT. Connect the BB + SWEEP OUTPUT to the 75Ω terminated Oscilloscope.** **Sinewave of at least 5V pk-pk present; refer to 3702B Figure G1-1, Test Point 1A.** **Sinewave not present; refer to 3715A/3716A General Service Sheet G1.**
4. Set the Yl Y2 CALIBRATION switch [32] to 1% and adjust the Y1 GAIN control [23] to give a split trace on Y1 of 4cm.	**Split trace of 4cm not available; refer to 3702B Figure G l-l, Test Point 1C.**
5. Check that the total slope on the Y1 trace is not greater than 0.4cm.	**Disconnect the cable from the 3702B BB INPUT and connect the 3716A BB + SWEEP OUTPUT to the 75 terminated Oscilloscope. Turn the 3715A/ 3716A SWEEP CAL control anticlockwise and check for a constant amplitude baseband signal.** **Amplitude constant; refer to 3702B Figure G1-1, Test Point 1C.** **Amplitude not constant; refer to 3715A/3716A General Service Sheet G1.**

6.	Repeat step 5 at all settings of the 3715A/ 3716A BB FREQUENCY switch [5] except OFF and EXT (3715A). Set the 3705A BB FREQUENCY switch [33] to the same settings as the 3716A BB FREQUENCY switch [5] for 2.4, 4.43, 5.6 and 8.2MHz. Adjust the 3705A PHASE LOCK [31] and SET LEVEL [30] controls for a 3705A meter [29] reading in the green band, as detailed in Paragraph 3-18 step 6.	
7.	Set the Y1 Y2 CALIBRATION switch [32] to 10% and adjust the Y1 GAIN control [23] to give a split trace of 8cm.	Split trace not available refer to 3702B General Service Sheet G3.
8.	Set the Y1 Y2 CALIBRATION switch [32] to 3% and check that the split is 2.4 ±0.24cm.	Calibration incorrect; refer to 3702B General Service Sheet G3.
9.	Set the Y1 Y2 CALIBRATION switch [32] to 1% and check that the split trace is 0.8 ±0.08cm.	Calibration incorrect; refer to 3702B General Service Sheet G3.
10.	Set the Y1 Y2 CALIBRATION switch [32] to OFF.	
11.	Set the 3702B SWEEP SOURCE switch [11] to EXT BB– , and check that the X display remains at 10cm.	10cm X display not possible; refer to 3702B Assembly Service Sheet A15.
12.	Set the BANDWIDTH switch [37] to 5kHz and check that the high frequency noise on the display increases.	Bandwidth operation incorrect; refer to 3702B Assembly Service Sheet A3.
13.	Reset the BANDWIDTH switch [37] to 1kHz.	

3-20. Baseband - BB-BB Group Delay and Differential Phase

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Check the BB linearity as detailed in Paragraph 3-19 steps 1 through 8.***	
2. **Set the 3702B Y2 DISPLAY switch [28] to DELAY, and the 3715A/3716A together with the 3703B/3705A BB FREQUENCY switches [5] and [33] to 500kHz.**	
3. **Adjust the 3703B/3705A SET LEVEL control [30] to give a steady reading in the green band of the 3703B/3705A meter [29].**	**Meter reading in the green band is not possible; measure the frequency of the BB OUTPUT using the Electronic Counter.** **Frequency is 500kHz ±2Hz; refer to 3703B/3705A General Service Sheet G1.** **Frequency is not 500kHz ±2Hz; refer to 3715A/3716A General Service Sheet G1.**
4. **Set the DELAY CALIBRATION switch [35] (37038) or the DIFFERENTIAL PHASE, CALIBRATION switch [35] (3705A) to 1ns and adjust the Y2 GAIN control [24] to give a calibration display of 4cm.**	**Calibration display of 4cm not available; refer to 3702B Figure G1-1, Test Point 1D.**
5. **Check that the total slope on the Y2 trace is greater than 0.4cm.**	
6. **Repeat step 5 with the 3715A/3716A, and the 37038/3705A BB FREQUENCY switches [5] and [33] set to 250kHz and** 83AkHz. **NOTE: There will be an increase in noise level on the trace at 250kHz of approximately 2 times, and at 63AkHz of approximately 6 times.**	
7. **Reset the 3715A/3716A and the 3703B/3705A BB FREQUENCY switch [5] and [33] to 500kHz.**	

8.	**Set the 3703B/3705A BANDWIDTH (kHz) switch [37] to 5kHz, and check that there is an increase in the high frequency noise level on the trace. Set the BANDWIDTH (kHz) switch [37] to 10kHz and check that there is a further increase in the noise level.**	**Bandwidth operation incorrect; refer to 3703B/ 3705A Assembly Service Sheet Al-3.**
9.	**Reset the BANDWIDTH (kHz) switch [37] to 1kHz.**	
10.	**Set the 3703B DELAY CALIBRATION switch [35] or the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to 10ns and adjust the Y2 GAIN control [24] to give a delay calibration of 8cm.**	**Calibration display of 8cm not available; refer to 3703B/3705A Assembly Service Sheet Al-l.**
11.	**Set the 3703B DELAY CALIBRATION/ 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to 3ns, and check that the delay calibration is 2.4 ±0.24cm.**	**Calibration incorrect; refer to 3703B Assembly Service Sheet Al-l.**
12.	**Set the 3703B DELAY CALIBRATION switch [35] or the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to 1ns and check that the delay calibration is 0.8 ±0.08cm.**	**Calibration incorrect; refer to 3703B/3705A Assembly Service Sheet A1-1;**

PROCEDURE	TROUBLESHOOTING
13. **Set the 3716A and 3705A BB FREQUENCY switches [5] and [33] to 2.4MHz, and if necessary adjust the 3705A PHASE LOCK control *[31]* to give a steady reading on the green band of the 3705A meter (29).**	**Steady meter reading not possible; check para. 3-18 step 6.**
14. **Set the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to l° and adjust the Y2 GAIN control [24] to give a calibration display of 2cm.**	**Calibration display of 2cm not possible; refer to 3705A Assembly Service Sheet A2.**
15. **Check that the total slope on the Y2 trace is not greater than 0.2cm.**	**Slope on trace too great; proceed as for Paragraph 3-20 step 5. If there is excessive noise on the trace; measure the frequency of the 3716A BB OUTPUT, with the BB FREQUENCY switch set to 2,4,4.43, 5.6 and 8.2MHz. Check if all the errors are in the same percentage. If not, there is a fault in the 3716A Phase Lock Loop; refer to 3716A General Service Sheet G2.**
16. **Repeat step 15 with the 3716A and 3705A BB FREQUENCY switches [5] and [33] set to 4.43, 5.6 and 8.2MHz. NOTE: It may be necessary to adjust the 3705A PHASE LOCK control [31] for a steady 3705A meter [29] reading in each case.**	
17. **Set the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to 20% RAD and adjust the Y2 GAIN control [24] for a calibration display of 8cm.**	**Calibration display of 8cm not. possible; refer to 3705A Assembly Service Sheet A2.**
18. **Set the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to 10° and check that the calibration display is 7 ±0.7cm.**	**Calibration incorrect; refer to 3705A Assembly Service Sheet A2.**
19. **Set the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to 1° and check the calibration display is 0.7 ±0.07cm.**	**Calibration incorrect; refer to 3705A Assembly Service Sheet A2.**
20. **Set the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35l to OFF.**	

3-21. IF SWEPT FREQUENCY

3-22. IF Swept Frequency - IF Markers

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5 through 3-8.***	
2. Connect the 3710A IF OUTPUT [G] to the 3702B IF INPUT [L], insert 10dB in the 3710A IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR [40]. Check that the 3702B meter [25] reading is on scale.	Meter reading not on scale; refer to Paragraph 3-11.
3. Adjust the 3710A IF FREQUENCY control [41] to line up the Y2 birdie with the Y1 marker, and check that the IF FREQUENCY control [41] setting is 70 ±O. 5MHz.	IF FREQUENCY control setting is not 70±0.5MHz; refer to Paragraph 3-12.
4. Set the Y2 DISPLAY switch [28] to IF and check that the AFC LOCK lamp [21] is lit.	AFC LOCK lamp is not lit; refer to Paragraph 3-15.
5. Set the 3710A SWEEP switch [6] to INT, and adjust the 3702B X GAIN control [18] to give a trace width of 10cm.	**10cm X display is not present. Set the Y2 DISPLAY switch to SPECTRUM, and the SPECTRUM WIDTH control fully clockwise. Check if the 'birdie' on the Y2 trace traverses the screen.** YES; refer to 3702B Figure Gl- 1, Test Point 1G. NO; refer to. 3710A General Service Sheet G1, Test Point 1B.
6. Set the 3702B MARKERS switch [34] to SLIDING and check that there are three markers displayed on the Y1 trace.	Three markers are not displayed; refer to 3702B Figure G1-1, Test Point 1M.
7. Set the BLANKING switch [13] to OFF, and adjust the 3782B X PHASE SHIFT control [17) to superimpose the markers on the forward and return traces. Reset the BLANK I NG switch [13] to ON.	The X. PHASE SHIFT control does not superimpose the markers; refer to 3702B General Service Sheet G5, Test Points 5D and 5E.

8.	**Turn the MARKER OFFSET control [36] to O, and check that the two sliding markers converge into the centre marker. If necessary, adjust the MARKER ZERO control [38] to achieve this.**	**The markers cannot be made to converge; refer to 3702B General Service Sheet G4, Test Point 4E.**
9.	**Set the MARKERS switch [34] to SLIDING + COMB, and check that a 2MHz marker comb is now displayed on the Y1 trace.**	**Marker comb is not present; refer to 3702B General Service Sheet G4, Test Point 4G.**
10.	**Using the 2MHz marker comb as standard check that the calibration of the MARKER OFFSET control [36] is accurate ±1MHz.**	**The MARKER OFFSET calibration is incorrect; refer to 3702B General Service Sheet G4. Adjustment: see 3702B Service Manual; IF Markers adjustment procedure.**
11.	**Set the MARKERS switch [34] to COMB, and check that only the 2MHz marker comb is present,**	**The 2MHz comb is not available independently; refer to 3702B General Service Sheer G4, Tables G4-1 and G4-2.**
12.	**Reset the MARKERS switch [34] to SLIDING.**	

3-23 IF Swept Frequency - IF Sweep Width

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. Perform Paragraph 3-22.	
2. **Adjust the MARKER OFFSET control [36] until the sliding markers just begin to disappear off the ends of the trace. Check that the MARKER OFFSET control [36] setting is 25 ±2MHz.**	**MARKER OFFSET control setting is not 25 ±2MHz; refer to 3710A General Service Sheet G1, Test Point 1B. Adjustment: 3710A A11R36**
3. **Check the calibration of the 3710A SWEEP WIDTH control [9] against the MARKER OFFSET control [36]. as in step 2, for SWEEP WIDTH settings down to 3MHz. The accuracy of the readings should be ±2MHz.**	**The SWEEP WIDTH control is inaccurate; refer to 3710A General Service Sheet G1, Test Point 1B. Adjustment: see 3710A Service Manual; IF Sweep Width adjustment procedure.**
4.. **Check that the X-display remains constant at 10cm ±0.5cm for all SWEEP WIDTH control [9] settings down to 3MHz.**	**The X-display 'does not remain constant; refer to 3702B General Service Sheet G5, Test Points 5D and 5E.**
5. **Reset the SWEEP WIDTH control [9] to 50MHt.**	
6. **Set the BLANKING switch [13] to OFF, and the 3710A SWEEP switch [6] to LINE. Check that the marker separation between the forward and return traces does not exceed 1cm.**	**Marker separation exceeds lcm; refer to 370'':: General Service Sheet G5, Test Points 5D and 5t.**
7. **Set the BLANKING switch [13] to ON, and repeat steps 2 through 5, with the 3710A SWEEP switch [6] set to LINE.**	
9. **Reset the 3710A SWEEP switch [C] to INT.**	
10. **Reduce the setting of the IF FREQUENCY control [41] and check that the REDUCE SWEEP WIDTH lamp [9] lights when the IF FREQUENCY control [41] setting is between 66 and 68MHz.**	**REDUCE SWEEP WIDTH lamp does not light; refer to 3710A Assembly Service Sheet A12. Adiustment: 3710A A12Rl0**

11. **Increase the setting of the IF FREQUENCY control [41] and check that the REDUCE SWEEP WIDTH lamp [9] extinguishes, then relights when the IF FREQUENCY control [41] setting is between 72 and 74MHz.**	**REDUCE SWEEP WIDTH lamp does not light; refer to 3710A Assembly Service Sheet A12. Adjustment: 3710A A12R4**
12. Check that the REDUCE SWEEP WIDTH lamp [9] is extinguished between 68 and 72MHz.	**REDUCE SWEEP WIDTH lamp is not extinguished; refer to 3710A Assembly Service Sheet A12. Adjustment: see 3710A Service Manual; Excess Sweep Width adjustment procedure.**
13. Reset the IF FREQUENCY control [41] to 7OMHz.	
14. If a 3716A BB GENERATOR Plug-in is fitted in the 3710A, measure the sweep width, as in step 2, at al: settings of the BB FREQUENCY switch [5], and check that for BB FREQUENCY switch settings above 500kHz the sweep width reduces by twice the BB FREQUENCY ±10%.	**Sweep width reduction with BB FREQUENCY switch setting is incorrect; refer to 3716A Assembly Service Sheet A3.**
15. Reset the BB FREQUENCY switch [5] to OFF.	

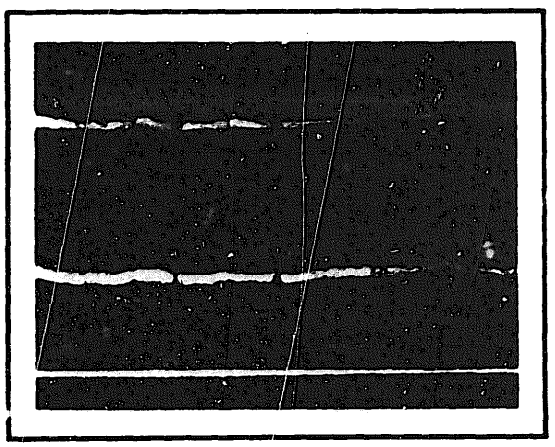
3-24. IF Swept Frequency - IF Flatness

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5 through 3-8.***	
2. ***Connect the 3710A IF OUTPUT [G] to the 3702B IF INPUT [L], insert 10dB in the 3710A IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR [40]. Check that the 3702B meter [25] reading is on scale.***	***Meter reading not on scale; refer to*** Paragraph 3-11.
3. ***Adjust the 3710A IF FREQUENCY control [41] to line up the Y2 birdie with the Y1 marker. Check that the IF FREQUENCY control [41] setting is 70 ±0.5MHz.***	***IF FREQUENCY control setting is not 70 ±0.5MHz; refer to*** Paragraph 3-12.
4. ***Set the Y2 DISPLAY switch [28] to IF, and check that the AFC LOCK lamp [21] is lit***	***AFC LOCK lamp is not lit; refer to*** Paragraph 3-15.
5. ***Set the 3710A SWEEP switch [6] to INT, and adjust the X GAIN control [18] to give a 10cm X display on the 3702B. Set the 3702B MARKERS switch [34] to SLIDING and the BLANKING switch [13] to OFF. Adjust the X PHASE SHIFT control [17] to superimpose the markers on the forward and return traces of the display. Set the BLANKING switch [13] to ON and check, using the markers, that the sweep width is 50 ±2MHz.***	***All faults; refer to*** Paragraph 3-23.
6. **Set the 3702B Y1 Y2 CALIBRATION switch [32] to 0.1dB and adjust the** Y2 **GAIN control [24] to give a split trace of km.**	**Split trace not present; refer to 3702B Figure G1-1, Test Point 1E.**

7. Check that the total slope on the Y2 trace is less than 1cm.	**Slope is greater than lcm. Set the 3710A SWEEP switch to OFF.** **Disconnect the** cable **from the 3710A IF OUTPUT and connect the Power Meter to the 3710A IF OUTPUT, via the 75/50^ Matching Pad. Slowly vary the 37 10A IF FREQUENCY control over the range 45 to 95MHz and check if the power reading varies by more than 0.1dB.** **YES; refer to 3710A General Service Sheet G3. NO; refer to 3702B Figure G1-1, Test Point 1E. Adiustment: 3710A A8C2 & A8L1**
8. Set the 3702B Yl Y2 CALIBRATION switch [32] to 1dB, and adjust the Y2 GAIN control [24] to give a split trace of 8cm.	**Calibration incorrect; refer to 3702B Assembly Service Sheet A4.**
9. Set the 3702B Y1 Y2 CALIBRATION switch [32] to 0.3dB, and check that the split trace is 2.4±0.24cm.	**Calibration incorrect; refer to 3702B Assembly Service Sheet A4.**
10. Set the 3702B Y1 Y2 CALIBRATION switch [32] to O.1dB, and check that the split trace is 0.8±0.08cm.	**Calibration incorrect; refer to 3702B Assembly Service Sheet A4.**
***11.* Adjust the 3702B Y1 GAIN control [23] to give a split trace on Y1 of the same amplitude as on Y2.**	**Y1 incorrect; refer to 3702B General Service Sheet G5.**
12. Check that the IF flatness display on Y1 is the same as on Y2.	**Y1 incorrect; refer to 3702B General Service Sheet G5.**
13. Set the 3702B Y1 Y2 CALIBRATION switch [32] to OFF.	

3-25 IF Swept Frequency - BB Linearity and Differential Gain

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5 through 3-8.***	
2. ***Connect the 3710A IF OUTPUT [G] to the 3702B IF INPUT [L], insert 10dB in the 3710A IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR, [40]. Check that the 3702B meter [25] reading is on scale.***	***Meter reading not on scale; refer to*** Paragraph 3-11.
3. ***Adjust the 3710A IF FREQUENCY control [41] to line up the Y2 birdie with the Y1 marker. Check that the IF FREQUENCY control [41] setting is 70 ±0.5MHz.***	***IF FREQUENCY control setting is not 70 ±0.5MHz; refer to*** Paragraph 3-12.
4. ***Set the Y2 DISPLAY switch [28] to IF, and check that the AFC LOCK lamp [21] is lit.***	***AFC LOCK lamp is not lit; refer to*** Paragraph 3-15.
5. ***Set the 3710A SWEEP switch [6] to INT, and adjust the X GAIN control [18] to give a 10cm X display on the 3702B.***	***The 10cm display is not present; refer to*** Paragraph 3-22.
6. ***Set the 3702B MARKERS switch [34] to SLIDING and the BLANKING switch [13] to OFF. Adjust the X PHASE SHIFT control [17] to superimpose the markers on the forward and return traces. Set the BLANKING switch [13] to ON. Check using the markers, that the sweep width is 50 ±2MHz.***	***The markers are not present; refer to*** Paragraph 3-22. ***Sweep width not 50 ±2MHz; refer to*** Paragraph 3.23.
7. ***Check the IF flatness as detailed in Paragraph 3-24 steps 6 and 7.***	***The IF flatness is incorrect; refer to*** Paragraph 3-24.
8. Set the 3702B Y1 DISPLAY switch [26] to BB, the 3710A DEVIATION [8] to 200kHz and set the Y2 GAIN control [24] fully anticlockwise. Set the 3715A/3716A BB FREQUENCY switch [5] to 83ΔkHz.	

9. **Adjust the 3702B BB POWER attenuator [39] to zero the 3702B meter [25]. Check that the 3702B BB POWER attenuator [39] setting is -20dBm ±2.5dBm.**	**Meter reading is not zero for a BB POWER setting 01 -*20dBm* ±2.5dBm; check DEVIATION as in Paragraph 3-14. DEVIATION correct; set 3702B BB POWER to -20dBm and refer to 3702B Figure G1-1, Test Point 1B. DEVIATION incorrect; refer to 3710A G1-1, Test Point 1A.**
10. **Set the 3702B Y1 Y2 CALIBRATION switch *[32]* to 1%, and adjust the Y1 GAIN control [23] to give a split trace on Y1 of 4cm.**	**Split trace of 4cm is not available; refer to 3702B Figure G1-1, Test Point 1C.**
11. Check that the total slope on the Y2 trace is not greater than 1.6cm (0.4%), see waveform below. 	**Slope too great; set the BLANKING switch to OFF, and check if the forward and return traces are coincident to within 0.5cm.** **NO; refer to 3702B General Service Sheet G2.** **YES; remove 2dB from 3702B IF ATTENUATOR and check if the slope decreases+.** **YES; refer to 3702B General Service Sheet G2.** **NO; refer to 3710A General Service Sheet G1, Test Point 1A.** **Adjustment: see 3702B Service Manual; Demodulator Section adjustment procedure.**
12. **Reduce the 3710A IF SWEEP WIDTH control [9] to 40MHz, and check that the total slope on the Y1 trace is not greater than 0.8cm (0.2%).**	**Slope too great; set the BLANKING 'switch to OFF, and check if the forward and return traces are coincident to within 0.5cm.** **NO; refer to 3702B General Service Sheet G2.** **YES; remove 2dB from 3702B IF ATTENUATOR and check if the slope decreases.** **YES; refer to 3702B General Service Sheet G2.** **NO; refer to 3710A General Service Sheet G1, Test Point 1A.**

*** This check is not conclusive. The only conclusive check is to substitute the 3710A/ 3715A/3716A and the 3702B/3703B/3705A with a known good system.**

13.	Repeat steps 9 through 12 with the 3715A/3716A BB FREQUENCY switch [5] set to 250 and 500kHz.	Slope too great; proceed as for steps 11 and 12.
+14.	Set the 3702B Y1 Y2 CALIBRATION switch [32] to 10% and adjust the Y 1 GAIN control [23] to give a Y1 split trace of 8cm.	Calibration incorrect; refer to 3702B Assembly Service Sheet A21.
+15.	Set the 3702B Y1 Y2 CALIBRATION switch [32] to 3% and check that the split trace is now 2.4 ±0.24cm.	Calibration incorrect; refer to 3702B Assembly Service Sheet A21.
+16.	Set the 3702B Y1 Y2 CALIBRATION switch [32] to 1% and check that the split trace is now 0.8 ±0.08cm.	Calibration incorrect; refer to 3702B Assembly Service Sheet A21.
+17.	Set the 3703B/3705A BANDWIDTH (kHz) switch [37] to 5kHz and check that the high frequency noise level on the Y1 trace increases.	Bandwidth incorrect; refer to 3702B Assembly Service Sheet A3.
18.	Set the 3702B Y1 Y2 CALIBRATION switch [32] to OFF and reset the 3710A SWEEP WIDTH control [9] to 50MHz.	

The following checks are necessary if the 3710A and 3702B contain a 3716A and 3705A respectively.

19.	Set the 3710A DEVIATION control [8] to 500kHz and the 3716A BB FREQUENCY switch [5] to 2.4MHz. Set the 3705A BB FREQUENCY switch [33] to 2.4MHz and the SET LEVEL control [30] fully clockwise.	
20.	Adjust the 3705A PHASE LOCK control [31] for a steady 3705A meter [29] reading and adjust the SET LEVEL control [30] to bring the meter reading to the green band.	Steady meter reading in green band not possible: Set the Y2 DISPLAY switch to SPECTRUM and the Y1 DISPLAY switch to REF. Set the 3710A SWEEP switch to OFF. Perform the Spectrum Setting up Procedures as detailed in Paragraph 3-8. Turn SPECTRUM WIDTH control clockwise and Y2 GAIN control clockwise and check for the presence of 2.4MHz sidebands on the Y2 display. Sidebands absent; refer to 3710A General Service Sheet G1, Test Point 1A. Sidebands present; Measure the frequency of the 3716A BB OUTPUT using the Electronic Counter. Output 2.4MHz ±12Hz. Set the Y2 DISPLAY switch to IF and refer to 3702B General Service Sheet G3, Test Point 3A.

† These steps have already been performed in paragraph 3-19 and need not be repeated.

20. (Cont.)

Output not 2.4MHz ±12Hz; refer to 3716A General Service Sheet G1.
Adjustment. As for para 3-18 step 6.

21. Adjust the 3702B BB POWER attenuator [38] to zero the 3702B meter [25] and check that the attenuator setting is -12dBm ±2dB.

Attenuator setting not -12dBm ±2dB; check the **3710A Deviation as detailed below:**

Deviation Check at 2.4 4.43 and 5.6MHz Baseband Frequencies

Set the 3710A SWEEP switch [6] to OFF and the DEVIATION control [8] to 500kHz.
Connect the IF OUTPUT [G] to the RF INPUT of the Spectrum Analyzer. Measure the amplitude of the 1st pair of sidebands relative to the carrier.

2.4MHz Baseband: 16.7 ±0.2dB down on carrier.

4.43MHz Baseband: 21.9 ±0.3dB down on carrier.

5.6MHz Baseband: 24.1 ±0.4dB down OR carrier.

Deviation correct. Set the 3702B BB POWER attenuator to - 12dBm and refer to 3702B, Figure 61-1, Test Point 1B.

Deviation incorrect; refer to 3710A General Service Sheet G1, Test Point 1A.

22. Repeat steps 10 through 12, and 18.

23. Repeat steps 19 through 22 with the 3716A and 3705B BB FREQUENCY switches [5] and [33] set to 4.43 and 5.6MHz. Reset the DEVIATION control [8] to 200kHz.

As for steps 19 through 22 but substituting 4.43MHz ±22Hz or 5.6MHz ±28Hz for 2.4MHz ±12Hz.

3-26. IF Swept Frequency - Group Delay and Differential Phase

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-5 through 3-8.***	
2. ***Connect the 3710A IF OUTPUT [G] to the 3702B IF INPUT [L], insert 10dB in the 3710A IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR [40]. Check that the 3702B meter [25] reading is on scale.***	***Meter reading not on scale refer to*** Paragraph 3-11.
3. ***Adjust the 3710A IF FREQUENCY control [41] to line up the Y2 birdie with the Y1 marker. Check that the IF FREQUENCY control [41] setting is 70 ±0.5MHz.***	***The IF FREQUENCY control setting is not 70 ±0.5MHz; refer to*** Paragraph 3-12.
4. ***Set the Y2 DISPLAY switch [28] to IF and check that the AFC LOCK lamp [21] is lit.***	***The AFC LOCK lamp is not lit; refer to*** Paragraph 3-15.
5. ***Set the 3710A SWEEP switch [6] to INT and adjust the X GAIN control [18] to give a 10cm X display on the 3702B.***	***The 10cm display is not present; refer to*** Paragraph 3-22.
6. ***Set the MARKERS switch [34] to SLIDING, and the BLANKING switch [13] to OFF. Adjust the X PHASE SHIFT control [17] to superimpose the markers on the forward and return traces. Set the BLANKING switch [13] to ON. Check, using the markers, that the sweep width is 50 ±2MHz.***	***The markers are not present; refer to*** Paragraph 3-22. ***Sweep width is not 50 ±2MHz; refer to*** Paragraph 3-23.
7. ***Check that the IF flatness is the same as in Paragraph 3-24 steps 6 and 7.***	***The IF flatness is incorrect; refer to*** Paragraph 3-24.
8. ***Set the Y1 DISPLAY switch [26] to BB, the 3710A DEVIATION control [8] to 200kHz, and the 3715A/3716A BB FREQUENCY switch [5] to 500kHz. Adjust the 3702B BB POWER attenuator [39] to zero the 3702B meter [25] and check that the attenuator setting is -19dBm ±2dB.***	***The attenuator setting for meter zero is not -19dBm ±2dB; refer to*** Paragraph 3-25.

9. *Check the BB Linearity as detailed in Paragraphs 3-25 steps 10 through 16 and the Diffential Gain as detailed in Paragraph 3-25* steps 19 *through 23.*

BB Linearity and. Differential Gain incorrect; refer to pa*ragraph 3-25.*

10. **Set the 3715A/3716A and the 3703B/3705A BB FREQUENCY switches [5] and (33) to 500kHz.**

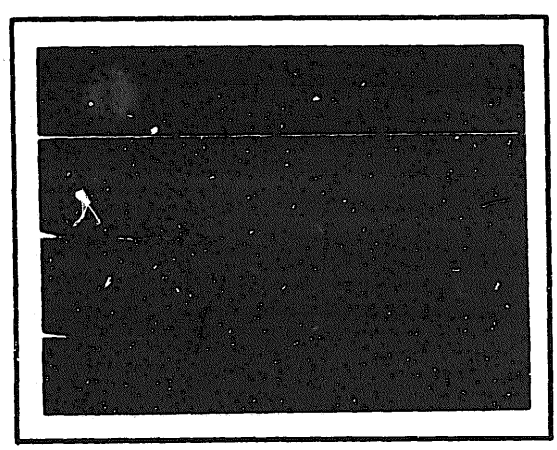
11. **Set the Y2 DlSPLAY switch [28] to DELAY. Adjust the 3702B/3705A SET LEVEL control [30] to** give a **steady reading on the green sector of the meter.**

Steady meter reading in the green band is not possible; measure the frequency of the 3715A/3716A BB OUTPUT using the Electronic Counter.
Frequency 500kHz ±2Hz; refer to 3703B/3705A General Service Sheet G1.
Frequency not 500kHz ±2Hz; refer to 3715A/3716A General Service Sheet G1.
Adjustments: see; 3715A Frequency adjustments
3716A Frequency adjustments
3705A **Low BB Frequency adjustments**

12. **Set the 3703B DELAY CALIBRATION switch [35] or the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to 1ns and adjust the Y2 GAIN control [24] for a calibration display of 2cm.**

Calibration trace of 2cm is not possible; refer to 3702B Figure G1-1, Test Point 1D.

