J68340A TEST BAY

CONTENTS

1. GENERAL

1.01 This section contains procedures for maintenance tests and adjustments for the J68340A Test Bay and its components.

1.02 Since the test bay consists of a number of more or less independent units, the maintenance of each will be considered separately.

2. J68340B METER AND CONTROL PANEL

(A) Sine Wave Output

2.01 Apparatus:

Dumont Model 2551 Oscilloscope

2.02 Procedure for Adjusting SWEEP PHASE Control

(1) Adjust the oscilloscope controls approximately as follows: Y-AXIS AMPLIFIER switch at INPUT UNDER 250V RMS; SYNC SIGNAL SELECTOR at LINE FREQ; COARSE FREQUENCY switch at 8-40; BLANKING at ON.

(2) Connect the oscilloscope Y-SIGNAL INPUT to the SINE SWEEP jack on the meter and control panel and adjust X and Y amplifier gain controls to obtain a pattern approximately 2" square.

(3) Adjust the SWEEP PHASE control and the FINE FREQUENCY control (on the oscilloscope) until the pattern appears similar to Fig. 1. Leave the control set at this point.

3. J68340C IF SWEEP OSCILLATOR

(A) General

3.01 It will be necessary to remove the IF sweep oscillator from the test bay for the following tests and adjustments.

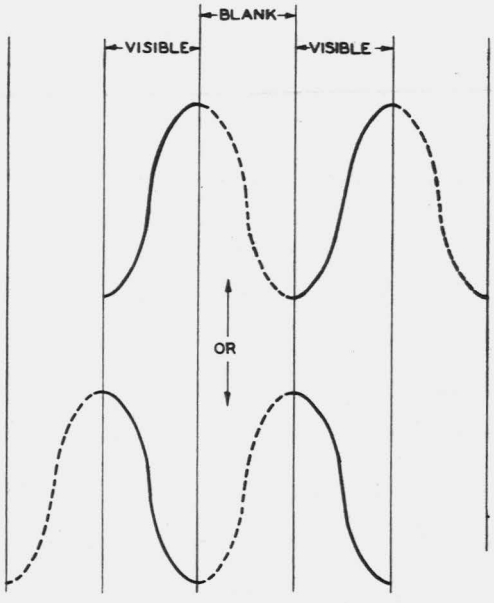


Fig. 1 - Scope Pattern for Proper Sweep Phase Setting

(B) Power Supply Circuit

3.02 Apparatus:

Weston Model 779 Analyzer.
AC Voltmeter, accurate to ±1.5 volts from 100 to 130 volts.
Ballantine Model 300 Voltmeter.
20,000 ohm, 5 watt resistor.
Variac, General Radio type V-5 MT, or equivalent.

3.03 Procedure to Check Regulation and Ripple:

(1) Connect the analyzer, the Ballantine Voltmeter and the 20,000 ohm resistor all in parallel across terminals 3 and 4 of TS1. The ground and negative leads go to terminal 3.

(2) Connect the AC voltmeter to terminals 1 and 2 of TS1, and apply 115 volts to these terminals from the Variac.

(3) Turn the PWR and OSC switches to ON, and after a five minute warm-up interval set the ADJ 200V control for an analyzer reading of 200 volts.

Requirement: The Ballantine Voltmeter should indicate not more than 0.015 volts rms ripple, nor should the analyzer reading change more than ±1 volt for any AC input between 105 and 130 volts.

(4) If the above requirements are not met, tubes V1, V2, V3, V4, and V5 should be checked by substitution or other means.

3.04 Procedure for Checking Socket Voltages:

(1) Using the test connections of 3.02 above, set the line voltage to 115 volts.

(2) Using the analyzer at 20,000 ohms per volt sensitivity (unless AC voltage is indicated), measure each of the voltages given in the table below:

From Component	From Term	To Component	To Term	Voltage (Approx.)
V1	1	GRD		325AC
V1	9	GRD		325AC
V1	3,4,7	GRD		420
V2	5	GRD		420
V2	6	GRD		420
V3	5	GRD		420
V3	6	GRD		420
V2	2	GRD		200
V3	2	GRD		200
V2	7	GRD		140
V3	7	GRD		140
V4	5	GRD		140
V4	7	GRD		108
V5	5	GRD		108
V4	6	V4	7	103
R17	3	V4	1	0
R17	3	GRD		102
V2	3	V2	4	6.3AC
V3	3	V3	4	6.3AC
V4	4	GRD		6.3AC

(3) Restore normal connections to the IF sweep oscillator.

(C) Discriminator Circuit

3.05 Apparatus:

J68340A, L1 Test Bay
Weston Model 779 Analyzer

3.06 Procedure to Check Discriminator Crossover and Polarity:

(1) For this and subsequent tests, AC power should be applied to terminals 1 and 2 of TS1 on the IF sweep oscillator by extending the leads in the test bay local cable, taking care to avoid turnover.

(2) Connect the apparatus as in Fig. 2, using "X" wiring. The IF sweep oscillator may be the unit under test providing the oscillator and 30 cycle switch sections are operable. It should be noted that the mercury relay will not operate properly if inverted or tilted more than about 30°. The discriminator need not be disconnected from the rest of the circuit, except for its input plug, P2. It is desirable to remove tube V8 if the circuit is left connected, to remove possible interference.

(3) Adjust the SENSITIVITY control on the meter and control panel for an XTAL CURRENT meter reading of about 2/3 of full scale.

(4) The oscilloscope should be operated at nearly full gain, with any convenient internal sweep. The BLANKING switch should be set to OFF.

(5) There should be two horizontal traces on the oscilloscope. Rotate the sweep condenser by hand until the traces exactly coincide. This is the frequency at which there is zero voltage from the discriminator.

(6) Measure this frequency by tuning the FREQ METER dial until there is a slight dip on the XTAL CURRENT meter.

Requirement: This frequency should lie between 65 and 75 MC.

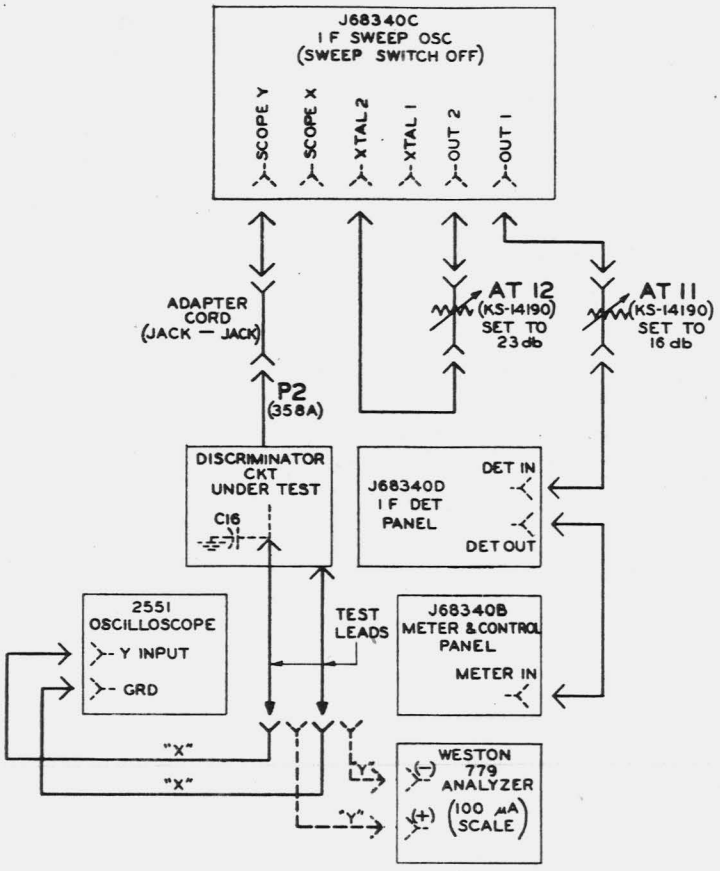


Fig. 2 - Circuit to Check Discriminator Cross-Over Frequency and Polarity

(7) If this requirement cannot be met, crystals CR1 and CR2 or resistors R24 and R25 are probably unbalanced at IF frequencies.

(8) Set the frequency of the oscillator in the vicinity of 85 MC (above crossover.)

(9) Using "Y" wiring in Fig. 2, note on the analyzer that the polarity of the discriminator output voltage is positive with respect to ground. This insures that when the IF sweep pattern is displayed on the oscilloscope in the normal fashion the highest frequency will be on the right-hand end of the sweep.

(10) If the output voltage is not positive, the polarity of one or both crystals is probably reversed.

(D) Oscillator and Sweep Circuits

3.07 Apparatus:

J68340A, L1 Test Bay.
Weston Model 779 Analyzer.
100,000 ohm resistor per KS-13490, L1 or equivalent.

3.08 Procedure to Check Output Power:

(1) Allow the sweep oscillator to warm up for about 5 minutes, with the OSC switch on and the SWEEP switch off.

(2) Connect the OUT-1 jack to the input of AT11, and the OUT-2 jack to AT12.

(3) Set each attenuator to 18 db; and connect the power meter in the test bay to the output of AT11. Record the power meter reading.

Requirement: The power meter reading should be -1.0 dbm or higher.

(4) Interchange the plugs in the OUT-1 and OUT-2 jacks.

Requirement: The power meter should read the same as recorded in (3) above ±0.5 db.

(5) If the output power is low, replace V7. Another possible trouble may be the cable and pad assemblies between J9 on the oscillator assembly

and the OUT-1 and OUT-2 jacks. To check this, connect J9 directly to AT11 (now set to 27 db) and again measure power.

Requirement: The power meter reading should be -1.0 dbm or higher.

(6) In the event that output power is still low it may be necessary to remove the oscillator assembly from the chassis and remove its sides in order to readjust the coupling between the oscillator coil and the pick-up loop, or to inspect the other components.

Caution: Do not let the pick-up loop come in contact with the turns of the oscillator coil, as the enamel on the wire may not withstand the plate potential.

(7) With the same connections as in Step (4) rotate the oscillator condenser slowly by hand, noting changes in power output. The output should not change by more than ±0.15 db over the frequency range of the unit. Adjustment for this will be covered in par. 3.10 (3).

3.09 Procedure to Check Sweep Waveform and Phase:

(1) Connect the Y-axis signal input of the oscilloscope to the SCOPE-X jack. It should be operated with internal sweep at about 30 cycles, line frequency sync, input attenuator at INPUT UNDER 250V, and with the gain control set to give about 2 inches deflection.

