
TL-1 MICROWAVE RADIO TRANSMITTER TESTS FREQUENCY AND LINEARITY

This section describes the methods used for adjusting transmitter frequency and linearity. Frequency is checked by monitoring RF power that has been passed through a precision reference cavity which is centered at the assigned frequency. Linearity is adjusted for lightly or heavily loaded systems using different methods. On lightly loaded systems (carrying 240 circuits or less), the repeller voltage is decreased by a fixed amount, producing good average linearity without using complex test procedures. On systems carrying more than 240 circuits, more sophisticated test procedures using the J99302BG linearity test set are required to maintain the full performance capabilities of the system.

This section is reissued to add test information to TL-1 systems that may now be equipped with either of the following:

- (a) The J99296AA-2, List 3 modulator-preamplifier unit with the J99296G-2 receiver IF and baseband unit

- (b) The J99296AA-2, List 3 modulator-preamplifier unit with the J99351E-1 IF amplifier unit and the J99351J-1 FM receiver unit.

This reissue affects the Equipment Test List.

Warning: Voltages inside the transmitter assembly are higher than those usually encountered in the telephone plant. Only that work which is absolutely necessary should be performed with the protective devices disabled or removed.

General instructions on the maintenance and handling of electronic equipment involving hazardous voltages as contained in Section 010-110-001 shall be strictly observed.

CHART	PAGE
1—In-Service Frequency Check	1
2—Transmitter Frequency and Linearity Adjustments for Systems Carrying 240 Circuits or Less	1
3—Transmitter Frequency and Linearity Adjustments for Systems Carrying More Than 240 Circuits	3

CHART 1
IN-SERVICE FREQUENCY CHECK

STEP**PROCEDURE**

Caution: *This test is intended for nondiversity systems only. Making an in-service frequency adjustment on a heavily loaded system can result in a serious performance impairment.*

- 1 Set the **FREQ** switch on the meter unit to the **XMTR** position. Note the position of the **XMTR RPLR** control.
- 2 Slowly adjust the **XMTR RPLR** control for a maximum indication on the upper meter.

Note: Since this adjustment is made with the transmitter in service, the travel distance of the **XMTR RPLR** control should not exceed 1/4 turn to obtain a maximum meter indication. Also, turn the control at a steady rate to minimize transmission degradation. If the required control change exceeds 1/4 turn, frequency and linearity adjustments should be made as outlined in Chart 2 at the earliest convenient time for an out-of-service test. In the meantime, the **XMTR RPLR** control should be returned to the setting noted in Step 1 of this chart.

CHART 2
**TRANSMITTER FREQUENCY AND LINEARITY ADJUSTMENTS
FOR SYSTEMS CARRYING 240 CIRCUITS OR LESS**

The following out-of-service test procedures must be followed when lining up a transmitter after a klystron has been replaced as outlined in Section 409-304-504.

For this test, the transmitter must not be modulated. To ensure this, the input to the transmitter baseband amplifier is removed. See Section 409-306-500 for procedure on removing and restoring service.

STEP**PROCEDURE**

- 1 Remove the patch cord from the transmitter baseband amplifier **IN** jack.
- 2 On the meter and control panel, turn the selector switch to the **XMTR RF PWR** position and the toggle switches **FREQ** and **LIN** to the **XMTR** and **TST** positions, respectively.
- 3 Adjust the **XMTR RPLR** control for a maximum **RF PWR** indication on the **dB** scale of the lower meter.

CHART 2 (Cont)

STEP	PROCEDURE
	<p>Note: Since the power output peak is relatively broad, this step should be performed <i>with care</i>. If the exact peak is difficult to locate, set the XMTR RPLR control half-way between the settings corresponding to equal but small decreases in power output on either side of the peak.</p>
4	<p>Adjust the XMTR KLY ADJ for a maximum indication on the upper meter.</p> <p>Warning: <i>At the extreme ends of the frequency range, care should be exercised when mechanically tuning the klystron to prevent forcing or excess pressure on the stops.</i></p> <p>Note: To compensate for the rectification efficiency of different 53A detectors, a sensitivity control SENS is provided to prevent the upper meter from indicating off scale during this adjustment. The SENS control should be adjusted to indicate between 25 and 40 microamperes on the upper meter to maintain good sensitivity and still indicate on scale.</p>
5	Repeat Steps 3 and 4 until the power and frequency indications are maximum.
6	Operate the LIN switch to the NOR position.
7	Readjust the XMTR KLY ADJ for a maximum indication on the upper meter. (Do <i>not</i> readjust the XMTR RPLR control.)
8	Restore the input patch cord to the transmitter baseband amplifier IN jack.