13. **Check that the total slope on the Y2 trace is less than 2cm.**
See waveform below.



NOTE: There is an adjustment for Group Delay slope. Refer to 3702B Service **Manual, Demodulator adjustment procedure.**
Slope too great; set the BLANKING switch to **OFF and check if the forward and return traces are coincident to within 0.25cm.**
NO; refer to 3702B General Service Sheet G2.
Yes; remove 2dB from the 3702B IF ATTENUATOR and check if the slope decreases.*
YES; refer to the 3702B General Service Sheet G2.
NO; refer to 3710A General Service Sheet G3.

* **This check is not entirely conclusive.** The only conclusive check is to substitute the 3710A/3715A/**3716A or the 3702B/3703B/3705A with a** known good system

14. Reduce the 3710A SWEEP WIDTH control [9] to 40MHz, and check that the Y2 slope is less than 1.2cm.	As for step 13.
15. Reduce the 3710A SWEEP WIDTH control [9] to 30MHz, and check that the Y2 slops is less than 0.8cm.	As for step 13.
16. Reset the 3710A SWEEP WIDTH control [9] to 50MHz, and repeat steps 13 through 15 with the 3715A/3716A and the 3703B/3705A BB FREQUENCY switches [5] and [33] set to 250 and 83AkHz. NOTE: The noise level on the trace will increase by approximately 2 times at 250kHz, and 6 times at 83AkHz.	Steady meter reading in the green band is not possible; measure the 3715A/3716A BB OUTPUT frequency using the Electronic Counter. Frequency correct, 250kHz ±2Hz or, 83AkHz ±2Hz; refer to 3703B/3705A General Service Sheet G1. Frequency incorrect; refer to 3715A/3716A General Service Sheet G1. Slope too great; proceed as for steps 13 through 15.
17. Reset the 3715A/3716A and the 3703B/3705A BB FREQUENCY switches [5] and [33] to 500kHz.	
+18. Check that the high frequency noise on the trace increases when the 3703B/3705A BANDWIDTH (kHz) switch [37] is set to 5kHz, and increases further when set to 10kHz. Reset the BANDWIDTH (kHz) switch [37] to 1kHz.	Bandwidth operation incorrect; refer to 3703B/3705A Assembly Service Sheet Al-3.
+19. Set the 3703B DELAY CALIBRATION switch [35] or the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to 10ns and adjust the Y2 GAIN control [24] for a calibration display of 8cm.	Calibration incorrect; refer to 3703B/3705A Assembly Service Sheet Al-l.
+20. Set the 3703B DELAY CALIBRATION/3705A DiFFERENTIAL PHASE CALIBRATION switch [35] to 3ns, and check that the calibration display is 2.4 ±0.24cm.	Calibration incorrect; refer to 3703B/3705A Assembly Service Sheet Al-l.
+21. Set the 3703B DELAY CALIBRATION switch [35] or the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to 1ns and check that the split trace is now 0.8 ±0.08cm.	Calibration incorrect; refer to 3703B/3705A Assembly Service Sheet Al-l.

† These steps have already been performed in paragraph 3-19 and need not be repeated.

22. **Set the *3703B* BELAY CALIBRATION witch [35] or the 3705A DIFFERENTIAL PHASE CALIBRATION switch [35] to OFF and the 3710A SWEEP WlDTH control [9] to 5OMHz.**

Additional Tests on 3716A/3705A

23. **Set the 3710A DEVIATION control (8) to 500kHz and the 3716A and 3705A BB FREQUENCY switches [5] and [33] to 2.4MHz, and if necessary adjust the 3705A PHASE LOCK control [31] to give a steady 3705A meter [29] reading. Adjust the SET LEVEL control [30] to bring the 3705A meter [29] reading to the green band.**

Steady meter reading in the green band not possible; measure the 3716A BB OUTPUT frequency using the Electronic Counter.
Frequency correct; 2.4MHz ±12Hz; refer to 3705A General Service Sheet G1.
Frequency incorrect; refer to 3716A General Service Sheet G1.
Adjustments: see; 3716A Frequency adjustments
3715A Frequency adjustments
3705A High BB Frequency adjustments

24. **Set the DIFFERENTIAL PHASE CALIBRATION switch [35] to l' and adjust the Y2 GAIN control [24] for a calibration display of 2cm.**

The 2cm calibration is not available; refer to 3705A Assembly Service Sheet A2.

25. **Check that the total slope on the Y2 trace is not greater than 1.2cm.**

Slope too great; proceed as for step 13.
If there is excessive noise on the trace; measure the frequency of the 3716A BB OUTPUT, with the 3716A BB FREQUENCY switch set to 2.4, 4.43, 5.6 and 8.2MHz. Check if all errors are in the same direction by the same percentage. If not there is a fault in the 3716A Phase Lock Loop; refer to 3716A General Service Sheet G2.

26. **Set the 3710A SWEEP WIDTH control [9] to 4OMHz, and check that the Y2 slope is less than O.&m.**

Slope too great; proceed as for step 13.

27. **Reset the 3710A SWEEP WIDTH control [9] to 50MHz and the 3716A and 3705A controls [5] and [33] to 4.43MHz. If necessary adjust the 3705A PHASE LOCK CONTROL [31] to give a steady meter reading [29]. Check that the total slope on the Y2 trace is not greater than l.6cm.**

Steady meter reading not possible; Measure the 3716A BB OUTPUT frequency using the Electronic Counter;
Frequency correct 4.43MHz ±22Hz; refer to 3705A General Service Sheet G1.
Frequency incorrect; refer to 3716A General Service Sheet G1.
Slope too great; proceed as for step 13.
Excessive noise; proceed as for step 25.
Adjustments: As for step 23.

28.	**Set the 3710A SWEEP WIDTH control [9] to 40MHz and check that the Y2 slope is less than 1.2cm.**	**Slope too great; proceed as for step 13.**
29.	**Set the 3710A SWEEP WIDTH control [9] to 30MHz and check that the Y2 slope is less than 0.8cm.**	**Slope too great; proceed as for step 13.**
30.	**Repeat 27 through 29 with the 3716A and 3705A BB FREQUENCY controls [5] and [33] set to 5.6MHz.**	**As for 27 through 29 substituting. BB Frequency 5.6MHz ±28Hz.**
+31.	**Set the DIFFERENTIAL PHASE CALIBRATION switch (35) to 20% RAD and adjust the Y2 GAIN control [24] for a calibration display of 8cm.**	**Calibration incorrect; refer to 3705A Assembly Service Sheet A2.**
+32.	**Set the DIFFERENTIAL PHASE CALIBRATION switch [35] to 10° and check that the calibration display is 7cm ±0.7cm.**	**Calibration incorrect; refer to 3705A Assembly Service Sheet A2.**
+33.	**Set the DIFFERENTIAL PHASE CALIBRATION switch [35] to 1° and check that the calibration display is 0.7cm ±0.07cm.**	**Calibration incorrect; refer to 3705A Assembly Service Sheet A2**
34.	**Set the DIFFERENTIAL PHASE CALIBRATION switch [35] to OFF, and the 3710A SWEEP WIDTH control [9] to 50MHz.**	

† These steps have already been performed in paragraph 3-20 and need not be repeated.

3-27. IF Swept Frequency - Return Loss Display and Sensitivity

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed** in Paragraphs 3-5 through 3-8.*	
2. ***Connect the 3710A If OUTPUT [G] to the 3702B IF INPUT [L] insert 10dB** in the 3710A IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR [40]. Check that the ,3702B meter [25] reading is on scale.*	***Meter reading not on scale; refer to Paragraph 3-11.***
3. ***Adjust the 3710A IF FREQUENCY control [41] to line up the Y2 birdie with the Y1 marker. Check that the IF FREQUENCY control [4] setting is 70 ±O.5MHz.***	***The IF FREQUENCY** control **setting is not 70 ±0.5MHz; refer to Paragraph 3-12.***
4. ***Set the Y2 DISPLAY switch [28] to IF, and check that the AFC LOCK lamp [21] is lit.***	***The AFC LOCK lamp is not lit; refer** to **Paragraph 3-15***
5. ***Set the 3710A SWEEP switch [6] to INT, and adjust the X GAIN control [18] to give a 10cm X display on the 3702B.***	***The 10cm display is not present; refer to Paragraph 3-22.***
6. ***set the MARKERS switch [34] to SLIDING and adjust the X PHASE SHIFT control [17] to centralize the middle marker on the display. Check, using the markers, that the sweep width is 50 ±2MHz.***	***Markers are not present; refer to Paragraph 3-22.*** ***Sweep width is not 50 ±2MHz; refer to 3-23.***
7. ***Check the IF flatness as detailed in Paragraph 3-24 steps 6 and 7.***	***The IF flatness is incorrect; refer to Paragraph***
8. ***Check the BB linearity as detailed in Paragraph 3-Z steps 7 through 12.***	***The BB linearity is incorrect; refer to Paragraph 3-25.***
9. ***Check the 3710A IF (UNCAL) OUTPUT [F] as detailed in Paragraph 3-16.***	***The IF (UNCAL) OUTPUT** is incorrect; refer to **Paragraph 3-16.***

10. Disconnect the cable from the 3710A IF OUTPUT [G] and connect it to the 3710A AUX OUTPUT [F]. Set the AUX OUTPUT switch [44] to IF (UNCAL), and set the Y1 DISPLAY switch [24] to IF. Adjust the 3702B IF ATTENUATOR [40] for an on scale 3702B meter [25] reading, Check that the AFC LOCK lamp [21] is lit.

    Meter reading not on scale; or the AFC LOCK lamp is not lit; refer to Paragraph 3-16.

11. Connect the 3710A IF OUTPUT [G] to the 3702B RETURN LOSS INPUT [H]. Insert 60dB in the 3710A IF ATTENUATOR [43]. Set the 3702B RETURN LOSS Attenuator [39] to 30dB.

12. Set the Y1 DISPLAY switch [26] to RET LOSS, and the Y2 GAIN control [24] fully anticlockwise.

13. Adjust the RETURN LOSS CALIBRATION control (27) to give a zero reading on the 3702B meter [25].

    Incorrect meter reading; refer to 3702B General Service Sheet G3.

14. Turn the Y1 GAIN control [23] clockwise until the slope of the trace is 1cm.

15. Set the RETURN LOSS Attenuator [39] to 31dB and check that the trace shifts by at least lcm.

    Trace shift is less than lcm; refer to 3702B General Service Sheet G3,
    Adjustment 3702B A20C3

16. Disconnect the cabling

3-28. ADDITIONAL 3702B CHECKS

3-29. Additional 3702B Checks - External Sweep Input

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraph 3-5 through 3-7.***	
2. **Set the 3710A SWEEP switch [6] to INT, and** the Y2 DISPLAY **switch [28] to IF.**	
3. **Connect the 3710A SWEEP OUTPUT [A] to the Oscilloscope and adjust the SWEEP OUTPUT LEVEL control [3] for a signal amplitude of 10V pk-pk.**	**Signal amplitude of 10V pk-pk not available; refer to 3710A General Service Sheet G2.**
4. **Disconnect the Oscilloscope from the SWEEP OUTPUT [A). Connect the SWEEP OUTPUT [A] to the 3702B EXT SWEEP INPUT {rear panel). Set the SWEEP SOURCE switch [11] to EXT.**	**10cm X display not available; refer to 3702B General Service Sheet** G5.
5. **Adjust the X GAIN control [18] for an X display of 10cm.**	

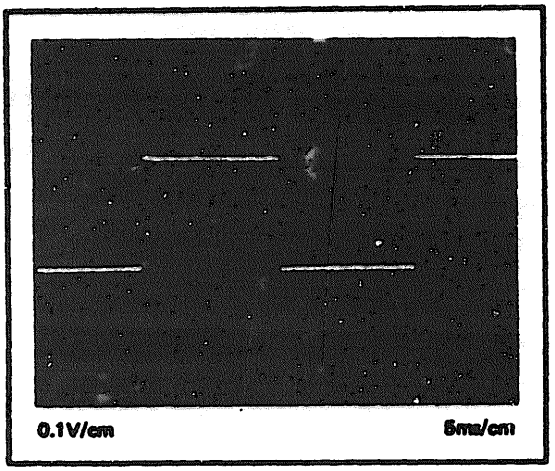
3-30. Additional 3702B Checks - External Input

Procedure	Troubleshooting
NOTE: It is necessary to perform the procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraph 3-29.***	
2. Set the 3702B Y1 DISPLAY switch [26] to EXT.	
3. Set the Y1 GAIN control [23] anticlockwise and adjust the Y1 POSITION control [23] to bring the Y1 trace to 1cm below the centre graticule line.	
4. Turn the Y1 GAIN control [23] fully clockwise, and adjust the Y EXT OFFSET control [15] to return the trace to 1cm below the centre graticule line.	
5. Turn the Y1 GAIN control [23] anticlockwise and check that the trace movement does not exceed 0.5cm.	Any fault; refer to 3702B General Service Sheet G5.
6. Connect the 250mV calibration signal from the Oscilloscope to the 3702B EXT INPUT [J].	
7. Adjust the Y1 GAIN control [23] to give a 5cm display.	
8. Set the 3702B CALIBRATION switch [12] to 10%, and check for a calibration signal of 0.5 ±0.05cm at the top of the display.	Calibration signal incorrect; refer to 3702B Figure G1-1 Test Point 1K.
9. Set the 3702B CALIBRATION switch [12] to 50mV, and check that for a calibration signal of 1 ±0.1cm.	Calibration signal incorrect; refer to 3702B Figure G1-1 Test Point 1L.
10. Set the 3702B CALIBRATION switch [12] to OFF, and disconnect the cable from the EXT INPUT [J].	

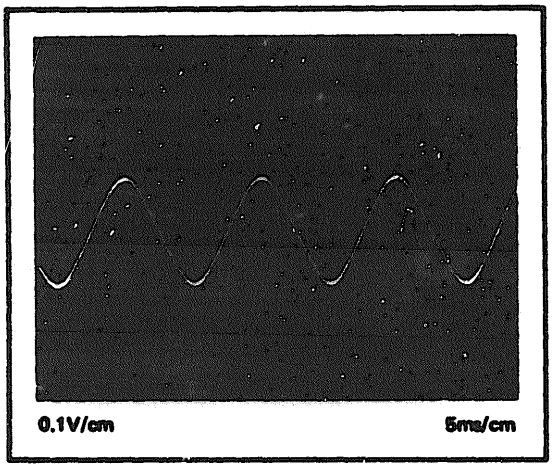
3-31. Additional 3702B - Slave Display and Slave Output

Procedure	Troubleshooting
NOTE: It is necessary to perform the Procedures in italics except when continuing from the previous paragraph.	
1. ***Perform the Procedures as detailed in Paragraphs 3-29 and 3-30.***	
2. **Set the Y2 DISPLAY switch [28] to SLAVE.**	
3. **Connect the 3710A IF OUTPUT [G] to the 3702B IF INPUT [L], insert 10dB in the 3710A IF ATTENUATOR [43] and 10dB in the 3702B IF ATTENUATOR [40]. Check that the AFC LOCK lamp [21] is lit.**	**AFC LOCK lamp is not lit; refer to** Paragraph 3-15.
4. **Set the MARKERS switch [34] to SLIDING and the BLANKING switch [13] to OFF. Adjust the X PHASE SHIFT control [17] to superimpose the markers on the forward and return traces. Reset the BLANKING switch [13] to ON.**	**Markers are not present; refer to** Paragraph 3-18.
5. **Adjust the Y2 GAIN and Y2 POSITION controls [24] and check that a trace sloping from the top left to the bottom right of the screen can be displayed.**	***An9* fault; refer to 3702B General Service Sheet G5.**
6. **Adjust the Y2 GAIN control [24] for an 8cm display on the Y2 trace.**	
7. **Set the 3702B CALIBRATION switch [12] to 50mV, and adjust the Y GAIN control [23] for an 8cm calibration trace on Y1.**	

8. Set the 3702B Y1 Y2 SLAVE switch (rear panel) to Y1, and connect the 3702B SLAVE OUTPUT (rear panel) to the Oscilloscope. A typical output is shown in (a) below. Set the 3702B Y1 Y2 SLAVE switch (rear panel) to Y2.
A typical output is shown in (b) below.



(a)



(b)

Slave output is faulty; refer to 3702B General Service Sheet G 5 .

3-32. ADDITIONAL 3710A CHECKS

3-33. Additional 3710A Checks - IF Frequency

Procedure	Troubleshooting
1. Set the 3710A SWEEP switch [6] to OFF.	
2. Connect the Electronic Counter to the 3710A IF OUTPUT [G].	
3. Check the IF OUTPUT [G] frequency, for all settings of the IF FREQUENCY control [41] and check that **they are accurate ±0.5MHz.**	**Frequency incorrect; refer to 3710A General Service Sheet G1, Test Point 1B.** **Adjustments:** 50MHz ---- A11R5 60MHz ---- A11R6 70MHz ---- A11R7 80MHz ---- A11R8 90MHz ---- A11R9 FINE FREQUENCY CONTROL ---- A11R2

3-34. Additional 3710A Checks - Sweep Output

Procedure	Troubleshooting
1. **Set the 3710A SWEEP witch [6] to INT.**	
2. **Connect the Oscilloscope to the 3710A SWEEP OUTPUT [A].**	
3. **Check as the SWEEP OUTPUT LEVEL control [3] is varied from fully anticlockwise to fully clockwise, that the SWEEP OUTPUT [A] signal varies from OV to at least 25V pk-pk sinewave.**	**Sweep output signal incorrect; refer to 3710A General Service Sheet G2.**

3-35. Additional 3710A Checks - Ext Sweep Input

Procedure	Troubleshooting
1. Set the 3710A SWEEP switch [6] to EXT.	
2. Connect the Test Oscillator set to 70Hz to the Oscilloscope and set the Oscillator output at 4V pk-pk.	
3. Disconnect the Oscilloscope from the Oscillator output, and connect the Oscilloscope to the 3710A SWEEP OUTPUT [A]. Connect the Oscillator output to the 3710A EXT SWEEP INPUT [B].	
4. Check as the 3710A SWEEP OUTPUT LEVEL control [3] is varied from fully anticlockwise to fully clockwise, that the SWEEP OUTPUT [A] signal varies from 0 to 25 ±5V pk-pk.	The signal from the SWEEP OUTPUT is incorrect; refer to 3710A General Service Sheet G2.

3-37. ADDITIONAL 3715A/3716A CHECKS

3-38. Additional 3715A/3716A Checks - BB Output

Procedure	Troubleshooting
1. Set the 3715A/3716A BB FREQUENCY switch [5] to 83.3kHz, and the BB OUTPUT VERNIER [1] to +10dBm.	
2. Connect the 75Ω terminated Oscilloscope to the 3715A/3716A BB OUTPUT [D].	
3. Check that the output signal amplitude is 2.45 ±0.15V pk-pk.	Output signal amplitude not 2.45 ±0.15V pk-pk; refer to 3715A/3716A General Service Sheet G1. **Adjustment:** 3716A AIR14
4. Turn the BB OUTPUT VERNIER [1] anti-clockwise, and check that the output signal amplitude reduces to not greater than 2.35V pk-pk.	**Adjustment:** 3716A AIR15 Recheck step 3.

3-39. Additional 3715A/3716A Checks - BB + Sweep Output (Sweep)

Procedure	Troubleshooting
1. **Set the 3710A SWEEP WIDTH control [9] to 50MHz, and the SWEEP switch [6] to INT. Set the 3715A/3716A BB FREQUENCY switch [5] to OFF, and the SWEEP GAL control [4] fully clockwise.**	
2. **Connect the BB + SWEEP OUTPUT [C] to the 75? terminated Oscilloscope, and check for an output signal amplitude of at least 5V pk-pk.**	**Output incorrect; refer to 3715A Assembly Service Sheet A3 or 3716A Genera1 Service Sheet G3.**
3. **Turn the SWEEP CAL control [4] anticlockwise and check** that **the output signal amplitude reduces to OV.**	**SWEEP CAL operation incorrect; refer to 3715A Assembly Service Sheet A3, or 3716A Assembly Service Sheet Al.**
4. **Reset the SWEEP CAL control (4) fully clockwise. Check that theoutput signal amplitude reduces to OV as the 3710A SWEEP WIDTH control [9] is reduced to OMHz. Reset the SWEEP WIDTH control [9] to 50MHz.**	**Output level does not reduce with 3710A SWEEP WIDTH control; refer to 3710A General Service Sheet G2 Test Point 2G.**
5. **Steps 5 and 6 are applicable only to the 3716A. Set the SWEEP CAL control [4] for an output signal amplitude from the BB + SWEEP OUTPUT [C] of 5V pk-pk. Set the BB POWER (-dBm) attenuator [7] setting to 49.**	
6. **Set the BB FREQUENCY switch [5] to 2.4, 4.43, 5.6 and 8.2MHz, and check that the output signal amplitude of the BB + SWEEP OUTPUT (C] reduces to 4.5 ±0.2V pk-pk; 4.1 ±0.2V pk-pk; 3.9 ±0.2V pk-pk; and 3.4 ±0.2V pk-pk respectively.** **[For Optional BB Frequencies: Set the BB FREQUENCY switch [5] to 3.58, 3.5, or 4.5 MHz as applicable, and check that the output signal amplitude of the BB + SWEEP OUTPUT [C] reduces to 4.3 ±0.2V; 4.3 ±0.2V; or 4.1 ±O.2V respectively)**	**Output level incorrect; refer to 3716A Assembly Service Sheet A3.**

3-40. Additional 3715A/3716A Checks - Ext BB Input (3715A)

Procedure	Troubleshooting
1. **Set the Test Oscillator to 80kHz, and connect the output to the 75Ω terminated Oscilloscope. Adjust the Oscillator output signal amplitude to give a reading of 0.24V pk-pk.**	
2. **Disconnect the Oscillator output from the Oscilloscope, and connect the Oscillator to the 3715A EXT BB INPUT.**	
3. **Connect the 75Ω terminated Oscilloscope to the 3715A BB OUTPUT [C], and set the BB FREQUENCY switch [5] to EXT. Set the BB OUTPUT VERNIER [1] to +10dBm.**	
4. **Check that the output signal amplitude is 2.45 ±0.2V pk-pk.**	**Output signal amplitude not 2.45 ±0.2V pk-pk; refer to 3715A General Service Sheet G1.**
5. **Vary the Oscillator frequency control over the range 80kHz to 10MHz, and check that the BB OUTPUT [D] signal amplitude remains within the limits 2.45 ±0.2V pk-pk. Note: it may be necessary to reset the oscillator output amplitude.**	

3-41. Additional 3715A/3716A Checks - Reduce BB Frequency (3716A)

Procedure	Troubleshooting
1. **Set the 3710A SWEEP WIDTH control [9] to 50MHz, and the SWEEP switch (6) to INT.**	
2. **Set the 3716A BB FREQUENCY switch [5] to 8.2MHz.**	
3. **Check that the REDUCE BB FREQUENCY lamp (42) is extinguished.**	**REDUCE BB FREQUENCY lamp operation is incorrect; check the operation of the 3710A SWEEP WIDTH control as in Paragraph 3-23. SWEEP WIDTH correct; refer to 3716A Assembly Service Sheet A3. SWEEP WIDTH incorrect; refer to 3710A General Service Sheet G2.**
4. **Reduce the 3710A SWEEP WIDTH control [9] setting, and check the REDUCE BB FREQUENCY lamp (42) lights when the SWEEP WIDTH control [9] setting is 32.8 ±3.3MHz.**	
5. **Set the BB FREQUENCY switch [5] to 5.6MHz, and check that the REDUCE BB FREQUENCY lamp [42] is extinguished.**	
6. **Reduce the 3710A SWEEP WIDTH control [9] setting, and check that the REDUCE BB FREQUENCY lamp [42] lights when the SWEEP WIDTH [9] setting is 22.5 ±2.8MHz.**	
7. **Set the BB FREQUENCY switch [5] to 4.43MHz, and check that the REDUCE BB FREQUENCY lamp [42] is extinguished.**	
8. **Reduce the 3710A SWEEP WIDTH control [9] setting, and check that the REDUCE BB FREQUENCY lamp [42] lights when the SWEEP WIDTH [9] setting is 17.7 ±1.7MHz.**	
9. **Set the BB FREQUENCY switch [5] to 2.4MHz, and check that the REDUCE BB FREQUENCY lamp [43] is extinguished.**	
10. **Reduce the 3710A SWEEP WIDTH control [9] setting, and check that the REDUCE BB FREQUENCY lamp [42] lights when the SWEEP WIDTH control [9] setting is 9.6 ±1MHz.**	

11. Check that the REDUCE BB FREQUENCY lamp [42] remains extinguished for BB FREQUENCY switch [5] settings of 83 Δ, 250 and 500kHz; when the SWEEP WIDTH control [9] is at any setting. NOTE: For instruments with Optional BB Frequency:- Set the BB FREQUENCY switch [5] to the Optical frequency of 3.58/3.5/4.5MHz and check that the REDUCE BB FREQUENCY [42] lamp is extinguished. Reduce the 3710A SWEEP WIDTH control [9] setting, and check that the REDUCE BB FREQUENCY lamp [42] lights when the SWEEP WIDTH [9] setting is 14.3 ±1.4MHz/ 14.0 ±1.4MHz/18.0 ±1.8MHz when the BB FREQUENCY selected is 3.58MHz/3.5MHz/ 4.5MHz respectively.	REDUCE BB FREQUENCY lamp operation is incorrect; check the operation of the 371CA SWEEP WIDTH control as in Paragraph 3-23. SWEEP WIDTH correct; refer to 371 6A Assembly Service Sheet A3. SWEEP WIDTH incorrect; refer to 3710A General Service Sheet G2.

SECTION IV

PERFORMANCE CHECKS

4-1. INTRODUCTION

4-2. This section provides a series of independent tests on the *hp* 3710A lF/BB Transmitter, the *hp* 3702B IF/BB Receiver, and the associated plug-ins. These tests will establish the specifications as stated in Section I. Figure 3-1 shows the reference settings of all the controls and is used as the starting point for all the following tests.

4-3. Preliminary Procedure

1. **Ensure that the correct operating voltage and fuse rating are selected on the line module at the rear of each instrument.**

2. **Connect the instruments to the line supply.**

3. **Set all the controls to the reference settings given in Figure 3-1.**

4. **Allow 1/2hour instrument warm-up time before proceeding with the performance checks**

4-4. 3710A IF/BB TRANSMITTER PERFORMANCE CHECKS

4-5. Sweep Section - Frequency

SPECIFICATION: INT: 70Hz ±3Hz
(OPT 006: 50Hz ±2Hz)
(OPT 007: 100Hz ±4Hz).

LINE: Locked to line frequency.
OPT: As INT.
(OPT 015: 18Hz ±2Hz).

TEST EQUIPMENT:

Electronic Counter . . . . . *hp* 5248M
Oscilloscope .... hp 180A/1801A/182lA
Cables . . . . . _ *hp* 15525A

Procedure

1. **Set the controls to their reference** settings as in **Figure 4-1.**

2. Set **the** SWEEP **switch [5] to INT and** the **OUTPUT LEVEL control [4] clockwise.**

3. **Connect the Electronic Counter to the SWEEP OUTPUT (A) and check that the frequency is 70Hz ±3Hz (OPT 006: 50kHz ±2Hz; OPT 007: 100Hz ±4Hz).**

4. **set the SWEEP switch [5] to OPT and check for the same frequency as INT (OPT 015: 18Hz ±2Hz).**

5. **Set the SWEEP switch [5] to LINE and check for line frequency.**

6. **Disconnect the Electronic Counter and connect the Oscilloscope to the SWEEP OUTPUT (A).**

7. **Wiring the Oscilloscope in the line trigger move check that the SWEEP OUTPUT frequency is locked to the line frequency.**

4-6. Sweep Output - Level

SPECIFICATION: 0 to 25V pk-pk minimum into 10kΩ.

TEST EQUIPMENT:

Oscilloscope .... *hp* 180A/l801A/1821 A

Procedure:

1. **Set** the **controls** to their **reference** settings as in Figure Q-1.

2. Set the SWEEP switch [5] to INT.

3. Connect the Oscilloscope to the SWEEP OUTPUT (A) terminated in 10kΩ.

4. Adjust the OUTPUT LEVEL [4] from fully counterclockwise to fully clockwise and check that the SWEEP OUTPUT level varies from 0 to at least 25V pk-pk.

5. Repeat step 4 with the SWEEP switch [5] set to LINE and OPT.

4-7. Sweep Output - Harmonics

SPECIFICATION: >45dB below fundamental.

TEST EQUIPMENT:

Wave Analyzer ..... *hp* 302A

Procedure

1. Set the controls to their reference settings as in Figure 4-l.

2. Set the SWEEP switch (5) to INT and the OUTPUT LEVEL [4] clockwise (adjust OUTPUT LEVEL (4) as necessary during check).

3. Connect the SWEEP OUTPUT (A) to the Wave Analyzer input.

4. Measure the level of the second and third harmonics of the SWEEP OUTPUT relative to the fundamental 70Hz. (OPT. 006: 50Hz; OPT. 007: 100Hz) and check that they are at least 45 dB below the fundamental.

5. Repeat step 4 with the SWEEP switch (5) set to LINE and OPT.

NOTE: In OPT position the fundamental is same as INT except OPT 015 which is 18Hz.