(2) With the sweep motor of the oscillator running, and with the oscilloscope blanking off, the observed pattern should be similar to that in Fig. 3(a). If the pattern appears flattened or clipped, it is an indication of overload caused by too much signal applied to the discriminator. This level may be reduced by bending sideways the one turn pick-up loop connected to J10 in the oscillator assembly. If the power meter is connected directly to this jack, it should read between -8 and -5 dbm.

(3) Note that the pattern appears stable and clean. If a slight vertical jump occurs at intervals, it may be an indication that the voltage regulator tube (V5) in the power supply section is unstable and should be replaced. Any slight variation in the DC supply voltage is amplified by the sweep circuit. This may be sometimes discovered as a sideways jitter in the oscilloscope pattern when the sweep is used in normal testing.

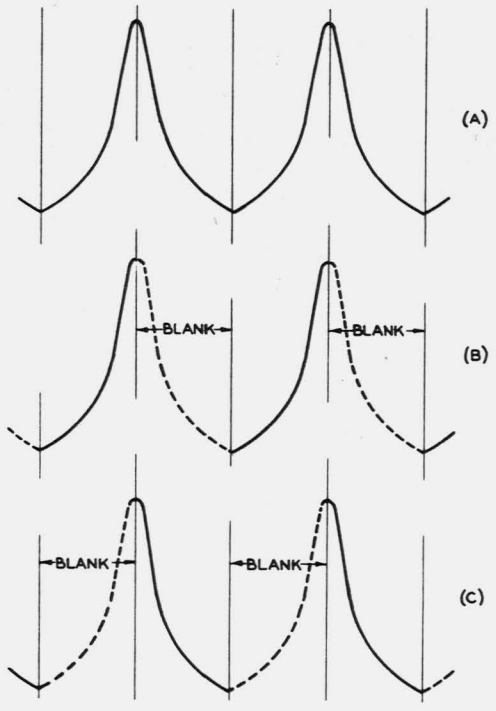


Fig. 3 - Wave Forms from Scope X Jack

(4) Turn off the sweep motor and bring it to a stop.

Requirement: The pattern should now be a nearly straight line. 60 cycle ripple on the trace should be less than 5% of the original amplitude.

(5) Turn the blanking on in the oscilloscope, and turn on the sweep motor. The pattern should now appear similar to Fig. 3(b) or 3(c). If not, slightly loosen the three nuts which lock the sweep motor in position and rotate the entire motor assembly until the pattern is in the correct phase with respect to the oscilloscope blanking.

Note: Of the two possible positions of the motor, use the one in which the oil-holes are more accessible from above. Retighten the nuts. If this adjustment is necessary, the rotor of condenser C18 has probably slipped relative to the motor shaft. Check the coupling for rigidity and backlash.

Caution: When turning the motor assembly, avoid contact with the 115 volt AC terminals exposed on the motor starting condenser C6.

(6) If the voltage from the SCOPE-X jack is unsatisfactory, observe the waveform by connecting the oscilloscope directly to the output of the discriminator, then at terminal 2 of the ADJ SLOPE potentiometer, etc., to find the point at which the signal fails. It may be necessary to test or replace V8.

3.10 Procedure to Check Frequency Range, Flatness and 70 MC Calibration:

(1) Set up the circuit of Fig. 4. It is assumed that the 30 cycle switch circuit is operating in accordance with pars. 3.13 to 3.15. The oscillator sweep motor should be turned on; and the SLOPE switch off. Attenuator AT12 should be set to 15 db. The oscilloscope should be switched to external sweep, with blanking on. The gain controls should be set to give a horizontal width of about 3 inches, and a vertical separation between the two horizontal traces of about 2 inches.

(2) Note that the pip from the IF frequency meter in the oscillator panel is visible on the upper trace.

Requirement: The pip should remain within the range of the sweep as the FREQ METER tuned over the range from 52 to 89 MC. If this requirement is not met, it may be necessary to squeeze together or pull apart the turns of the oscillator coil L14.

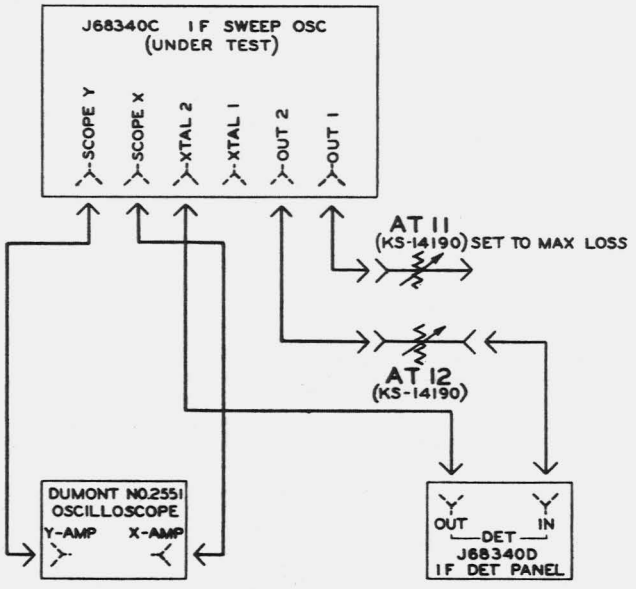


Fig. 4 - Circuit to Check Frequency Range, Flatness and 70MC Calibration

Caution: If the pick-up loop comes in contact with the turns of the oscillator coil, a short of the oscillator plate voltage to ground may result.

(3) Reduce the oscilloscope horizontal gain to obtain about 1/4" total sweep, so that amplitude variations in the upper trace are more noticeable. This is another method of checking the oscillator output characteristic (see par. 3.08 (7)), although in this case the frequency characteristic of the IF detector is a factor. To reduce amplitude variations during the sweep, remove the top of the oscillator can assembly, and adjust the tuning slug in coil L5 while the oscillator is sweeping until the amplitude variations as indicated on the oscilloscope are minimized. If L5 is adjusted the tests of 3.08 (7) should be repeated.

(4) Turn off the sweep motor, and set the SWEEP OSC dial on the end of the shaft to the 70 MC calibration point. There will now be two dots on the oscilloscope. Tune the FREQ METER dial slowly until the upper dot dips slightly.

Requirement: The frequency indicated should be 70 ±3 MC. If this requirement is not met, loosen the set-screws which fasten the SWEEP OSC dial to the motor shaft. It will be necessary to remove the oscillator assembly from the chassis to make these accessible. Replace the oscillator assembly, but do not screw it down. Set the FREQ METER dial to 70 MC and slowly rotate the motor shaft until the upper dot on the oscilloscope dips slightly, indicating that the frequency is 70 MC. Hold the motor shaft, and rotate the dial until the 70 MC mark is under the index line. Tighten the set-screws, and recheck the frequency calibration after replacing the oscillator assembly.

Note: This adjustment should be made only after all other adjustment to the oscillator assembly are completed.

3.11 Sweep Motor Performance

(1) The sweep motor should run smoothly, with little or no vibration or play in the shaft bearings. The effect of vibration will be excessive jitter of the test trace, with the frequency meter pip appearing unstable in position or even as two pips. Such jitter may also be due to a loose condenser coupling. If such jitter is traceable to bearing trouble, the oscillator should be returned to the Western Electric Co. for replacement and alignment.

(2) A drop or two of light oil should be applied to each oil hole every 3 or 4 months to reduce bearing wear.

3.12 Procedure for Checking Socket Voltages

(1) Using the analyzer at 20,000 ohms per volt sensitivity (unless AC voltage is indicated), measure each of the voltages in the oscillator and sweep circuits which are indicated in the table below:

From Component	Term	To	Voltage (Approx.)
V7	9	GRD	6.3AC
V7	3,4,5,8	GRD	< 0.1AC
C18	stator	GRD	165
V8	9	GRD	6.3AC
V8	3	GRD	1.1
V8	8	GRD	1.1
V8	2	GRD	0
V8	7	GRD	0
V8	1	GRD	125
V8	6	GRD	125

In the above tests the DC voltage supply should be 200 volts, and the OSC and SWEEP switches should be on. In measuring the voltage at the stator of C18 the circuit may be stopped from oscillating by the test lead capacitance. To prevent this, a 100,000 ohm 1/2 watt resistor should be connected in series with the tip of the positive test lead. The value given in the above table is for this condition, with the analyzer on the 250 volt scale.

(E) 30 Cycle Switch, and Slope Circuits

3.13 Apparatus:

J68340A, L1 Test Bay
Weston Model 779 Analyzer

3.14 Procedure to Check Switch Symmetry, Slope Network, and Range of ADJ XTAL 1 Potentiometer

Note: This adjustment may be made without removing the IF sweep oscillator from the test bay.

(1) Set up the circuit of Fig. 5. The SLOPE switch should be off and the ADJ XTAL 1 potentiometer set at maximum (CW). The oscilloscope should be operated with internal sweep at about a 15 cycle rate, with line frequency sync and no blanking.

(2) Turn the ADJ 30~ control until the switch synchronizes in a stable manner at a 30 cycle rate and the oscilloscope pattern is similar to Fig. 6(a). If there is any doubt that

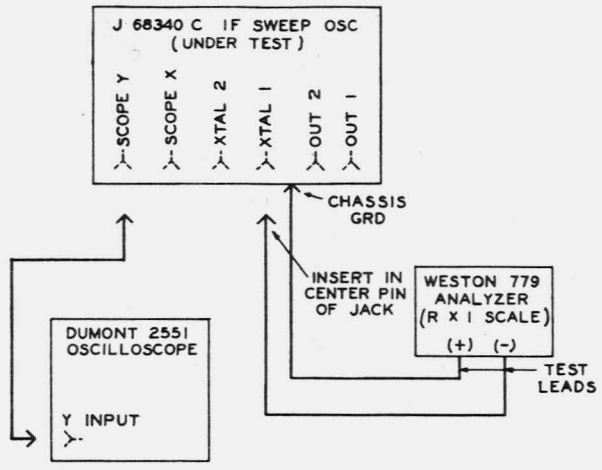


Fig. 5 - Circuit to Check Switch and Slope Circuits

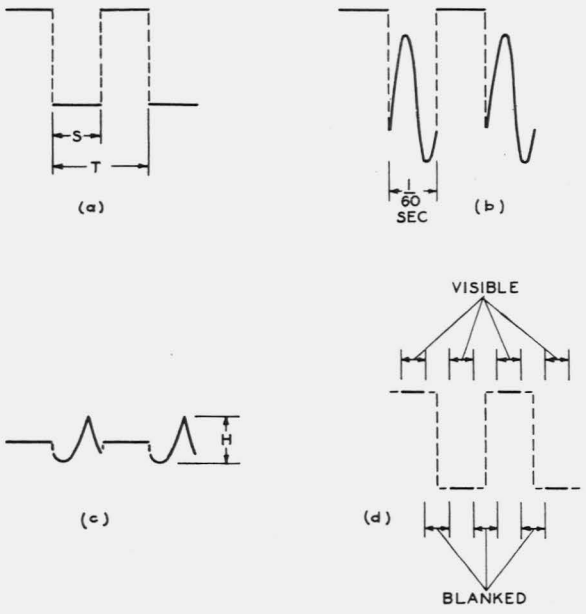


Fig. 6 - 30~ Switch Wave Forms

the frequency is correct, patch the SINE SWEEP jack to the XTAL-1 jack, and note that a full cycle of line frequency appears superimposed on one half of the switch pattern as in Fig. 6(b). Thus, one half of the switch period is 1/60 second, or 1/30 second for the full period. Remove this connection when the rate is correct.

