

**TJ/TM-1 MICROWAVE RADIO
SYSTEM TESTS — TELEPHONE WITH DIVERSITY
TRANSMITTER-RECEIVER LINK DEVIATION**

The transmitter-receiver link deviation and receiver output adjustments are the foundation of all subsequent system tests. Should the basic link gains be misadjusted, improper loading will upset other adjustments no matter how carefully they may have been set. This procedure first checks transmitter frequency and receiver intermediate frequency, adjusts transmitter deviation by observing receiver IF, and sets the proper level at REC OUT. By checking the radio components as they actually work together, cumulative errors arising from setting each component separately are eliminated.

For initial system line-up this section assumes that all individual transmitter and receiver tests have been made. For periodic tests this section should precede all other system tests since readjustments required herein will affect all others.

When the link must be removed from service, observe the procedures and precautions of Section 409-241-500.

Tests covered are as follows:

1 — TJ Transmitter and Receiver Frequency	Steps 1 to 9
2 — TJ Transmitter Deviation	Steps 10 to 17
3 — TJ Receiver Output	Steps 18 to 21
4 — TM-1 Transmitter and Receiver Frequency	Steps 22 to 27
5 — TM-1 Transmitter Deviation	Steps 28 to 35
6 — TM-1 Receiver Output	Steps 36 to 38

APPARATUS:

- 2 — J99262AA Test Sets
- 1 — KS-16647 RF Test Set
- 2 — J68376C Impedance Matching Test Sets
- 1 — Hewlett-Packard 130-Type Oscilloscope
- 1 — J68337F FM Test Set
- 2 — 26A Split Pads
- 1 — Length Flexible Waveguide (Supplied with RF Test Set)
- 3 — P3AH Cords
- 7 — P2AW Cords
- 1 — ED-59517-10 GR27 Cord
- 2 — 372A Plugs

STEP	PROCEDURE	
TJ TRANSMITTER AND RECEIVER FREQUENCY		
<div style="border: 1px solid black; padding: 5px; margin: 0 auto; width: 80%;"> <p>LEGEND — T AFTER STEP # INDICATES PERFORM AT TRANSMITTER R AFTER STEP # INDICATES PERFORM AT RECEIVER</p> </div>		
1	T & R	Remove the link to be tested from service. The 228B waveguide switch should be <i>ON</i> during tests.
2	T & R	Set up the test circuit of Figs. 1 and 2, turn on all test equipment, and allow a suitable warm-up period.
3	T	On the RF test set, operate the RF power switch to IN and the ADD TO PWR METER dial to approximately midscale.
4	T	<p>Connect the RF test set to the transmitter under test in place of the 53A detector and measure the frequency in accordance with instructions supplied with the test set.</p> <p>Requirement: ± 3 mc from that indicated in Table A.</p>
5	T	<p>Tune the frequency meter away from the assigned frequency and measure the power. (This port of the 488A network is 24 db down from actual klystron power.)</p> <p>Requirement: 0 dbm or greater as read on the RF test set.</p> <p>Note: To read power, add the setting on the ADD TO PWR METER to the indication on the power meter.</p> <p>If the requirement in Step 4 or 5 is not met, refer to Section 409-210-501.</p>
6	R	Set the controls of the oscilloscope for DC amplification on the Y axis and for 60-cycle internal sweep. Adjust the Y gain and vertical position controls for maximum Y gain consistent with a centered presentation on the screen.
7	R	<p>On the FM Test Set, put the MV switch on SW. Slowly tune the oscillator in the FM Test Set while observing the oscilloscope presentation. When the oscillator is tuned to the IF, the traces will be coincident.</p> <p>Requirement: 70 ± 1 mc.</p> <p>Note: The input levels to the FM Test Set should be equalized at or near 70 mc by adjusting the OSC LEV control to obtain the same level at Input 2 as received at Input 1. This indication may be observed on the FM Test Set meter.</p>
8	R	<p>With the VOM, measure between jacks J9 and GRD on the receiver base-band amplifier.</p> <p>Requirement: 150 ± 10 volts.</p> <p>If the requirement of either Step 7 or 8 is not met, proceed immediately to Section 409-241-504, Part 3 and reset receiver AFC.</p>
9	T & R	If all preceding requirements have been met, proceed to Part 2.