CHART 3
**TRANSMITTER FREQUENCY AND LINEARITY ADJUSTMENTS
FOR SYSTEMS CARRYING MORE THAN 240 CIRCUITS**

The following test procedure ensures that optimum linearity and correct transmitter frequency are obtained. It requires a technician at each end of the hop under test. A J99302BG linearity test set and a J99262AA TL test set are required at each location.

The preferred method of adjustment requires that the circuit under test be looped back at the far end so that the technician adjusting the transmitter can observe the receiving test equipment meter indications. This makes the adjustments much easier to carry out, but requires freeing a channel in the return direction in addition to the channel under test. When a second channel is not available, an alternate single-channel procedure is used and is described in this section. In either case, communication between personnel at each end of the link is necessary. This can be provided over the order wire or a parallel facility. The channels to be used for testing will be determined on the basis of which transmitter is to be serviced and which return channel is inactive.

CHART 3 (Cont)

APPARATUS:

2—J99302BG Linearity Test Sets

2—J99262AA TL Test Sets

5—P2BJ Cords

STEP**PROCEDURE****Looped Adjustment**

1 Remove one channel in each direction of transmission from service as described in Section 409-306-500.

2 Disconnect the input to the IN jack on the transmitter baseband amplifier.

Note: When this adjustment is made on a routine basis, proceed with Steps 3 through 18. However, when it is necessary to line up the transmitter after a shutdown (for example, after a klystron has been replaced), Steps 2 through 7 of Chart 2 must be performed before proceeding with Step 3.

3 On the meter and control panel, turn the selector switch to the XMTR RF PWR position and the FREQ switch to the XMTR position.

4 Make test connections at the transmitting and receiving stations as shown in Fig. 1.

5 Slowly adjust the XMTR RPLR control on the transmitter control unit for a minimum indication on the TL test set voltmeter.

Requirement: The indication shall be less than -20 dBm (-19 dBm does not meet this requirement).

Note: In most cases, a slight rotation of the XMTR RPLR control will be sufficient, and the minimum indication will require no more than $1/2$ turn of the control.

6 Adjust the transmitter XMTR KLY ADJ control for a maximum indication on the upper meter of the meter and control panel. The FREQ switch must be in the XMTR position.

7 Repeat Steps 5 and 6 until the two conditions (TL test set voltmeter indicates minimum and upper meter on the meter and control panel indicates maximum) are both satisfied.

8 To linearize the other channel which was removed from service in Step 1, repeat Steps 2 through 7 in the opposite direction.

9 Restore normal patching to the IN jack on the transmitter control unit.

CHART 3 (Cont)

STEP	PROCEDURE
10	Restore service as described in Section 409-306-500. Straightaway Adjustment <i>Note:</i> In this measurement, the adjustments are made at the transmitting end of the hop and the results are observed at the receiving end. Good communications between both ends of the link over the order wire or a parallel facility are essential in obtaining optimum linearity.
11	Remove the channel to be linearized from service as described in Section 409-306-500.
12	Disconnect the input to the IN jack on the transmitter baseband amplifier.
13	On the meter and control panel, turn the selector switch to the XMTR RF PWR position and the FREQ switch to XMTR position. (See note of Step 2, Looped Adjustment.)
14	Make test connections as shown in Fig. 2.
15	Slowly adjust the XMTR RPLR control on the transmitter control unit for a minimum indication on the TL test set voltmeter.
16	Adjust the transmitter XMTR KLY ADJ control for a maximum indication on the upper meter of the meter and control panel. The FREQ switch on this unit must be in the XMTR position.
17	Repeat Steps 15 and 16 until the two conditions (TL test set voltmeter indicates a minimum and upper meter on the meter and control panel indicates maximum) are satisfied. <i>Requirement:</i> The indication on the TL test set must be less than -40 dBm (-39 dBm does not meet this requirement).
18	After linearity adjustments have been completed, replace all normal patching and restore service as described in Section 409-306-500.