(3) Referring to Fig. 6(a), adjust the oscilloscope horizontal gain until one switch period, T, is 2 inches wide.

Requirement: The half period, S, should be between 0.75 and 1.25 inches wide. If not, the trouble may be in V6, the internal adjustment of K1, or due to unsymmetrical values of the resistors and condensers in the 30 cycle multivibrator circuit.

(4) Adjust the oscilloscope vertical gain to obtain 1-1/2 inches deflection. Since the DC voltage obtained from the analyzer on the scale is nearly 1.5 volts in this application, the oscilloscope is now set for approximately 1 volt per inch sensitivity. Reduce the ADJ XTAL 1 control to minimum.

Requirement: The height should now be between 0.9 and 1.2 inches. If not, check R50 and R52.

(5) Turn the ADJ SLOPE control to maximum, and turn the SLOPE, OSC and SWEEP switches on. Remove the Analyzer test lead from the XTAL 1 jack. The pattern should now appear similar to Fig. 6(c).

Requirement: The height, H, should not be less than 0.4 inches.

(6) Reduce the ADJ SLOPE control to minimum (CCW). The pattern should become a single straight line, free of transients or other disturbances. Turn the SLOPE switch off and on several times. Any noticable change in the amplitude of the pattern is an indication of probable excessive DC leakage in C38. If the required value of H was not obtained, increase the discriminator loop coupling, discussed in par. 3.09 (2).

3.15 Procedure to Check Phase of 30 Cycle Switch

Note: This adjustment may be made without removing the IF sweep oscillator from the test bay.

(1) Set up the circuit of Fig. 5. With the SLOPE switch off, turn the oscilloscope blanking on. Note that the pattern is like that of Fig. 6(d). The transfer time of the switch contacts should occur near the middle of the blanked-out portion of the trace. If not, turn the ADJ 30 ~ control until this is so. If the synchronization appears unsteady near this setting, reverse the plug of the oscilloscope power cord in its receptacle to change the relative polarity of blanking, and again adjust to obtain the correct pattern.

(2) As an aid to understanding the phase relations which have been set up, refer to Fig. 7. The phase of the

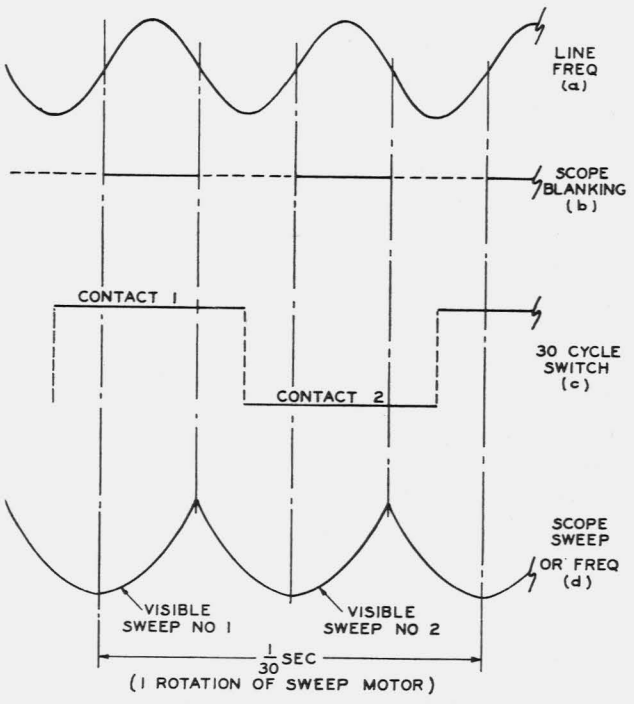


Fig. 7 - Phase Relations in Test Set

30 cycle switch and of the sweep motor (which determines the oscilloscope sweep) have been independently adjusted with respect to the oscilloscope blanking, which is fixed relative to line frequency.

3.16 Procedure for Checking Socket Voltages

(1) Using the analyzer at 20,000 ohms per volt sensitivity (unless AC voltage is indicated) measure each of the voltages in the 30 cycle switch and slope circuits indicated in the table below:

From Component	Term	To	Voltage (Approx.)
C22	2	GRD	238
K1	7	GRD	238
K1	8	GRD	238
V6	1	GRD	152 *
V6	2	GRD	148 *
V6	4	GRD	6.3 AC
V9	5	GRD	115
V9	6	GRD	0
V9	7	GRD	4.1
V9	4	GRD	6.3 AC
C38	1	GRD	>0.5 **

* Measured with a 1/2 watt, 100,000 ohm resistor in series with the tip of the positive test lead.

** Measured with SLOPE switch off.

(F) J68337E, L4 Frequency Meter

3.17 This frequency meter should be calibrated in accordance with the instructions for the J68337E, L3 Frequency Meter on the J68340D IF Detector Panel, given in pars. 5.10 and 5.11. These units are electrically identical.

4. J68340M 30 CYCLE SWITCH

(A) General

4.01 The 30 cycle switch panel should be removed from the test bay for the following tests and adjustments. For tests not involving the Variac, AC power should be applied to terminals 1 and 2 of TS1 on the sweep oscillator by extending the leads in the test bay local cable, taking care to avoid turnover.

(B) Power Supply Circuit

4.02 Apparatus:

Weston Model 779 Analyzer
AC Voltmeter, accurate to ±1.5 volts from 100 to 130 volts.
Ballantine Model 300 Voltmeter
20,000 ohm, 5 watt resistor
Variac, General Radio type V-5MT, or equivalent

4.03 Procedure to Check Regulation and Ripple:

(1) Connect the analyzer, the Ballantine Voltmeter, and the 20,000 ohm resistor all in parallel across terminals 3 and 4 of TS1. The ground and negative leads connect to terminal 3.

(2) Connect the AC voltmeter to terminals 1 and 2 of TS1, and apply 115 volts to these terminals from the Variac.

(3) Turn the PWR and OSC switches on, and after a suitable warm-up set the ADJ 200V control for an analyzer reading of 200 volts.

Requirement: The Ballantine Voltmeter should indicate not more than 0.015 volts rms ripple, nor should the analyzer change more than ±1 volt for any input between 105 and 130 volts AC. If these requirements are not met, tubes V1, V2, V3, V4, and V5 should be checked by substitution or other means.

4.04 Procedure for Checking Socket Voltages

(1) Using the Weston 779 Analyzer at 20,000 ohms per volt sensitivity (unless AC voltage is indicated), measure each of the voltages in the power supply circuit given in the table below:

From Component	From Term	From Component	From Term	Voltage (Approx.)
V1	1	GRD		325 AC
V1	9	GRD		325 AC
V1	3,4,7	GRD		435
V2	5	GRD		435
V2	6	GRD		435
V3	5	GRD		435
V3	6	GRD		435
V2	2	GRD		200
V3	2	GRD		200
V2	7	GRD		178
V3	7	GRD		178
V4	5	GRD		178
V4	7	GRD		108
V5	5	GRD		108
V4	6	V4	7	135
R17	3	V4	1	0
R17	3	GRD		102
V2	3	V2	4	6.3 AC
V3	3	V3	4	6.3 AC
V4	4	GRD		6.3 AC

The above measurements are with 115 volts AC applied, and under the load conditions of par. 4.03(c) above:

(C) 30 Cycle Switch Circuit

4.05 Apparatus:

J68340A, L2 Test Bay
Weston Model 779 Analyzer
100,000 ohm resistor per KS-13490, L1 or equivalent

4.06 Procedure to Check Switch Symmetry and Range of ADJ XTAL 1 Potentiometer:

(1) Set up the circuit of Fig. 8. The ADJ XTAL 1 potentiometer should be at maximum. Operate the oscilloscope with internal sweep at about a 15 cycle rate, with line frequency sync and no blanking.

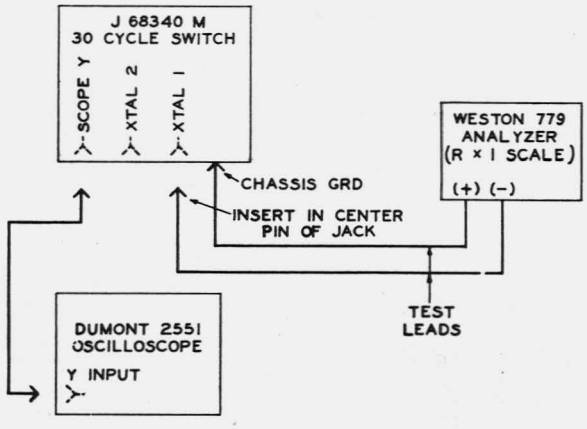


Fig. 8 - Circuit to Check Switch Circuit

(2) Turn the ADJ 30~ control until the switch synchronizes in a stable manner at a 30 cycle rate and the oscilloscope pattern is similar to Fig. 6(a). If there is any doubt that the frequency is correct, patch the SINE SWEEP jack to the XTAL 1 jack, and note that a full cycle of line frequency appears superimposed on one half of the switch pattern as in Fig. 6(b). Thus, one half of the switch period is 1/60 second, or 1/30 second for the full period. Remove this connection when the rate is correct. If synchronization is difficult, check R1, C2, and R25.

(3) Referring to Fig. 6(a), adjust the oscilloscope horizontal gain until one switch period, T, is 2 inches wide.

Requirement: The half period, S, should be between 0.75 and 1.25 inches wide. If not, the trouble may be in V6, the internal adjustment of K1, or improper values of the condensers or resistors in the multivibrator circuit.