4-8. BB + Sweep Output - Level

SPECIFICATION: Level: 0 to 5.5V pk-pk minimum x k, into 75Ω.

$$k = \frac{\text{Sweep width (MHz)}}{50} \quad \text{(BB frequency below 2.4MHz)}$$

$$k = \frac{\text{Sweep width (MHz)} - 2 \times \text{BB frequency}}{50}$$

(BB frequency 2.4MHz or greater)

TEST EQUIPMENT:

Oscilloscope .. .. *hp* 180A/1801A/1821A
75Ω termination .. .. *hp* 15522A
BNC Tee .. .. ——

Procedure

1. Set the controls to their reference settings as in Figure 4-1.

2. Set the SWEEP switch (5) to INT and BB Power to -49dBm.

3. Connect the Oscilloscope, terminated in 75Ω to the BB + SWEEP OUTPUT [C].

4. Check that the level can be adjusted from 0 to at least 5.5V pk-pk by the SWEEP CAL control [3].

5. Check that when reducing the SWEEP WIDTH setting [7], the level reduces by a factor of:

$$\frac{\text{SWEEP WIDTH (MHz)}}{50}$$

6. Reset the SWEEP WIDTH [7] to 50MHz.

7. **If a 3716A plug-in is fitted, set the BB FREQUENCY (9) to 2.4MHz and check that the level reduces to 4.5V pk-pk, i.e. reduces by a factor of:**

$$\frac{\text{SWEEP WIDTH (MHz) -2 x BB frequency}}{50}$$

8. **Repeat step 7 for any combined SWEEP WIDTH (7) setting and BB FREQUENCY (9) setting of 2.4MHz or greater, and check that the level reduces by appropriate factor.**

9. **Repeat test with SWEEP switch [5] set to LINE and OPT.**

4-9. BB + Sweep Output - Harmonics

SPECIFICATION: >40dB below fundamental.

TEST EQUIPMENT:

Wave Analyzer . . . . . hp 302A

Procedure

1. **Set the controls to their reference settings as in Figure 4-l.**

2. **Set the SWEEP switch (5) to INT and the SWEEP CAL (3) clockwise. (Adjust SWEEP CAL (3) as necessary during test).**

3. **Connect the BB + SWEEPOUTPUT (C) to the Wave Analyzer input.**

4. **Measure the level of the second and third harmonics of the BB + SWEEP OUTPUT (C) relative to the fundamental 70Hz (OPT 006: 50Hz, OPT 007: 100Hz) and check that they are at least 40dB below the fundamental.**

5. **Repeat step 4 with the SWEEP switch (5) set to LINE and OPT.**
NOTE: In OPT position the fundamental is the same as INT except OPT 015 which is 18Hz.

4-10. Baseband Section - Frequency

SPECIFICATION: 83.333,250,5OOkHz ±2Hz.

2.4, 4.43, 5.6, 8.2MHz ±5ppm (3716A only).

[Optional as indicated by BB frequency switch. 92.593, 277.778, 555.556kHz ±2Hz 3.5, 3.58, 4.5MHz ±5ppm (3716A only)].

TEST EQUIPMENT:

Electronic Counter . . . . . hp 5248M

Procedure

1. **Set the controls to their reference settings as in Figure 4-1.**

2. **Set the BB FREQUENCY (9) to 8%.**

3. **Connect the Electronic Counter to the BB OUTPUT (D) and check for 83.333kHz ±2Hz.**

   OPT: BB FREQUENCY (9) to 92 Δ and check for 92.593kHz ±2Hz.

4. **Set the BB FREQUENCY (9) to 250 and check for 250kHz ±2Hz.**

   OPT: BB FREQUENCY (9) to 277 Δ and check for 277.778kHz ±2Hz.

5. **Set the BB FREQUENCY (9) to 500 and check for 500kHz ±2Hz**

   OPT: BB FREQUENCY (9) to 555 Δ and check for 555.556kHz ±2Hz.

6. **Set the BB FREQUENCY (9) to 2.4 and check for 2.4MHz ±12Hz.**

7. **Set the BB FREQUENCY [9] to 4.43 and check for 4.43MHz ±22Hz.**

   OPT: BB FREQUENCY [9] to 3.5 and check for 3.5MHz ±17Hz.

BB FREQUENCY [9] to 3.58 and check for 3.58MHz ±18Hz.

BB FREQUENCY [9] to 4.5 and check for 4.5MHz ±22Hz.

8. **Set the BB FREQUENCY (9) to 5.6 and check for 5.6MHz ±28Hz.**

   OPT: BB FREQUENCY (9) to 4.43 and check for 4.43MHz ±22Hz.

9. **Set the BB FREQUENCY (9) to 8.2 and check for 8.2MHz ±41Hz.**

   OPT: BB FREQUENCY (9) to 5.6 and check for 5.6MHz ±28Hz.

4-11. BB Output - Level

SPECIFICATION: +lOdBm ±0.5dB reduced by VERNIER (1) by not less than 1dB.

TEST EQUIPMENT:

RMS Voltmeter	**hp 3403C**
75Ω termination	***hp* 15522A**
BNC Tee	
Cable	***hp* 15525A**

Procedure

1. **Set the controls to their reference settings as in Figure 4-1.**
2. **Set the BB FREQUENCY (9) to 83Δ (Opt. 92Δ).**
3. **Connect the RMS Voltmeter, terminated in 75Ω, to the BB OUTPUT** (D) **and check for a reading between 0.818V and 0.917V.**
4. **Set the VERNIER (1) counterclockwise and check that the reading falls by at** feast 95mV.
5. Repeat **steps 3 and 4 at all other settings** of **BB FREQUENCY (9) except OFF.**

4-12. BB Output - Harmonics

SPECIFICATION: >38dB below fundamental.

TEST EQUIPMENT:

Spectrum Analyzer . . *hp* 140S/8552A/8553B

Procedure

1. **Set the controls to their reference settings as in Figure 4-1.**
2. **Set the BB FREQUENCY (9) to 83Δ (Opt 92 Δ).**
3. **Connect the BB OUTPUT (D) to the Spectrum Analyzer input.**
4. **Measure the harmonic content of the BB OUTPUT (D) and check for >38dB down on the fundamental.**
5. **Repeat step 4 for all settings of the BB FREQUENCY switch (9) except OFF.**

4-13. BB Output - Return Loss

SPECIFICATION: Better than 30dB

TEST EQUIPMENT:

RMS Voltmeter	***hp 3403C***
Test Oscillator	***hp* 654A**
Hybrid	***hp* 15537A**
75Ω termination	***hp* 15522A**
17dB Mismatch	***hp* 15521A**
Cables	***hp* 15525A**

Procedure

1. Set the controls to their reference settings **as in Figurc** 4-1.
2. Connect the equipment as in Figure 4-2 with

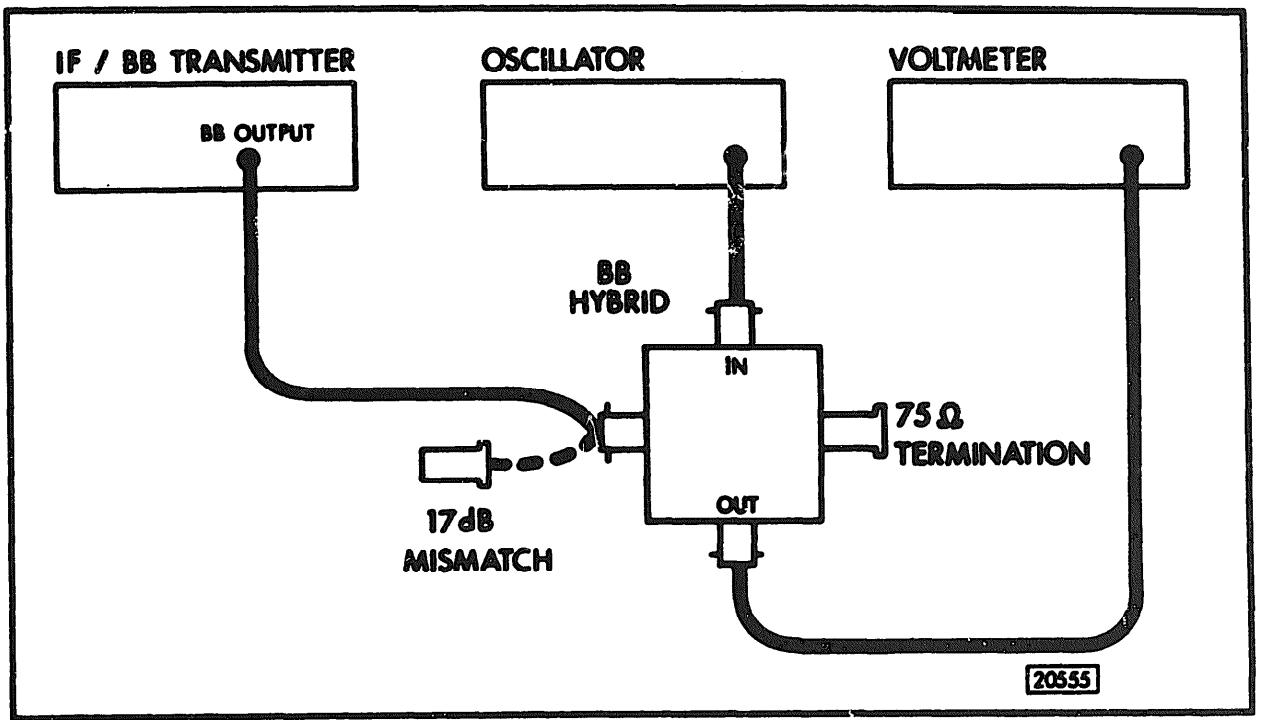


Figure 4-2 BB Output - Return Loss Check

the 17dB mismatch connected to the hybrid.

3. Set the Test Oscillator frequency to 80kHz, 75Ω unbalanced output and output level of OdBm.

4. Adjust the Test Oscillator Amplitude control to provide a reference reading on the RMS Voltmeter.

5. Disconnect the 17dB mismatch and connect the BB OUTPUT (D) to the hybrid.

6. Check that the reading on the RMS Voltmeter falls by at least 13dB.

7. Vary the Test Oscillator frequency over the range 80kHz to 10MHz and check that the RMS voltmeter reading remains at least 13dB below the reference level set in step 4.

4-14. BB + Sweep Output - Level

SPECIFICATION: **0 to -49dBm in dB steps by BB Power.**

Tolerance: **±0.5dB at OdBm**
±1dB at other levels.
Vernier provides continuous variation of not less than 1dB.

TEST EQUIPMENT:

RMS **Voltmeter**	*hp* **3400A**
RMS Voltmeter	*hp 3403C*
75Ω termination	*hp* **15522A**
Cable	*hp* 15525A
BNC Tee 75Ω	" ... -
Attenuator	*hp* 3750A

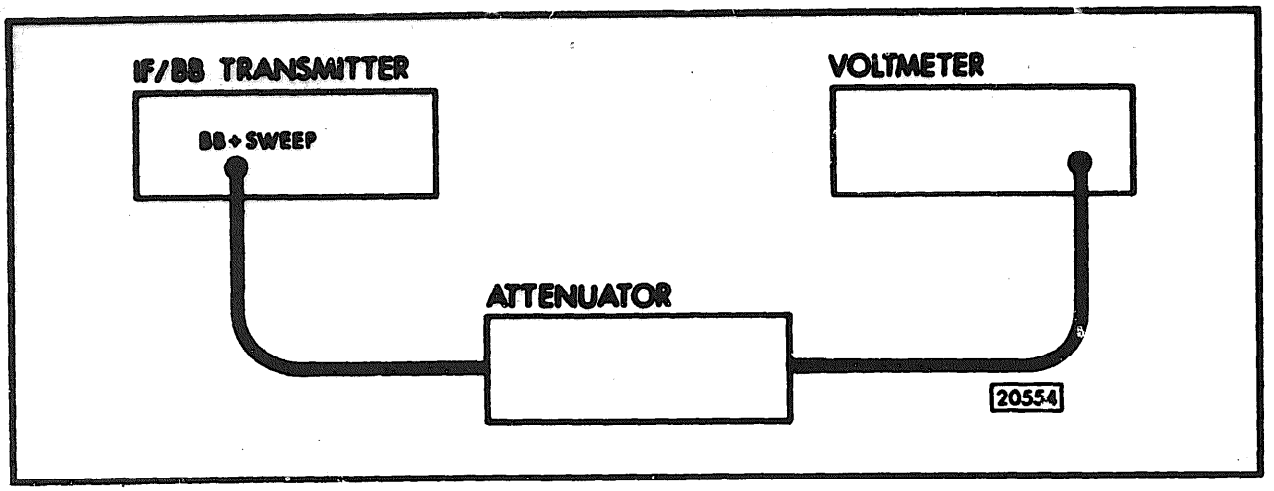


Figure 4-3 BB + Sweep Output Level Check

Procedure

1. Set the controls to their reference. settings as in Figure 4-1.

2. Set the BB FREQUENCY (9) to 83Δ (Opt. 92 1Δ)

3. Connect the 3403C RMS Voltmeter, terminated in 75 Ω, to the BB + SWEEP OUTPUT (C) and check for a reading between 0.259 and 0.290V.

4. Set the VERNIER (2) counterclockwise and check that the reading falls by at least 30mV.

5. Repeat steps 3 and 4 at all other settings of BB FREQUENCY (9) except OFF.

6. Disconnect the 3403C RMS Voltmeter and connect the equipment as in Figure 4-3. Insert 4 9dB in the Attenuator and adjust the VERNIER (2) to give a convenient reference reading on the 3400A RMS Voltmeter, dB scale.

7. Remove 1dB from Attenuator and set the 3716A BB POWER (6) to 1dBm.

8. Check that the 3400A RMS Volt meter reading does not change by more than ±0.5dB.

9. Using the Attenuator check all positions of BB POWER (6) attenuator for ± 0.5dB accuracy.

4-15. BB + Sweep Output - Harmonics

SPECIFICATION: >40dB below fundamental.

TEST EQUIPMENT:

Spectrum Analyzer . . *hp* 140S/8552A/8553B

Procedure

1. Set the controls to their reference settings as in Figure 4-1.

2. Set the BB FREQUENCY (9) to 83 Δ (Opt-92 1Δ).

3. Connect the BB + SWEEP OUTPUT (C) to the Spectrum Analyzer input.

4. Measure the harmonic content of the BB + SWEEP OUTPUT (C) and check for >4OdB down on the fundamental.

5. Repeat step 4 for all settings of BB FREQUENCY (9) switch except OFF.

4-16. BB + Sweep Output - Return Loss

SPECIFICATION: Better than 30dB.

TEST EQUIPMENT

RMS Voltmeter	*hp* 3403C
Test Oscillator	*hp* $WA
BB Hybrid	*hp* 15537A
75Ω termination	*hp 15522A*
17dB Mismatch.	*hp* 15521A
Cable	*hp* 15525A

Procedure

1. Set the **controls to their reference settings as in Figure 4-1.**
2. **Connect the equipment as in Figure 4-4 with the 17dB mismatch connected to the Hybrid.**
3. **Set the Test Oscillator frequency to 80kHz, 75Ω unbalanced output and- output- level of 0dBm.**
4. **Adjust the Test Oscillator amplitude control to provide a reference wading on the RMS Voltmeter.**
5. **Disconnect the 17dB mismatch and connect the BB + SWEEP OUTPUT (C) to the Hybrid.**
6. **Check that the reading on the RMS Voltmeter falls by at least 13dB.**
7. **Vary the Test Oscillator frequency over the range 80kHz to 10 MHz and check that the RMS Voltmeter reading remains at least 13dB below the reference level set in step 4.**

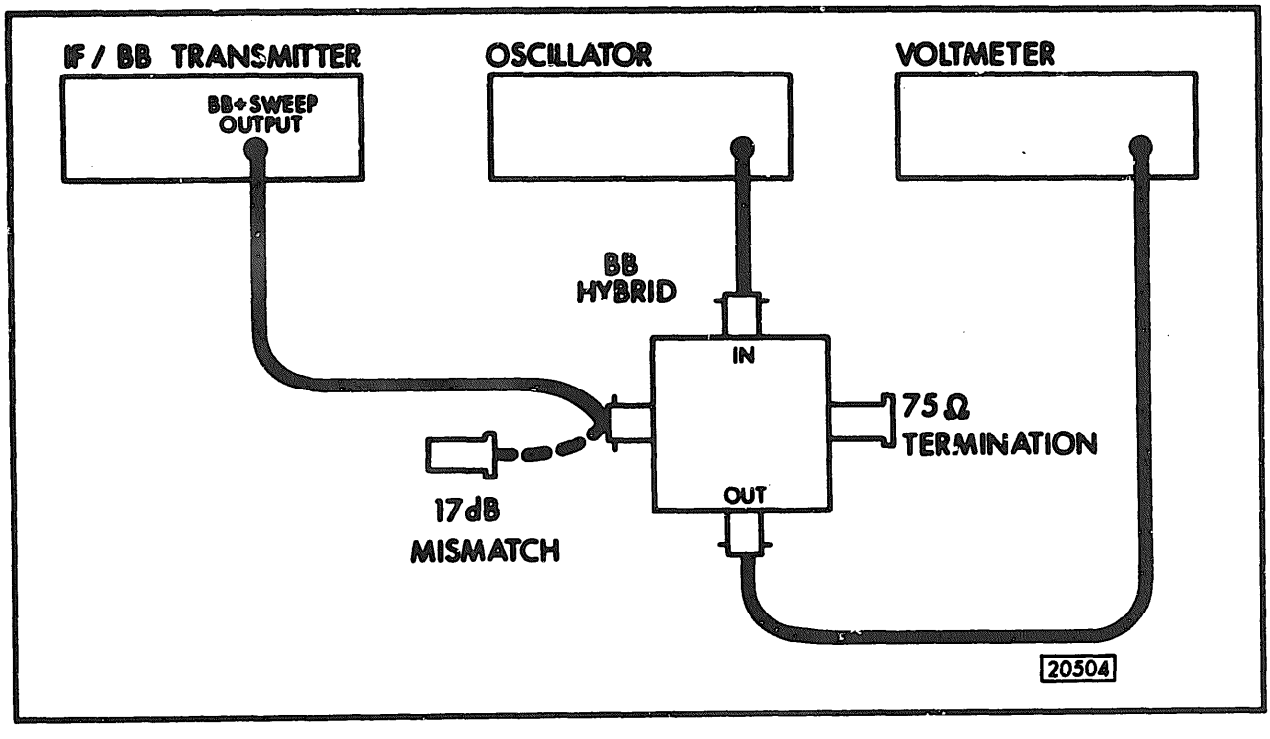


Figure 4-4 BB + Sweep Output - Return Loss Check

4-17. IF Section - Frequency

SPECIFICATION: **Range: 45 to 95MHz**
Scale Accuracy: ±0.5MHz
Stability: ±lOOkHz per 5hr period at 70MHz (after 1/2hr warm-up).

TEST EQUIPMENT:

Electronic Counter . . . . . *hp* 5248M

Procedure

1. **Set controls to reference settings as in Fig ure 4-1.**
2. **Connect the IF OUTPUT (G) to the Electronic Counter and check for 70MHz ±0.5MHz.**
3. **Measure the frequency at 1MHz intervals as the IF FREQUENCY (11) is varied over the range 45 to 95MHz and check for a scale accuracy 0.5MHz.**
4. **Reset the IF FREQUENCY (11) to 70MHz.**

4-18. IF Section - Deviation

SPECIFICATION: **Scale Accuracy:**
10kHz to 100kHz ±10%
100kHz to 500kHz +5%

TEST EQUIPMENT:

Spectrum Analyzer . . *hp* 140S/8552A/8553B
75Ω/50ΩMatching Pad . . Rohde & Schwarz type DAF BN 18084 or Greenpar SA 104718

METHOD 1 100kHz to 500kHz

A convenient way to check deviation is to use a Bessel Zero test. This makes use of the carrier or sideband disappearance at certain known modulation indices (M.I.). The deviation (ΔF) can be calculated from:

ΔF = M.I. x Modulation Frequency

Note: This formula gives pea& deviation which is converted to RMS in the normal way:

ie $\frac{\Delta F \text{ peak}}{\sqrt{2}}$

Procedure

1. **Set the controls to their reference settings as in Figure 4-1.**
2. **Set the BB FREQUENCY (9) to 83 Δ (Opt. 92 ΔF).**
3. **Connect the IF OUTPUT (G) to the Spectrum Analyzer RF input via the 75Ω/50Ω matching pad.**
4. **Obtain a display on the Spectrum Analyzer .to show the carrier and at least 2 sideband pairs.**
5. **Set the DEVIATION (8) to 141kHz (Opt. 157kHz) and obtain a first carrier zero, see Figure 4-5.**
   Note: It may be necessary to adjust the front panel DEVIATION CAL (8) to obtain zero.
6. **Turn the DEVIATION (8) towards 225kHz and check that the 1st pair of sidebands reduces to zero at 225 ±11kHz (Opt. 251 k12kHz).**
7. **In the same way other points on the DEVIATION (8) scale may be checked as in Table 4-1.**

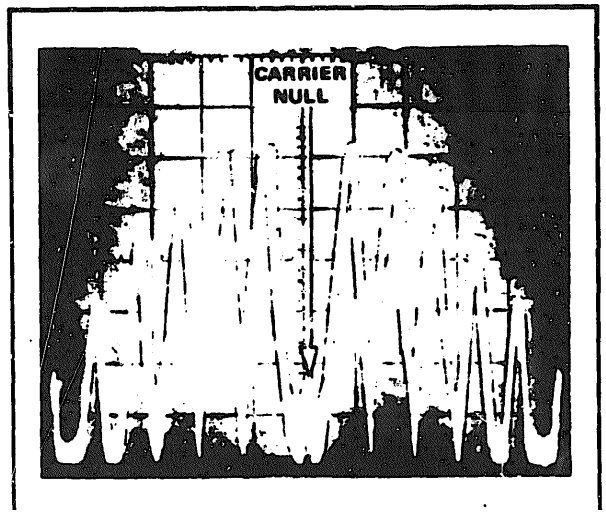


Figure 4-5 First Carrier Null

Table 4-1

BB Deviation (kHz rms)	Carrier or Sideband Pair at Null Point	Modulation Index	Modulation Frequency (kHz)
141 ± 7	Carrier (J_0)	2.4048	83.333
225 ±11	1st Sideband Pair (J_1)	3.8317	83.333
303 ±15	2nd Sideband Pair (J_2)	5.1356	83.333
325 ±16	Carrier (J_0)	5.5201	83.333
413 ±20	1st Sideband Pair (J_1)	7.0156	83.333
496 ±25	2nd Sideband Pair (J_2)	8.4172	83.333
	Options		
158 ± 8	Carrier (J_0)	2.4048	92.593
251 ±12	1st Sideband Pair (J_1)	3.8317	92.593
336 ±17	2nd Sideband Pair (J_2)	5.1356	92.593
361 ±18	Carrier (J_0)	5.5201	92.593
459 ±23	1st Sideband (J_1)	7.0156	92.593
472 ±24	Carrier (J_0)	2.4048	277.778

METHOD 2 10 to 100kHz

The lowest frequency at which a Bessel occurs using the BB frequencies generated in the 3715A/3716A is 141kHz. To check the DEVIATION (8) below this the amplitude of the first pair of sidebands relative to the carrier can be calculated from the following formula:

$$J_n(x) = \frac{x^n}{2^n\, n!}\left\{1 - \frac{\left(\frac{x}{2}\right)^2}{1!\,(n+1)} + \frac{\left(\frac{x}{2}\right)^4}{2!\,(n+1)(n+2)} - \frac{\left(\frac{x}{2}\right)^6}{3!\,(n+1)(n+2)(n+3)} + \cdots\cdots\right\}$$

$$= \frac{x^n}{2^n\, n!}\left\{1 - \frac{x^2}{4\,(n+1)} + \frac{x^4}{32\,(n+1)(n+2)} - \frac{x^6}{384\,(n+1)(n+2)(n+3)} + \cdots\cdots\right\}$$

where x = modulation index

$$= \frac{\Delta f \text{ peak}}{\text{Modulating Frequency}}$$

n = Order of Bessel Function eg, n = 0 for carrier
n = 1 for 1st sideband pair

Example: With 500kHz Baseband and 50kHz RMS Deviation:

$$J_0(x) = 1\left(1 - \frac{.02}{4} + \ldots\ldots\right)$$

$$= 0.995$$

$$J_1(x) = \frac{0.14142}{2}\left(1 - \frac{.02}{8} + \ldots\ldots\right)$$

$$= 0.0707$$

∴ Ratio of first sideband pair to carrier is 0.0707:0.995 = 0.071

i.e. first sideband pair is 23dB down on carrier

Similarly for 50kHz – 12% ie, 44kHz first sideband pair is 24.1dB down on carrier

and for 50kHz + 12% ie, 56kHz, first sideband pair is 22dB down on carrier

Therefore to be within specification for a Base band frequency of 500kHz and DEVIATION (8) set to 50kHz the first sideband pair should be 23dB ±1dB down on the carrier.

Similarly with 500kHz BB frequency and 10kHz deviation the first sideband pair is 37 ±1dB down on the carrier and at 30kHz deviation 27.4 ±1dB.

Similary with the optional BB frequency of 555.556

10kHz is 38 ±1dB .
30kHz is 28 ±1dB
50kHz is 24 ±1dB

Procedure

1. Set the controls to their reference settings Figure 4-l.
2. Set the BB Frequency (5) to 500kHz (OPT. 555.ΔΙ kHz) and the deviation to 10kHz.
3. Connect the IF OUTPUT (G) to the Spectrum Analyzer RF Input via the 75/50 Ω Matching Pad.
4. Obtain a display on the Spectrum Analyzer to show the carrier and the first sideband pair.
5. Adjust the Spectrum Analyzer level controls to bring the first sideband pair to a reference point on the display.
6. Insert attenuation in the 3710A IF ATTENUATOR (12) to bring the carrier to the reference point noted in step 5.
7. The IF ATTENUATOR (121 setting should be 37 ±1dB (OPT. 38 ± 1dB).
8. Similarly check 30kHz and 50kHz DEVIATION settings for 27.4 ±1dB) and 23 ± 1dB (OPT .24 x 1dB) respectively.
9. Other DEVIATION settings can be checked by calculating the sideband carrier ratio.

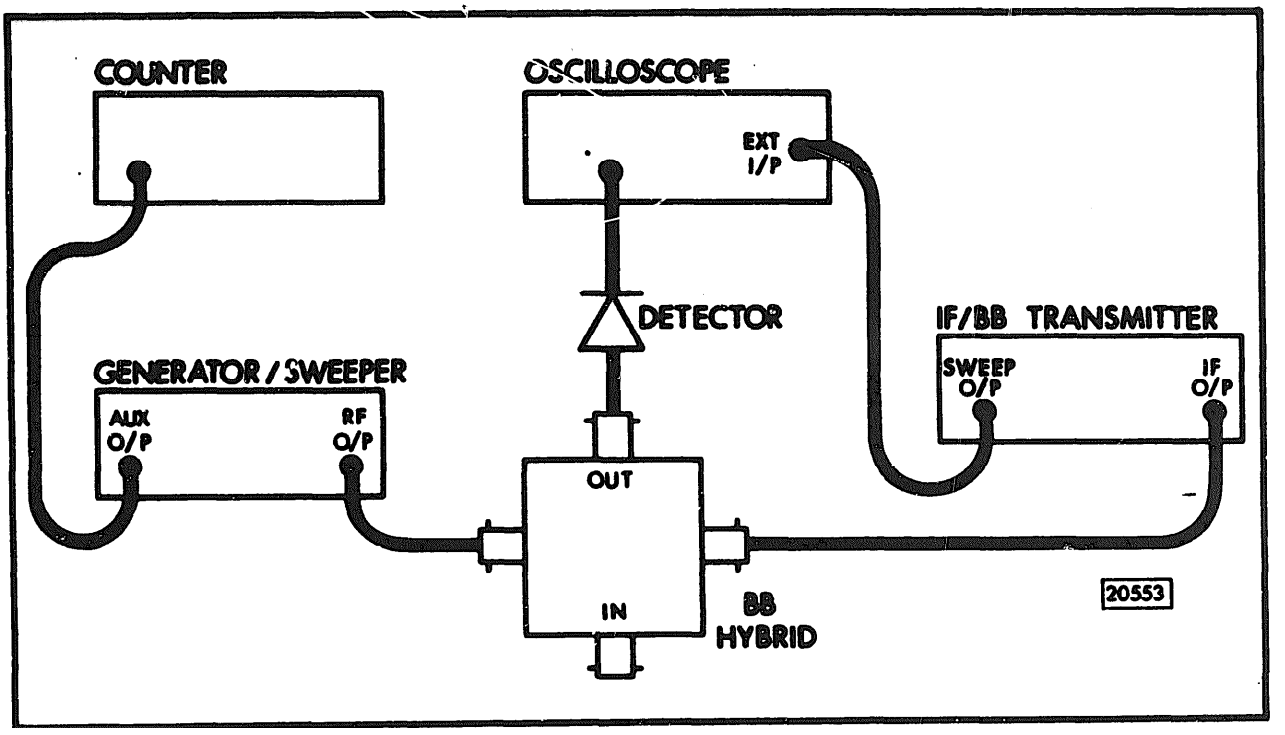


Figure 4-6 IF Section - Sweep Width Check

4-19. IF Section - Sweep Width

SPECIFICATION: 0 to 5OMHz ±2MHz

TEST EQUIPMENT:

Generator/Sweeper	*hp* 8601A
Oscilloscope	*hp* 18OA/1820A/1802A
Detector	*hp* 8471A
Hybrid	*hp* 15520A
3 x cables	*hp* 15525A
Counter	*hp 5248M*

Procedure

1. **Set the controls to their reference settings as in Figure 4-1.**
2. **Set the SWEEP (5) to INT and the OUTPUT LEVEL (4) fully clockwise.**
3. **Connect the equipment as in Figure 4-6.**

Set the Generator/Sweeper controls as follows:

SWEEP	cw
RANGE	110
FREQUENCY	45MHz
OUTPUT LEVEL	-20dBm

Set Oscilloscope controls as follows:

EXT. INPUT	DC
DISPLAY	EXT. SENS
MAGNIFIER	Xl

4. **Adjust the Oscilloscope EXT. SENS. control to give a 10cm horizontal display on the Oscilloscope.**
5. **Adjust the Generator/Sweeper Frequency until a marker is observed on the Oscilloscope trace and position this marker at the extreme left-hand edge of the trace.**
6. **Measure the Generator/Sweeper Frequency with the Counter.**

7. Increase the Generator/Sweeper frequency until the marker is at the right hand edge of the trace and measure the Generator/Sweeper frequency.