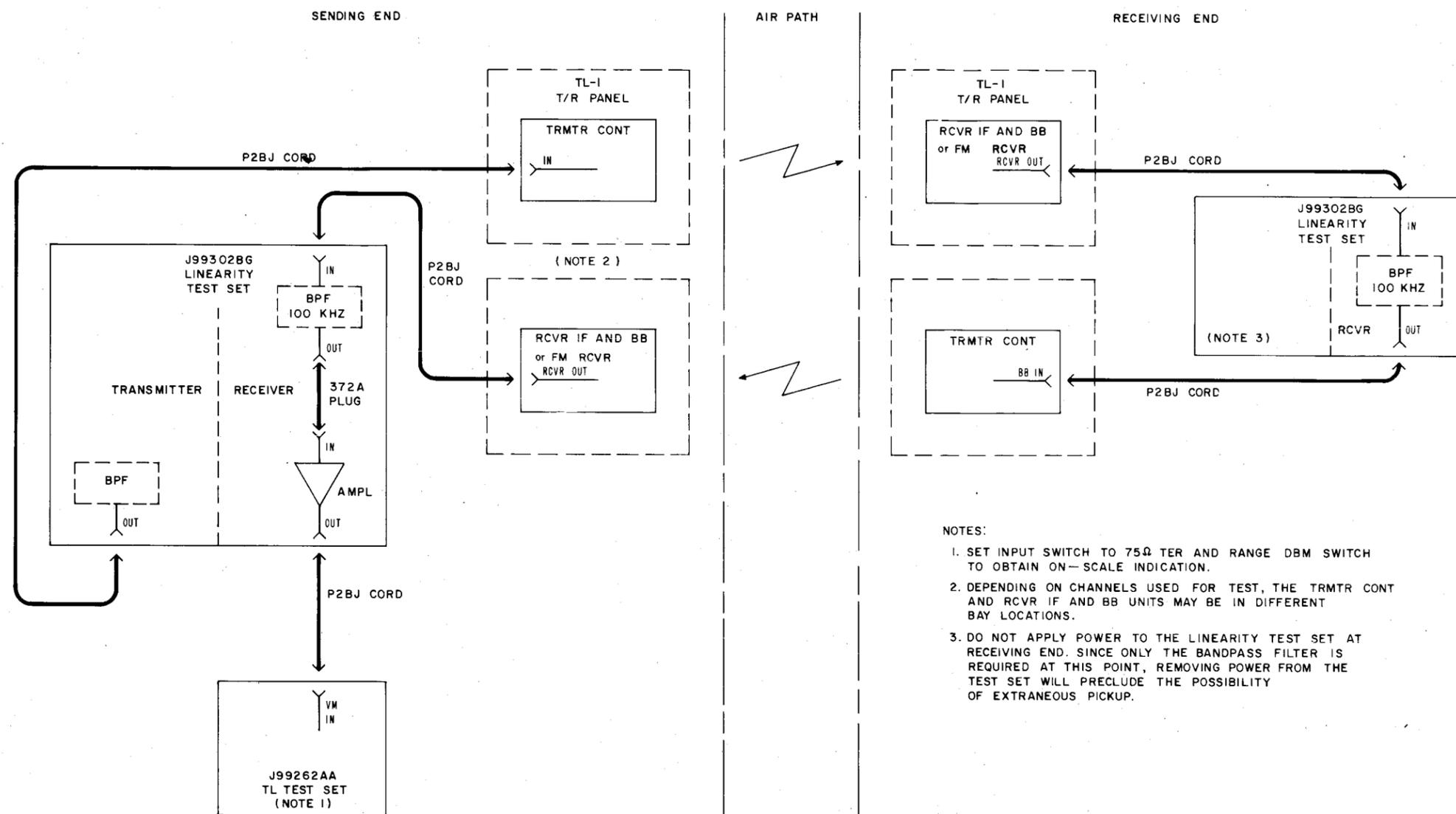


Fig. 1—Transmitter, Frequency, and Linearity Looped Tests—Test Setup Diagram