(4) Adjust the oscilloscope vertical gain to obtain 1-1/2 inches deflection. Reduce the ADJ XTAL 1 control to minimum.

Requirement: The height should now be between 0.9 and 1.2 inches. If this requirement is not met, check R27 and R28.

4.07 Procedure to Check Phase of 30 Cycle Switch:

Note: This adjustment may be made without removing the 30 cycle switch panel from the test bay.

(1) Set up the circuit of Fig. 8. Return the ADJ XTAL 1 control to maximum and switch on the oscilloscope blanking. Note that the pattern is like that of Fig. 6 (d). The transfer time of the switch contacts should occur near the middle of the blanked-out portion of the trace. If not, turn the ADJ 30 cycle control until this is so. If the synchronization appears unsteady near this setting, reverse the plug of the oscilloscope power cord in its receptacle to change the relative polarity of blanking, and again adjust to obtain the correct pattern.

(2) As an aid to understanding the phase relationships which have been set up, refer to Fig. 7(a), (b) and (c).

4.08 Procedure for Checking Socket Voltages

(1) Using the Weston 779 Analyzer at 20,000 ohms per volt sensitivity (unless AC voltage is indicated) measure each of the voltages in the 30 cycle switch circuit indicated in the table below:

From Component	From Term	To	Voltage (Approx.)
C5	2	GRD	250
K1	7	GRD	250
K1	8	GRD	250
V6	1	GRD	163 *
V6	2	GRD	160 *
V6	4	GRD	6.3 AC

* Measured with a 1/2 watt, 100,000 ohm resistor in series with the tip of positive test lead.

5. J68340D IF DETECTOR PANEL

(A) General

5.01 The IF detector panel includes an oscilloscope pre-amplifier and its associated filament supply, an IF detector and an IF frequency meter. The following tests cover maintenance of these components and also of the separate IF detector furnished with the test bay.

(B) Oscilloscope Pre-amplifier Tests

5.02 Apparatus:

J68340A, List 1 or 2 Test Bay
Weston Model 779 Analyzer

5.03 Procedure for Checking Gain and Low Frequency Response

(1) Connect the test circuit in accordance with Fig. 9 using the "X" connection. Set AT13 at 0 and AT14 at 10 db. Turn the PRE AMP switch on the meter and control panel to ON and check that the PWR switch on the IF sweep oscillator or 30 cycle switch panel is on.

(2) Operate the oscilloscope with line frequency sync, internal sweep at about 15 cycles, and blanking switch off. Adjust the vertical gain until the square wave pattern is 3 inches high. Use a total horizontal deflection of about 1 inch to make any slope across the flat portion of the square wave more apparent.

(3) Observe how much the top of the square wave slopes relative to the horizontal reference lines on the oscilloscope screen. The oscilloscope should be able to meet the requirements of par. 7.

(4) Reconnect the circuit using "Y" wiring in Fig. 9. Increase the attenuation of AT13 until the pattern is three inches high, to the nearest 1/2 db.

Requirement: The total attenuation in AT13 shall be at least 19 db for a 3 inch deflection.

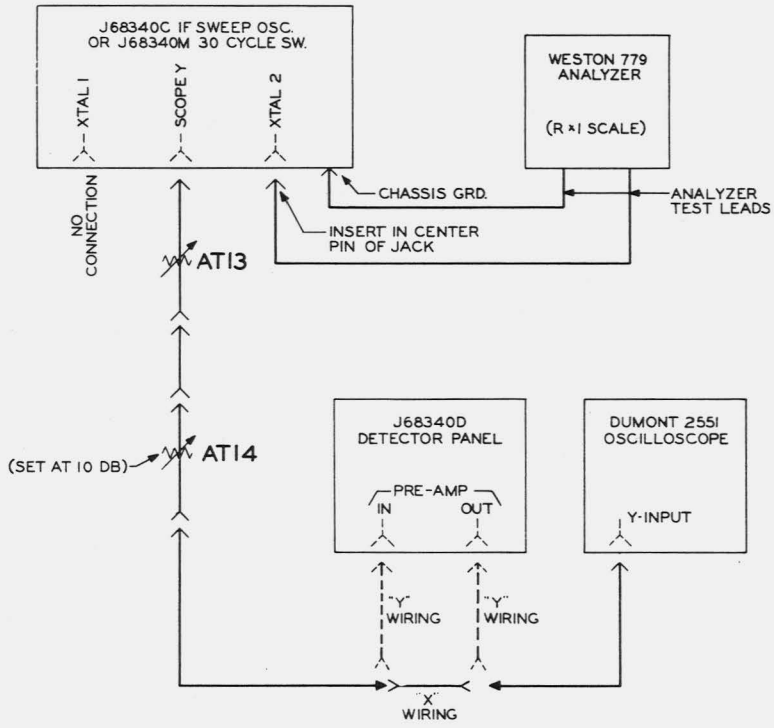


Fig. 9 - Circuit to Check Gain and Low-Frequency Response of Pre-amplifier

(5) Observe how much the top of the square wave now deviates from the horizontal reference lines.

Requirement: The slope along the flat portions of the square wave shall not differ from the slope noted in (3) by more than 0.05 inch (1/2 scale division).

5.04 Procedure for Checking Voltages:

(1) It will in most cases be necessary to dismount the panel from the test bay for these tests. Power supply connections with the bay must be maintained, however, and this may require extension of the leads.

(2) Use the analyzer on 20,000 ohms per volt sensitivity (unless AC voltage is indicated). With 115 volts AC applied to terminals 3 and 4 of TS2 and 200 volts DC applied to terminals 3 and 4 of TS1, measure the voltages given in the table below:

From Apparatus	From Term.	From Apparatus	From Term.	Voltage (Approx.)
TS2	2	T1	8	124 AC
TS2	2	C4	2	145
TS2	2	C4	3	40*
GRD		TS1	1	40*
GRD		V1	5	20
GRD		V1	9	40
GRD		V1	4	92
GRD		V1	6	66
GRD		V1	2,8	1.1
GRD		C3	2	155
GRD		C3	2	92

*Measured with pre-amplifier connected to heater supply, with V1 in place.

Caution: Do not connect power to the heater supply unless it is connected to a pre-amplifier with tube in place. Disconnect power or remove fuse from the IF detector panel before removing or replacing tube in pre-amplifier.

(C) IF Detector Tests

5.05 Apparatus:

J68340A, L1 Test Bay
J68333A Test Bench

5.06 Procedure for Checking Sensitivity and Flatness:

(1) Arrange the circuit of Fig. 10. Adjust the oscillator to 55 MC. This may be done by tuning the frequency meter in the oscillator panel to 55 MC and then turning the sweep motor shaft

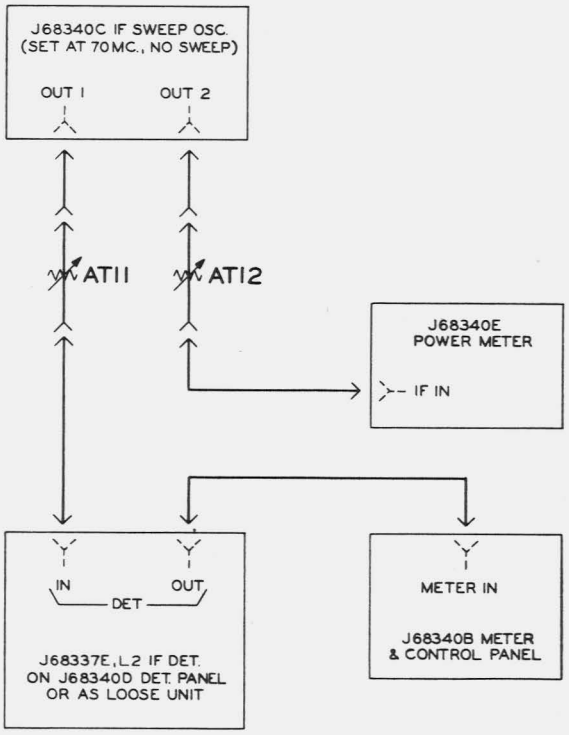


Fig. 10 - Circuit to Check Sensitivity of IF Detector

slowly by hand until a small sharp dip is noted on the CRYSTAL CURRENT meter. After setting the shaft at the point where the dip occurs, rotate the FREQ METER control to determine that dip is at 55 ±2 mc. Adjust AT12 so that the Power Meter indicates +4 dbm ±0.5 db. Make the loss in AT11 equal to that in AT12. Maintain at least 10 db in each attenuator at all times to protect the detector and power meter from overload.

(2) Gradually rotate the SENSITIVITY control on the meter and control panel in a clockwise direction.

Requirement: The CRYSTAL CURRENT meter shall read full scale (200 μa) before the SENSITIVITY control is maximum.

(3) If this sensitivity is not obtained, the 404A varistor (CR1) in the IF detector should be carefully replaced. Excessive lead length will cause reduction in sensitivity at the high end of the band.

(4) Note the exact reading of the power meter; and adjust the SENSITIVITY control for a reading of exactly 190 μa on the CRYSTAL CURRENT meter.

(5) Increase AT11 by 1 db and note the change in meter reading. Divide this change by 10 to determine the change in meter reading corresponding to 0.1 db, for the purpose of this test. Restore AT11 to its previous setting.

(6) Reset the oscillator to 85 MC, using a procedure similar to that in (1). Observe the change in readings of both power meter and CRYSTAL CURRENT meter. Convert the change in the CRYSTAL CURRENT meter to tenths of a db using the information from (5).

Requirement: The change in the CRYSTAL CURRENT meter (in db) shall be equal to the change in the power meter reading (in db) ±0.2 db.

5.07 Procedure for Checking Match of Two IF Detectors

(1) Connect the test circuit in accordance with Fig. 11. Set AT11 and AT12 at 18 db. The oscillator should be sweeping. Turn the ADJ XTAL 1 control to maximum and readjust AT12 so that the traces match within ±0.5 db.

Requirement: The setting of AT12 shall not differ from the setting of AT11 by more than 3 db.

(2) Make the two traces coincide as nearly as possible by adjusting the ADJ XTAL 1 control, and AT12 if necessary.

(3) Reduce the setting of AT12 by 1 db and adjust the vertical gain and centering controls of the oscilloscope until the traces are one inch apart.

(4) Increase setting of AT12 by 1 db and observe whether traces again match. If not, repeat (2), (3), and (4).

(5) If the two traces do not coincide throughout, set the ADJ XTAL 1 control so that the highest point on one trace between 55 and 85 MC coincides with the other trace. Observe the difference between the traces over the band.