8. The difference in frequency measurement between step 6 and step 7 should be 50MHz ±2MHz.

9. Other settings of the SWEEP WIDTH (7) control may be verified using the technique given in steps 4 through 8.

10. Set the SWEEP switch (8) to LINE and repeat the Sweep Width tests, steps 3 through 8 above. The Sweep Width should again be 50MHz ±2MHz.

4-20. IF Section - Sweep Width Reduce Lamp

SPECIFICATION: Lights when the IF is being swept outside 45 to 95MHz range.

Procedure:

1. See Paragraphs 3-23-9 through 3-23-13.

4-21. IF Section - Auto Sweep Reduction (with 3716A plug-in only)

SPECIFICATION. When BB frequency setting is 2.4MHz or greater, the SWEEP width reduces by 2 x BB freq. ±10%.

Procedure

1. See Paragraph 3-23-14.

4-22. IF Output - Power

SPECIFICATION: Ref. Level: +10dBm ±0.5dB.

Vernier: not less than ±1dB.

Attenuator: 0 to 61dB ±0.1dB, or ±1% whichever is greater.

TEST EQUIPMENT:

Power Meter	*hp 432A*
Thermistor Mount	*hp* 478A
75/50Ω Matching Pad	Rohde & Schwarz type DAF BN 18084 or Greenpar SA 104718

Procedure

1. Set the controls to their reference settings as in Figure 4-1.

2. Connect the power meter via the Thermistor Mount and the 75/50Ω Matching Pad to the IF OUTPUT (G).

3. Check that the IF OUTPUT level is +10dBm ±0.5dB.

Note: Loss through 75/50Ω Matching Pad
Rohde and Schwarz . . . . . -6dB
Greenpar . . . . . -8.2dB

4. Adjust the IF FREQUENCY (11) over the range 45 to 95MHz and check that the Power Meter reading does not vary by more than 0.1dB. Reset the IF FREQUENCY (11) to 70MHz.

5. Set the IF VERNIER (14) to -1dB and check that the Power Meter reading falls by at least 1dB. Reset the IF VERNIER (14) to 0.

6. Set the IF VERNIER (14) to +1dB and check that the Power Meter reading rises by at least 1dB. Reset the IF VERNIER (14) to 0.

7. Adjust the IF VERNIER (14) for a reference reading on the Power Meter.

8. Check the IF ATTENUATOR (12) accuracy for ±0.1 dB up to 10dB attenuation and ±1% of setting for greater than 10dB.

4-23. IF Output - Harmonics

SPECIFICATION: >28dB below fundamental.

TEST EQUIPMENT:

Spectrum Analyzer . . . . . *hp* 140S/8552A/ 8553B

Procedure

1. **et the controls to their reference settings as in Figure 4-1.**

2. **Insert 30dB in the IF ATTENUATOR (12).**

3. **Connect the IF OUTPUT (G) via the 75/'50Ω matching pad to the Spectrum Analyzer RF Input.**

4. **Vary the IF FREQUENCY (11) over the range 45 to 95MHz and check that the harmonic level is at least 28dB below the fundamental.**

4-24. IF Output - Return Loss

SPECIFICATION: 55 to 85MHz: better than 30dB.

45 to 95MHz: better than 28dB.

TEST EQUIPMENT:

Oscilloscope . . .. .. hp 180A/1801A/1821A
Swept Generator . . . . . *hp* 3710A
Attenuator . . . . . *hp* 3750A
Amplifier . . . .*hp* 461A
Detector . . . . . *hp* 8471A
Accessory Kit . . . . . *hp* 15550A
Cables . . . . . *hp* 15525A

Procedure:

1. **To measure the Return Loss of the IF OUTPUT (G), it is necessary to disconnect the IF signal. This is done by removing the top cover from the 3710A and disconnecting the BROWN coded cable from A6J1.**

2. **Set the controls to their reference** settings as **in Figure 4-1.**

3. **Set the Oscilloscope control as follows:**

INPUT (1801A) . . . . . DC
VOLTS/DIV (1801A) 02
DISPLAY EXT SENS
MAGNIFIER:: :: :: :: :: :: :: :: :: Xl
POLARITY (1801A) . . . . . -UP

Set the Swept Generator controls as follows:

SWEEP . . INT
SWEEP WIDTH :: :: :: :: :: :: :: :: 50MHz
OUTPUT LEVEL . . . . . clockwise
BB FREQUENCY . . . . . OFF
IF FREQUENCY . . . . . 70 MHz
IF ATTENUATOR 0

Set the Reference Attenuator to 11dB.
Set the Amplifier for 40dB gain.

4. **Connect the equipment as in Figure 4-7 with the Hybrid connected to the 17dB Mismatch. Adjust the Oscilloscope vertical position and sensitivity to obtain a display on the CRT. Adjust the Oscilloscope ExT SENS control to give a 10cm horizontal display. The display on the Oscilloscope CRT is that of Return Loss v Frequency.**

Using a negative output detector es in this test, and with the Oscilloscope polarity set to -UP, the Return Loss is displayed with high (better) values at the top of the screen and low (worse) values at the bottom of tHe screen.

5. **Adjust the Oscilloscope vertical position to move the trace to a suitable reference point on the CRT.**

6. **Disconnect the 17dB Mismatch from the** Hybrid and **connect the Transmitter IF OUTPUT (G) to the vacated port on the Hybrid.**

7. Remove the attenuation from the **Reference** Attenuator and check that the trace remains below the reference level established in step 5. (See Figure 4-8).

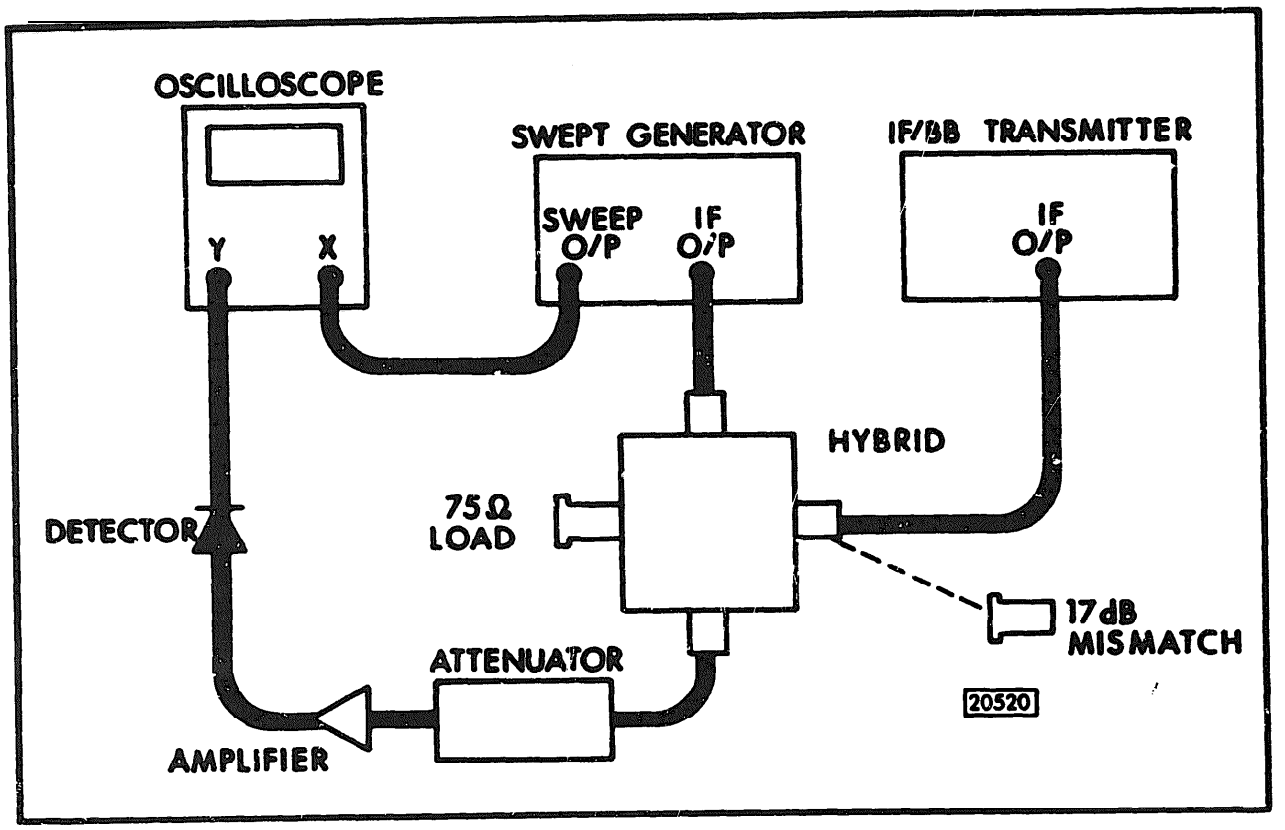


Figure 4-7 IF Output Return Loss Check

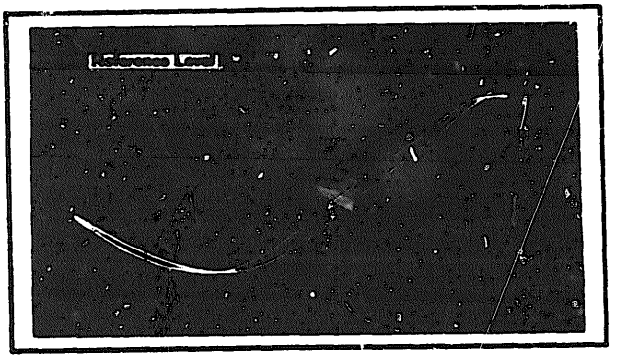


Figure 4-8 Reference Level

8. Check that the trace remains below the reference level for any settings of the IF ATTENUATOR (12).

9. Repeat steps 3 through 8 with the Swept Generator SWEEP WIDTH set to 30MHz and the Reference Attenuator set to 13dB.

10. Reconnect the BROWN coded cable to A6J1. Note: Before reconnecting A6J1 the Return Loss check in Paragraph 4-25 may be performed.

4-25. Aux Output - IF Uncal

SPECIFICATION: Level:
not less than -10dBm.

Return Loss:
better than 20dB.

TEST EQUIPMENT:

Power Meter ..... hp 432A

Thermistor Mount . . . . . *hp* 478A
75/50Ω Matching Pad . . . . Rohde & Schwarz type DAF 18084 or Greenpar SA 104718
Oscilloscope . . . . *hp* 180A/1801A/1821A
Swept Generator . . . . . *hp* 3710A
Attenuator . . . . . *hp* 3750A
Amplifier . . . . . *hp* 461A
Detector . . . . . *hp* 8471A
Accessory Kit . . . . . *hp* 15550A
Cables . . . . . *hp* 15525A

Procedure

1. Set the controls to their reference settings as in Figure 4-l.

2. Set the AUX OUTPUT switch (13) to IF UNCAL.

3. Connect the Power Meter via the Thermistor Mount and 75/50Ω Matching Pad to the AUX OUTPUT (F).

4. Adjust the IF FREQUENCY (11) over the range 45 to 95MHz and check that the output level does not fall below -10dB.

Note: Loss through 75/50 Ω matching pad
Rohde and Schwarz . . . . . -6dB
Greenpar . . . . . -8.2dB

5. Measure the Aux Output Return Loss, as in Paragraph 4-24 steps 1 through 7 with the Reference Attenuator set to 3dB.

4-26. Aux Output - 70MHz Xtal

a. Frequency

SPECIFICATION: 70MHz ±5kHz.

TEST EQUIPMENT:

Electronic Counter . . . . . *hp* 5248M
Cable . . . . . *hp* 15525A

Procedure

1. Set the controls to their reference settings as in Figure 4-1

2. Connect the AUX OUTPUT (F) to the Electronic Counter.

3. Check that the Counter reading is 70MHz ±5kHz.

b. Harmonics

SPECIFICATION: >28dB below fundamental.

TEST EQUIPMENT:

Spectrum Analyzer . . *hp* 140S/851/52A/85538
75/50 Ω Matching Pad . . . Rohde & Schwarz type DAF 18084 or Greenpar SA 104718

Procedure

1. Set the controls to their reference settings as in Figure 4-1.

2. Connect the AUX OUTPUT (F) via the 75/50Ω Matching Pad to the Spectrum Analyzer RF Input.

3. Check that the harmonic content of the AUX OUTPUT (F) is at least 23dB below the fundamental.

c. Power

SPECIFICATION: +10dBm ±0.5dB

TEST EQUIPMENT:

Power Meter . . . . . *hp* 432A
Thermistor Mount . . . . . *hp* 478A
75/50 Ω Matching Pad . . . . Rohde & Schwarz type DAF 18084 or Greenpar SA 104718
Cable . . . . . *hp* 15525A

Procedure

1. Set the controls to their reference setting as in Figure 4-1.

2. Connect the Power Meter via the Thermistor Mount and 75/50Ω Matching Pad to the AUX OUTPUT (F).

3. Check that the AUX OUTPUT level is 10dBm ±0.5dB.

Note: Loss through matching pad
Rohde and Schwarz ..... -6dB
Greenpar .. .. -8.2dB

d. Return Loss

SPECIFICATION: >26dB.

TEST EQUIPMENT:

Oscilloscope	*hp* 18OA/1801A/1821A
Swept Generator	*hp* 3710A
Attenuator	*hp* 3750A
Amplifier	*hp* 461A
Detector	*hp* 8471 A
Accessory Kit.....	*hp* 15550A
Cables	*hp* 15525A

Procedure

1. In order to measure the Return Loss it is necessary to make the oscillator inoperative.

2. Set the LINE switch to OFF, remove the instrument top cover and unplug the crystal from the Al6 Assembly. Reset the LINE switch to ON.

3. Measure the Return Loss' of the AUX OUTPUT (F) at 70MHz as detailed in Paragraph 4-24. Steps 1 through 7 with the Swept Generator SWEEP WIDTH set to 3MHz and the Reference Attenuator set to 9dB.

4. Check that the Return Loss is at least 26dB. Replace the crystal into the Al6 Assembly.

4-27. Ext Sweep Input

SPECIFICATION: Frequency:
18 to 100Hz.

lnput Level:
4V pk-pk maintains system calibration ±20%.

TEST EQUIPMENT:

Test Oscillator	*hp* 654A
Oscilloscope	*hp* 180/1801A/1821A
75Ω termination	*hp 15522A*
BNC Tee	-
sweeper	*hp* 8601A
Detector	*hp* 8741A
Hybrid	*hp* 15520A
3 x Cables	hp 15525A

Procedure

1. Set the controls to their reference settings es in Figure 4-1.

2. Set the Test Oscillator frequency to 18Hz and 75Q unbal output.

3. Connect the Test Oscillator Output to the Oscilloscope and adjust the Output Level and Amplitude controls to give 4V pk-pk.

4. Disconnect the Oscilloscope and connect the Test Oscillator Output to the EXT. SWEEP INPUT (B).

5. Set the SWEEP switch (5) to EXT.

6. Check the SWEEP OUTPUT as in Paragraph 4-6 for ±20% accuracy.

7. Check the BB + SWEEP OUTPUT as in Paragraph 4-8 for ±20% accuracy.

8. Check the SWEEP WIDTH as in Paragraph 4-19 for ±20% accuracy.

9. Repeat steps 6 through 8 for Test Oscillator frequencies up to 100Hz.

4-28. Ext BB Input (3715A only)

SPECIFICATION: **Frequency:**
80kHz to 10MHz.

Level:
-10dBm input maintains calibration ±10%.

Input Return Loss:
Better than 30dB.

TEST EQUIPMENT:

Test Oscillator	*hp* 654A
RMS Voltmeter	*hp* 3403C
75Ω termination	*hp* 15522A
BNC Tee	—
Hybrid	*hp* 15520A
17dB mismatch	*hp* 15521A
Spectrum Analyzer	*hp* 140S/8552A/8553B
75/50Ω matching pad	Rohde & Schwarz type DAF 18084 or Greenpar SA 104718
Cables	*hp* 15525A
Electronic Counter	*hp* 5248M

Procedure

1. Set the controls to their reference settings as in Figure 4-1.
2. Set the Test Oscillator frequency to 80kHz and 75Ω unbalanced output.
3. Connect the RMS Voltmeter, terminated in 75Ω, to the Test Oscillator output and adjust the Output Level and Amplitude for a Voltmeter reading of 86mV.
4. Disconnect the RMS Voltmeter and 75Ω termination and connect the Test Oscillator Output to the EXT BB INPUT (B).
5. Set the BB FREQUENCY switch (9) to EXT.
6. Check the BB OUTPUT level as in Paragraph 4-11 for ±10% accuracy.
7. Check the BB + SWEEP OUTPUT level as in Paragraph 4-14 for ±10% accuracy.
8. Repeat steps 6 and 7 at Test Oscillator frequencies up to 10MHz.
9. Set the Test Oscillator frequency to 83.333kHz using the Electronic Counter and check the DEVIATION as in Paragraph 4-18 for ±10% accuracy.

4-29. AM Input

SPECIFICATION: **Frequency:**
500kHz to 10MHz.

Dial Accuracy:
±15% of setting.

TEST EQUIPMENT:

Generator/Sweeper	*hp* 8601A
Spectrum Analyzer	*hp* 140S/8552A/8553B
RMS Voltmeter	*hp* 3403C
75/50Ω Matching Pad	Rohde & Schwarz type DAF 18084 or Greenpar 104718
75Ω termination	*hp* 15522A
BNC Tee	—

Procedure

1. Set the controls to their reference settings as in Figure 4-1.
2. Set the % MODULATION (15) to 16.
3. Set the Generator/Sweeper to operate in the CW mode with CRYSTAL CAL and 1kHz MOD set to OFF.
4. Set the Generator/Sweeper frequency to 500kHz and connect the RF Output via the 75/50Ω Matching Pad to the RMS Voltmeter terminated in 75Ω.
5. Adjust the Generator/Sweeper Output Level to give a reading of 0.374V on the RMS Voltmeter.

6. Disconnect the RMS Voltmeter and 75Ω termination and connect the Generator/Sweeper RF Output via the 75/50Ω Matching Pad to the AM INPUT (E).

7. Connect the Spectrum Analyzer via a 75/50Ω Matching Pad to the IF OUTPUT (G).

8. Adjust the Spectrum Analyzer controls to display the 70MHz carrier and two sidebands.

9. Measure the amplitude of the sidebands relative to the carrier and check for -21.9 ±1.3dB.

   Note: The relative amplitude of the side. bands to the carrier is given by 20log (M/2) where M is the Modulation Index, ie for 16% modulation, relative amplitude is:

$$\frac{20 \log (0.16)}{2} = -21.9\text{dB}$$

10. Measure the relative amplitude of the sidebands to carrier for other settings of % MODULATION (15) as in Table 4-2.

Table 4-2

% Modulation	Sideband: Carrier Relative Amplitude dB
2	-40 ±1.3
4	-34 ±1.3
6	-30.5 ±1.3
8	-28 ±1.3
10	-26 ±1.3
12	-24.4 ±1.3
14	-23.1 ±1.3
16	-21.9 ±1.3

11. Repeat the checks with Generator/Sweeper frequency settings up to 10MHz.

4-30. Impedance Converter (Opt. 004)

SPECIFICATION: Input impedance: 75Ω unbalanced.

Output impedance: 124Ω balanced.

Frequency range: 18Hz to 100Hz; 80kHz to 10MHz.

Conversion: 18Hz to 100Hz; 1:1 Voltage ±0.5dB

Conversion: 80kHz to 10MHz; 1:1 Power ±0.2dB.

Balance: 10Hz to 100MHz, 1% 80kHz to 1MHz, 1% 1MHz to 10MHz, 3%.

TEST EQUIPMENT

Test Oscillator ..... *hp* 654A
RMS Voltmeter ..... *hp* 3400A
BNC Tee .....
Balance Box ..... See Figure 4-9
75Ω termination ..... *hp* 15522A

Procedure:

BALANCE & CONVERSION: 18Hz to 100Hz.

1. Connect the Test Oscillator, sat to 18Hz and 75Ω unbalanced output, to the RMS Voltmeter terminated in 75Ω.

2. Adjust the Test Oscillator output level and amplitude to give 2.12V rms.

3. Remove the RMS Voltmeter and connect the Test Oscillator output to the 75Ω INPUT of the Transmitter.

. Connect the Transmitter 124Ω BAL output

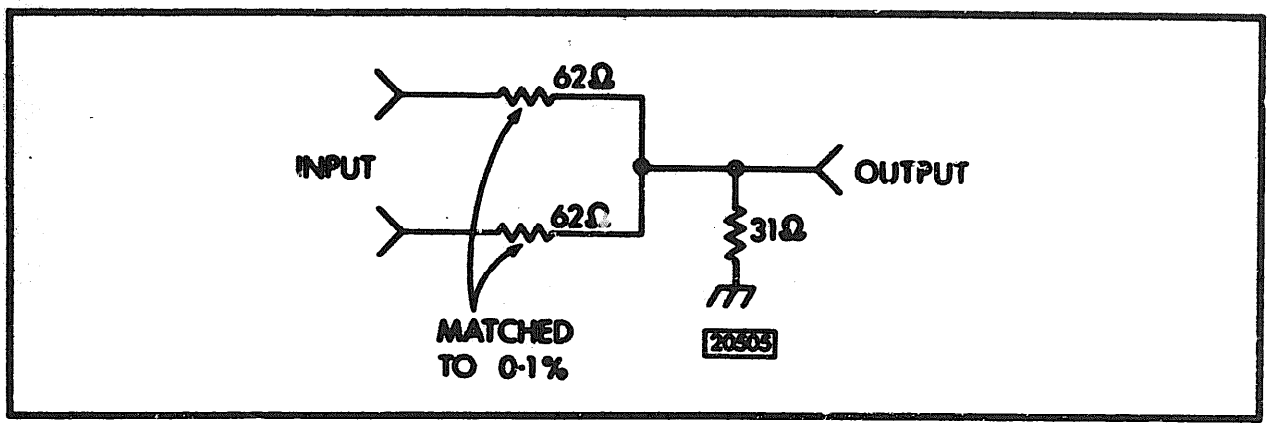


Figure 4-9 Balance Box

to the input of the Balance Box, and connect the Balance Box output to the RMS Voltmeter (unterminated).

5. Check that the RMS Voltmeter reading does not rise above 21mV as the Test Oscillator frequency is varied from 18Hz to 100Hz.

6. Disconnect each port of the 124Ω BAL output in turn and check that the RMS Voltmeter reading remains within the limits 0.40V to 0.45V as the Test Oscillator frequency is varied from 100Hz to 10Hz.

BALANCE & CONVERSION:
80kHz to 10MHz.

1. Connect the Test Oscillator, set to 80kHz and 75Ω unbalanced output, to the RMS Voltmeter terminated in 75Ω.

2. Adjust the Test Oscillator Output Level and Amplitude to give 0.36V rms.

3. Remove the RMS Voltmeter and connect the Test Oscillator output to the 75Ω INPUT of the Transmitter.

4. Connect the Transmitter 124Ω BAL output to the input of the Balance Box and the Balance Box output to the RMS Voltmeter (unterminated).

5. Check that the RMS Voltmeter reading does not rise above 11mV as the Test Oscillator frequency is varied from 80kHz to 1MHz; and not above 33mV as the Test Oscillator frequency is varied from 1MHz to 10MHz.

6. Disconnect each port of the 124Ω BAL output in turn and check that the reading on the RMS Voltmeter remains with the limits 216mV to 226mV as the Test Oscillator frequency is varied from 80kHz to 10MHz.

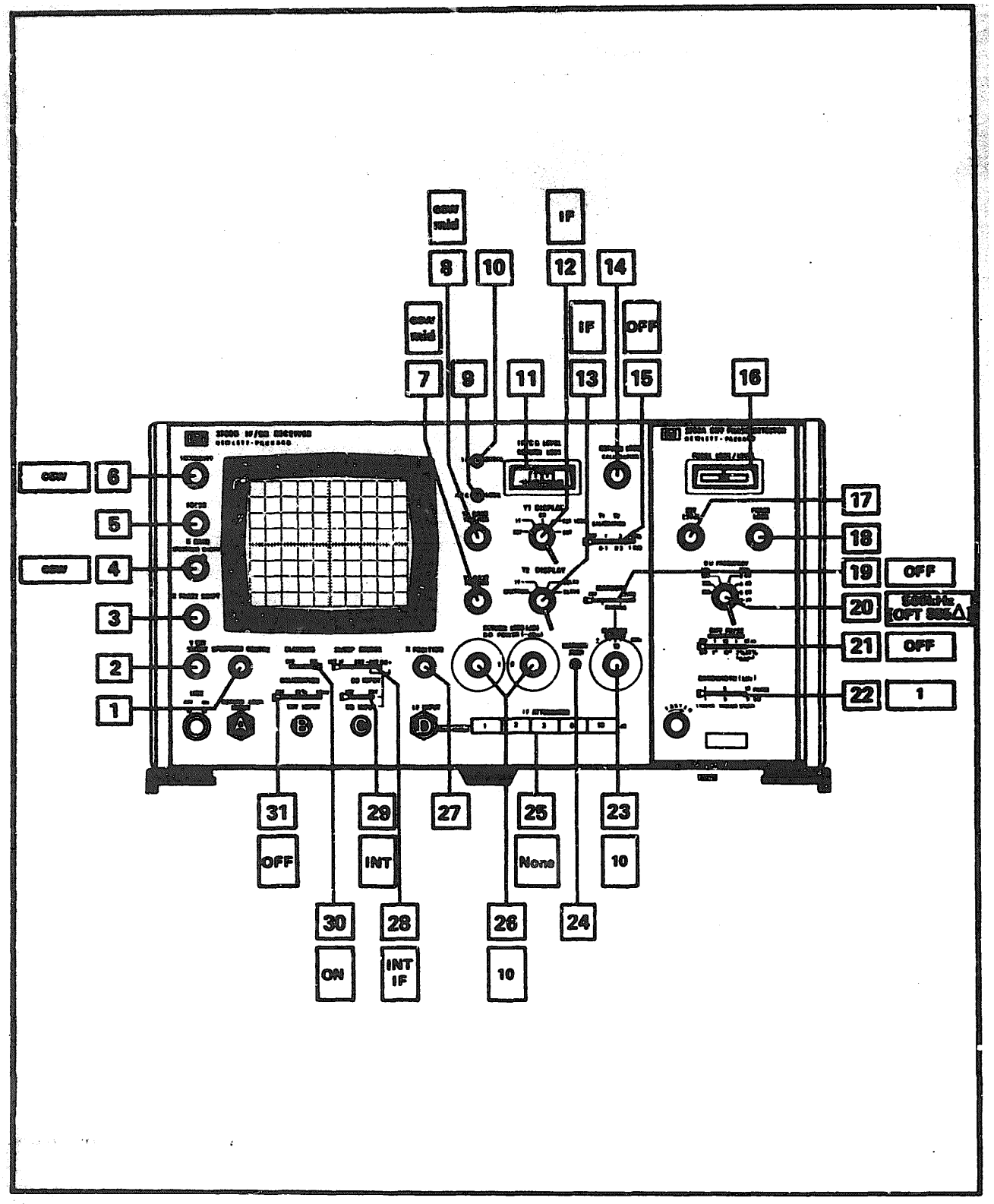


Figure 4-10 IF/BB Receiver Reference Setting

4-31. 3702B IF/BB RECEIVER PERFORMANCE CHECKS

4-32. Preliminary Procedure

1. Set the controls to their reference settings as in Figure 4-10.
2. Turn the INTENSITY control (6) clockwise until two spots just appear on the screen.
3. Adjust the FOCUS control (5) and if necessary the ASTIGMATISM control (rear panel) to give a sharp round spot.
4. Set the Y2 DISPLAY switch (13) to SPECTRUM and adjust the INTENSITY control (6) to display two traces of normal brilliance.
5. Adjust the X-GAIN control (4) and the X-POSITION control (27) for a 10cm horizontal display symmetrical about the centre graticule line.
6. If necessary adjust the TRACE ALIGN control (rear panel) make the traces parallel to the horizontal graticule lines.
7. Reset the Y2 DISPLAY switch (13) to IF.

