J68333A TEST BENCH

CONTENTS

1. GENERAL

1.1 The principal parts of the circuitry on the test bench that are not covered by maintenance instructions in this or other BSP sections are the connecting cables and loose apparatus. A schematic and an ohmmeter will, in general, be adequate to check the wiring continuities.

2. IF DIRECTIONAL COUPLER

(A) General

2.1 The IF Directional Coupler is tested by measuring its forward loss, between A and C, or between B and D, and by measuring its return loss. The return loss of the coupler with its terminations is determined by comparing the loss in the backward direction, between A and D, or between B and C, with the forward loss. The difference, in db, between the backward and forward losses is called the return loss of the terminated coupler.

(B) Transmission Tests

2.2 Apparatus:

J68340A, List 1 Test Bay
J68333A Test Bench

2.3 Procedure:

(1) Set up the test equipment as in Fig. 1, but patch directly from AT11 to AT13.

(2) Adjust AT13, AT14, and the ADJ XTAL 1 control on the IF sweeper so that the two traces match at 70 MC.

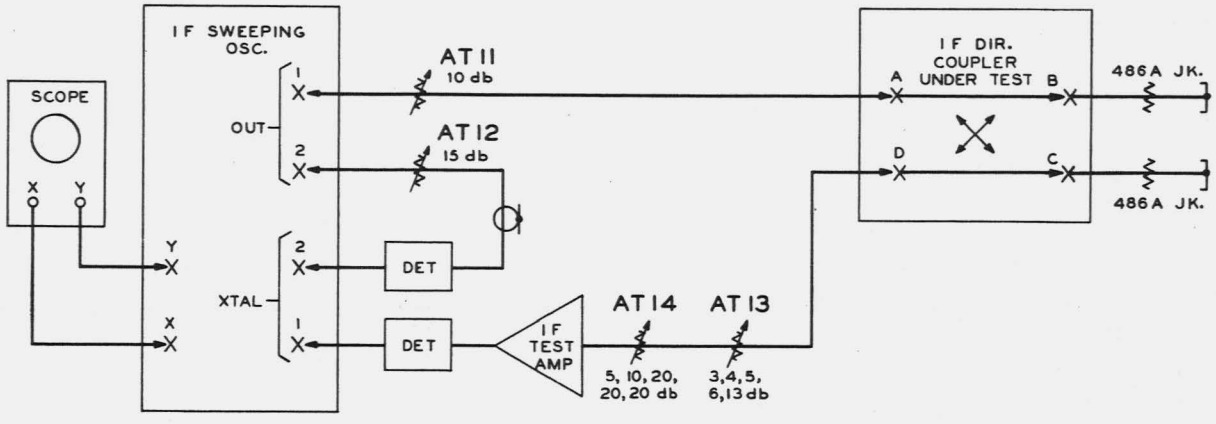

Fig. 1 - Setup for Testing IF Directional Coupler when it is Terminated with No. 486A Jacks.

(3) Set the vertical gain control of the oscilloscope so that changing an attenuator by 1 db displaces the traces by approximately 1/2 inch. Match the traces again at 70 MC.

(4) Note setting of AT13 and AT14.

(5) Connect the coupler to AT11 and AT13 as shown in Fig. 1. Connect a No. 486A jack at B, but not at C. Use no patch cord for this connection.

(6) Check the forward loss of the coupler by resetting AT13 and AT14 until the test trace (i.e., the signal from the test amplifier) matches or is less than 1 db above the reference trace. Note setting of AT13 and AT14.

Requirement: The total attenuation of AT13 and AT14 in Par. (6) shall be either 23 or 24 db less than in Par. (4). If this requirement is not met, see Par. 2.6.

(7) Determine the reference setting of AT13 and AT14 as follows:

(a) Adjust AT13 and AT14 until the test and reference traces match approximately at the center of the scope.