Requirement: When adjusted as above, the traces shall be within 0.1 db of each other between 55 and 85 MC.

(6) Repeat (5), considering only the range from 60 to 80 MC.

Requirement: When adjusted as above, the traces shall be within 0.05 db of each other between 60 and 80 MC.

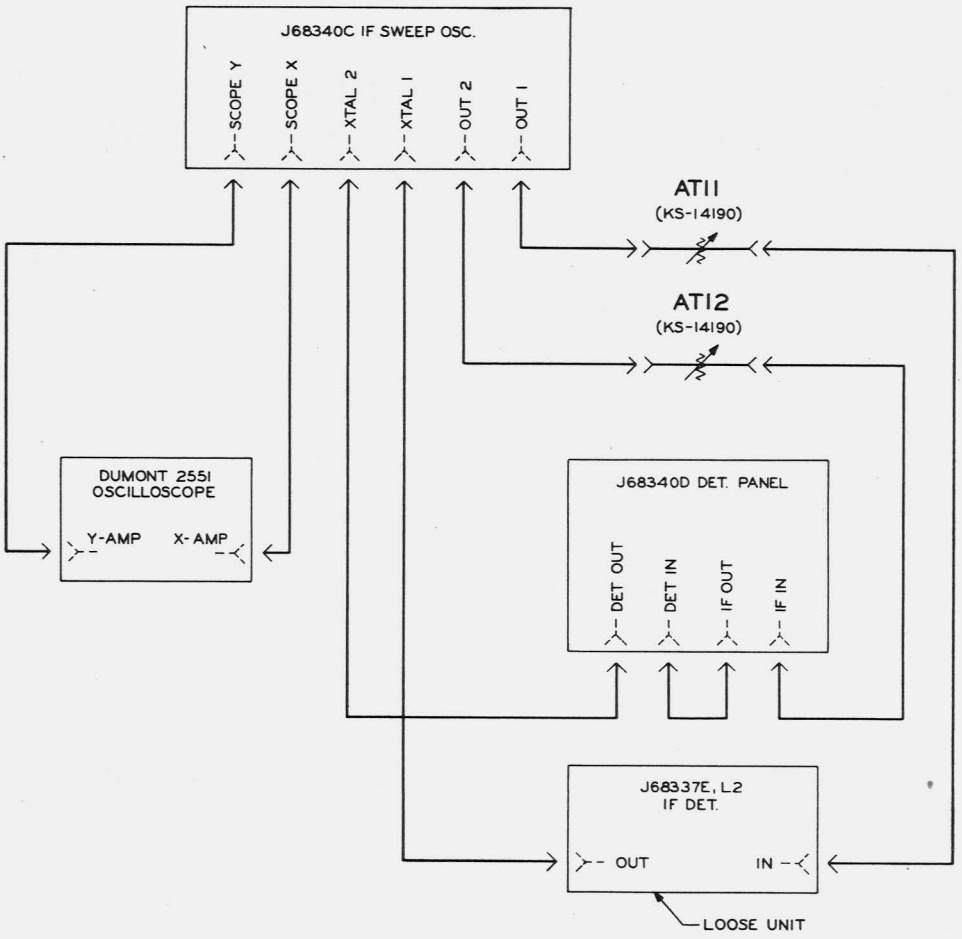


Fig. 11 - Circuit to Check IF Detector Match

Note: The total length of cable from OUT-1 to DET IN for one detector should be approximately the same as the length from OUT-2 to DET IN for the other detector, and this length should be kept to a minimum. It may further be necessary to interchange cables to meet the above requirement. In general, the same cables which are used in matching the detectors should be used in subsequent tests when these detectors are used to check other equipment.

5.08 Procedure for Checking Input Impedance (Return Loss) of IF Detectors

(1) Connect the test circuit as in Fig. 12. Set AT11 to 13 db.

(2) Connect a 486A jack to the B connection of the coupler in the position marked TERM I. Omit TERM II.

(3) Adjust attenuators AT13 and AT14 until the test and reference traces coincide at the center of the oscilloscope. The vertical gain of the oscilloscope should be set so that 1 db is 1/4 to 1/2 in.

(4) Turn slope circuit on, and adjust the slope of the reference trace until it matches the test trace.

Note: It may be necessary to re-adjust the attenuators and the ADJ XTAL 1 control on the sweep oscillator to match the traces.

(5) Record the total attenuation in AT13 and AT14. This corresponds to complete reflection at the C plug of the coupler, since this output is unterminated.

(6) Check the performance of the directional coupler as follows: Connect a second 486A jack to the C plug of the directional coupler in the position marked TERM II. Since the coupler is now terminated, the test trace should show practically no reflection (very high return loss).

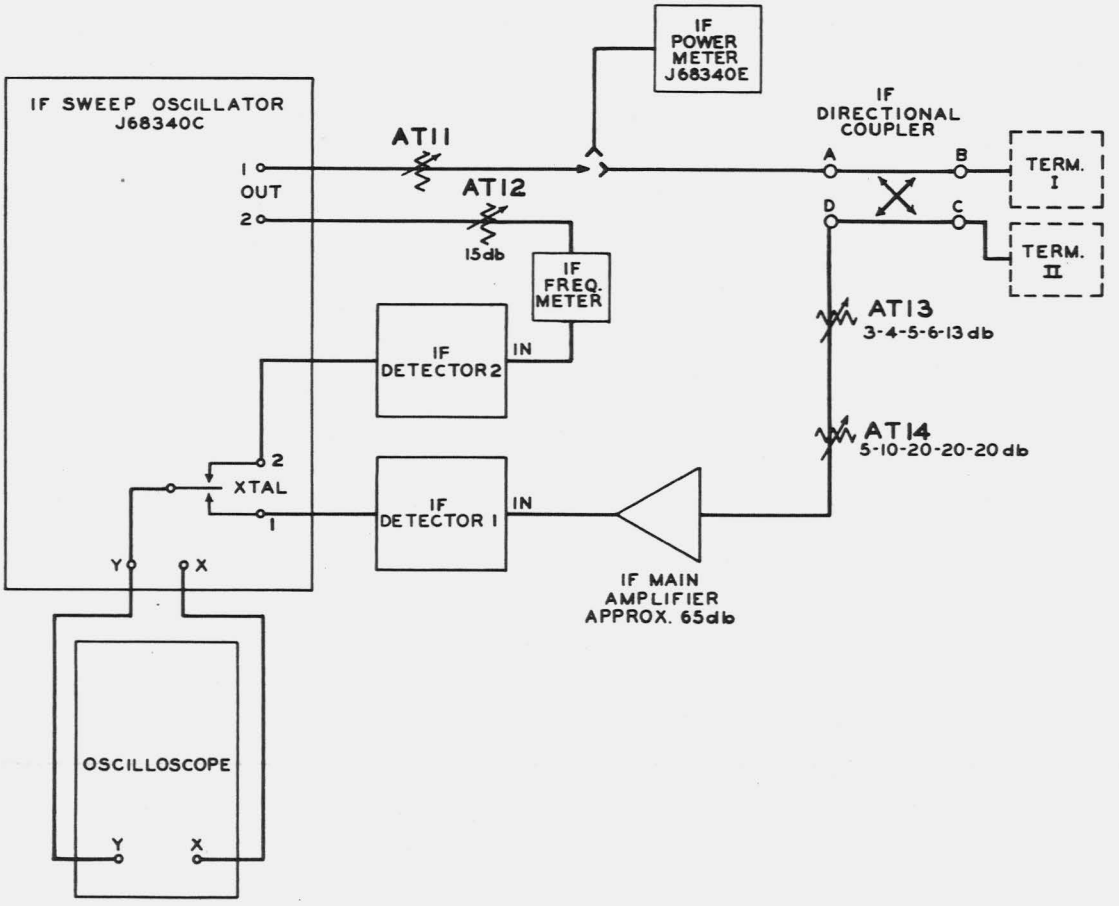


Fig. 12 - IF Impedance Measurement Test Setup

Requirement: With the total attenuation of AT13 and AT14 40 db less than the value in (5), the test trace shall remain below the reference trace.

Note: Failure to meet this requirement indicates that either the directional coupler or the 486A jacks are defective and should be repaired or replaced.

(7) Remove the 486A jack from the C connection of the coupler, and in its place connect the DET IN jack of the detector under test. This connection must be made directly, without use of a patch cord.

(8) Adjust the attenuation of AT13 and AT14 as required until the test trace is as close to the reference trace as possible, but still below it from 60 to 80 MC.

Requirement: The total attenuation in AT13 and AT14 in (8) shall be at least 27 db less than the total in (5).

Note: The difference in total attenuation between (8) and (5) is the return loss of the component under test.

(D) IF Frequency Meter Tests

5.09 Apparatus:

J68340A List 1 Test Bay
J68333A Test Bench
Test Cord per ES-882763 (print attached)

5.10 Test Procedure for Frequency Calibration

(1) Check the amplitude of the frequency meter dip by setting up a typical test circuit and adjusting for an oscilloscope sensitivity of one inch per db. The procedure of par. 5.07(1) to (4) is satisfactory for this purpose.

Requirement: The frequency meter dip in the oscilloscope trace shall have a depth of 0.1 db minimum, 0.3 db maximum.

(2) If the depth of the dip varies over the band, adjust L3 to make the depth of the dip as uniform as possible over the frequency range from 52 to 89 MC.

(3) Before proceeding with the frequency calibration, rotate the dial of the frequency meter as far clockwise as it will go. Observe whether the index mark on the dial coincides with the fixed index. If not, adjust the dial on the shaft (loosening the two set screws) until the marks coincide with the shaft rotated clockwise against the stop. Tighten the set screws firmly.

(4) Set up the J68330G microwave generator on the test bench for use as a frequency standard by inserting a 28AB (or KS-13978L2) 20 megacycle crystal as Y1. This crystal is normally used with the J68330J 40-megacycle generator. The crystal oven is not required.

Note: A 20 megacycle crystal will give frequency reference points at 60 and 80 MC (3 and 4 times its fundamental frequency). If such a crystal is unobtainable, one of the 28AA (or KS-13978L1) crystals furnished with the microwave generator may be used, and will produce frequency reference points at 3, 4, and 5 times its fundamental frequency.

(5) Set the meter switch on microwave generator at V1-IG1 position, and adjust L2 for maximum meter reading.

(6) Remove cap from FREQ TEST point on microwave generator and connect test cord per ES-882763. Ground the shield of the test cord to a convenient point (such as the shield of an adjacent tube).