Procedure:

1. Set the controls to their reference settings as in Figure 4-10 and insert 10dB in the IF ATTENUATOR (25).
2. Set the Transmitter controls as follows:

   SWEEP .. .. OFF
   BB FREQUENCY .. .. OFF
   IF FREQUENCY 70MHz
   IF ATTENUATOR 10dB
   IF VERNIER 0

3. Connect the Transmitter IF OUTPUT to the Receiver IF INPUT (D). Check that the AFC LOCK lamp (9) lights.
4. Disconnect the IF INPUT (D) and check that the AFC LOCK lamp (9) extinguishes.
5. Set the Transmitter IF FREQUENCY to 67MHz. Re-connect the IF INPUT (D) and check that the AFC LOCK lamp (9) lights.
6. Disconnect the IF INPUT (D) and set the Transmitter IF FREQUENCY to 73MHz. Reconnect the IF INPUT (D) and check that the AFC LOCK lamp (9) lights.
7. Vary the Transmitter IF FREQUENCY over the range 45 to 95MHz and check that the AFC LOCK lamp (9) remains lit.

IF CHARACTERISTICS

4-33. IF Input - Frequency

SPECIFICATION: AFC Captive Range: 70 ±3MHz.
AFC Hold-in Range: 70 ±25MHz.

TEST EQUIPMENT:

IF/BB Transmitter .. .. *hp* 3710A
Cable .. .. *hp* 15525A

4-34. IF Input - Power

SPECIFICATION: Range: -10 to +21dBm.
Measurement Accuracy: ±0.5dB.

TEST EQUIPMENT:

IF/BB Transmitter .. .. *hp* 3710A
Power Meter .. .. *hp* 432A

Thermistor Mount .. .. *hp* 478A
75/50Ω Matching Pad .. .. Rohde & Schwarz DAF BN18084
or Greenpar SA 104718
Cable .. .. *hp* 15525A

Procedure

1. Set the controls to their reference settings as in Figure 4-10.

2. Set the Transmitter controls as follows:

SWEEP .. .. OFF
BB FREQUENCY .. .. OFF
IF FREQUENCY 70MHz
IF ATTENUATOR 0dB

3. Connect the Power Meter via the Thermistor Mount and 75/50Ω Matching Pad to the Transmitter IF OUTPUT.

4. Adjust the Transmitter IF VERNIER to make the IF Output +10dBm.

Note: Matching Pad Losses are:

Greenpar 8.2dB
Rohde & Schwarz 6.0dB

5. Disconnect the Power Meter, Thermistor Mount and 75/50Ω Matching Pad from the Transmitter IF OUTPUT.

6. Connect the Transmitter IF OUTPUT to the Receiver IF INPUT (D).

7. Insert 20dB in the Receiver I F ATTENUATOR (25) and check that the IF LEVEL meter (11) reads 0 ±0.5dB.

8. C heck other IF INPUT power levels as per Table 4-3.

4-35. IF Input - Return Loss

SPECIFICATION: 55 to 85MHz >30dB
45 to 95MHz >28dB

TEST EQUIPMENT:

Oscilloscope . . . hp 180A/180lA/1821A
Swept Generator . . . . . *hp* 3710A
Attenuator . . . . . *hp* 3750A
Amplifier . . . . . *hp* 461A
Detector . . . . . *hp* 423A
Accessory Kit . . . . . *hp* 15550A
Cables . . . . . *hp* 15525A
75/50Ω Matching Pad . . . . Rohde & Schwarz DAF BN18084
or Greenpar SA 104718

Table 4-3.

Receiver IF Attenuator	Transmitter IF Attenuator	IF/BB Level Meter Reading
1dB	16-t 2+ 1dB	0 ±0.5dB
2dB	16 + 2dB	0 ±0.5dB
4dB	16dB	0 ±0.5dB
8dB	8 + 4dB	0 ±0.5dB
16dB	4dB	0 ±0.5dB

Procedure

1. Set the controls to their reference settings as in Figure 4-10

2. Set the Oscilloscope controls as follows:

INPUT (1801A)	DC
VOLTS/DIV (1801A)	.02
DISPLAY	EXT SENS
MAGNIFIER	X1
POLARITY (1801A)	-UP

Set the Swept Generator controls as follows:

SWEEP	INT
SWEEP WIDTH	50MHz
OUTPUT LEVEL	clockwise
BB FREQUENCY	OFF
IF FREQUENCY	70MHz
IF ATTENUATOR	10dB

Set the Reference Attenuator to 11dB.
Set the Amplifier for 40dB gain.

4. Connect the equipment as in Figure 4-11 with the Hybrid connected to the 17dB Mismatch. Adjust the Oscilloscope controls to obtain a display on the CRT. Adjust the EXT SENS control to give a 10cm horizontal deflection. The display on the Oscilloscope CRT is that of Return Loss v Frequency.

Using a negative output detector as in this test, and with the Oscilloscope polarity set to -UP, the Return Loss is displayed with low (worse) values at the top of the screen and high (better) values at the bottom of the screen.

5. Adjust the Oscilloscope vertical position control to move the trace to a suitable reference point on the CRT.

6. Disconnect the 17dB Mismatch from the

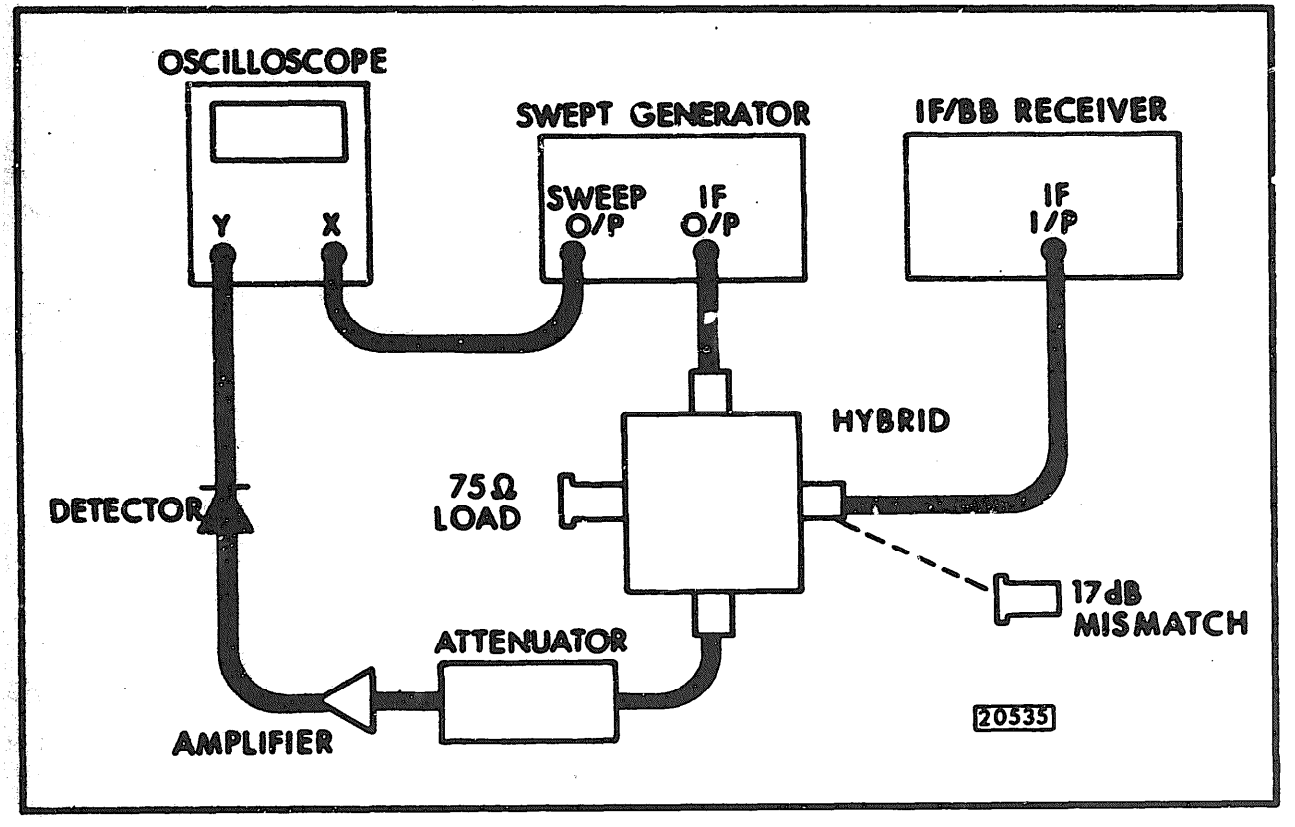


Figure 4-11. IF Input Return Loss Check

Hybrid and connect the Receiver IF INPUT (D) to the vacated port on the Hybrid.

7. Remove the attenuation from the Reference Attenuator and check that the trace remains below the reference level established in step 5.

8. Check that the trace remains below the reference level for any settings of the IF ATTENUATOR (25).

9. Repeat steps 3 through 8 with the Swept Generator SWEEP WIDTH set to 30MHz and the Reference Attenuator set to 13dB.

4-36. IF Display Calibration

SPECIFICATION: Calibration Magnitudes: 0.1dB, 0.3dB, 1dB.
Accuracy: ±10%.

TEST EQUIPMENT:

IF/BB Transmitter	*hp* 3710A
IF Switch	*hp* 3740A
Power Meter	*hp* 432A
Thermistor Mount	*hp* 478A
Hybrid	*hp* 15520A
Attenuator	Texscan Model RA-73
Cables	*hp* 15525A
75/50Ω Matching Pad	Rohde & Schwarz, DAF BN18084 or Greenpar SA104718

Procedure

1. Perform the preliminary procedure as in Paragraph 4-32.

2. Connect the equipment as in Figure 4-12 with the IF Switch output connected to the Receiver IF INPUT (D).

3. Set the Transmitter controls as follows:

SWEEP	INT
SWEEP WIDTH	5MHz
IF FREQUENCY	70MHz
IF ATTENUATOR	10dB

4. Set the IF Switch FUNCTION control to A.

5. Adjust the Receiver IF ATTENUATOR (25) and the Transmitter IF VERNIER controls for a zero reading on the IF/BB LEVEL meter (11).

6. Set the MARKERS switch (19) to SLIDING, the MARKER OFFSET (23) to 1MHz, and the BLANKING (30) to OFF.

7. Adjust the X-PHASE SHIFT (3) to superimpose the markers on the forward and return traces. Set the BLANKING (30) to ON.

8. Set the Y1/Y2 CALIBRATION (15) to 1.0dB and adjust the Y2 GAIN (7) for an 8cm split trace. set the Y1/Y2 CALIBRATION (15) to OFF.

9. Set the IF Switch FUNCTION control to INT and adjust the Texscan Attenuator for a Y2 display of a split trace of approximately 8cm amplitude. Note the exact amplitude of this trace.

10. Calculate this amplitude to be a fraction of 8.

Example: if the split trace has an amplitude of 7.8cm, this would yield the fraction:

$$\frac{7.8}{8.0} = 0.97$$

11. Disconnect the IF Switch from the Receiver and connect it, via a 75/50Ω Matching Pad and Thermistor Mount, to the Power Meter.

12. Set the IF Switch FUNCTION control to A and note the reading of the Power Meter.

13. Set the IF Switch FUNCTION control to B and note the reading on the Power Meter.

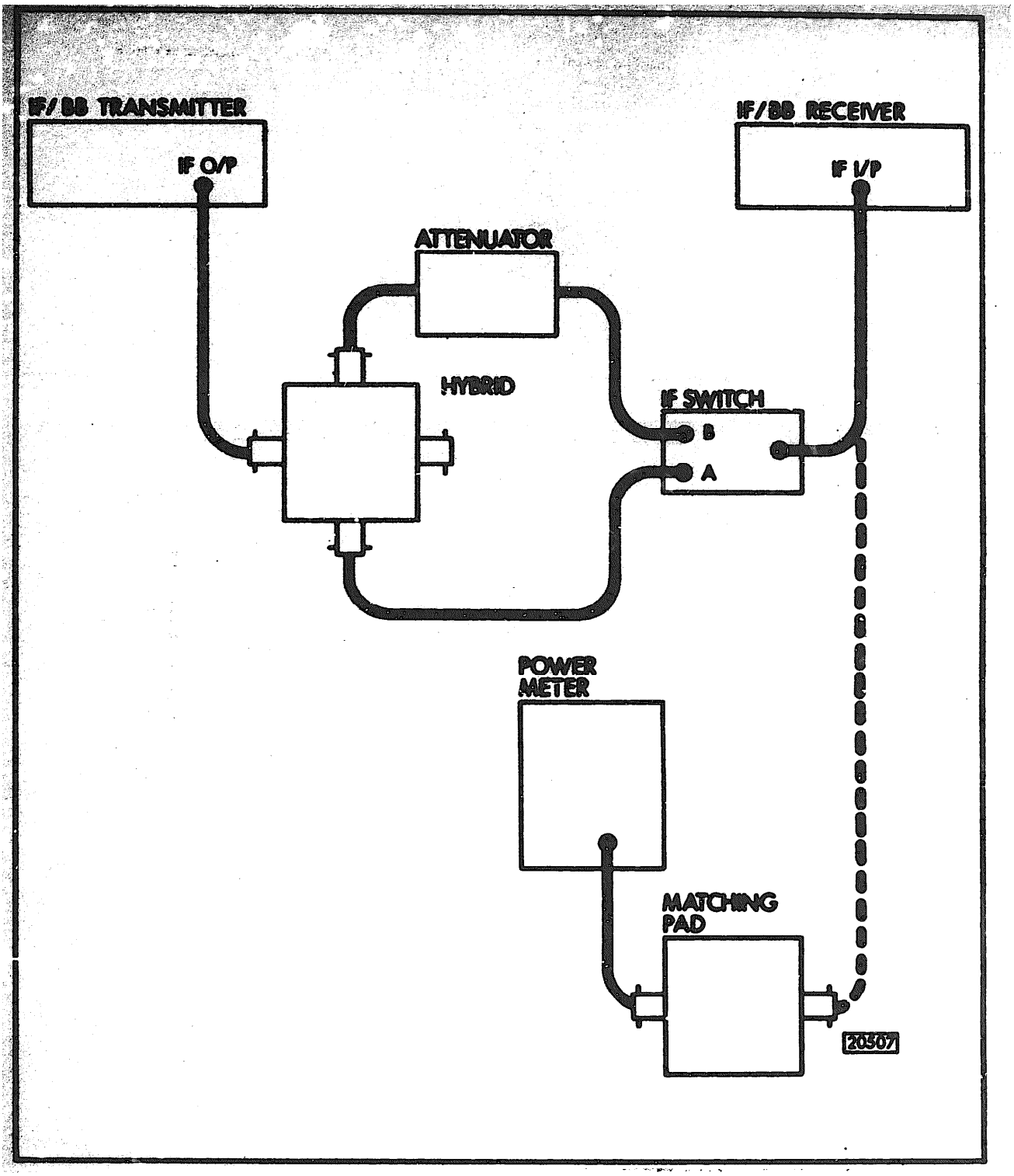


Figure 4-12 IF Display Calibration Check

14. The difference between the readings taken in steps 12 and 13 should yield the same fraction as was calculated in step 10 with an accuracy of ±10%. Example: for the example mentioned in step 10, the difference between steps 12 and 13 would be: 0.97dB ±10%.

15. Disconnect the IF Switch output from the 75/50Ω Matching Pad and connect it to the Receiver IF INPUT (D). Set the IF Switch FUNCTION to A.

16. Set the Y1/Y2 CALIBRATION (15) to 0.3dB and check for a spllit trace of 2.4 x 0.24cm

17. Set the Y1/Y2 CALIBRATlON (15) to 0.1dB and check for a split trace of 0.8 ±0.08cm.

4-37. Frequency Markers

SPECIFICATION: Centre Marker: 70MHz ±0.1 MHz.
Marker Offset: 0 to ±25MHz; ±1 MHz.
Comb markers: 2MHz ±0.1MHz.

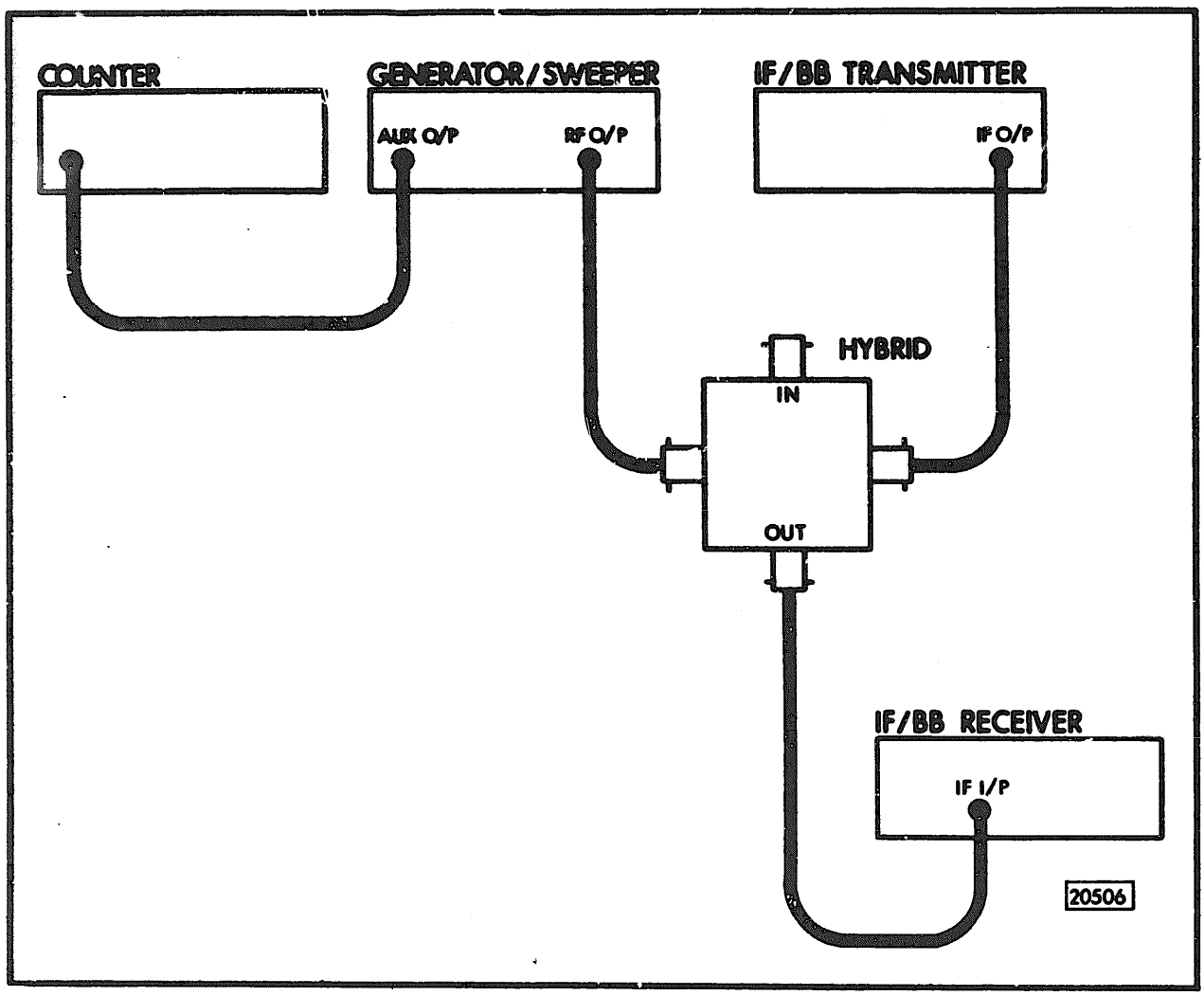


Figure 4-13 Frequency Markers Check

TEST EQUIPMENT:

IF/BB Transmitter	*hp* 3710A
Electronic Counter	*hp* 5248M
Sweeper/Generator	*hp* 8601A
Hybrid	*hp* 15520A
Cables	*hp* 15525A

Procedure

1. Perform the preliminary procedure as in Paragraph 4-32.

2. Set the Transmitter controls as follows:

SWEEP	INT
SWEEP WIDTH	50MHz
BB FREQUENCY	OFF
IF FREQUENCY	70MHz
IF ATTENUATOR	10dB
IF VERNIER	0

3. Connect the equipment as in Figure 4-13.

4. Set the Generator/Sweeper controls:

SWEEP	CW
FREQUENCY	70MHz
OUTPUT LEVEL	-30dBm
CRYSTAL CAL	OFF
SWEEP MODE	MANUAL
1kHz MOD	OFF

5. Adjust the IF ATTENUATOR (25) for an on-scale reading on the IF LEVEL meter (11).

6. Set the BLANKING (30) to OFF and the MARKERS (19) to SLIDING.

7. Adjust the X-PHASE SHIFT (3) to superimpose the markers on the forward and return traces. Set the BLANKING (30) to OFF.

8. Turn the Y2 GAIN (7) clockwise to display a birdie of approximately 2cm on the Y2 trace.

9. Adjust the Generator/Sweeper frequency to place the birdie in the middle of the centre marker on the Y1 trace. Check that the Generator/Sweeper frequency is 70 ±0.1MHz.

10. Set the MARKERS switch (19) to COMB.

11. Using the same technique as in step 9, check that the markers occur at 2MHz ±0.1MHz intervals away from 70MHz.

12. Set the MARKERS switch (19) to SLIDING + COMB and use the marker comb as a standard to check that the MARKER OFF-SET dial (23) is accurate ±1MHz over the range 0 to ±25MHz.

4-38. Spectrum

SPECIFICATION: Centre frequency: 70MHz.

Marker: 70 ±9MHz.

Scan Width: ±0.5 to ±9MHz.

Nulling Sensitivity: Detects ±0.1dB change in modulation index at a Bessel zero.

TEST EQUIPMENT:

IF/BB Transmitter	*hp* 3710A/3715A
Test Oscillator	*hp* 654A
Electronic Counter	*hp* 5248M
Attenuator	Texscan
Cables	*hp* 15525A

Procedure:

1. Perform preliminary procedure as in Paragraph 4-32. Set the *Y2* DISPLAY switch (13) to SPECTRUM.

2. Set the SPECTRUM WIDTH control (4) fully clockwise. Adjust the SPECTRUM CENTRE control (1) if necessary to display

a marker on the Y1 trace. Set the BLANKING switch (30) to OFF and adjust the X-PHASE SHIFT control (3) to superimpose the markers on the forward and return trace. Adjust the SPECTRUM CENTRE control (1) to bring the markers to the centre of the trace. Turn the SPECTRUM WIDTH control (4) counterclockwise and re-adjust the X-PHASE SHIFT control (3) and SPECTRUM CENTRE controls (1), if necessary, for superimposed markers in the centre of the trace. Set the BLANKING switch (30) to ON.

3. Set the Transmitter controls as follows:

SWEEP	OFF
BB FREQUENCY	EXT
IF FREQUENCY	70MHz
IF ATTENUATOR	10dB
IF VERNIER	0
AUX OUTPUT	IF UNCAL

4. Connect the Transmitter AUX OUTPUT to the Electronic Counter and the Transmitter IF OUTPUT to the Receiver IF INPUT (D).

5. Adjust the IF ATTENUATOR (25) for an on-scale reading on the IF LEVEL meter (11).

6. Adjust the Y2 GAIN control (7) to display a birdie of approximately 2cm on the Y2 trace.

7. Adjust the Transmitter IF FREQUENCY to bring the birdie to the centre of the Y1 marker.

8. Check the Electronic Counter reading is 70MHz ±5kHz.

9. Adjust the Transmitter IF FREQUENCY to bring the birdie to the left hand edge of the trace, and check that the Electronic Counter reading is not less than 69.5MHz.

10. Adjust the Transmitter IF FREQUENCY to bring the birdie to the right hand side of the trace and check that the Electronic Counter reading is not greater than 70.5MHz.

11. Set the SPECTRUM WIDTH control (4) fully clockwise. Set the BLANKING (30) to OFF and adjust the X-PHASE SHIFT (3) and SPECTRUM CENTRE (1) to superimpose the markers in the centre of the trace. Set the BLANKING (30) to ON.

12. Adjust the Transmitter IF FREQUENCY to bring the birdie to the left hand edge of the

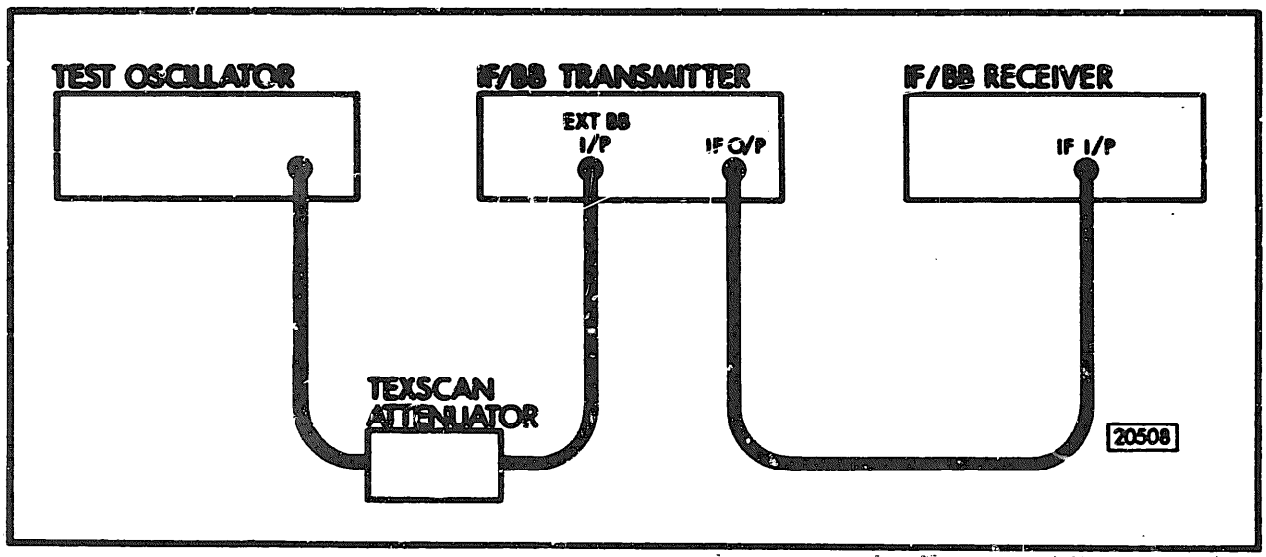


Figure 4-14 Spectrum Check

trace and check that the Electronic Counter reading is not greater than 61MHz.

13. **Adjust the Transmitter IF FREQUENCY to bring the birdie to the right hand range of the trace and check that the Electra, Counter reading is not less than 79MHz.**

14. **Connect the equipment as in Figure 4-14:Set the Test Oscillator frequency to 83.3kHz and the output level to -10dBm 75 Ω UNBAL. Set the Texscan Attenuator or 0.5dB. Set the Transmitter DEVIATION to 140kHz.**

15. **Adjust the SPECTRUM WIDTH control (4) to give a display of two or three pairs of sidebands.**

16. **Turn the Y2 GAIN (7) fully clockwise and adj adjust the Test Oscillator Amplitude control to produce a carrier null on the display. See Figure 4-15.**

17. **Adjust the Texscan Attenuator by ±0.1dB and check that a change in the carrier amplitude can be observed.**

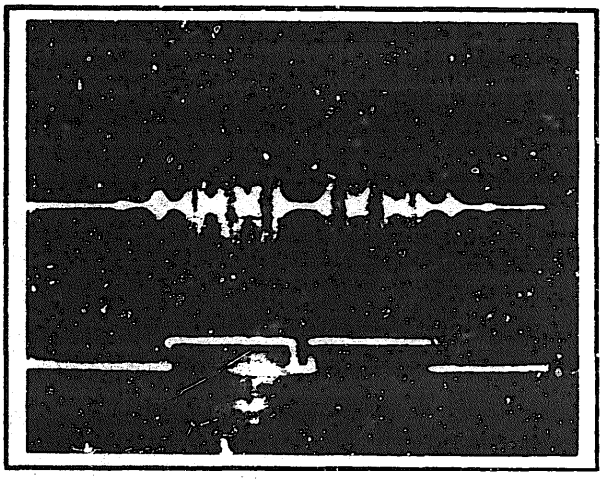


Figure 4-15 Carrier Null

4-39. Return Loss Input - Power

SPECIFICATION: Frequency Range:
70 ±25MHz.
Power Range:
-22 to -50dBm.
Flatness:
1dB.

TEST EQUIPMENT:

IF/BB Transmitter	*hp* **3710A**
Cables	*hp* **15525A**

Procedure:

Perform the preliminary procedure as in Paragraph 4-32.

2. **Set the Transmitter controls as follows:**

SWEEP	**INT**
SWEEP WIDTH	**50MHz**
BB FREQUENCY	**OFF**
IF FREQUENCY	**70MHz**
IF ATTENUATOR	**32dB**
IF VERNIER	**0**
AUX OUTPUT	**IF UNCAL**

3. **Connect the Transmitter AUX OUTPUT** to **the IF INPUT (D) and adjust the IF ATTENUATOR (25) to give an on-scale meter reading.**

4. Se? the MARKERS (19) to SLIDING and the BLANKING (30) to OFF. Adjust the X-PHASE SHIFT control (3) to superimpose the markers' on the forward and return traces and set the BLANKING (30) to ON

5. Connect the Transmitter IF OUTPUT to the RETURN LOSS INPUT (A).

6. Set the RETURN LOSS attenuator (26) to 1OdB and the Y1 DISPLAY switch (12) **to** RET LOSS.

7. Adjust the RETURN LOSS CALIBRATION

control (14) to bring the RETURN LOSS meter (11) reading to 0.