STEP	PROCEDURE											
		TJ TRANSMITTER DEVIATION										
10	T	Using the VOM, measure between jacks J7 and J11 on the transmitter baseband amplifier and, if necessary, adjust V1 BIAS for a zero reading on the lowest DC scale.										
11	T	Repeat Step 10 at jacks J15 and J16, adjusting V2 BIAS.										
12	T	Adjust the TL test set to send 100 kc at -13.8 dbm (equals -14 at the balance input to transmitter pad).										
13	R	Tune the oscillator in the FM Test Set above 70 mc until the oscillator trace coincides with the lower excursion of the deviation trace. Record the oscillator frequency. (See Fig. 5.)										
14	R	<p>Tune the oscillator below 70 mc until the oscillator trace coincides with the upper excursion of the deviation trace. Record the oscillator frequency.</p> <p>Requirement: The measurements of Steps 13 and 14 should be $8 \pm .5$ mc apart and within ± 0.5 mc of being centered around the IF as measured in Step 7.</p> <p>If this requirement is met, proceed to Part 3.</p> <p>If the $8 \pm .5$ mc requirement is not met, proceed to Step 15.</p> <p>If the symmetry about IF requirement is not met, check the transmitter per individual sections.</p>										
15	R	Set the oscillator frequency 4 mc higher than the IF as measured in Step 7.										
16	T & R	Slowly adjust the transmitter baseband amplifier GAIN control until the reference oscillator trace and the lower excursion of the deviation trace coincide.										
17	R	<p>Tune below 70 mc to check that the 8 mc requirement is now met.</p> <p>Note: The 4, 8, or 12 db 25-type pad in SIG OUT — TRS IN at the transmitter should be selected to keep the transmitter GAIN potentiometer approximately midrange.</p>										
		TJ RECEIVER OUTPUT										
18	R	With the 100 kc signal inserted at the transmitter producing an 8 mc deviation, restore normal patching between IF main amplifier and limiter-discriminator.										
19	R	<p>Set the variable attenuator on the diversity switch unit to obtain one of the following levels on the voltmeter.</p> <p>-2.2, -0.2, +1.8, or +3.8</p>										
20	R	<p>Select a 25-type pad for REC OUT — SW IN as follows:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">LEVEL SET IN STEP 19</th> <th style="text-align: center;">25-TYPE PAD REQ'D</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">-2.2</td> <td style="text-align: center;">0 db</td> </tr> <tr> <td style="text-align: center;">-0.2</td> <td style="text-align: center;">2 db</td> </tr> <tr> <td style="text-align: center;">+1.8</td> <td style="text-align: center;">4 db</td> </tr> <tr> <td style="text-align: center;">+3.8</td> <td style="text-align: center;">6 db</td> </tr> </tbody> </table>	LEVEL SET IN STEP 19	25-TYPE PAD REQ'D	-2.2	0 db	-0.2	2 db	+1.8	4 db	+3.8	6 db
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-2.2	0 db											
-0.2	2 db											
+1.8	4 db											
+3.8	6 db											
21	T & R	Remove all patches and restore circuits to normal.										