(b) Turn on the slope circuit of the sweeping oscillator and adjust the slope control, the ADJ XTAL 1 control, and AT13 and AT14 until the two traces match at 60 and 80 MC.

(c) Note the settings of AT13 and AT14. This total attenuation is the reference to be used in subsequent tests.

(8) Adjust and check the return loss of the coupler, when terminated with No. 486A jacks, as follows:

(a) Connect a second No. 486A jack directly to C, using no patch cord.

(b) Reduce the setting of AT13 and AT14 until the test trace is as close as possible to the reference trace, but still below it from 60 to 80 MC. Determine the return loss by subtracting the total of these readings from the reference determined in Par. (7).

(c) Adjust the CPLG ADJ screws until the test trace is as far as possible below the reference trace. In adjusting these screws, take care that they both project the same amount (±1/64 inch), from the body of the coupler.

(d) Determine the return loss after this adjustment by the procedure of Par. (6). Continue to adjust and check return loss until further adjustment of the screws in either direction causes the test trace to move upward.

(e) After adjustment of the coupler, redetermine the reference as in Par. (7).

(f) Determine the return loss after adjustment as in Par. (d), using the new reference setting found in Par. (e).

Requirement: The return loss of the coupler shall be at least 40 db, when terminated in No. 486A jacks.

(9) Adjust and check the return loss of the coupler when terminated with No. 368A plugs, as follows:

(a) Rearrange the circuit in accordance with Fig. 2, connecting a No. 368A plug at A, using no patch cord. Omit plug at D.

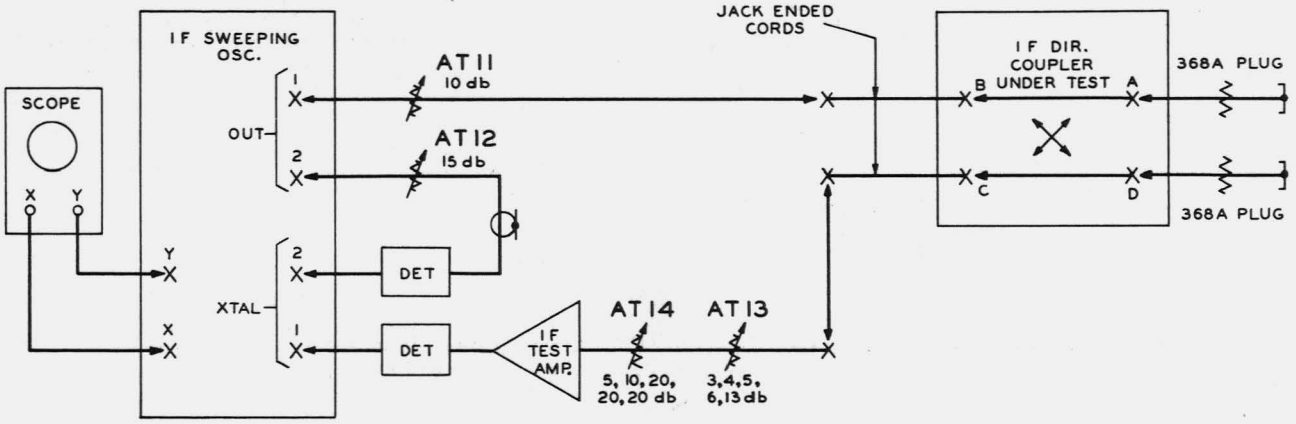

Fig. 2 - Setup for Testing IF Directional Coupler when it is Terminated with No. 368A Plugs.

(b) Determine the reference as in Par. (7). If the gain of the test amplifier has not varied, this should be the same as determined in the previous test in Par. (8)(e).

(c) Connect a second No. 368A plug at D. Reduce the setting of AT13 and AT14 until the test trace is as close as possible to the reference trace, but still below it from 60 to 80 MC. Determine the return loss under this condition by substracting this total from the reference determined in Par. (b).

Requirement: The return loss of the coupler shall be at least 40 db, when terminated in No. 368A plugs.

