
L3 CARRIER

PEARL

MEASUREMENTS AT MAIN REPEATERS

This section contains procedures for calibration and use of the PEARL (Performance Evaluation of Amplifiers at Remote Locations) test set. The purpose of the PEARL test set is to provide a means of detecting and identifying, from a main station, a failed or defective amplifier at an unattended repeater station. On L3 routes conditioned for PEARL, individual L3 line repeaters are equipped with PEARL oscillators which provide the means for making in-service measurements of repeaters. Oscillators are frequency-assigned to each repeating line amplifier. Oscillator power measured at terminal or switching main repeaters may be used to evaluate the performance of each line amplifier. The PEARL set may also be used to locate amplifiers with intermodulation distortion characteristics. However, the *L line must be out of service* for this test.

This section is reissued to change the location of the connection to the PEARL TRUNK IN jack on the ED-59280-71, G1 panel to provide more accurate PEARL tone measurements. Arrows are used to indicate changes. Equipment Test Lists are not affected.

CHART	PAGE
1—PEARL Test Set Calibration	2
2—PEARL Tone Measurement	2
3—PEARL Modulation Products Measurement	4
4—Measurement of Special PEARL Frequencies (260 to 269 kHz)	6
5—Interpretation of PEARL Data (Normal System)	7

APPARATUS:

Receiving Test Equipment (RTE), per Section 356-010-500, having the following characteristics (Chart 4):

Frequency: 50 kHz to 5 MHz

Power: -100 to 0 dBm

Impedance: 75 ohms

NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

J68830R PEARL Main Station Patching Panel (contains the KS-19895 L3 PEARL test set)

CHART 1

PEARL TEST SET CALIBRATION

STEP	PROCEDURE
1	Check the condition of the internal batteries of the L3 PEARL test set, if batteries are used, by depressing the PWR TEST switch. Requirement: The meter should indicate the battery condition on the special scale marking. Replace batteries if necessary.
2	Set the FUNCTION switch to the CAL position.
3	Set the LINE LEVEL DBM switch to the -20 CAL position.
4	Position the three FREQUENCY selector switches to indicate 240 kHz.
5	Tune the test set for maximum meter deflection using the VERNIER dial. Requirement: 0-dB meter indication (-20 dBm).
6	If the requirement of Step 5 is not met, adjust the slotted 240-kHz CAL control.

CHART 2

PEARL TONE MEASUREMENT

STEP	PROCEDURE
	Note: This measurement can be performed while the equipment is in service.
1	Calibrate PEARL test set per Chart 1.
2	◆Verify that Receiving Bay Jack Field is connected as shown in Fig. 1.◆
3	◆Refer to office records for repeater identification and their assigned PEARL frequencies.◆

CHART 2 (Contd)

STEP

PROCEDURE

RECEIVING BAY JACK FIELD ED-59280-71, G1

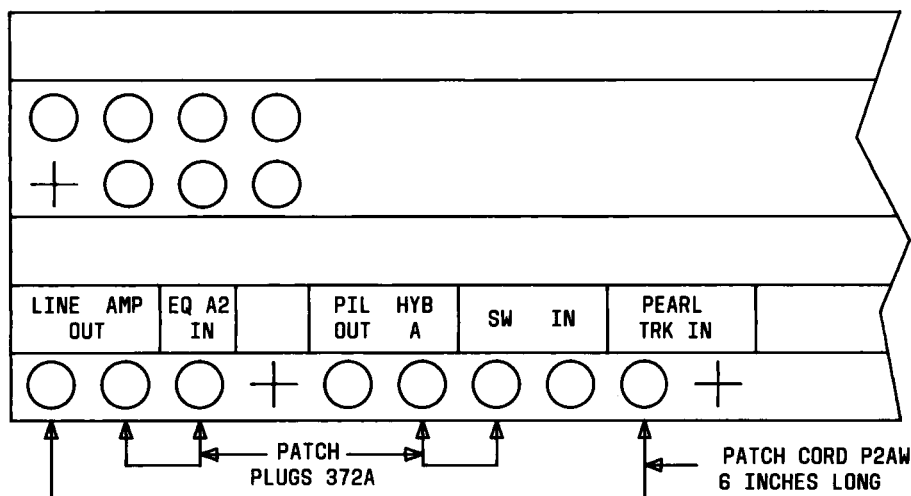


Fig. 1—PEARL Tone Test Jack Field Arrangement

- 4 Patch from the PEARL IN jack on the PEARL test set to the RCVG RTS jack of the line under test (receiving circuit, Fig. 2).
- 5 Turn the FUNCTION switch to MEASURE.
- 6 Position the FREQUENCY control to 259 kHz and adjust the LEVEL DBM control as required for an on-scale meter indication. Adjust the VERNIER control for maximum deflection of the DB meter.
- 7 Measure and record the power (Fig. 3).
- 8 Repeat Steps 5 and 6 for each frequency assigned to the line.