8. Adjust the Y1 GAIN control (8) until the non-linearity in the Y1 trace covers 1 cm.

9. Insert 1dB in the Transmitter IF ATTENUATOR and check that the Y1 trace shifts by at least 1cm. Remove the 1dB.

10. Set the Transmitter IF ATTENUATOR to 50dB and the RETURN LOSS attenuator (26) to 49dB and repeat steps 7 through 9.

4-40. Return Loss Input - Return Loss

SPECIFICATION: Impedance: 75Ω.
Return Loss:
45 to 95MHz
Better than 28dB. ,

TEST EQUIPMENT:

As for Paragraph 4-35.

Procedure:

1. Set the controls to their reference settings as in Figure 4-10.

2. Measure the Return Loss of the RETURN LOSS INPUT (A) using the method in Paragraph 4-35, steps 1 through 7.

BASEBAND CHARACTERISTICS

4-41. BB Input - Power

SPECIFICATION: Frequency Range:
80kHz to 10MHz*
Power Range:
-49 to -10dBm.
Measurement Accuracy:
+0.5dBm.

*NOTE: To coyer the entire frequency range 80kHz to 10MHz the plug-in must be removed. With the plug-in fitted Baseband Power can only be measured above 500kHz at the frequencies set by the plug-in BB FREQUENCY switch.

TEST EQUIPMENT:

Test Oscillator	hp 654A
Attenuator	hp 3750A
RMS Voltmeter	hp 3403C
Cables	*hp* 15525A
75 Ωtermination	hp 15522A.
BNC Tee	-
IF/BB Transmitter	hp 3710A/3716A

Procedure (Plug-in removed):

1. Set the controls-to their reference settings as in Figure 4-10 and remove the plug-in.

2. Set the Test Oscillator frequency to 80kHz and output level to -10dBm and 75Ω UNBAL.

3. Connect the Test Oscillator output to the 3750A Attenuator and the Attenuator output to the RMS Voltmeter terminated in 75 Ω. Remove all attenuation from the Attenuator. Adjust the Test Oscillator Amplitude control to give a reading of 86mV on the RMS Voltmeter,

4. Remove the RMS Voltmeter and 75 Ω termination and connect the Attenuator output to the BB INPUT (C).

5. Set the Y1 DISPLAY switch (12) to BB and the BB INPUT switch (29) to EXT.

6. Check that the BB LEVEL meter (11) reading is 0 ±0.5dB.

7. Set the BB POWER attenuator (26) to -11dBm and insert 1dB in the 3750A Attenuator. Check that BB LEVEL meter (11) reading is again 0 ±0.5dB.

8. Similarly check other settings of the BB

POWER attenuator (26) to -49dBm.

9. Reset the BB POWER attenuator (26) to -10dBm and remove all attenuation from the 3750A Attenuator.

10. Repeat steps 6 through 9 with any setting of Test Oscillator frequency in the range 80kHz to 10MHz.

Procedure (Plug-in fitted):

1. Set the controls to their reference settings: as in Figure 4-10.

2. Set the Transmitter controls as follows:

SWEEP OFF
BB FREQUENCY- :: :: :: :: :: :: :: 3ΔkHz

3. Connect the Transmitter BB OUTPUT to the 3750A Attenuator and the Attenuator output to the RMS Voltmeter terminated in 75 Ω.

4. Insert 2OdB in the Attenuator and adjust the Transmitter BB OUTPUT VERNIER to give a reading of 86mV on the RMS Voltmeter. (The Attenuator may have to be changed by 1dB).

5. Disconnect the RMS Voltmeter and 75 Ω termination and connect the Attenuator output to the BB INPUT (C).

6. Set the Y1 DISPLAY switch (12) to BB, the BB INPUT switch (29) to EXT and the BB FREQUENCY switch (20) to 83A.

7. Check that the BB LEVEL meter (11) reading is 0 ±05dB.

8. Set the BB POWER (26) attenuator to -11 dBm and insert an additional 1dB in the 375OA Attenuator. Check that the BB LEVEL meter (11) reading is again 0 ±0.5dB.

9. Similarly check the other settings of the BB POWER attenuator (26) to -49dBm.

10. Reset the BB POWER attenuator (26) to -10dBm and the 3750A attenuator to 20dB.

11. Repeat steps 4 through 10 for other settings of the BB FREQUENCY switch (20) with the Transmitter BB FREQUENCY switch set to the same frequency as the BB FREQUENCY switch (20).

OPT. 004 only
BB Input - Power (124Ω BAL INPUT)

SPECIFICATION: Frequency Range: 80kHz to 10MHz*
Power Range: -49 to -10dBm
Measurement Accuracy: ±0.5dB

*NOTE: To cover the entire frequency range 80kHz to 10MHz the plug-in must be removed. With the plug-in fitted Baseband Power can only be measured above 500 kHz at the frequencies set by the plug-in BB FREQUENCY switch.

TEST EQUIPMENT:

Test Oscillator	*hp* 654
Attenuator	*hp* 3750A
RMS Voltmeter	*hp* 3403C
Cables	*hp* 15551A
75Ω Termination	*hp* 15522A
BNC Tee	-
IF/BB Transmitter	*hp* 3710A/ *hp* 3716A Opt. 004

Procedure (Plug-in removed]:

1. Set the controls to their reference settings as in Figure 4-10 and remove the plug-in.

2. Set 'the Test Oscillator frequency to 80kHz and output level to -10dBm and 75 Ω UNBAL.

3. Connect the Test Oscillator output to the 3750A Attenuator and the Attenuator Out-

put to the RMS Voltmeter terminated in 75Ω. Remove all attenuation from the Attenuator. Adjust the Test Oscillator Amplitude control to give a reading of 86mV on the RMS Voltmeter.

4. Remove the RMS Voltmeter and 75 Ω termination and connect the Attenuator output to the Transmitter 75 Ω UNBAL INPUT and the 124Ω BAL OUTPUT to the RECEIVER 124Ω BAL INPUT.

5. Set the Y1 DISPLAY switch (12) to BB and the BB INPUT switch (29) to 124Ω.

6. Check that the BB LEVEL meter (11) reading is 0 ±0.5dB.

7. Set the BB POWER attenuator (26) to -11dBm and insert 1dB in the 3750A Attenuator. Check that the BB LEVEL meter (11) reading is again 0 ±0.5dB.

8. Similarly check other settings of the BB POWER attenuator (26) to -49dBm.

9. Reset the BB POWER attenuator (26) to -10dBm and remove all attenuation from the 3750A Attenuator.

10. Repeat steps 6 through 9 with any setting of Test Oscillator frequency in the range 80kHz to 10MHz.

Procedure (Plug-in fitted):

1. Set the controls to their reference settings as in Figure 4-10.

2. Set the Transmitter controls as follows:

SWEEP ..... OFF
BB FREQUENCY 92ΔkHz

3. Connect the Transmitter BB OUTPUT to the 3750A Attenuator and the Attenuator output to the RMS Voltmeter terminated in 75 Ω.

4. Insert 20dB in the Attenuator and adjust the Transmitter BB OUTPUT VERNIER to give a reading of 86mV on the RMS Voltmeter. (The Attenuator may have to be changed by 1dB).

5. Disconnect the RMS Voltmeter and 75Ω termination and connect the Attenuator output to the Transmitter 75Ω UNBAL INPUT and the 124Ω BAL OUTPUT to the RECEIVER 124Ω BAL INPUT.

6. Set the Y1 DISPLAY switch (12) to BB, the BB INPUT switch (29) to 124Ω and the BB FREQUENCY switch (20) to 92Δ.

7. Check that the BB LEVEL mater (11) reading is 0 ±0.5dB.

8. set the BB POWER (26) attenuator to -11dBm and insert an additional 1dB in the 3750A Attenuator. Check that the BB LEVEL meter (11) reading is again 0 ±0.5dB.

9. Similarly check the other settings of the BB POWER attenuator (26) to -49dBm.

10. Reset the BB POWER attenuator (26) to -10dBm and the 3750A attenuator to 20dB.

11. Repeat steps 4 through 10 for other settings of the BB FREQUENCY switch set to the same frequency as the BB FREQUENCY switch (20).

4-42. BB Input - Return Loss

SPECIFICATION: Input Impedance: 75Ω.

Return Loss: >26dB.

TEST EQUIPMENT:

Test Oscillator	*hp* 654A
Hybrid	*hp* 15537A
17dB Mismatch	*hp* 15521A
Cables	*hp* 15525A
75 Ω termination	*hp* 15522A
RMS Voltmeter	*hp* 3400A

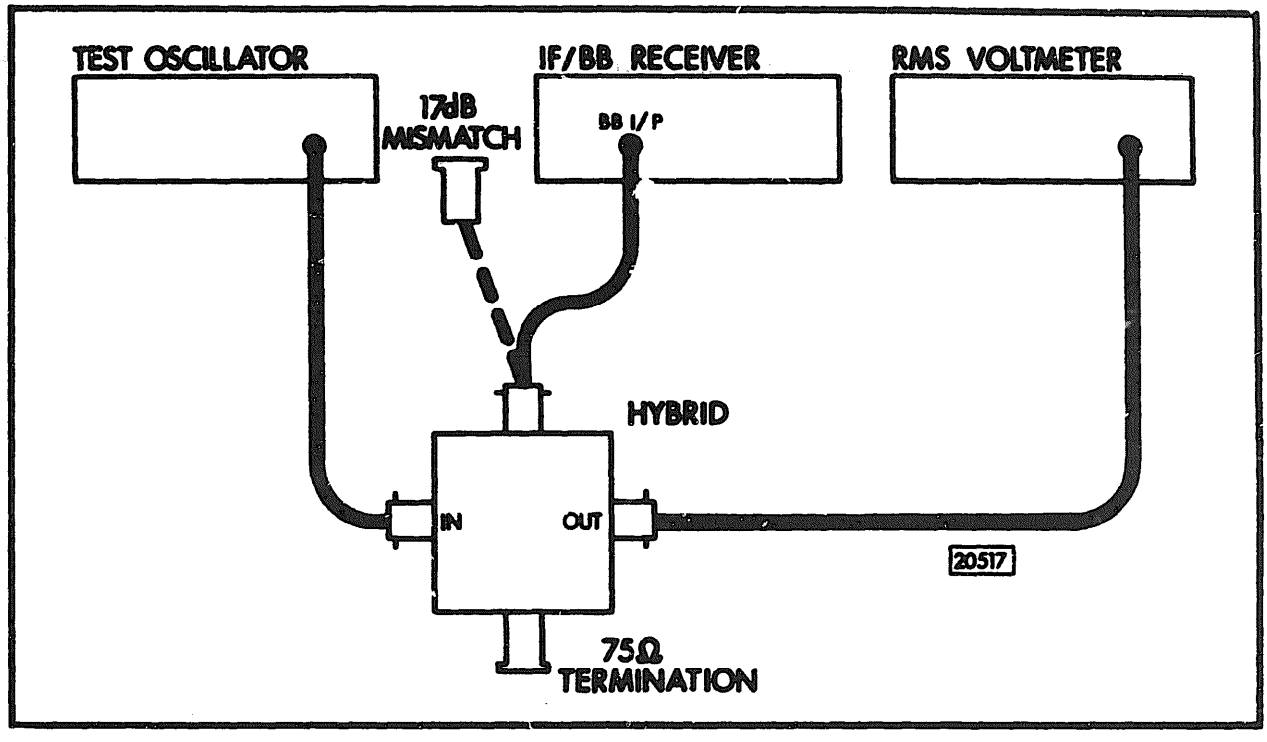


Figure 4-16 BB Input Return Loss Check

Procedure

1. **Set the controls to their reference settings as in Figure 4-10. Set the BB INPUT (29) to EXT.**

2. **Connect the equipment as in Figure 4-16. with the 17dB mismatch connected to the Hybrid.**

3. **Set the Test Oscillator frequency to 80kHz and the output level to -10dBm 75 Ω UNBAL.**

4. **Adjust the Test Oscillator amplitude control for a reference level on the RMS Voltmeter dB scale.**

5. **Remove the 17dB mismatch from the Hybrid and connect the Hybrid to the BB INPUT (C).**

6. **Note by how much the RMS Voltmeter level drops (in dB).**

7. **The return loss of the BB INPUT is calculated as follows:**

   Return Loss = 17 +(dB's noted in step 6). This should be greater than 26dB.

8. **Repeat steps 3 through 7 with settings of Test Oscillator frequency up to 10.2MHz.**

4-43. BB Calibration

SPECIFICATION: Calibration Magnitudes: 1, 3, 10%.

Accuracy: ±10%.

TEST EQUIPMENT:

Pulse Generator	*hp* 214A
Signal Generator	*hp* 606A
Attenuator	*hp* 355D

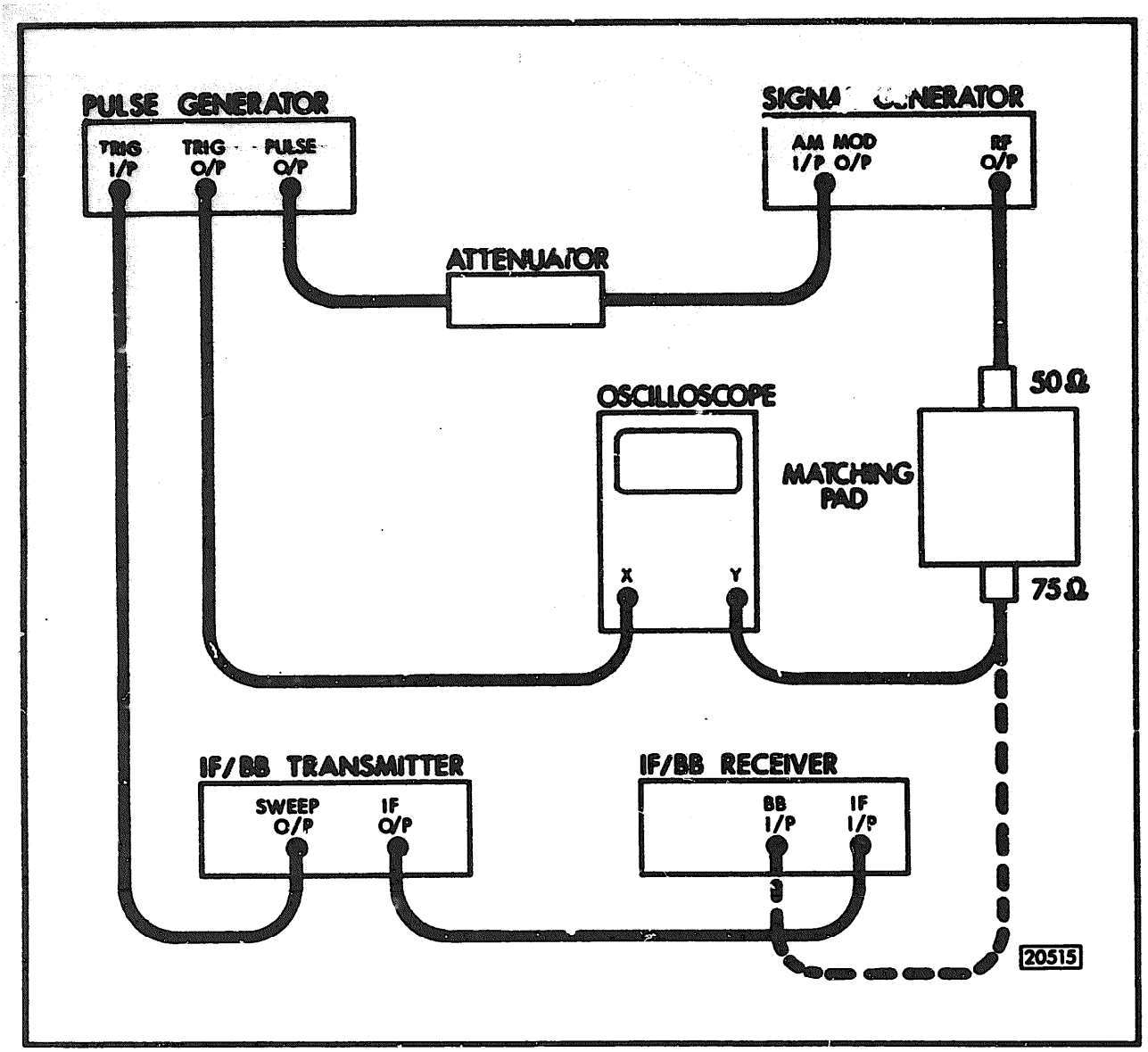


Figure 4-17 BB Calibration Check

Oscilloscope .. .. *hp* 180A/1801A/1821A
75/50Ω Matching Pad .. .. Rohde & Schwarz DAF BN 18084 or Greenpar SA 104718
IF/BB Transmitter . . . . . *hp* 3710A
Cables . . . . . *hp* 15525A

Procedure:

1. Perform the preliminary procedure as in Paragraph 4-32. Set the BB INPUT (29) to EXT and connect the equipment as shown in Figure 4-17.

2. Set the Transmitter controls as follows:

SWEEP	. . INT
SWEEP WIDTH :: :: :: :: :: :: :: ::	:: 50MHz
OUTPUT LEVEL	Clockwise
BB FREQUENCY .. .. :: ::	. . 500kHz

IF FREQUENCY 70MHz
IF ATTENUATOR 10dB

3. Connect the Transmitter IF OUTPUT to the Receiver IF lNPUT (D). Adjust the IF ATTENUATOR (25) for an on-scale reading on the IF/BB LEVEL meter (11). Set the Y1 DISPLAY switch (12) to BB. Set the BLANKING (30) to OFF and the MARKERS (19) to SLIDING. Adjust the X-PHASE SHIFT (3) to superimpose the markers on the forward and return traces. Set the BLANKING (30) to ON.

4. Set the Pulse Generator controls as follows:

TRIGGER MODE . . . . . EXT
PULSE POSITION (psec) . . . . . 10 - 100
PULSE POSITION VERNIER 5
PULSE WIDTH (μsec) . . . . . 1k - 10k
PULSE AMPLITUDE
(volts into 50Ω) 10
TRIGGER INPUT SLOPE . . . . . +
TRIGGER OUTPUT . . . . . +
PULSE OUTPUT . . . . . -

5. Set the Signal Generator controls as follows:

FREQUENCY 500kHz
MODULATION SELECTOR . . . . EXT DC
MODULATION AMPLITUDE . . . . Clockwise
ATTENUATOR . . . . . -10dBm (Meter at 0)

6. Set the 355D Attenuator to 10dB.

7. Adjust the Pulse Generator EXT TRIG LEVEL, if necessary, and the PULSE WIDTH VERNIER controls for a suitable display on the Oscilloscope with a mark-to-space ratio of approximately 1: 1.

8. Adjust the Pulse Generator PULSE AMPLITUDE VERNIER control for 100% modulation. This will be evident on the Oscilloscope display as a straight line in the space area. CAUTION: Adjust the VERNIER control so that the space area JUST becomes a straight line - do not increase the setting of the control beyond this point.

9. set the 355D Attenuator to 30dB. This will give 10% modulation.

10. Transfer the connection between the Matching. Pad and the Oscilloscope to go between the Matching Pad and the BB INPUT (C).

11. Adjust the BB POWER Attenuator (26) for an on-scale BB LEVEL meter (11) reading.

12. Adjust the Y1 GAIN and Y1 POSITION (8) controls for a 8cm vertical display. The X-PHASE SHIFT (3) may be adjusted to allow the trace to be viewed.
Note: use only the flat portion, top and bottom, to establish the 8cm display.

13. Remove the cable from the Pulse Generator output.

14. Set the Y1/Y2 CALIBRATION (15) to 10% and check that the split trace is 8cm ±0.8cm.

15. Set the Y1/Y2 CALIBRATION (15) to 3% and check for a split trace of 2.4 x 0.24cm.

16. Set the Y1/Y2 CALIBRATION (15) to 1% and check for a split trace of 0.8 ±0.8cm.

4-44. Demodulator

SPECIFICATION: Frequency Range:
80kHz to 5.6MHz.
Deviation Range:
11kHz to 500kHz.

TEST EQUIPMENT:

IF/BB Transmitter . . . . . hp 3710A/3715A

Procedure:

1. Set the controls to their reference settings as in Figure 4-10.

2. Set the BB FREQUENCY (20) to 83Δ.

3. Set the IF/BB Transmitter controls as follows:

SWEEP	OFF
DEVIATION	10kH
DEVIATION	10kHz
BB FREQUENCY	83Δ
IF FREQUENCY	70MHz
IF ATTENUATOR	10dB

4. Connect the Transmitter IF OUTPUT to the Receiver IF INPUT (D). Adjust the IF ATTENUATOR (25) for an on-scale meter reading.

5. Set the Y1 DISPLAY (12) to BB and check that the BB POWER attenuator (26) can be adjusted to give an on-scale meter reading.

6. Repeat step 5 at all BB frequencies up to 5.6MHz.
Note: The Transmitter and Receiver BB FREQUENCY controls must be at the same setting.

7. Repeat steps 5 and 6 with the Transmitter DEVIATION set to 500kHz.

4-45. Horizontal Deflection

SPECIFICATION: Sweep Source:
INT IF: Sweep derived from swept IF INPUT.
EXT: Sweep derived from EXT SWEEP INPUT.
EXT BB+: Sweep derived from BB INPUT.
EXT BB-: As for EXT BB+ but with reversed sweep direction.
Frequency:
18Hz to 100Hz.
Level:
AGC: Via EXT SWEEP INPUT and BB INPUT 600mV to 10V pk-pk via IF INPUT, 3MHz to 50M Hz Sweep Width (maintains 10cm ±5mm horizontal deflection).

TEST EQUIPMENT:

Test Oscillator	: hp 654A
Oscilloscope	hp 180A/1801A/1821A
IF/BB Transmitter	*hp* 3710A
75Ω termination	*hp* 15522A
3 x Cables	*hp* 15525A
BNC Tee	-

Procedure (INT IF):

1. Perform the preliminary procedure as in Paragraph 4-32. Set the MARKERS switch (19) to SLIDING.

2. Set the Transmitter controls:

SWEEP	EXT
SWEEP WIDTH	.50MHz
BB FREQUENCY	OFF
IF FREQUENCY	70MHz
IF ATTENUATOR	10dB

3. Connect the Transmitter IF OUTPUT to the Receiver IF INPUT (D). Adjust the Receiver IF ATTENUATOR (25) for an on-scale meter reading. Ensure the AFC LOCK lamp (9) is lit.

4. Set the Test Qscillator frequency to 70Hz and the Output Level to 1V rms.

5. Connect the Test Oscillator output to the Transmitter EXT SWEEP INPUT.

6. Set the BLANKING switch (30) to OFF and adjust the X-PHASE SHIFT (3) to superimpose the markers on the forward and return traces. Set the BLANKING switch (30) to ON.

7. Set the MARKER OFFSET control (23) to 25 and adjust the Test Oscillator amplitude control until the 25MHz markers are at the trace edges.

8. Adjust the X-GAIN control (4) for a 10cm horizontal display on the CRT.

9. Set the Transmitter SWEEP WIDTH controls

to 3MHz and check that the horizontal display remains at 10cm ±5mm.

Repeat steps 5 through 9 with the Test Oscillator set to any frequency within the range 18 to 100Hz.

Procedure (EXT SWEEP INPUT):

1. Perform the preliminary procedure as in Para 4-32. Set the SWEEP SOURCE switch (28) to EXT.
2. Set the Test Oscillator frequency to 70Hz and output to.75Ω UNBAL.
3. Connect the Test Oscillator output to the Oscilloscope and adjust the Output Level and Amplitude controls to give 10V pk-pk.
4. Disconnect the Oscilloscope and connect the Test Oscillator output to the EXT SWEEP INPUT (rear panel).
5. Adjust the X-GAIN control for 10cm horizontal deflection on the CRT.
6. Disconnect the Test Oscillator from the EXT SWEEP INPUT and reconnect it to the Oscilloscope.
7. Adjust the Test Oscillator output level and amplitude for 600mV pk-pk.
8. Disconnect the Oscilloscope and connect the Test Oscillator output to the EXT SWEEP INPUT (rear panel).
9. Check that the horizontal deflection is 10cm ±5mm.
10. Repeat steps 3 through 9 with the Test: Oscillator set to any frequency within the range 18 to 100Hz.

Procedure (BB INPUT):

1. Perform the preliminary procedure as in Paragraph 4-32. Set the SWEEP SOURCE switch (28) to EXT BB+ and BB INPUT switch (29) to EXT.
2. Set the Test Oscillator to 70Hz and the output to 75Ω UNBAL.
3. Connect the Test Oscillator output to the Oscilloscope terminated in 75Ω. Adjust the Output Level and Amplitude controls to give 10V pk-pk.
4. Disconnect the Oscilloscope and connect the Test Oscillator output to the BB INPUT (C).
5. Adjust the X-GAIN control (4) for a 10cm horizontal deflection on the CRT.
6. Set the SWEEP SOURCE switch (28) to EXT BB- and check for a 10cm horizontal display.
7. Disconnect the Test Oscillator from the BB INPUT (C) and reconnect it to the Oscilloscope terminated in 75Ω
8. Adjust the Test Oscillator and Amplitude control for 600mV pk-pk.
9. Disconnect the Oscilloscope and connect the Test Oscillator output to the BB INPUT (C).
10. Check that the horizontal deflection is 10cm ±0.5cm.
11. Set the SWEEP SOURCE switch (28) to EXT BB+ and check that the horizontal deflection is 10cm ±0.5cm.
12. Repeat steps 3 through 15 with the Test Oscillator set to any frequency within the range 18 to 100Hz.
13. Disconnect the Test Oscillator.
14. Set the Transmitter controls as follows:

SWEEP INT
SWEEP WIDTH- :: : :: :: :: :: :: :: 50MHz

IF FREQUENCY 70MHz
IF ATTENUATOR 10dB
SWEEP CAL .. .. Clockwise

15. Connect the Transmitter BB + SWEEP OUTPUT to the BB INPUT (C).

16. Set the MARKERS (19) to SLIDING and the BLANKING (30) to OFF. Adjust the IF ATTENUATOR (25) for an on-scale meter reading.

17. Adjust the X-PHASE SHIFT control (3) to superimpose the markers on the forward and return traces. Set the BLANKING (30) to ON.

18. Set the Y2 DISPLAY switch (3) to SLAVE and adjust the Y2 GAIN control (7) for a Y2 display sloping from top left to bottom right.

19. Set the SWEEP SOURCE switch (28) to EXT BB- and check that the Y2 display now slopes from bottom left to top right.

OPT 004 only
Procedure (BB INPUT; **124Ω BAL INPUT):**

1. Perform the preliminary procedure as in Paragraph 4-32. Set the SWEEP SOURCE switch (28) to EXT BB+ and the BB INPUT switch (29) to 124Ω BAL.

2. Set the Test Oscillator to 70Hz and the output to 75Ω UNBAL.

3. Connect the Test Oscillator output to the Oscilloscope terminated in 75Ω. Adjust the Output level and Amplitude controls to give 10V pk-pk.

4. Disconnect the Oscilloscope and connect the Test Oscillator output to the Transmitter (Opt. 004) 75Ω UNBAL INPUT. Connect the Transmitter 124Ω BAL OUTPUT to the Receiver 124Ω BAL INPUT.

5. Adjust the X-GAIN control (4) for 10cm horizontal deflection on the CRT.

6. Set the SWEEP SOURCE switch (28) to EXT BB- and check for a 10cm horizontal display.

7. Disconnect the Test Oscillator from the BB INPUT (C) and reconnect it to the Oscillator terminated in 75Ω.

8. Adjust the Test Oscillator and Amplitude controls for 600mV pk-pk.

9. Disconnect the Oscilloscope and connect the Test Oscillator output to the Transmitter (Option 004) 75Ω UNBAL INPUT. Connect the Transmitter 124Ω BAL OUTPUT to the Receiver 124Ω BAL INPUT.

10. Check that the horizontal deflection is 10cm ±0.5cm.

11. Set the SWEEP SOURCE switch (28) to EXT BB+ and check that the horizontal deflection is 10cm ±0.5cm.

12. Repeat steps 3 through 15 with the Test Oscillator set to any frequency within the range 18 to 100Hz.

4-46. EXT INPUT

SPECIFICATION: Frequency Range:
dc to 12MHz (3dB)

Maximum Input:
0.5V pk-pk.

DC Offset Range:
±2V.

Calibration:
50mV ±5%
10% ±1% of input.

TEST EQUIPMENT:

IF/BB Transmitter .. .. *hp* 3710A
Test Oscillator .. .. *hp* 654A
Oscilloscope .. .. .. *hp* 180A/1801A/1821A
Power Supply .. .. *hp* 6205B
Digital Voltmeter .. .. *hp* 3440A

Procedure:

1. Perform the preliminary procedure as in Paragraph 4-32.

2. Set the Transmitter controls as follows:

   SWEEP ..... INT
   SWEEP WIDTH 50MHz
   IF FREQUENCY 70MHz
   IF ATTENUATOR 10dB

3. Connect the Transmitter IF OUTPUT to the Receiver IF INPUT (D) and adjust the IF ATTENUATOR (26) for an on-scale meter reading. Set the BLANKING (30) to OFF and the MARKERS (19) to SLIDING. Adjust the X-PHASE SHIFT (3) to superimpose the markers on the forward and return traces. Set the BLANKING (30) to ON.