(d) If the above requirement cannot be met, readjust the coupler as in Par. (8)(c) until the requirement is met. Then repeat the tests of Par. (7), (8)(a) and (8)(b).

Requirement: Final adjustment of the coupler shall be such that its return loss is at least 40 db when tested with both types of terminations, with no change in adjustment.

(e) If necessary, repeat the tests and adjustments of Par. (7), (8), (9)(a), (9)(b) and (9)(c) until a compromise adjustment is arrived at which meets the requirement of Par. (9)(d).

(C) Trouble Location

2.4 If the transmission requirements cannot be met, a defective termination may be indicated. This can best be determined by changing terminations. Some, but not all, termination defects may be located by a DC resistance measurement, if a sufficiently accurate means of measurement, such as a bridge, is available.

Requirement: The DC resistance of the terminations shall be 74 to 76 ohms.

2.5 If changing terminations does not help, it will be necessary to examine and adjust the center conductors. To obtain access to the inside of the coupler, remove the four screws having dots steel stamped adjacent to their heads and loosen the four screws located at the ends of the coupler. It will then be possible to remove one of the blocks forming the side of the coupler, without disturbing the plugs and jacks and the adjustment. The following paragraphs describe some of the troubles which may be encountered.

2.6 Low forward loss: This indicates either a very poor adjustment or a short between the two center conductors. If the forward loss is within a few db of the requirement, proceed with the return loss adjustment, and then recheck the forward loss.

2.7 Very low return loss: This may result from an open circuit between the coupler and a termination, or an extremely poor adjustment. See also Par. 2.8.

2.8 Does not quite meet return loss requirement: This indicates misadjustment of the center conductors. Examine and adjust them as follows:

(a) The flexible leads making connection to the jacks and plugs should be formed into smooth curves, and all four should have the same radius and be as nearly symmetrical as can be judged by eye.

(b) The half-round silver conductors, after electrical adjustment of the screws as above, should be straight and parallel over the entire distance between the supporting insulators. Any kinks in these conductors, or bends which make them closer together at one end than at the other, will unbalance the coupler and spoil its return loss.

2.9 Very high loss, forward or return: This may indicate an internal ground, or an open circuit between the coupler and the sweeping oscillator or the test amplifier.

3. IF SIGNAL INSERTER

(A) General

3.1 The IF Signal Inserter is tested by measuring its input return loss in the IF band. To make this measurement, it is necessary to terminate the signal inserter in a resistance to simulate the amplifier with which it is normally used.

(B) Direct Current Test

3.2 Apparatus:

Weston Model 779 Analyzer or equivalent.

3.3 Procedure:

(1) Set analyzer on the R x 1 scale.

(2) Measure the resistance from the center conductor to the shield of input plug.

Requirement: The DC input resistance shall be minimum 72, maximum 88 ohms.

(3) Set analyzer on the R x 10,000 scale.

(4) Measure the resistance from the terminal at the end of the signal inserter to its shell.

Requirement: The DC output resistance shall be at least 10 megohms.