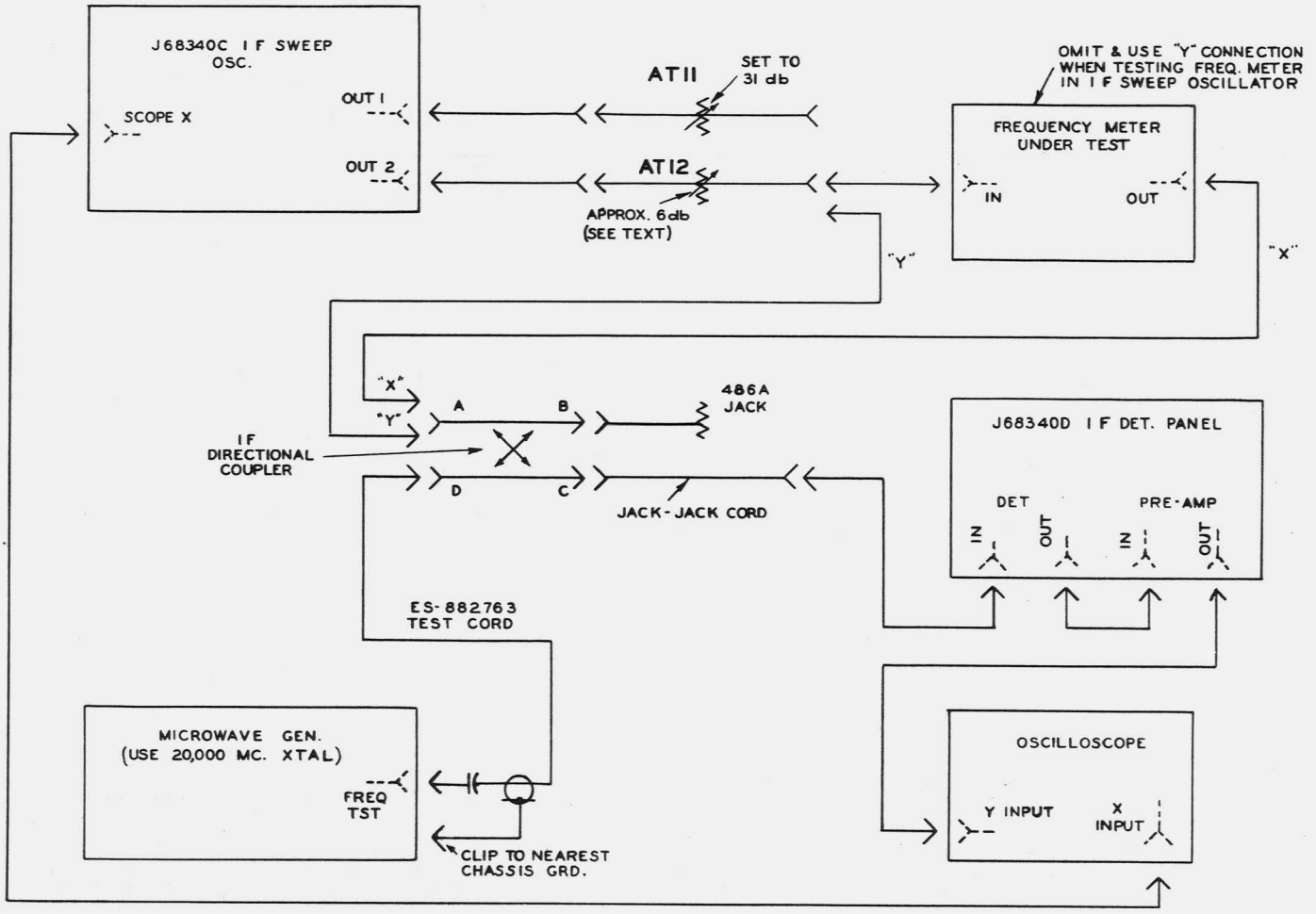


Fig. 13 - Circuit to Calibrate IF Frequency Meters

(7) Set up remainder of test circuit as in Fig. 13. If the frequency meter to be calibrated is in the IF sweep oscillator, use the "Y" connection. Otherwise use the "X" connection. Repeat the adjustment of (5) above.

(8) Adjust the oscilloscope gain and centering controls to obtain a pattern as shown in Fig. 14. Vertical marks will be observed at points where the sweeping oscillator fundamental and harmonics beat with the harmonics of the microwave generator output. These beat indications will appear as follows, listed in order of reducing size:

Frequency (Based on 20 MC Crystal)	Corresponds to:
60 MC	3 x fundamental
80	4 x fundamental
70 (weak)	7/2 x fundamental
53.3)	8/3 x fundamental
66.7) very weak	10/3 x fundamental
73.3)	11/3 x fundamental

Note: Additional beats may be observed due to pickup from radio or television stations, other test equipment, etc. If in doubt about which are the correct signals, remove the crystal in the microwave generator from its socket, so that its harmonics disappear. Any remaining signals will be due to pickup and should be disregarded.

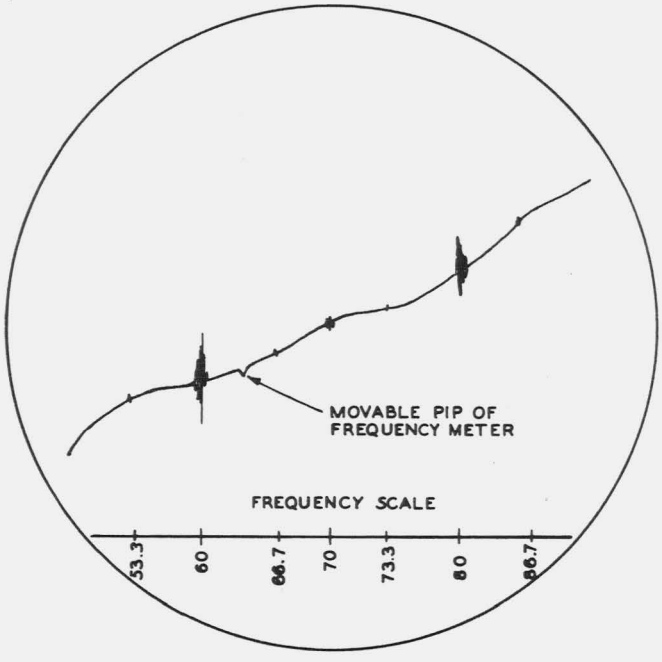


Fig. 14 - Scope Pattern in Frequency Meter Calibration

(9) The oscilloscope controls should be adjusted to make the 60 and 80 MC beats readily visible. AT12 may then be adjusted to make the frequency meter dip of suitable size for aligning with the beat indications.

(10) Set the dial of the frequency meter at exactly 60 MC. Observe whether frequency meter dip is centered on the 60 MC beat indication. If not, adjust L4 until they coincide exactly.

(11) Set the dial of the frequency meter at exactly 80 MC. If frequency meter dip and beat indication do not coincide, adjust C11 to center the dip on the beat indication.

(12) Repeat (10) and (11) until no further adjustment of either is necessary.

(13) When above adjustment is completed, the frequency indicated by the dial marking should be correct over the full range of the dial within ±0.2 MC. The additional harmonic beats may be used if desired for checking at other frequencies.

5.11 Test Procedure for Impedance Measurement: The return loss seen looking into the IF IN jack with the IF OUT jack terminated in a 368A plug should be measured, using the procedure of par. 5.08.

Requirement: The return loss should be greater than 30 db between 60 and 80 MC.

6. J68340G IF ATTENUATOR PANEL

6.01 Apparatus:

J68340A, L1 Test Bay
J68333A Test Bench
Weston Model 779 Analyzer

6.02 Procedure for Checking Attenuation:

(1) The following procedure is not an accurate measure of attenuation; it is a means of comparing one attenuator with another presumed to be good. If there are discrepancies, one or both of the units should be checked further, or returned to the Western Electric Co.

(2) Set up the circuit of Fig. 15. The reference attenuator, A1, may be as shown, or any other 75 ohm type capable of 1 db steps, since this is a DC test. It should be set initially to about 31 db; and the attenuator under test, A2, should be zero or removed from the circuit. Adjust the oscilloscope gain so that the height of the square wave pattern is exactly 2 inches.

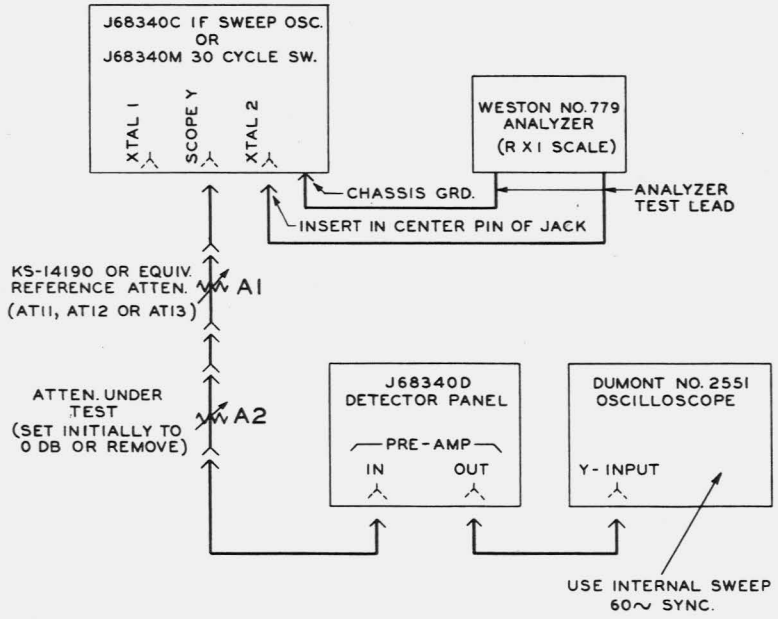


Fig. 15 - Circuit to Check Calibration of 75Ω IF Attenuators

(3) Insert the various steps of A2 one at a time, reducing A1 by the same nominal amount.

Requirement: The oscilloscope deflection for each pad section tested shall remain at 2 ±0.1 inches. This corresponds to a maximum discrepancy between the two attenuators of ±0.5 db. Note that the loss is stable and reproducible.

6.03 Procedure for Checking Return Loss

(1) A return loss measurement is often of more value in determining attenuator trouble than a loss measurement. The return loss should be measured at each end of the attenuator, with each pad section inserted one at a time, and with the opposite jack terminated in a 368A plug.

(2) Follow the procedure given in par. 5.08. The minimum return loss should be greater than 30 db.