4. Set the Y1 DISPLAY switch (12) to EXT and the Y1 GAIN (8) fully counterclockwise. Adjust the Y1 POSITION (8) to bring the Y1 trace to the centre graticule line. Set the Y1 GAIN (8) fully clockwise and adjust the Y-EXT OFFSET (2) to return the trace to the centre graticule line. Set the Y1 GAIN (8) fully counterclockwise.

5. Set the Test Oscillator frequency to 1 kHz and connect the output to the Oscilloscope. Adjust the Output controls to give 500mV pk-pk.

6. Disconnect the Oscilloscope and connect the Test Oscillator Output to the EXT INPUT (B).

7. Adjust the Y1 GAIN (8) for an 8cm Y1 display.

8. Vary the Test Oscillator Frequency over the range 10Hz to 12kHz and check that the Y1 display does not fall below 5.6cm.

9. Disconnect the Test Oscillator and set the Y1 GAIN (8) counterclockwise.

10. Monitor the Power Supply output and adjust it for +2V.

11. Connect the Power Supply output to the EXT INPUT (B) and adjust the Y1 GAIN (8) to give approximately 2cm vertical offset.

12. Check that the Y1 trace can be returned to the centre graticule line by adjusting the Y-EXT OFFSET (2).

13. Disconnect the Power supply and adjust the Y EXT OFFSET (2) to return the trace to the centre graticule line.

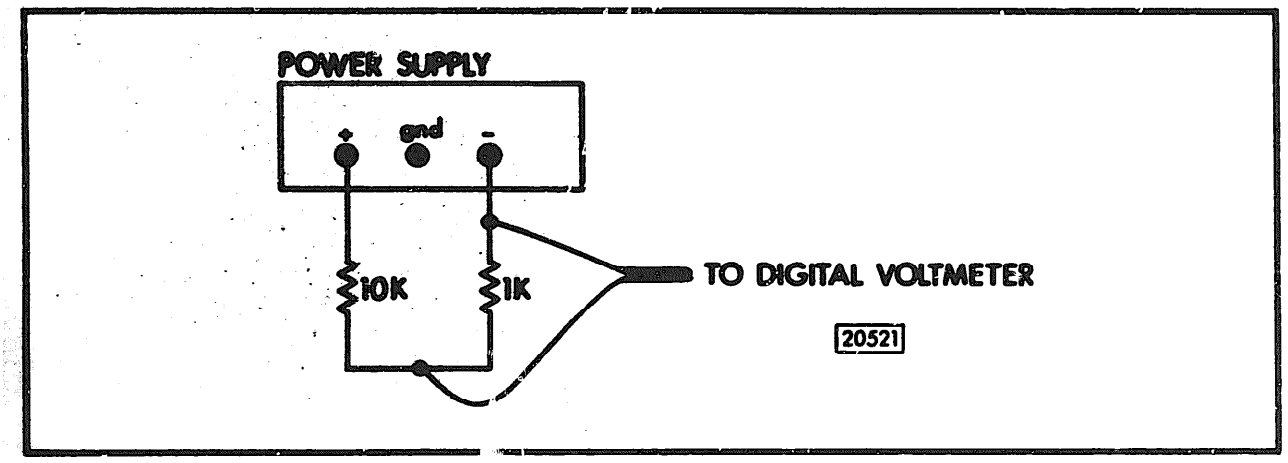


Figure 4-18 Ext Input Check

14. Repeat steps through 11 through 13 with -2V input from the Power Supply.

15. Repeat step 4.

16. Connect the Digital Voltmeter to the Power Supply as shown in Figure 4-18.

17. Set the Power Supply output to give a reading of 80mV on the DVM.

18. Set the Y1 POSITION (27) to bring the Y1 trace to the bottom graticule line.

19. Disconnect the DVM and connect the 80mV to the EXT INPUT (B).

20. Adjust the Y1 GAIN (8) to give 8cm vertical offset on the Y1 trace.

21. Set the CALIBRATION (31) to 10% and clock for a split trace display of 0.8cm ±0.1 cm.

22. Set the CALIBRATION (31) to 50mV and check for a split trace of 5cm ±0.25cm.

4-47. Slave Output

SPECIFICATION: **Level:**
50 ±10mV/cm of Y1 or Y2 display with frequency markers added.

TEST EQUIPMENT:

IF/BB Transmitter	*hp* 3710A
Oscilloscope	*hp* 180A/1802A/1821A
Cables	*hp* 15525A

Procedure:

1. Perform the preliminary procedure as in Paragraph 4-32.

2. Set the Transmitter controls as follows:

SWEEP	INT
SWEEP WIDTH	56MHz
IF FREQUENCY	70MHz
IF ATTENUATOR	10dB

3. Connect the Transmitter IF OUTPUT to the Receiver IF INPUT (D) and adjust the IF ATTENUATOR (25) for an on-scale meter reading.

4. Set the MARKERS switch (19) to SLIDING and the BLANKING (30) to OFF. Adjust the X-PHASE SHIFT control (3) to superimpose the markers on the forward and return traces. Set the BLANKING (30) to ON.

5. Set the Y1 Y2 CALIBRATION switch (15) to 1dB and adjust the Y1 GAIN (8) for a 1cm split trace display.

7. Check for a square wave of 500mV ±10mV pk-pk with markers added as in Figure 4-19.

6. Set the SLAVE switch (rear panel) to Y1 and connect the SLAVE output to the Oscilloscope.

8. Set the Y1 GAIN (8) counterclockwise and adjust the Y2 GAIN (7) for a split trace of 1 cm.

9. Set the SLAVE switch (rear panel) to Y2 and check for a square wave of 50mV ±10mV pk-pk with markers added as in Figure 4-19.

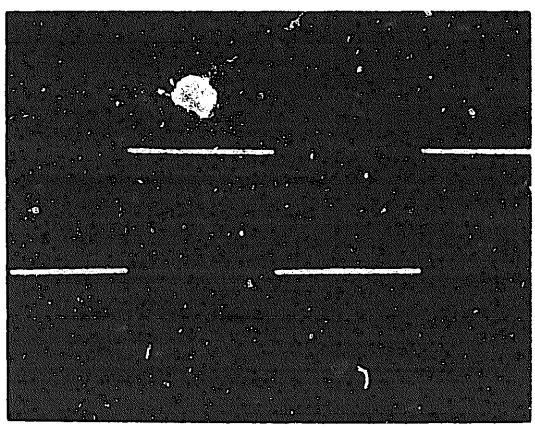


Figure 4-19 Slave Output

DELAY CHARACTERISTICS

4-48. Input Frequency Range & Phase Detector Capture Range

SPECIFICATION: ±5Hz at 83.333, 250 & 500kHz.

±15Hz (3703B Opt. 009 3705A Opt. 010/011/012).

±5ppm at 2..4,4.43.5.6 and 8.2MHz (3705A only)

TEST EQUIPMENT:

IF/BB Receiver .. .. *hp* 3702B
AM/FM Signal Generator .. .. *hp* 8640B
Electronic Counter .. .. *hp* 5248M
Cable ..... *hp* 15525A

Procedure:

1. Set the controls to their reference settings as in Figure 4-10.

2. Set the Receiver controls as follows:

   BB FREQUENCY (20) 83Δ
   SET LEVEL (17) .. .. mid pos
   BB INPUT (29) .. .. EXT
   Y2 DISPLAY (13) .. .. DELAY
   [OPT: BB FREQUENCY (20) .. .. 92Δ]

3. Set the Signal Generator AM and FM to OFF. Connect the RF OUTPUT to the Electronic Counter and adjust the frequency to give a Counter reading of 83.333kHz (OPT: Counter reading of 83.333kHz (OPT. 92.593kHz).

   Disconnect the Counter and connect the Signal Generator RF OUTPUT to the BB INPUT (C).

5. Adjust the Signal Generator Output Level control to give a PHASE LOCK/LEVEL meter (16) reading in the green band. [OPT. Adjust the PHASE LOCK control (18) to obtain a steady meter reading. Disconnect the Signal Generator.

6. Repeat steps 3 through 5 with the Signal Generator frequency set to 83.328kHz and 83.338kHz [Opt: 92.608kHz and 92.578kHz].

7. Set the BB FREQUENCY switch (20) to259 [OPT:27[Δ].

8. Repeat steps 3 through 5 with the Signal Generator frequency set to:

   250.000kHz, 249.995kHz & 250.005kHz [Opt: 277.778kHz, 277.763kHz & 277.793kHz].

9. Repeat steps 3 through 5 with the Signal Generator frequency set to: 500.000kHz, 499.995kHz & 500.005kHz. [Opt: 555.556kHz, 555.541kHz &555.571kHz].

3705A only

10. Set the BB FREQUENCY switch (20) to 2.4MHz.

11. Connect the Signal Generator RF OUTPUT to the Electronic Counter and adjust the frequency to give a Counter reading of 2.400000MHZ.

12. Disconnect the Counter and connect the Signal Generator RF OUTPUT to the BB INPUT (C).

13. Adjust the **PHASE LOCK** control (18) to obtain a steady **PHASE LOCK/LEVEL meter** (46) reading in the green band. Disconnect the Signal Generator.

14. Repeat steps 11 through 14. with the Signal Generator frequency set to 2.399988MHz and 2.400012MHz.

15. Set the BB *FREQUENCY switch (20) to 4.43 [Opt: 3.5].

16. Repeat steps 12 through 14 with the Signal Generator frequency set to 4.430000MHz, 4.429979MHz and 4.430021MHz.
[Opt: 3.500000MHz, 3.499983MHz & 3.500017MHz.
Opt: 3.580000MHz, 3.579982MHz & 3.580018MHz.
Opt: 4.500000MHz, 4.499978MHz & 4.500022MHz].

17. Set the BB FREQUENCY switch (20) to 5.6 [Opt: 4.43].

18. Repeat steps 12 through 14 with the Signal Generator frequency set to 5.600000MHz, 5.999972MHz and 5.600028MHz.
[Opt: 4.430000MHz, 4.429978MHz & 4.430022MHz.

19. Set the BB FREQUENCY switch (20) to 8.2 [Opt: 5.6]

20. Repeat steps 12 through 14 with the Signal Generator frequency set to 8.200000MHz, 8.199959MHz & 8.200041MHz.
[Opt: 5.600000MHz, 5.999972MHz & 5.600028MHz].

4-49. Delay Calibration

SPECIFICATION: 1, 3 and 10ns ±10% et BB Frequencies below 2.4MHz 1°, 10° and 20% radian at BB Frequencies of 2.4MHz or greater [3705A only).

TEST EQUIPMENT:

IF/BB Transmitter	hp 3710A/3716A
IF/BB Receiver	hp 3702B
BB Hybrid	hp 15537A
75Ω termination	*hp* 15522A
Test Oscillator	*hp* 654A
RMS Voltmeter	*hp* 3400A
4 x Cable	*hp* 15525A
BNC Tee	-

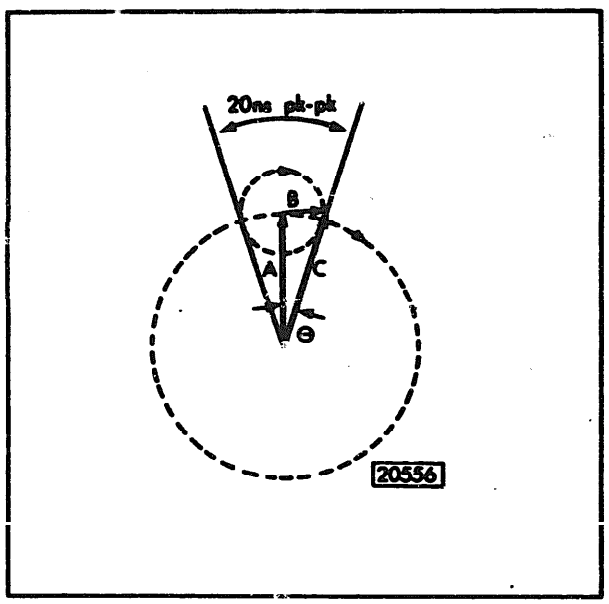


Figure 4-20 Phasor Diagram

METHOD

If an input signal with a known time delay is fed into a Group Delay Detector, the resultant display will indicate this accurately known delay on the Y-axis. The split trace calibration system used in the 3702B/3705A may then be checked against this known time delay.

A delayed input signal may be generated by means of adding two signals of different frequencies, producing phase modulation dependent on the relative amplitudes of the two added signals at the difference frequency.

Consider Figure 4-20 which shows the addition of two signals of frequency f1 and f2. Phasor (rotating vector) A rotates at the reference frequency f1 while phasor B rotates about the extremity of A at frequency f2 - f1 , producing phase modulation. Maximum phase displacement occurs when phasor B is at right angles to phasor A (as shown)

and the time delay of the resultant (phasor C) relative to A can be accurately calculated as shown below. When fed to the 3705A phasor C may be used as a sinusoidally varying group delay with accurately known limits.

CALCULATION:
At a reference frequency of 500kHz, the periodic time = 2us.

This is the time taken for phasor A (see Figure 4-20) to travel through 360°.

Therefore:

in 10ns, phasor A travels through:

$$\frac{\text{to}}{2000} \times 360 = 1.8°$$

Therefore:

for a 20ns pk-pk time delay due to phase modulation:

d (in Figure 4-20) = 1.8°.

Therefore:

the relative amplitude of B to A = tan 1.8°
= 0.03193

Therefore:

$$\text{the level of B} = \left(20 \log \frac{1}{0.03193}\right)\text{dB} = 30.05\text{dB}$$

down on A.

Thus: for a 20ns pk-pk delay, the signals to be added must have a difference in amplitude of 30.05dB.

Similarly, for a frequency of 555.556kHz and a 20ns pk-pk delay, the signals to be added must have a difference in amplitude of 29.14dB.

Similarly, for a frequency of 2.4MHz and above and 10°, the signals to be added must have a difference in amplitude of 15.1dB.

Procedure: /

1. Perform the preliminary procedure as in Paragraph 4-32.

2. Set the Transmittar controls as follows:

3710A SWEEP ..... INT
3710A IF ATTENUATOR 10dB
3716A BB FRFQUENCY 500kHz
(Opt. 555ΔkHz]
3716A BB POWER ..... -10dBm

Set the Receiver controls as follows:

3702B BB INPUT (29).. ..... EXT
3702B IF ATTENUATOR (25) 10dB
3702B Y2 DISPLAY (13) ..... DELAY
3702B MARKERS (19) ..... SLIDING
3703B/3705A BANDWIDTH (22) 10kHz

3. Connect the Transmitter IF OUTPUT to the Receiver. IF INPUT (D). Ensure that the IF/ BB LEVEL mater (11) is on-scale. Adjust the Receiver for a 10cm horizontal display on the CRT.

4. Set the BLANKING witch (30) to OFF and adjust the X-PHASE SHIFT control (3) to superimpose the markers on the forward and return traces. Set the BLANKING switch (30) to ON.

5. Connect the equipment as in Figure 4-21 with the 75 Ω termination connected to the Hybrid.

6. Adjust the RMS Voltmeter to obtain a suitable reading and note the reading.

7. Set the Test Oscillator frequency to 500.300kHz ±100Hz. [OPT: 555.757kHz ±100Hz] and output to 75Ω UNBAL. Remove the 75Q termination from the Hybrid and connect the Test Oscillator to the vacated port. Remove the Transmitter BB + SWEEP OUTPUT connection from the Hybrid and

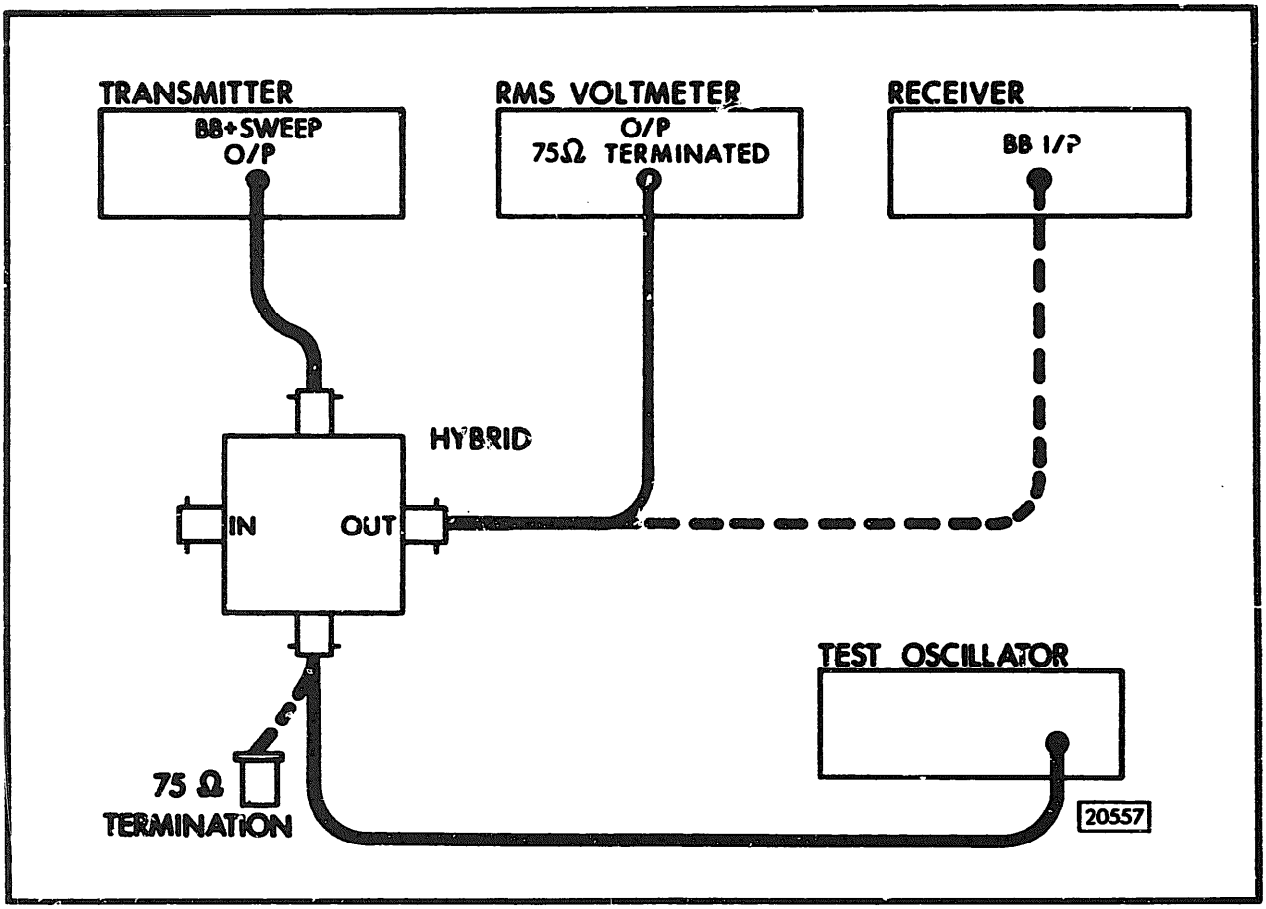


Figure 4-21 Delay Calibration Check

connect the 75Q termination to the vacated port.

8. Select a range on the RMS Voltmeter 30dB lower and adjust the Test Oscillator to obtain an output lever 30dB lower than that noted in step 6. [OPT: 29.ldB lower] .

9. Reconnect the Transmitter BB + SWEEP OUTPUT to the Hybrid, in place of the 75Q termination, and connect the Hybrid OUT port to the Receiver BB INPUT (C) in place of the RMS Voltmeter.

10. Adjust the plug-in SET LEVEL control (17) to obtain a green band reading of the PHASE LOCK/LEVEL meter (16). [OPT: Adjust the PHASE LOCK control **(18) for a steady meter** reading].

11. Adjust the Y2 GAIN (7) until **the display is** exactly 8cm pk-pk.

12. Disconnect the Test Oscillator from the Hybrid and terminate the vacated port **with 75Q.**

13. Set the DIFF PHASE/DELAY CALIBRATION switch (21) to 10ns and check for a calibration display of 4 ±0.4cm on the Y2 trace.

14. Adjust the Y2 GAIN control (7) for a l0cm calibration display. Set the DIFF PHASE/ DELAY CALIBRATION switch (2.1) to 2ns and check for a calibration display of 2.4cm ±0.24cm.

15. Set the DIFF PHASE/DELAY CALIBRATION witch (21) to 1ns and check for a calibration display of ±0.08cm.

3705A only

16. Set the BB FREQUENCY switch (20) to 2.4MHz.
Set the Transmitter BB FREQUENCY switch to 2.4MHz.

17. Repeat steps 5 through 7 with the Test Oscillator frequency set to 2.4003MHz ±100Hz.

18. Select a range on the RMS Voltmeter 10dB lower and adjust the Test Oscillator to obtain an output level 15.1dB lower than noted in step 17.

19. Reconnect the Transmitter BB + SWEEP OUTPUT to the Hybrid in place of the 75Ω termination and connect the Hybrid OUT port to the Receiver BB INPUT (C) in place of the RMS Voltmeter.

20. Adjust the PHASE LOCK control (18) to obtain a steady PHASE LOCK/LEVEL meter (16) reading and the SET LEVEL control (17) for a reading in the green band.

21. Adjust the Y2 GAIN control (7) until the display is exactly 8cm pk-pk.

22. Disconnect the Test Oscillator from the Hybrid and terminate the vacated port in 75 Ω.

23. Set the DIFF PHASE CALIBRATION switch (21) to 10° and check for a calibration display of 8cm ±0.8cm on the Y2 trace.

24. Set the DIFF PHASE CALIBRATION switch (21) to 1° and check for a calibration display of O.&m ±0.08cm on the Y2 trace.

25. Set the DIFF PHASE CALIBRATION switch (219 to 20% Rad and adjust the Y2 GAIN for an 8cm calibration display.

26. Set the DIFF PHASE CALIBRATION switch (21) to 10° and check for a calibration display of 7cm ±0.7cm.

4-50. Measurement Bandwidth

SPECIFICATION: 1,5 or 10kHz ±10%

TEST EQUIPMENT:

IF/BB Transmitter	*hp* 3710A/3716A
IF/BB Receiver	*hp* 3702B
BB Hybrid	*hp* 15537A
75Ω Termination	*hp* 15522A
Test Oscillator	*hp* 654A
Electronic Counter	*hp* 5300A/5301A
RMS Voltmeter	*hp* 3400A
Cables	*hp* 15525A
BNC Tee	

METHOD

As a continuation from Paragraph 4-49, if the difference in frequency between the added signals is increased to the measurement bandwidth limit, then the amplitude of the display Group Delay or Differential Phase signal will decrease to 0.707 of its former value.

Procedure

1. Connect the equipment as in Figure 4-21 and perform the check detailed in Paragraph 4.49, steps 1 through 11. Note: The Test Oscillator output level need not be set exactly.

2. Connect the Counter to the Receiver SLAVE OUTPUT (rear panel). Set the SLAVE switch to Y2 (rear panel).

3. Increase the Test Oscillator-frequency until the signal amplitude, on the Receiver display, has fallen to 5.6cm.

4. Check that the Counter is reading between 9 and 11 kHz.

5. Set the BANDWIDTH switch (22) to 5kHz and reduce the Test Oscillator frequency until the display amplitude rises to 5.6cm Check that the counter feeding is between 4.5 and 5.5kHz.

6. Set the BANDWIDTH switch (22) to 1kHz and reduce the Test Oscillator frequency until the display amplitude rises to 5.6cm. Check that the counter reading is between 0.9 and 1.1kHz.

7. [OPT 015 only.] Set the BANDWIDTH switch (22) to 180Hz and reduce the Test Oscillator frequency until the display amplitude rises to 5.6cm. Check that the counter reading is be tween 162 and 198Hz.

8. [OPT 015 only]. Set the BANDWIDTH switch (22) to 180kHz and reduce the Test Oscillator frequency until the display amplitude rises to 5.6cm. Check that the counter reading is be tween 81 and 99Hz.

4-51. Dynamic Range

SPECIFICATION: >200ns below 2.4MHz
>18° or 31.4% RAD
at 2.4MHz or greater.
[3705A only].

TEST EQUIPMENT:

As for Paragraph 4-49.

Procedure:

Repeat the check performed in Paragraph 4-49, steps 1 through 10.

2. Increase the Test Oscillator output and simultaneously reduce the Receiver Y2 GAIN (7) until the display is just limiting. Set the Y2 GAIN (7) for an 8cm display.

3. Remove the Test Oscillator from the Hybrid and terminate the vacated port with 75Q.

4. Switch the DIFF PHASE/DELAY CALIBRATION switch (21) to 10ns and check that a calibration display of less than 0.4cm is obtained.

5. Set the BB FREQUENCY switch (20) to 2.4MHz. Set the Transmitter BB FREQUENCY switch to 2.4MHz.

6. Adjust the PHASE LOCK control (18) for a peak reading on the PHASE LOCK/LEVEL meter (169.

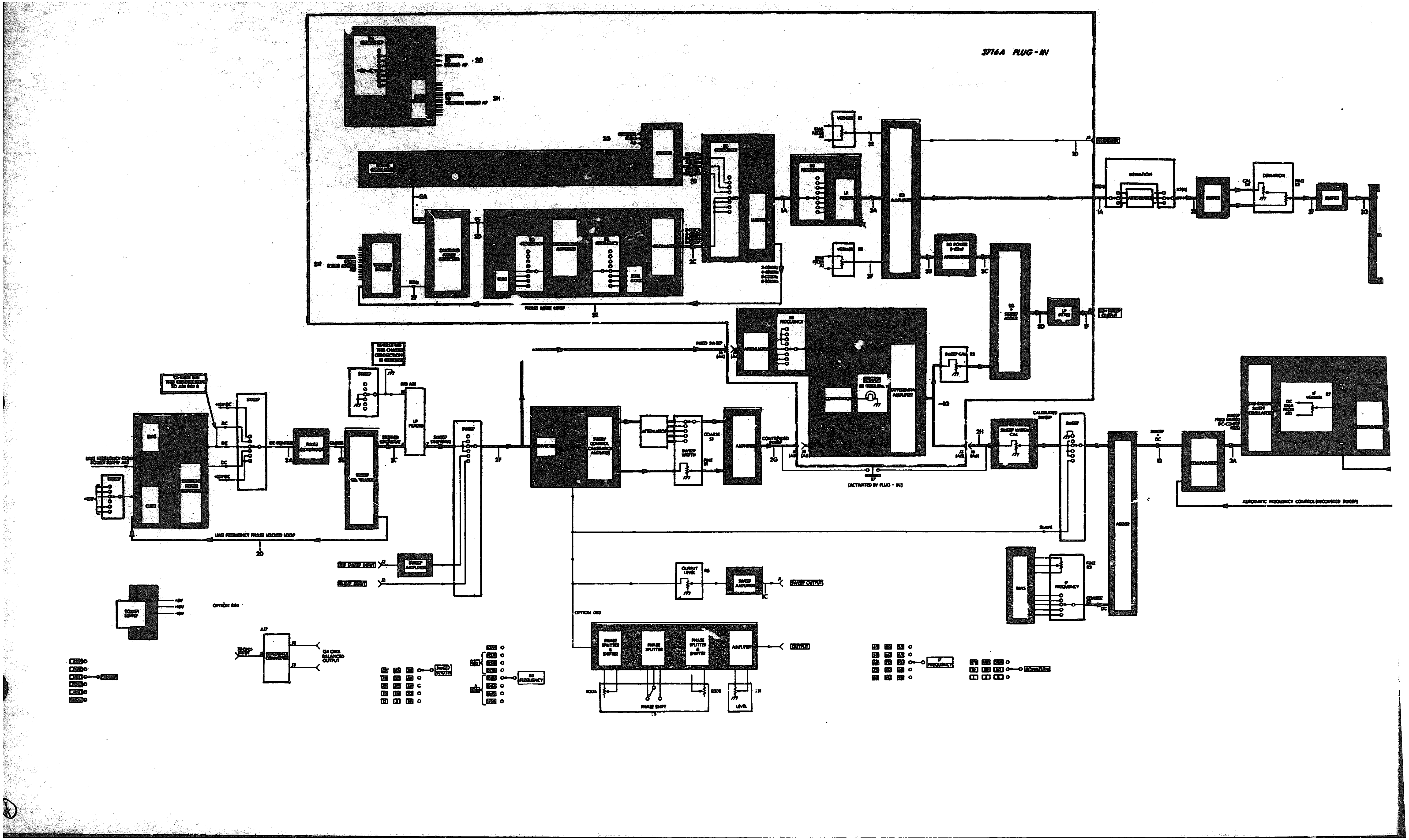
7. Adjust the SET LEVEL control (17) for a reading in the green band.