STEP	PROCEDURE	
TM-1 TRANSMITTER AND RECEIVER FREQUENCY		
22	T & R	Remove the link to be tested from service. The 225A waveguide switch should be <i>ON</i> during tests.
23	R	Set up the connections of Fig. 3.
24	R	Set the controls of the oscilloscope for DC amplification on the Y axis and for 60-cycle internal sweep. Adjust the Y gain and vertical position controls for maximum Y gain consistent with a centered presentation on the screen.
25	R	<p>Slowly tune the oscillator in the FM Test Set, observing the scope presentation. When the oscillator is tuned to the intermediate frequency, the oscillator trace and the IF trace will coincide.</p> <p>Requirement: 70 ± 1 mc.</p> <p>Note: The input levels to the FM Test Set should be equalized at or near 70 mc by adjusting the OSC LEV control to obtain the same level at Input 2 as received at Input 1. This indication may be observed on the FM Test Set meter.</p> <p>If this requirement cannot be met, the receiver must be readjusted per Section 409-406-502.</p>
26	R	Connect the J99296K meter unit to the receiver control unit.
27	R	<p>Operate the FREQ switch to IF and the selector switch to AFC.</p> <p>Requirement: The upper meter shall indicate $0 \pm 2 \mu a$ and the lower meter shall indicate between 13 and 15 volts.</p> <p>If these requirements are not met, align receiver per Section 409-406-502 and/or the transmitter per Section 409-404-501.</p>
TM-1 TRANSMITTER DEVIATION		
28	T	Set up the test connections of Fig. 4.
29	T	<p>Measure between BIAS and GRD jacks on the transmitter control unit (BIAS negative) using VOM.</p> <p>Requirement: 7.25 volts.</p> <p>If this requirement is not met, readjust bias control.</p>
30	T	Adjust the TL test set to send 100 kc at -13.8 dbm as indicated on the meter (equals -14 at balanced input to transmitter).
31	R	Tune the oscillator in the FM Test Set above 70 mc until the oscillator trace and the lower excursion of the deviation trace are coincident. Record the oscillator frequency.
32	R	<p>Tune the oscillator below 70 mc until the oscillator trace coincides with the lower excursion of the deviation trace. Record the oscillator frequency.</p> <p>Requirement: The measurements of Steps 31 and 32 should be $8 \pm .5$ mc apart, and within ± 0.5 mc of being centered around the IF as measured in Step 25.</p>

STEP	PROCEDURE	
		<p>If this requirement is met, proceed to Step 36. If the 8 ± 0.5 mc requirement is not met, proceed to Step 33. If the symmetry about IF requirement is not met, check the transmitter per Section 409-404-501.</p>
33	R	Set the oscillator 4 mc higher than the IF as measured in Step 25.
34	T & R	Slowly adjust the transmitter baseband amplifier GAIN control until the reference oscillator trace and the lower excursion of the deviation trace coincide.
35	R	Tune the oscillator in the FM Test Set below 70 mc to check that the 8 ± 0.5 mc requirement is now met.
TM-1 RECEIVER OUTPUT		
36	R	Set the variable attenuator on the diversity switch unit for receiver (X) at an indicated 1 db.
37	R	With the 100 kc signal inserted at the transmitter producing an 8 mc deviation, adjust the GAIN potentiometer on the Receiver IF and Baseband unit to obtain a voltmeter indication of +1 dbm.
38	T & R	Remove all patches and restore circuits to normal.

TABLE A — TRANSMITTER AND BEATING OSCILLATOR FREQUENCY ASSIGNMENTS		
CHANNEL NO.	FREQ mc	BO FREQ mc
4A	10,715	10,785
1A	10,755	10,825
10A	10,795	10,865
11A	10,835	10,905
6A	10,875	10,945
7A	10,915	10,985
2A	10,955	10,885
3A	10,995	10,925
12A	11,035	10,965
9A	11,075	11,005
8A	11,115	11,045
5A	11,155	11,085
9B	11,245	11,315
12B	11,285	11,355
5B	11,325	11,395
8B	11,365	11,435
1B	11,405	11,475
4B	11,445	11,515
11B	11,485	11,415
10B	11,525	11,455
7B	11,565	11,495
6B	11,605	11,535
3B	11,645	11,575
2B	11,685	11,615