Note 1: The attenuator must be removed from its panel for this test to permit connection of the IF directional coupler directly to its jacks.

Note 2: The attenuator being checked for return loss may not be one of the four on the list 1 test bay used for checking it, since all four are needed in the test set-up.

7. DUMONT MODEL 2551 OSCILLOSCOPE

7.01 This unit may ordinarily be repaired through the use of the instruction booklet accompanying it. If field repairs are not practical, the oscilloscope should be returned to the Western Electric Co. There are certain performance requirements which are of particular importance in the use of the oscilloscope in the J68340A Test Bay. Simple tests for these are described below:

7.02 Apparatus:

J68340A Test Bay
Weston Model 779 Analyzer

7.03 Procedure for Checking Y-amplifier Gain and Low-frequency Response

(1) Set up the circuit of Fig. 16, using "Y" wiring. Operate the oscilloscope with maximum Y-amplifier gain, internal sweep at about a 15 cycle rate, and with the blanking switch off. Set AT13 to 31 db.

Requirement: The vertical deflection should be at least one inch.

Note: An oscilloscope which provides the gain claimed by the manufacturer should give a deflection of 2 inches or more.

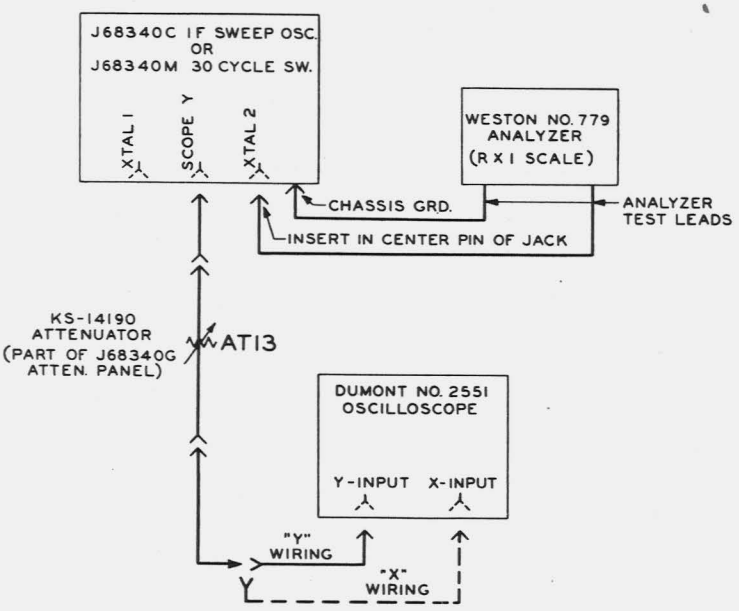


Fig. 16 - Circuit to Check Gain and Low-Frequency Response of Du Mont No.2551 Oscilloscope

(2) Adjust the input level and gain of the oscilloscope until the square-wave pattern is 3 inches high. Use a fairly small horizontal deflection of about 1/2 to 1 inch to make any slope across the flat portions of the wave more apparent. The maximum slope should not exceed 0.1 inch.

7.04 Procedure for Checking X-amplifier Gain

(1) Using "X" wiring in Fig. 16, operate the oscilloscope with maximum X-amplifier gain, internal sweep off, and with reduced beam intensity so that the two spots will not discolor the screen. Reduce AT13 to zero loss.

Requirement: The separation of the two spots horizontally should be at least 1/2 inch. To meet the manufacturer's stated sensitivity, the separation should be 1 inch.

8. J68340E POWER METER

8.01 Maintenance methods for the J68340E Power Meter and related units is covered in Section R70.234.

8.02 If the zero setting of the power meter changes when the RF head is connected to a bay or other unit under test, it is an indication that there is a DC potential difference between the test bay and the other framework. This may occur if 60 cycle power for the test bay is obtained from a receptacle not on the framework under test. Such effects are due to slight difference in ground potentials (even less than 0.1 volt) between the test point and the receptacle at which ground is established for the test bay.

Caution: It is possible to overload the thermistor units if excessive power is applied. This may result in permanent damage.

9. KS-5789 1500 VOLT RECTIFIER

9.01 Maintenance information for the KS-5789 Rectifier Unit may be found in Section A301.318.

10. J68340H RF SWEEP OSCILLATOR

10.01 Apparatus: No apparatus is required other than that which is supplied with the test bay on which it is mounted.

10.02 Procedure to Check Power Output:

(1) Set up the circuit of Fig. 17, using "X" wiring. Turn on and adjust the RF sweep oscillator in accordance with Section R70.202. AT2 should be set to 20 db, and AT1 adjusted for a power meter reading of 0 dbm. The power output of the RF sweep oscillator in dbm is the sum of the settings of AT1 and AT2.

Requirement: The power output should be greater than +28 dbm for a good oscillator, although +25 dbm will probably be satisfactory for most applications.

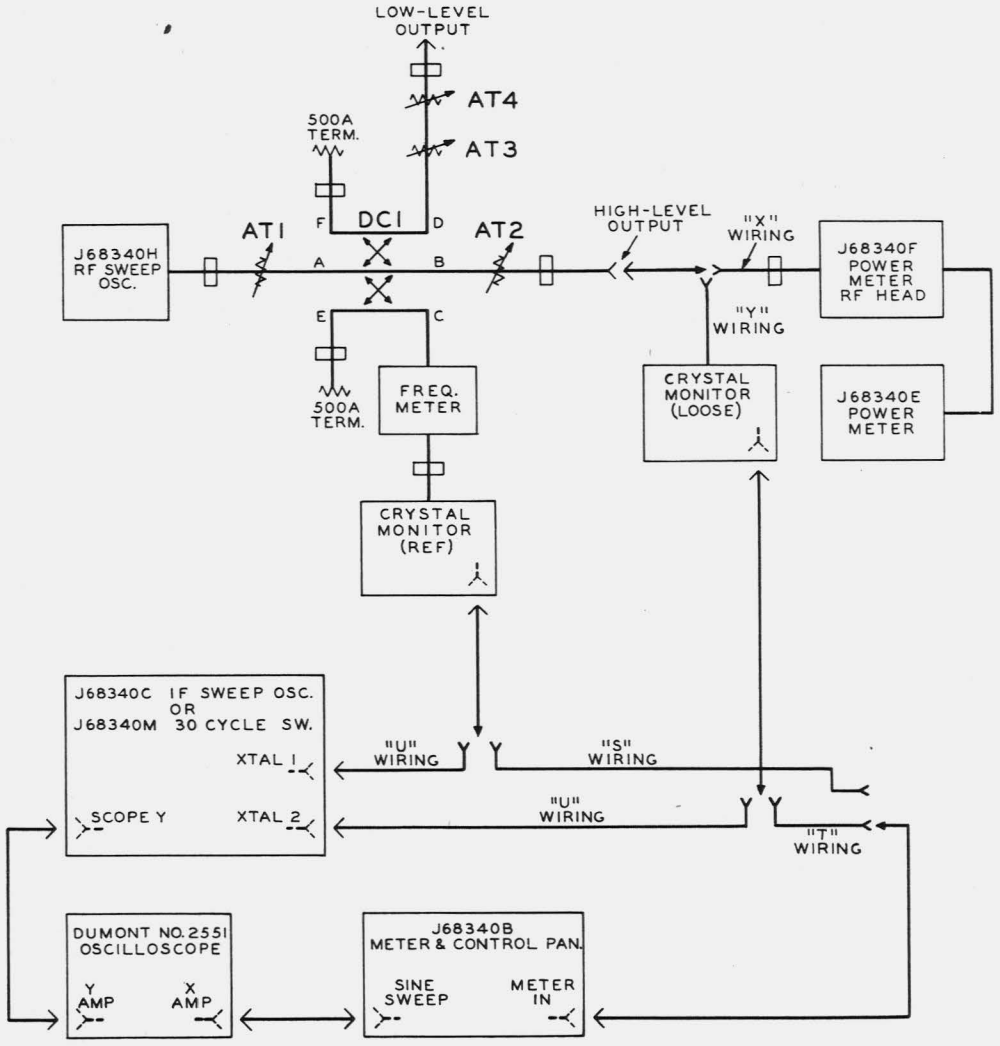


Fig. 17 - Test Circuit for RF Sweep Oscilloscope and Waveguide Components

(2) This power output should be obtainable at any frequency between 3700 and 4200 mc, regardless of whether or not the sweep motor is operating. If the output is lower than +28 dbm, return the oscillator to the Western Electric Co. for tube replacement or other repair.

10.03 Operating Voltage and Current Data: When the oscillator is adjusted properly, the following operating conditions should exist:

(1) The cathode voltage should be between 900 and 1400 volts, depending upon the oscillator frequency and the particular tube used.

(2) The disc current should be less than 8 ma at all times, and is normally between 2 and 5 ma. This current is affected by both the accelerator voltage and the adjustment of the magnetic shunt. If the oscillator is turned on with these improperly adjusted, or if the ACCELERATOR control is advanced too rapidly in an attempt to produce the proper collector current, an excessive disc current may occur which will burn out the gaps in the 402A oscillator tube. It may be desirable to turn the ACCELERATOR control full counterclockwise before turning on the oscillator, and then advance it slowly while adjusting the other controls to maintain the disc current at a safe level.

(3) Collector current should be normally between 20 and 25 ma, but at no time should it exceed 30 ma. To improve tube life, it should not be increased much past the point at which adequate output power is obtained.

10.04 Blower and Sweep Motor Operation: These motors should be lubricated with a drop or two of light oil in their oil holes every 3 months to reduce bearing wear. They should operate smoothly, without excessive vibration. The sweep motor shaft should not exhibit any noticeable eccentricity or end play.

10.05 Procedure to Check Flatness of Oscillator Output:

(1) Under the operating conditions of par. 10.02, set the sweep width to about 70 mc, with the output as flat as possible.

(2) Turn the sweep motor off and rotate it slowly with the screwdriver adjustment.

Requirement: The reading of the power meter should not drop more than 0.2 db from the maximum observed value. If so, a readjustment of the oscillator controls is indicated.

10.06 Procedure to Check Phase of Sweep Vane:

(1) Set up the circuit of Fig. 17, using "Y" and "U" wiring. The phase of the sine wave sweep voltage should be adjusted as described in par. 2.04. Set AT1 to about 10 db and AT2 to 20 db. The RF oscillator should be sweeping over about a 40 MC band. Adjust the frequency meter, the oscilloscope gain and the ADJ XTAL 1 control so that the two sweep traces are separated somewhat, with the frequency meter pip visible. Turn the oscilloscope blanking off and consider one of the traces. Two frequency meter pips will be visible: one normally visible and the other normally blanked out as the oscillator is sweeping in the reverse direction. Set the horizontal gain of the oscilloscope so that the horizontal trace under consideration is exactly 3 inches long.