Note: The most distant amplifier is always assigned 259 kHz. The next measurement will be to the next most distant amplifier (258 kHz). Each succeeding measurement will be in decreasing 1-kHz steps to 210 kHz. If more frequencies are required, the next measurement will be 260 kHz. Refer to Chart 4 of this section for measurement of special PEARL frequencies.

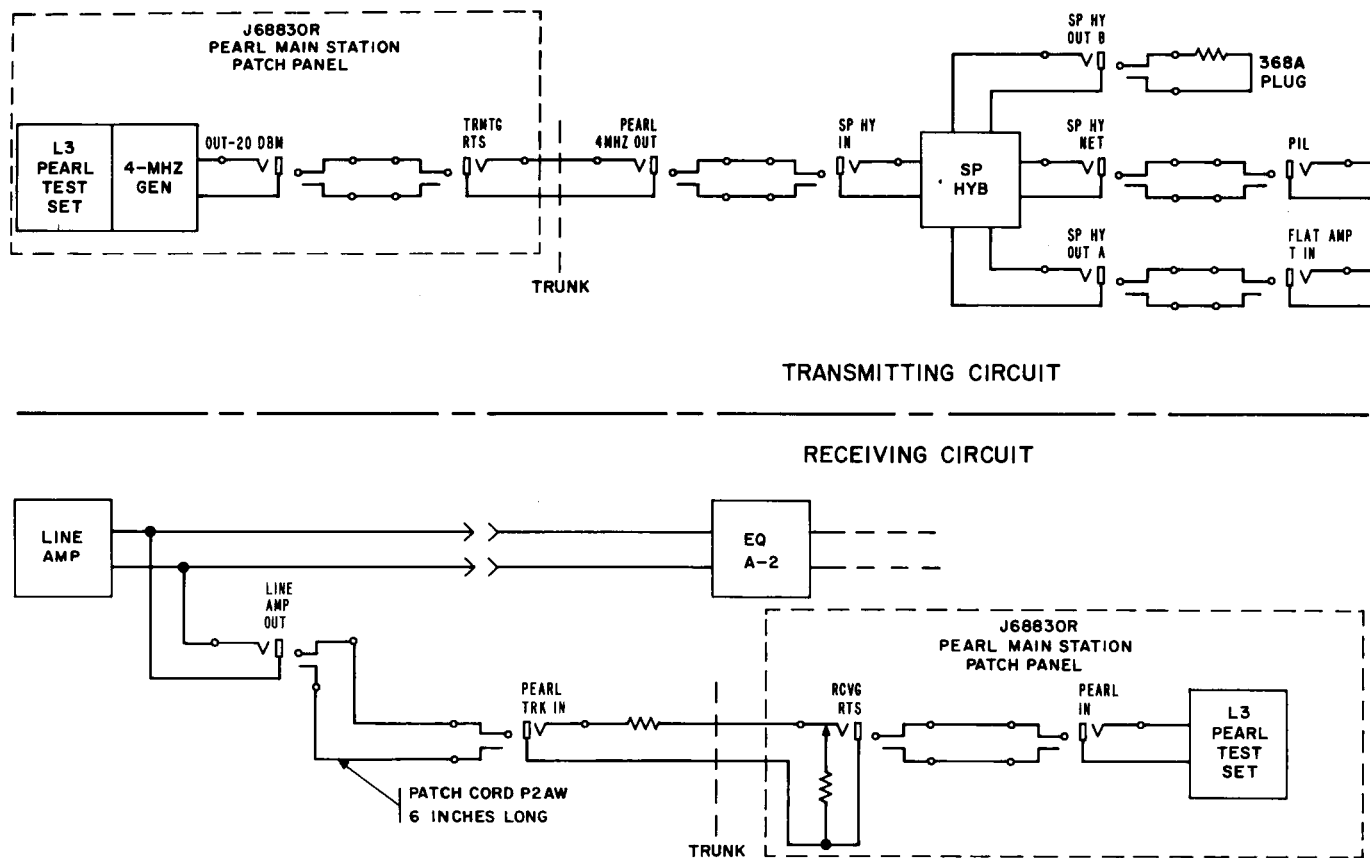


Fig. 2—Measurements at Main Repeaters

CHART 3

PEARL MODULATION PRODUCTS MEASUREMENT

STEP	PROCEDURE
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At the transmitting main station terminal (Fig. 2):

Note: This measurement must be performed while the equipment is *out of service*. If out-of-service tests cannot be performed, proceed to Chart 5.

- 1 Set up and calibrate the RTE for a direct measurement at the SP PIL jack as described in Section 359-035-505.
- 2 Measure the pilot power, as described in Section 359-035-505, at a SP PIL jack.
- 3 Patch from the SP HY NET jack to the SP PIL jack measured in Step 2.