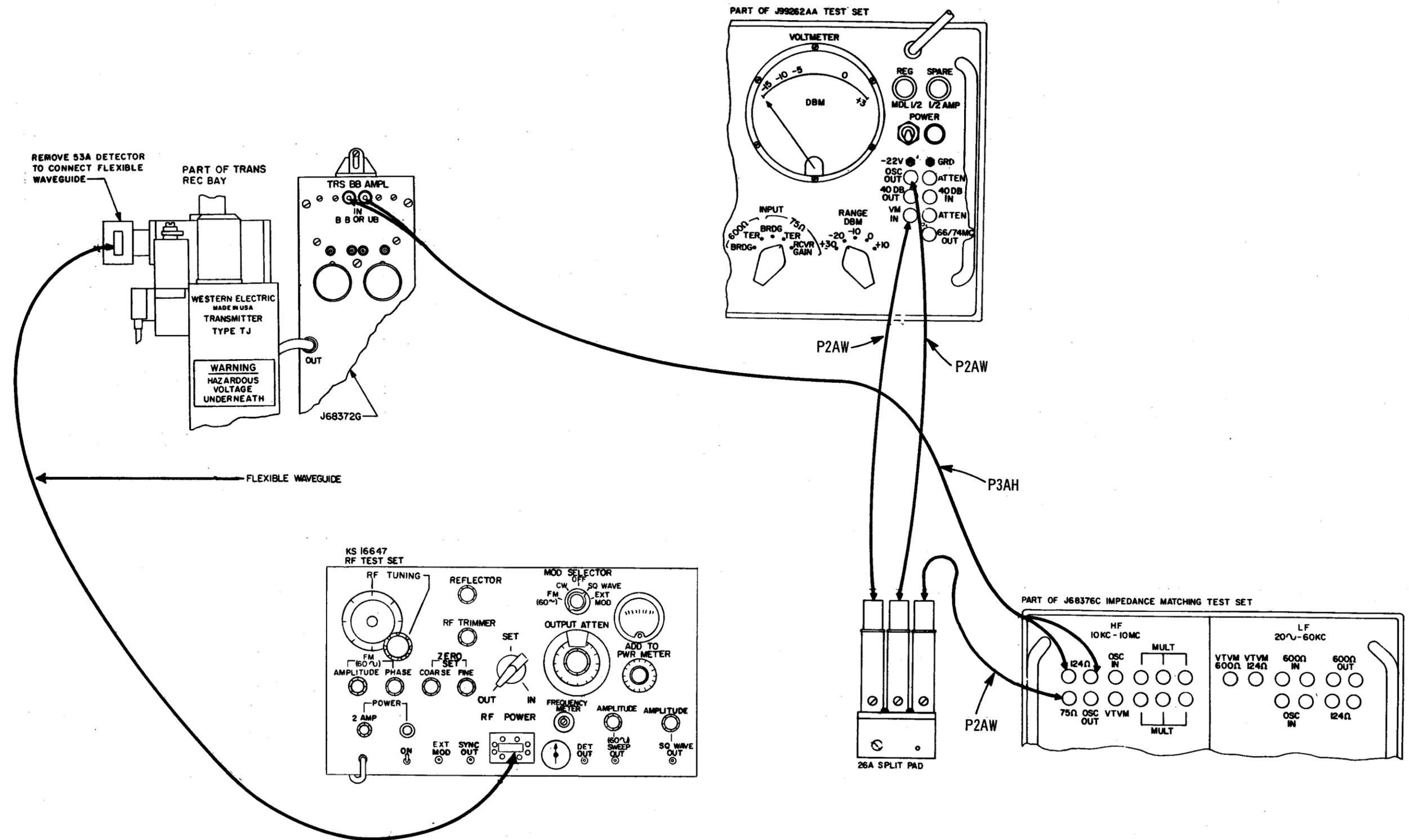


Fig. 1 - Test Connections for TJ Transmitter Measurements

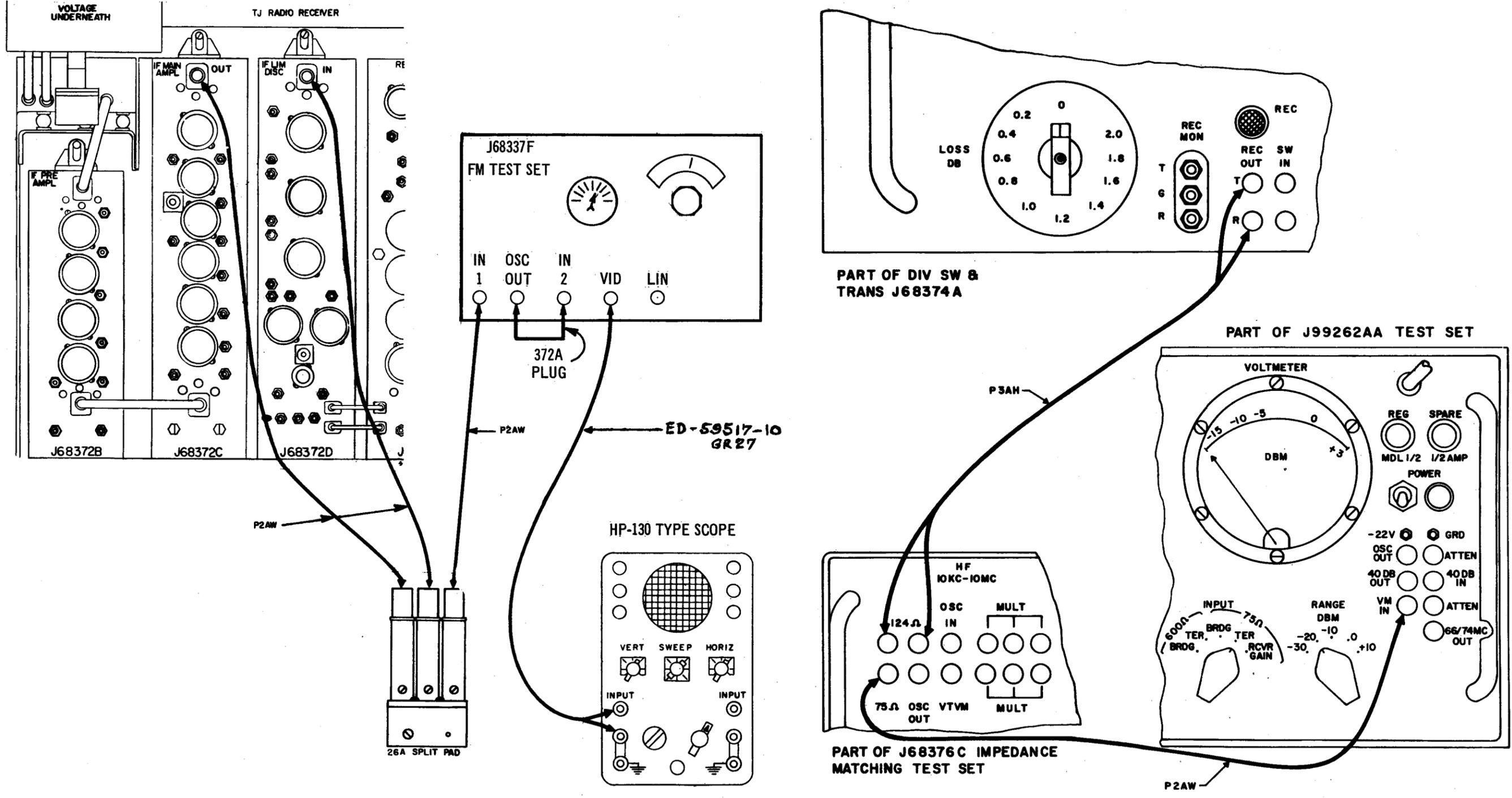