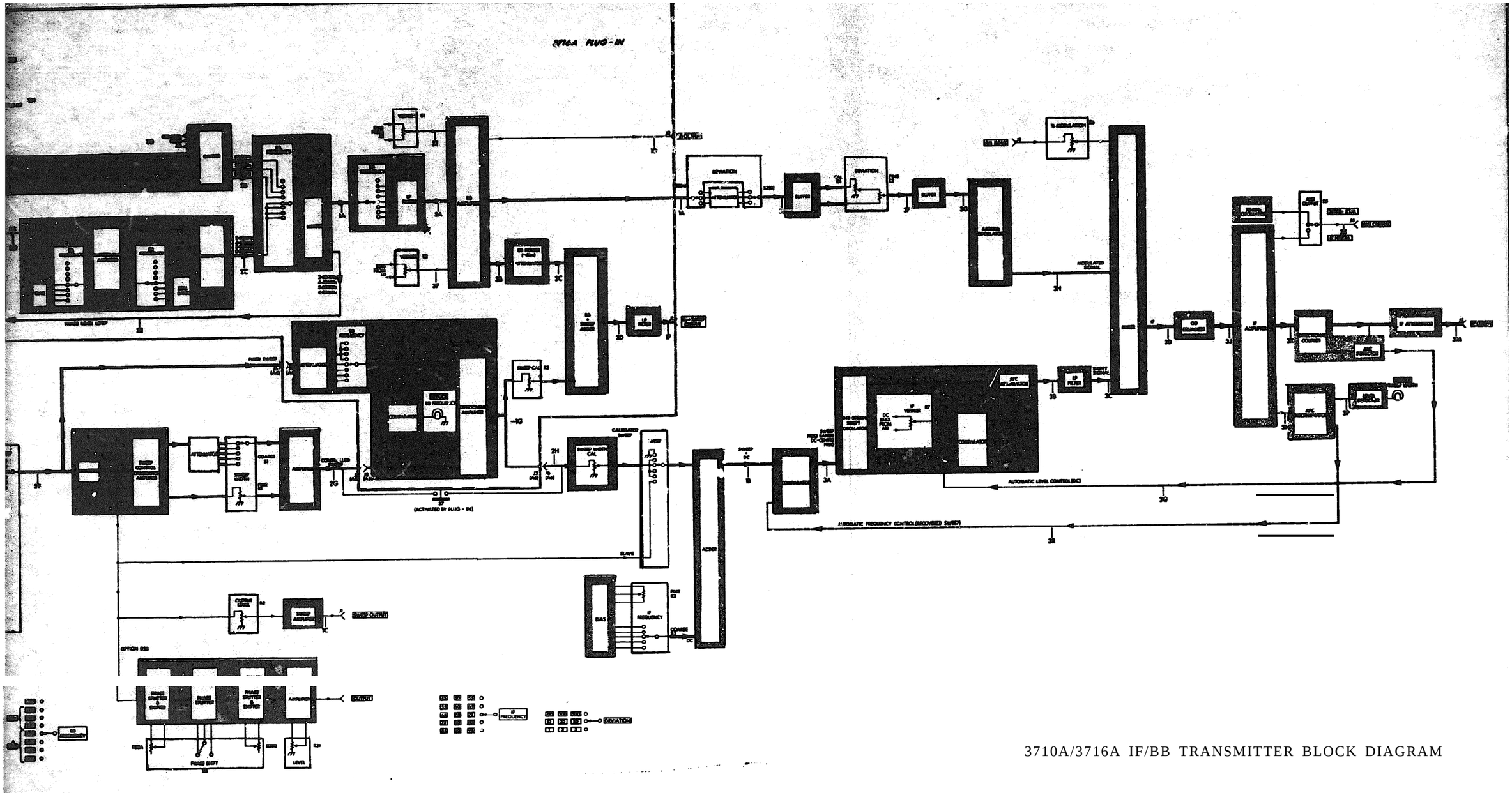
8. Set the DIFF PHASE CALIBRATION switch (21) to 10° and adjust the Y2 GAIN for 2cm display. Set the DIFF PHASE CALIBRATION switch (219 to OFF.

9. Set the Test Oscillator frequency to 2.400300MHz ±100Hz. Remove the 75Q Termination from the hybrid and connect the Test Oscillator to the vacated port.

10. Adjust the Test Oscillator output level until the Y2 display just limits.

11. Check that the Y2 display is not less than 3.6cm.


3716A PLUG-IN



3710A/3716A IF/BB TRANSMITTER BLOCK DIAGRAM

Y1 DISPLAY
OFF
IF
BB
RET LOSS
EXT

Y1 Y2 CALIBRATION
OFF
0-1
0-3
1-6
dB

BB INPUT
EXT
INT

BLANKING
OFF
ON

Y2 FREQUENCY
40dB
250
200
0-40
MHz
1-40
2-40
0-20

OPTION 002
75Ω
n-17 DEMOD
12A & 5AL

SLAVE
Y1
Y2

Y2 DISPLAY
SPECTRUM
IF
DELAY
SLAVE

SWEEP SOURCE
INT IF
EXT
INT BB+
EXT BB+

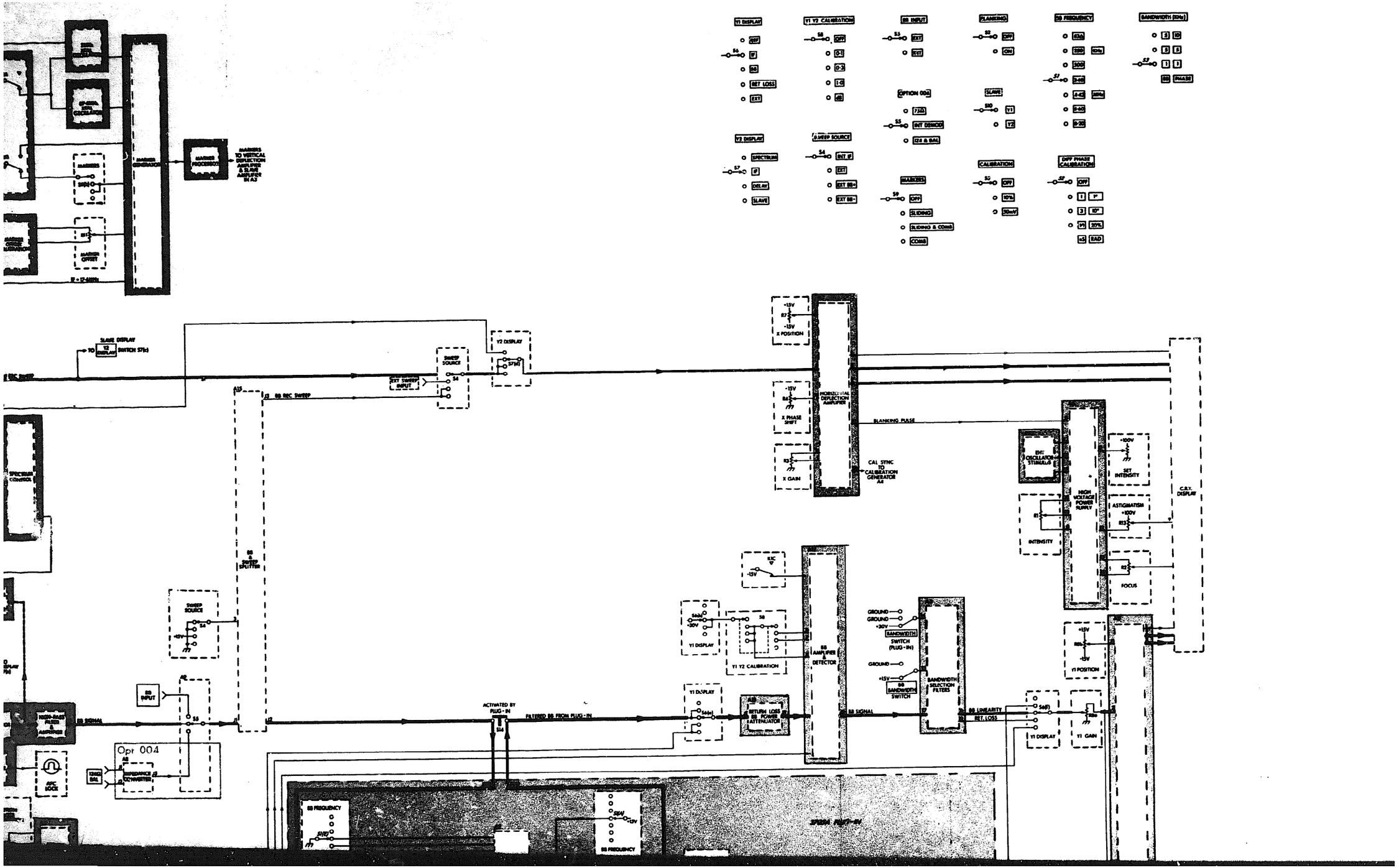
VARIERS
OFF
SLIDING
SLIDING & COMB
COMB

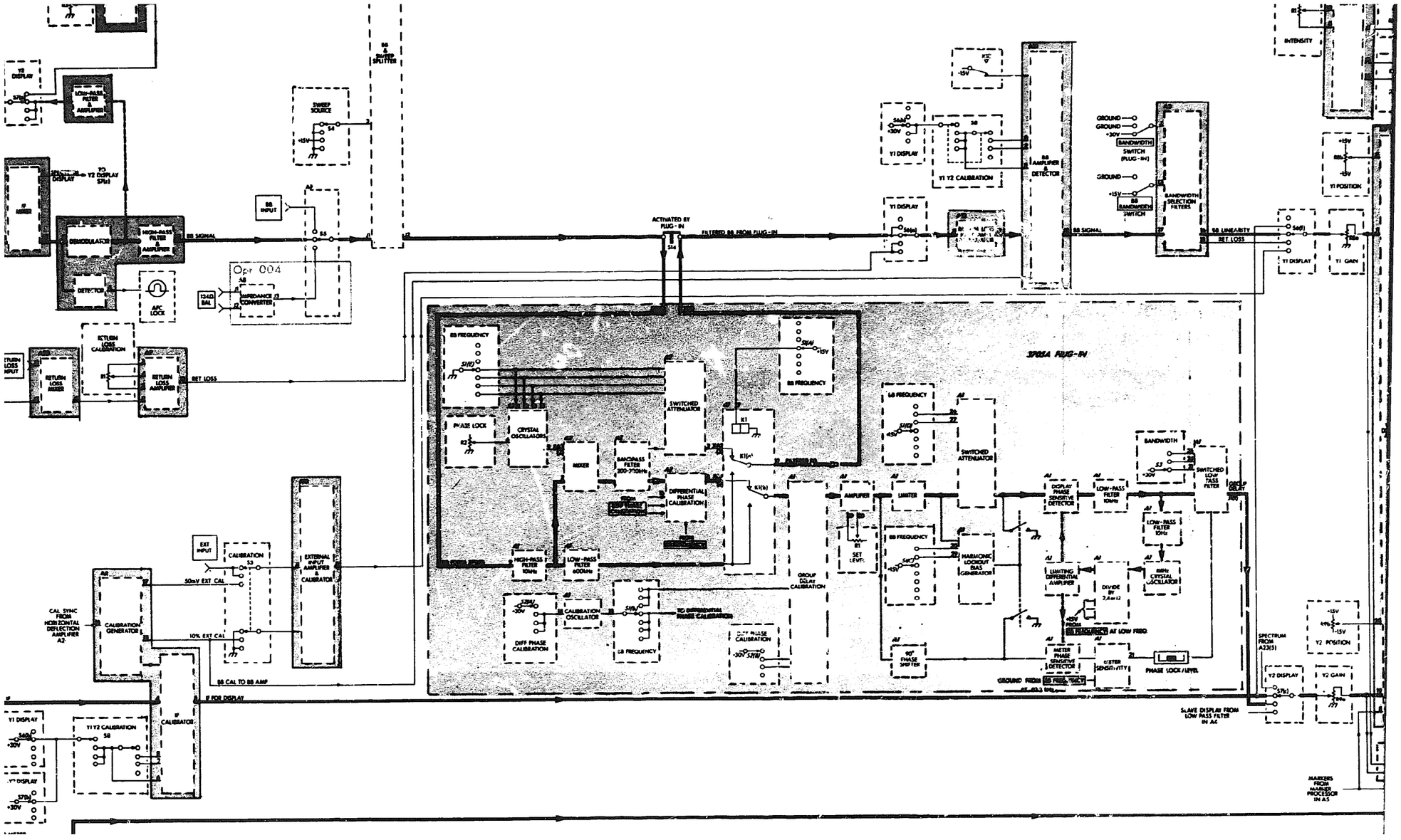
CALIBRATION
OFF
50%
50mV

DIFF PHASE CALIBRATION
OFF
1 1°
3 3°
10 10%
>5 BAD

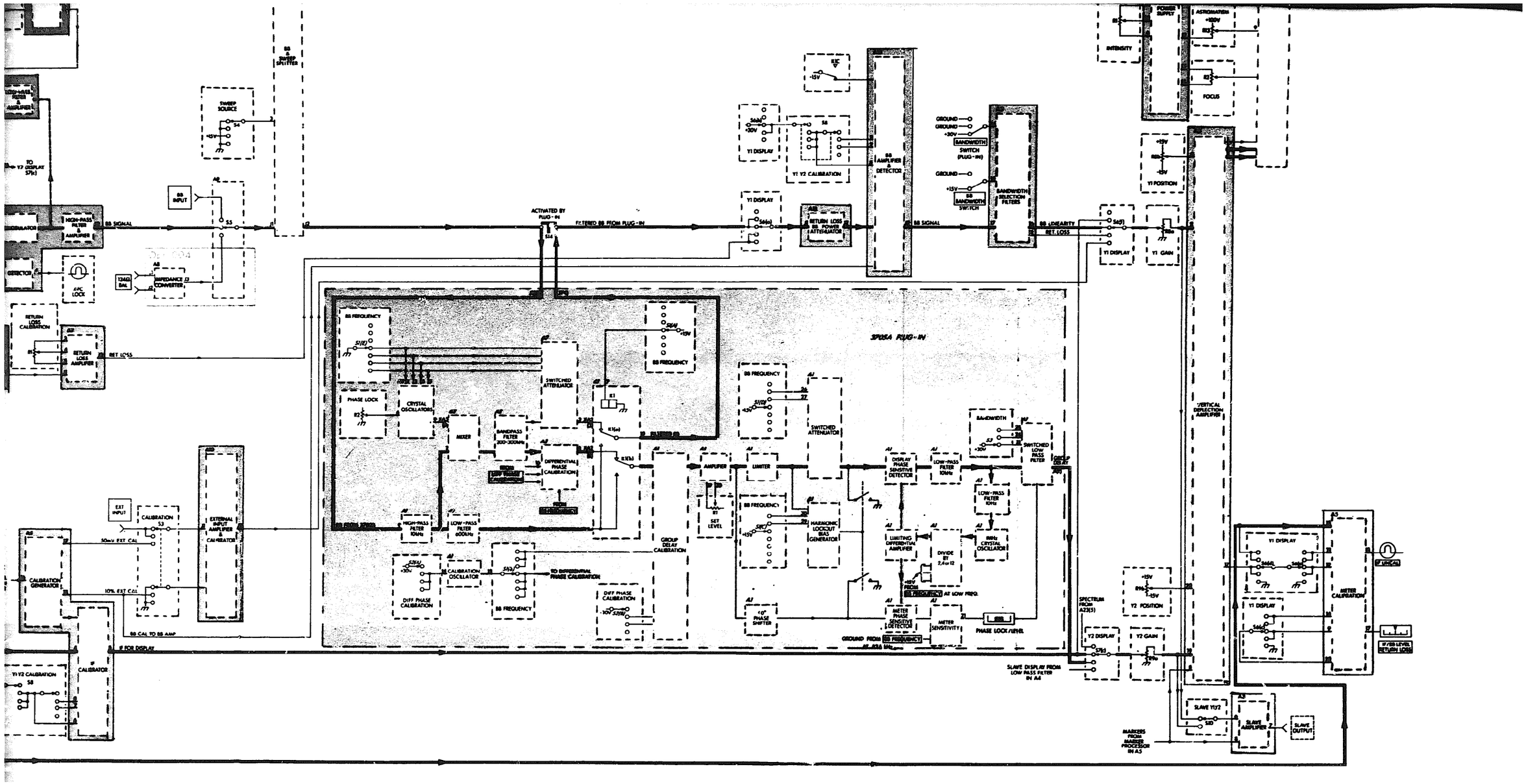
MARKERS
MARKER OSCILLATOR
MARKER PROCESSOR
MARKERS TO VERTICAL DEFLECTION AMPLIFIER & ERASE AMPLIFIER IN A3
MARKER WIDTH CALIBRATION
MARKER ZERO
MARKER OFFSET
IF = 17.5MHz

SLAVE DISPLAY TO Y2 DISPLAY SWITCH S7(c)
IF REC SWEEP
LOW-PASS FILTER
SPECTRUM SWEEP
SPECTRUM SWEEP GENERATOR
SPECTRUM CENTRE
SPECTRUM WIDTH
SPECTRUM CONTROL
EXT SWEEP INPUT
SWEEP SOURCE
Y2 DISPLAY
S7(f)
BB REC SWEEP
BB SWEEP SPLITTER
+1V
-15V
X POSITION
X PHASE SHIFT
X GAIN
DEFLECTION AMPLIFIER
BLANKING PULSE
CAL SYNC TO CALIBRATION GENERATOR A4
INT OSCILLATOR STIMULUS
INTENSITY
HIGH VOLTAGE POWER SUPPLY
ASTIG
FOCUS
Y1 POSITION
Y1 GAIN
Y1 DISPLAY
S46(f)
BB LINEARITY
REF LOSS
BB SIGNAL
BB AMPLIFIER & DETECTOR
BANDWIDTH SELECTION FILTERS
BANDWIDTH SWITCH (PLUG-IN)
BB BANDWIDTH SWITCH
GROUND
+30V
+15V
Y1 Y2 CALIBRATION
RETURN LOSS BB POWER ATTENUATOR
ACTIVATED BY PLUG-IN
FILTERED BB FROM PLUG-IN
S14
Y1 DISPLAY
S46(b)
Y1 DISPLAY
S46(a)
BB FREQUENCY
SWITCHED ATTENUATOR
S14(f)
+15V
BB FREQUENCY
BB FREQUENCY
S14(b)
IF INPUT
ATTENUATOR
LOCAL OSCILLATOR
IF AMP
DEMODULATOR
HIGH-PASS FILTER & AMPLIFIER
DETECTOR
AFC LOCK
BB SIGNAL
SPECTRUM DISPLAY
TO Y2 DISPLAY S7(c)
Y2 DISPLAY
S7(b)
LOW-PASS FILTER & AMPLIFIER
SWEEP SOURCE
+15V
BB INPUT
S5
Opt 004
A6
IMPEDANCE CONVERTER
12kΩ
0Ω
RETURN LOSS CALIBRATION
RETURN LOSS INPUT
RETURN LOSS AMPLIFIER
RET LOSS


Y1 DISPLAY
Y1 Y2 CALIBRATION
RF INPUT
FLAGGING
50 FREQUENCY
BANDWIDTH (KHz)
OFF
IF
50Ω
RET LOSS
EXT
0-1
0-3
1-0
dB
EXT
OFF
ON
3
10
1
1
PHASE
OPTION 003
75Ω
INT DEMOD
Q5 & BAL
SLAVE
Y1
Y2
CALIBRATION
OFF
10%
50mV
50 DIFF PHASE CALIBRATION
1°
10°
20%
RAD
Y2 DISPLAY
SPECTRUM
IF
DELAY
SLAVE
SWEEP SOURCE
INT IF
EXT
EXT BB+
EXT BB-
MARKERS
OFF
SLIDING
SLIDING & COMB
COMB
SLAVE DISPLAY
TO Y2 DISPLAY (SWITCH S7(b))
Y2 DISPLAY
S7(a)
SWEEP SOURCE
EXT SWEEP INPUT
S4
A5
J3 BB REC SWEEP
BB REC SWEEP SPLITTER
SPECTRUM CONTROLS
SWEEP SOURCE
+15V
S4
BB INPUT
S5
VIDEO FILTER & AMPLIFIER
BB SIGNAL
J1
J2
ACTIVATED BY PLUG-IN
FILTERED BB FROM PLUG-IN
S14
Opt 004
A8
IMPEDANCE MATCHING XFORMER
J5
J6
TONE BAL
AFC LOCK
Y1 DISPLAY
S66(a)
RETURN LOSS BB ECHOES & ATTENUATOR
A8
Y1 Y2 CALIBRATION
S6
BB AMPLIFIER & DETECTOR
A5
-15V
S7
X POSITION
-15V
S8
X PHASE SHIFT
R3
X GAIN
HORIZONTAL DEFLECTION AMPLIFIER
BLANKING PULSE
CAL SYNC TO CALIBRATION GENERATOR A4
GROUND
GROUND
+30V
BANDWIDTH SWITCH (PLUG-IN)
GROUND
+15V
S9
BANDWIDTH SWITCH
BANDWIDTH SELECTION FILTERS
BB LINEARITY
RET. LOSS
S66(f)
Y1 DISPLAY
Y1 GAIN
R88
+15V
-15V
Y1 POSITION
EHT OSCILLATOR STIMULUS
HIGH VOLTAGE POWER SUPPLY
INTENSITY
R1
+100V
SET INTENSITY
ASTIGMATISM +100V
R13
R2
FOCUS
C.R.T. DISPLAY
BB FREQUENCY
RAW
+12V
BB FREQUENCY
SPARE PLUG-IN



3702B/3705A IF/BB RECEIVER



3702B/3705B IF/BB RECEIVER BLOCK DIAGRAM

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)
Commander
Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703

DATE 4 April 1978

PUBLICATION NUMBER	DATE	TITLE
TM 11-5840-340-14&P	23 Jan 74	Radar Set AN/PLC-76

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.	
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of [illegible] knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
E-5				For item 2, change the NSN to read: 5835-00-134-9186. REASON: Accuracy.
E-8		E-3		Identify the cover on the junction box (item no. 5). REASON: It is a separate item and is not called out on figure 19.
E-9				Add the cover of the junction box as an item in the listing for figure 19. REASON: Same as above.

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:
SSG I. M. DeSpiritof 999-1776	SSG I. M. DeSpiritof

DA FORM 1 AUG 74 2028-2

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TEAR ALONG DOTTED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

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DATE

PUBLICATION NUMBER	DATE	TITLE
TM 11-6625-2917-10	27 AUG 79	Microwave Link Analyzer

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PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

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E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
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Ft Richardson (CERCOM) (1)
WSMR (1)
USAERDAA (1)
USAERDAW (1)
Army Dep (1) except
LBAD (10)
SAAD (30)
TOAD (14)
SHAD (3)
USA Dep (1)
Sig Sec USA Dep (1)
Units org under fol TOE:
29-134 (1)
29-136 (1)
29-207 (2)
29-610 (2)

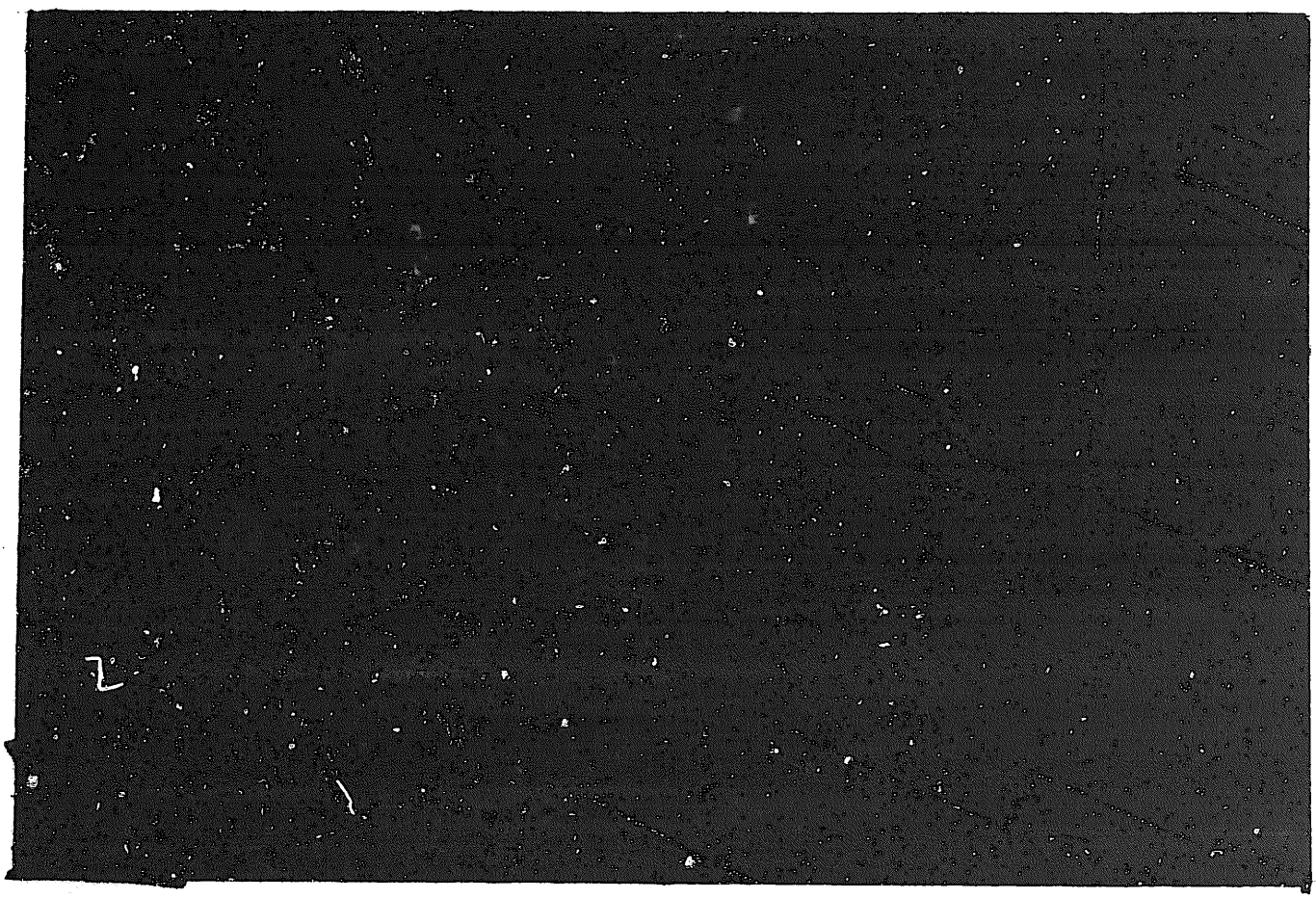
ARNG & USAR: None

For explanation of abbreviations used, see AR 310-50.

END

03-20-83

DATE



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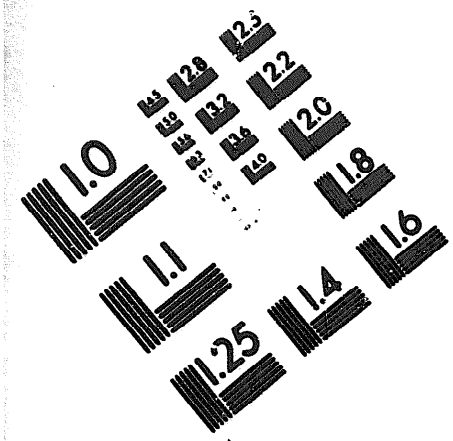
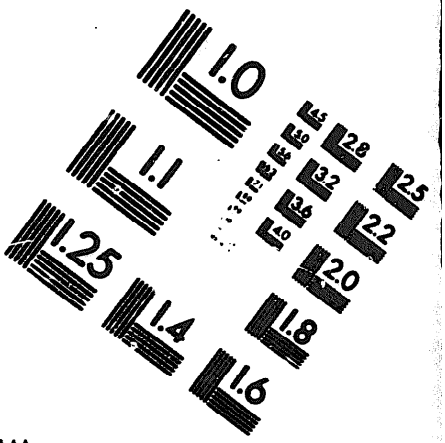
TEST TARGET





150 MM

1.0 mm (e= .81 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

1.5 mm (e= 1.09 mm)

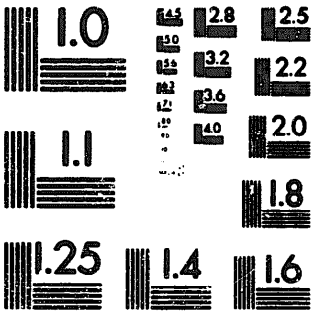
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

2.0 mm (e= 1.37 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*



1.0 mm (e= .81 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

1.5 mm (e= 1.09 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

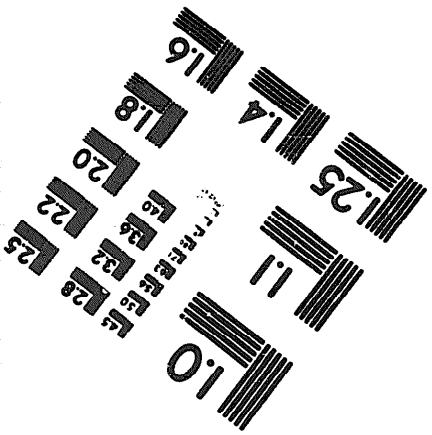
2.0 mm (e= 1.37 mm)

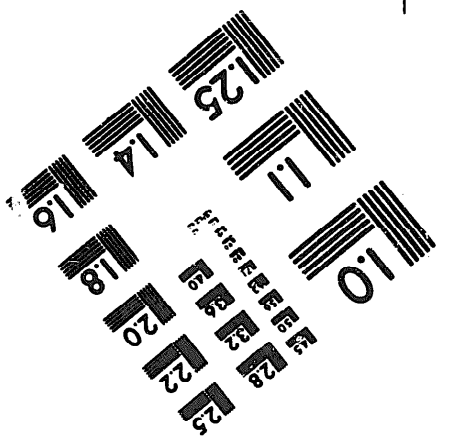
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

200 MM





250 MM