(2) Turn the frequency meter toward one end of the band. The pips should travel toward one end of the trace, merge as one at the extreme end of the trace, and then disappear. This should also occur as the frequency meter is tuned toward the other end of the band. If either point at which the pips merge is not within 0.2 inch of the end of the trace, the RF sweep oscillator should be returned to the Western Electric Co. for repair and readjustment.

(3) In actual operation of the RF sweep oscillator, slight errors in phase between the sine wave sweep voltage (as adjusted in par. 2.02) and the actual sweep frequency may be corrected by a readjustment of the SWEEP PHASE control while the unblanked sweep pattern is being observed.

11. WAVEGUIDE COMPONENTS

(A) RF Attenuator per ED-63927-01

11.01 Apparatus:

J68340A Test Bay

11.02 Procedure to Check Loss Calibration:

(1) Set up the circuit of Fig. 17, using "X" wiring only. Set AT2 to 20 db, and adjust AT1 to obtain 0 dbm on the power meter. The RF oscillator should be set at about 3950 mc, with no sweep.

(2) Insert the attenuator to be tested between the high-level RF output of the test bay and the RF head of the power meter. Set the attenuator under test to zero loss, and note that the power meter again indicates 0 dbm. For each value of the unknown attenuation to be measured, reduce AT2 to maintain 0 dbm on the power meter. The unknown loss is the difference between the two settings of AT2.

(3) This is not an accurate measurement of attenuation; it is merely a comparison with a unit assumed to be correct. If two attenuators per ED-63927-01 are being compared, a discrepancy of more than 0.5 db is an indication that one or both are outside their rated limits and should be compared further with other units or returned to the Western Electric Co. for repair and calibration.

(B) RF Directional Coupler per ED-63561-01, G1

11.03 Electrical tests are ordinarily not required for field use of the RF directional coupler. If it is evident that there is mechanical damage of any sort, such as slight dents, bulges, etc., the unit should be returned to the Western Electric Co. for repair or replacement.

(C) RF Crystal Monitor per ED-63906-01, G4

11.04 Apparatus:

J68340A Test Bay
Weston Model 779 Analyzer

11.05 Procedure to Check Sensitivity:

(1) Set up the circuit of Fig. 17, using "X" wiring. Set AT2 equal to the directional coupler loss indi-

cated between arms A and C. Adjust AT1 to give 0 dbm on the Power Meter. The RF Sweep Oscillator may be at any frequency between 3700 and 4200 MC, and should not be sweeping.

(2) Now change to "Y" and either "S" or "T" wiring, depending on which unit is being tested. Rotate the SENSITIVITY control on the meter and control panel slowly in the clockwise direction.

Requirement: The XTAL CURRENT meter should read full scale (200 microamperes) before the control is at maximum.

If this requirement is not met, and mechanical defects are not evident, replace the 406A varistor in the unit.

11.06 Procedure to Check Crystal Match

(1) Using the circuit of Fig. 17, with "X" wiring, set AT2 to the loss of the directional coupler between arms A and C, and AT1 to a value which gives about +2 dbm on the Power Meter. Any frequency between 3700 and 4200 MC may be used, as required, with approximately a 70 MC sweep. Set AT3 to 20 db.

(2) Now use "Y" and "U" wiring. Turn the ADJ XTAL 1 control to maximum and adjust the oscilloscope vertical gain control until a variation of exactly 1.0 db in AT2 corresponds to a 1 inch change in oscilloscope deflection. It will be necessary to change the setting of AT2 slightly from its previous value to make the traces coincide if the two varistors are not equally sensitive. If it should be necessary to increase the loss in AT2 beyond its calibrated range it means that the reference crystal is the more sensitive. It will be preferable in this case to interchange the 406A varistors in order to allow the two traces to be superimposed with an adjustment of AT2 in its calibrated region.

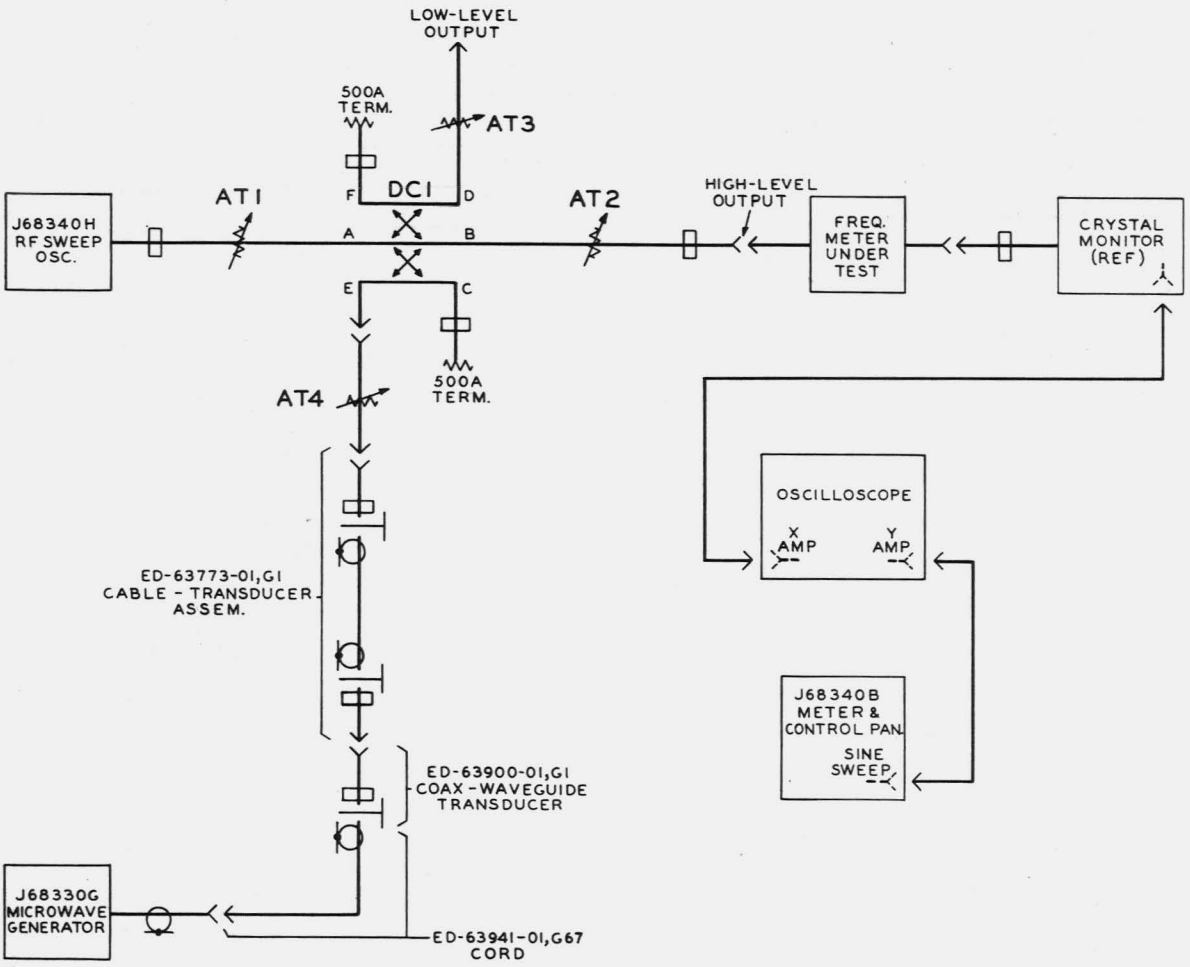


Fig. 18 - Circuit to Check Calibration of RF Frequency Meter

(3) Make the two traces coincide exactly at the center of the sweep, using AT2. The separation of the traces elsewhere should not be greater than 0.1 db for a total sweep range of 70 MC. If this requirement cannot be met, repeat this test using other combinations of 406A varistors. The requirement of par. 11.05 must still be met.

11.07 Procedure to Check Internal Resistor:

(1) Remove the 406A varistor from the Monitor. With the analyzer measure the resistance between the center conductor and shell of the coaxial jack.

Requirement: The resistance shall be 180 ±10 ohms.

(D) RF Frequency Meter

11.08 Apparatus:

J68340A, L1 Test Bay
J68333A Test Bench

11.09 Procedure to Calibrate:

(1) Set up the circuit of Fig. 18. AT1 should be 10 db; AT2, 20 db; and AT3, 20 db. Set up the microwave generator in the test bench to the frequency at which a calibration point is required, and adjust the RF sweep oscillator to sweep approximately ±20 MC about this point. The frequency meter under test or a separate one may be used to adjust the sweep oscillator by observing the pip produced on the oscilloscope. If this adjustment is correct a small beat-frequency pattern will also be observed, with a region of zero beat in its center, which can be seen if the horizontal sweep is sufficiently expanded. AT4 and the oscilloscope gain should be adjusted until the beat pattern is most easily visible; preferably of about the same amplitude as the frequency meter pip.

(2) Tune the frequency meter until its pip coincides exactly with the center of the beat pattern. It is now tuned to the output frequency of the microwave generator.

(3) Repeat as required for other frequencies which the microwave generator will produce.

(E) 500A Termination

11.10 No electrical tests are required. If it is evident that mechanical damage of any sort has occurred to the waveguide or the internal vane, the unit should be returned to the Western Electric Co. for repair or replacement.

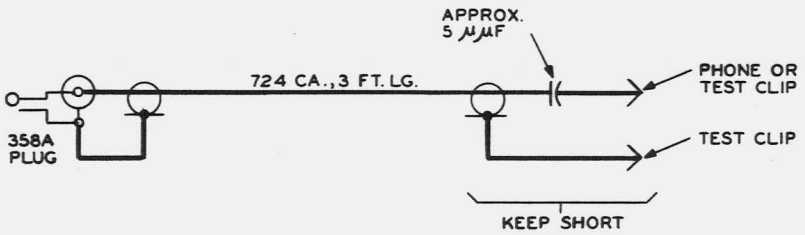
(F) Cable - Transducer Assembly (ED-63773-01, G1)

11.11 This assembly may be calibrated for attenuation by following the procedure given in par. 11.02.

12. ATTACHMENTS

12.01 The following drawing is attached:

ES-882763 Test Cord for IF Frequency Meter Calibration



Test Cord for IF Frequency Meter Calibration