Fig. 2 - Test Connections for TJ Receiver Measurements

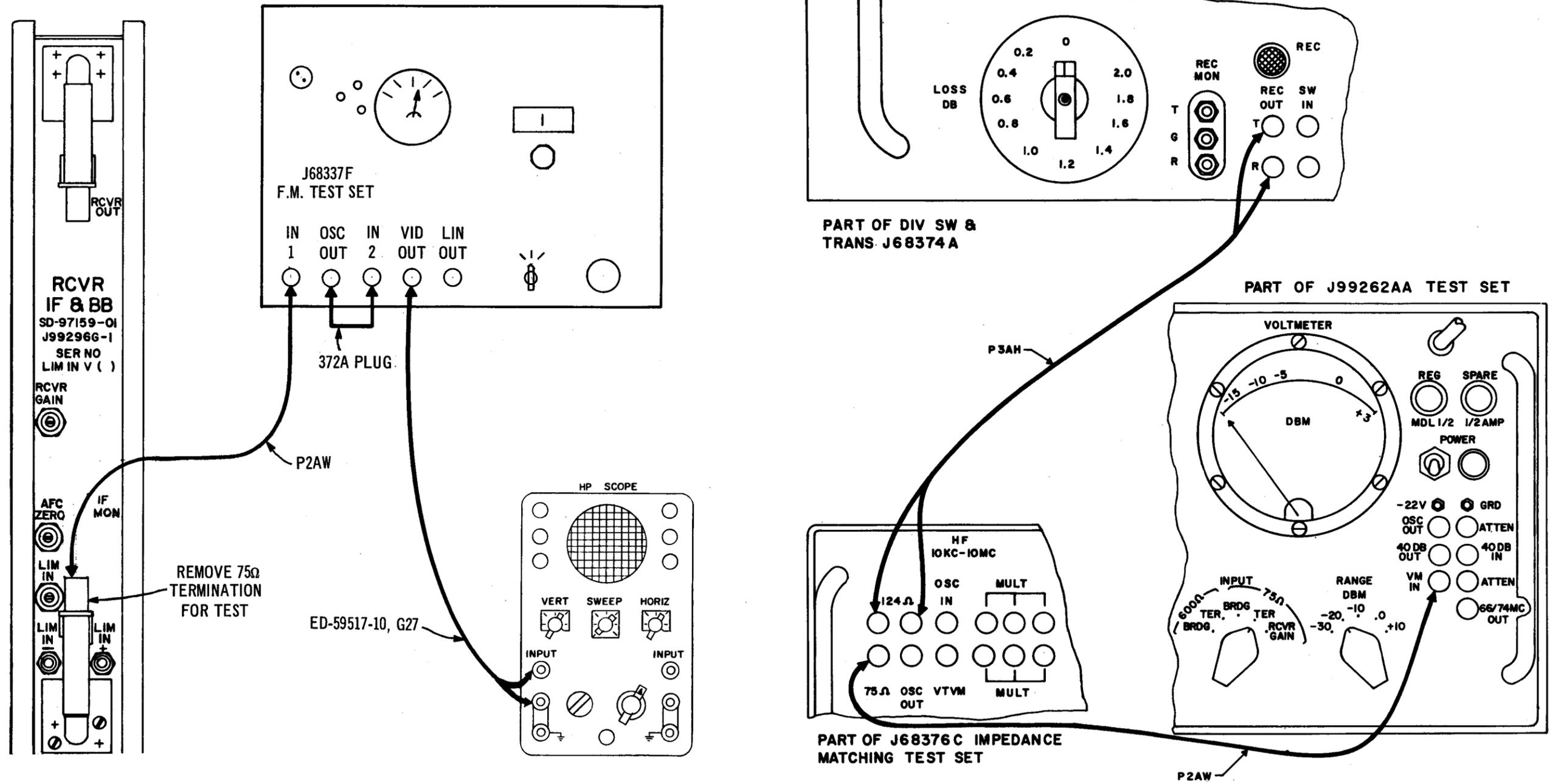


Fig. 3 - Test Connections at TM-1 Receiver

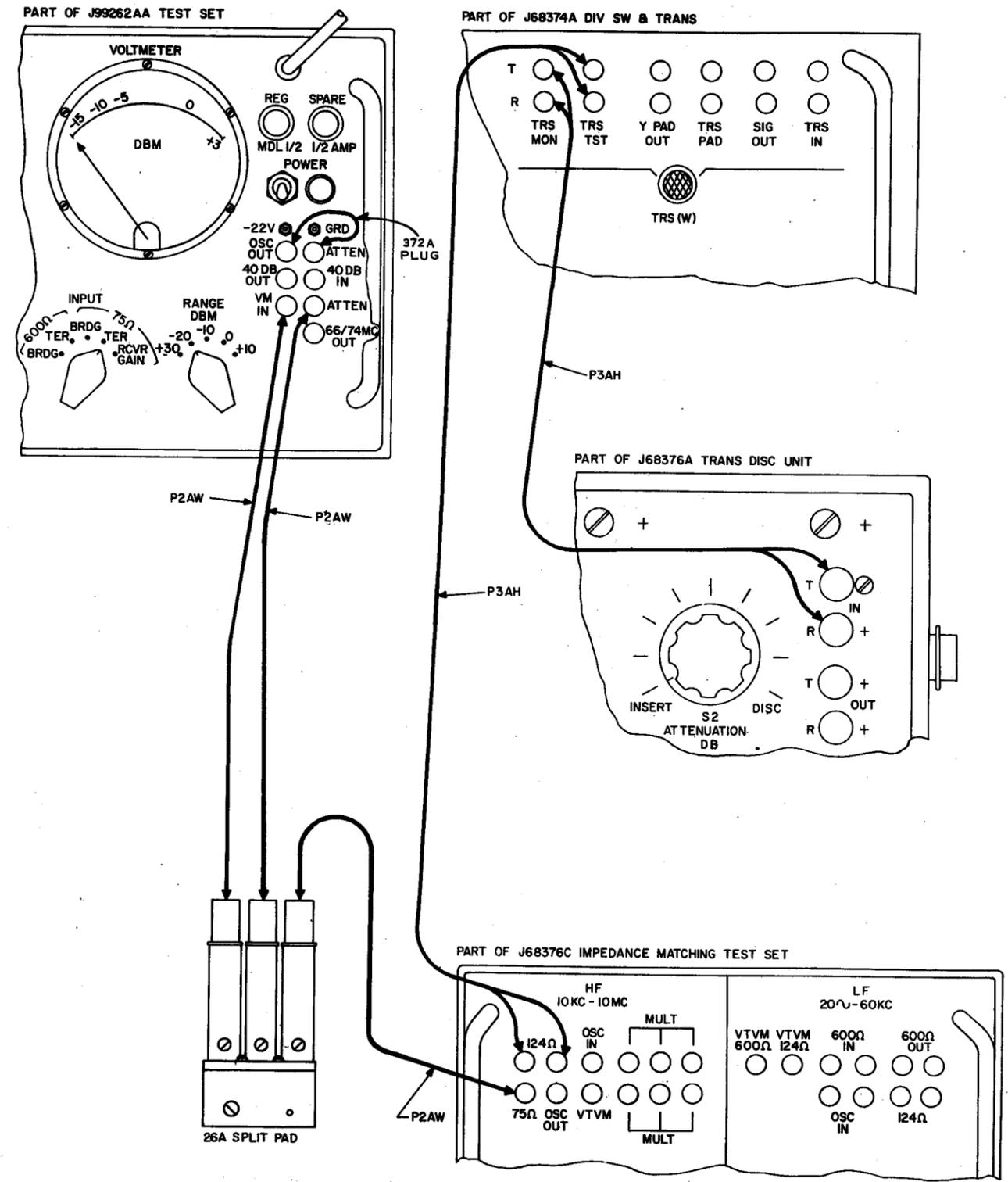