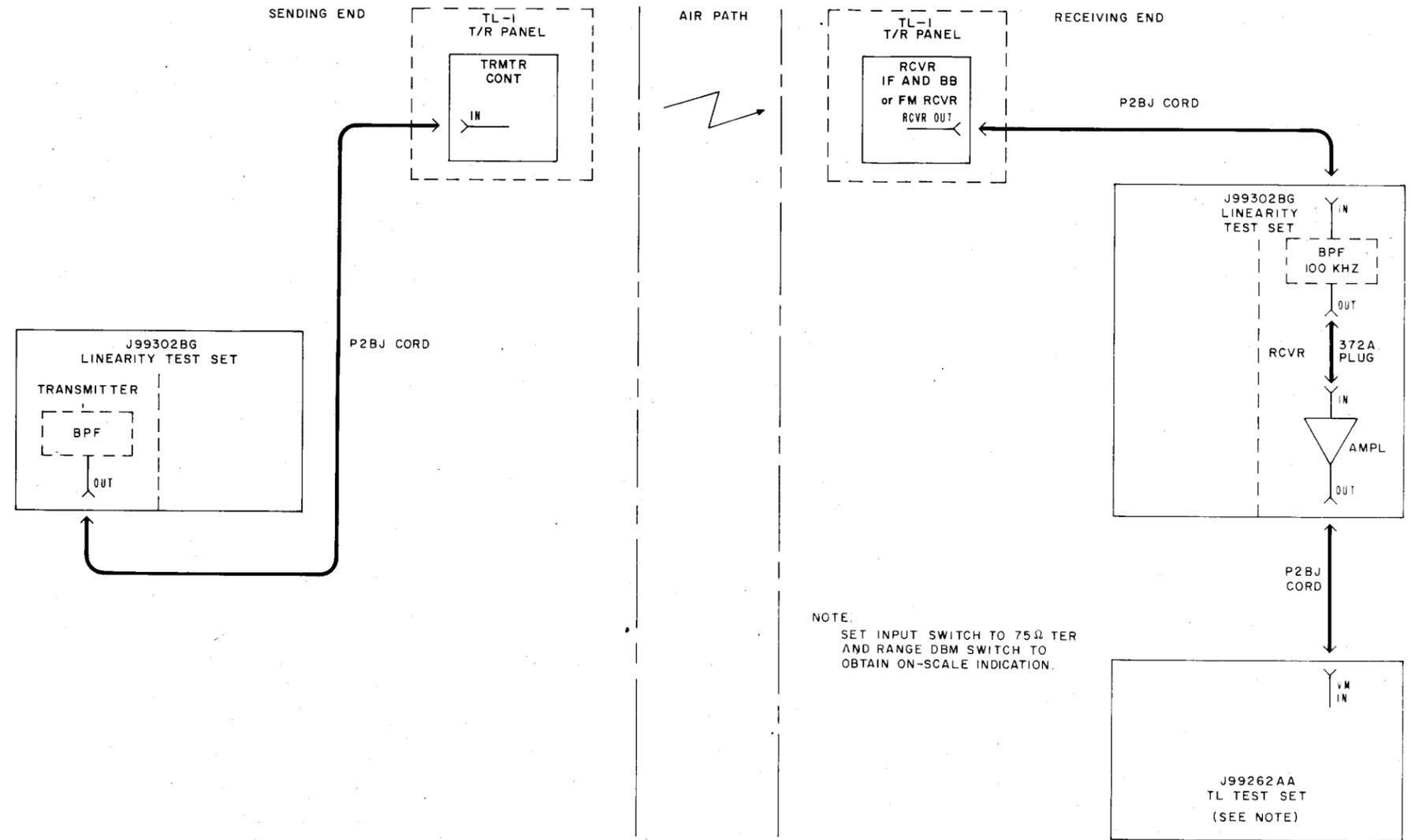


Fig. 2—Transmitter, Frequency, and Linearity Straightaway Tests—Test Setup Diagram