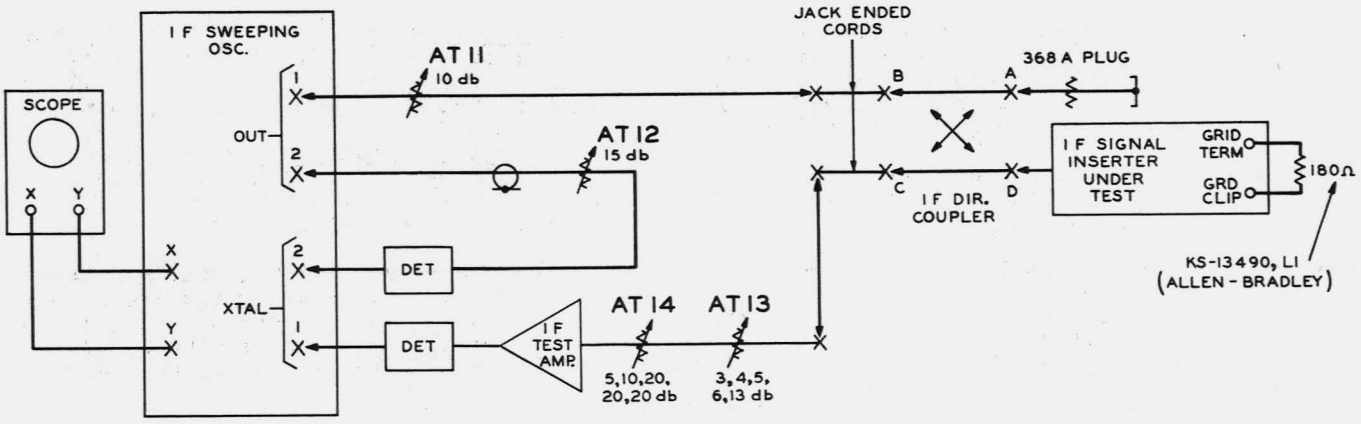

Fig. 3 - Setup for Testing IF Signal Inserter

(C) Transmission Test

3.4 Apparatus:

J68340A, List 1 Test Bay
J68333A Test Bench
Resistor, KS-13490, List 1, 180 ohms, manufactured by Allen Bradley Co.

3.5 Procedure:

(1) Set up the test equipment as in Fig. 3, except do not connect the signal inserter to the directional coupler.

(2) Determine the reference setting of AT13 and AT14 as follows:

(a) Adjust AT13 and AT14 until the test and reference traces match approximately at the center of the scope.

(b) Turn on the slope circuit of the sweeper and adjust the slope control, the ADJ XTAL 1 control, and AT13 and AT14 until the two traces match at 60 and 80 MC.

(c) Note the setting of AT13 and AT14.

(3) Connect the INPUT plug of the signal inserter to the D connection of the directional coupler. Connect a terminating resistor to the inserter as shown in Fig. 3. Keep resistor lead lengths at the absolute minimum.

(4) Reduce the attenuation of AT13 and AT14 until the test trace is as close as possible to the reference trace, but still below it from 60 to 80 MC. Determine the return loss of the signal inserter by substracting the total attenuation of AT13 and AT14 from the reference total obtained in Par. (2).

Requirement: The return loss of the signal inserter shall be at least 25 db from 60 to 80 MC.

(D) Trouble Location

3.6 Fails to meet DC requirements: Disassemble the inserter as described in Par. 3.7 and check individual resistors for resistance and the blocking capacitor for leakage.

3.7 To disassemble the signal inserter: First, remove the knurled coupling at the rear of the body. Next, unsolder an internal lead from the terminal at the end, by applying a soldering iron to the end terminal while pulling on the cable. This will permit the internal components, which are attached to the cable, to slide out.

3.8 Fails to meet transmission test: This may be due to variations in the value of the two resistors, which should agree with the schematic within 5%, as required by their specification. It may also be due to excessive length of leads on any of the components. This trouble will cause the test trace to be higher (return loss less) at the 80 MC end of the band. An open-circuited coupling capacitor will also cause failure to meet the transmission requirement. This will make the return loss less throughout the band. If such an open exists, removing the 180 ohm test resistor will have no effect.

4. WAVEGUIDE PARTS

4.1 These parts should be kept free of metal slivers, drops of solder, drops of liquid and any other foreign material.

5. COAXIAL CABLE ASSEMBLIES

5.1 These parts should be checked frequently for electrical stability with reasonable bending.

6. REFERENCES

6.1 BSP Section R90.314 has subsections covering the maintenance of the following assemblies:

J68330A IF Main Amplifier
J68330B Receiver Control Unit
J68330G Microwave Generator
J68330H 40 MC Shifter
J68330M Transmitter Control Unit

Bell Telephone Laboratories, Inc.