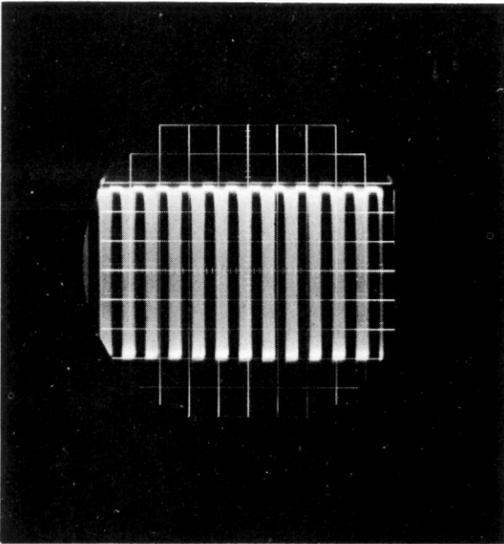
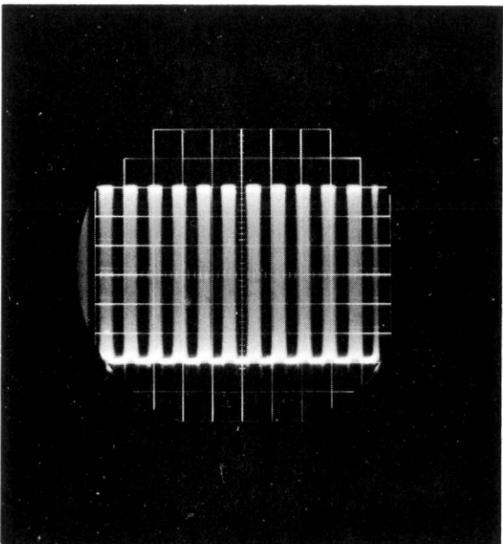


Fig. 4 - Test Connections at TM Transmitter



REFERENCE OSCILLATOR TRACE
ABOVE 70 MC



REFERENCE OSCILLATOR TRACE
BELOW 70 MC

100 KC 8 MC DEVIATION

Fig. 5 - Oscilloscope Presentation — Adjustment of ± 4 mc Deviation