PEARL MEASUREMENTS

ROUTE: _____ TO _____
TONE / MODULATION POWER IN DBM

POWER SECTION	L3 LINE NO.									
	DATE									
	TIME									
	REASON									
	TESTED BY									
	STA * DESIG	FREQ †	T M ‡	T M	T M	T M	T M	T M	T M	T M
NOTE: THIS FORM MAY BE REPRODUCED LOCALLY FOR USE IN RECORDING THE RESULTS OF EACH PEARL MEASUREMENT. EVALUATION OF A SERIES OF THESE MEASUREMENTS WILL SHOW CHANGES OR POSSIBLE DETERIORATION IN THE PERFORMANCE OF AN AMPLIFIER. * LIST STATIONS IN ORDER, FAR TO NEAR. † LIST FREQUENCY OF TONE AT STATION (MODULATION FREQUENCY IS THEN TONE PLUS 4 MHZ). ‡ CIRCLE T IF TONE POWER IS MEASURED, CIRCLE M IF MODULATION POWER IS MEASURED.										

Fig. 3—Sample Form for PEARL Measurements

CHART 3 (Contd)

STEP	PROCEDURE
4	Remove the 368A termination plug from the SP HY IN jack on the spare hybrid.
5	Patch from the SP HY IN jack to the PEARL 4-MHZ OUT trunk.
6	On the PEARL test set, turn the 4 MHZ GEN switch to ON. Patch from the OUT -20 DBM jack of the PEARL test set to the appropriate TRMTG RTS jack on the jack field.
7	Remove the line to be tested from service in accordance with Section 359-075-301.
8	Remove the 368A termination plug from the SP HY OUT A jack.
9	Patch one end of a test cord to the SP HY OUT A jack and, making a rapid patch, remove the FLAT AMP T IN patch and insert the patch from the SP HY OUT A jack.
	At the receiving main repeater terminal (Fig. 2):
10	Set up and calibrate the PEARL test set as described in Chart 1 of this section.
11	Position the FREQUENCY control to 4259 kHz and adjust the LEVEL DBM control for an on-scale meter deflection. Adjust the VERNIER control for maximum deflection. Measure and record the power.
	Note: Modulation products frequencies are PEARL tone frequencies plus 4 MHz.
12	Measure and record the remaining frequencies in the same order as for PEARL tone measurements (Fig. 3).

CHART 4

MEASUREMENT OF SPECIAL PEARL FREQUENCIES
(260 to 269 KHZ)

Ten additional PEARL frequencies are available for special installations requiring more than the normal 50 frequencies. The PEARL test set cannot be used to measure these frequencies as they are not included in the frequency spectrum of the test set.

STEP	PROCEDURE
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Note: Complete Chart 2 of this section using the PEARL test set to measure the first 50 assigned frequencies.

CHART 4 (Contd)

STEP	PROCEDURE
1	Set up and calibrate the RTE for a bridged measurement of 260 kHz. Caution*: <i>With 1-kHz PEARL frequency spacing, it may be necessary to check the RTE frequency reading and correct for frequency accuracy.</i>
2	Patch from the RTE to the RCVG RTS jack of the line under test (Fig. 2). Note: The needed bridging pad is a part of the built-in RCVG RTS circuit.
3	Measure and record (Fig. 3) the power of the PEARL tone. Note*: With 1-kHz PEARL frequency spacing, the RTE will not see nulls between adjacent tones. If a high-level tone is adjacent to a low-level tone, it may not be possible to measure the low-level tone. This, however, does not defeat the purpose since the high-level tone is the most significant.
4	Repeat Step 3 in increasing steps of 1 kHz for the remaining PEARL frequencies.
5	Perform Steps 1 through 9 of Chart 3 of this section.
6	Measure and record (Fig. 3) the modulation products at 4260 kHz.
7	Repeat Step 6 in increasing steps of 1 kHz for the remaining frequencies.
8	Interpret the data obtained in accordance with Chart 5. Note: The measurements obtained in this section are bridged measurements. The loss through the bridge is 30 dB. This 30-dB loss must be considered when interpretation of results is made.
*These statements are true for 37B TMS, not necessarily for all test equipment listed in Section 356-010-500.	

CHART 5

**INTERPRETATION OF PEARL DATA
(NORMAL SYSTEM)**

STEP	PROCEDURE
 Note 1: The range of values recorded should indicate a tone level measurement of less than -40 dBm.	

CHART 5 (Contd)

STEP	PROCEDURE
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Note 2: The modulation products tests will indicate the following:

Line Amplifiers: -75 to -62 dBm

Flat Gain Amplifiers: -78 to -66 dBm.

A. Total Failure

- 1 The tone level of a failed amplifier will be about -20 dBm $\pm$ 5 dB.

Caution: *The balance level of the next several pilot-regulated amplifiers succeeding the failed amplifier will be moderately high. These amplifiers are probably not in trouble.*

- 2 Modulation products test will not yield any results as the failed amplifier will not pass the 4 MHz necessary to produce modulation products.

B. Partial Failure

- 3 Start at the most distant amplifier. Trouble is indicated in the first amplifier to indicate more than -40 dBm (probably about -30 dBm).
- 4 If in Step 1 several amplifiers indicate about -40 dBm, the most distant repeater should be suspected. The nearest amplifiers will probably return to normal indication on replacement or repair of the most distant repeater.
- 5 If no clear answer to the amplifier trouble can be obtained from the PEARL tone measurement, refer to the modulation products test in Chart 3.
- 6 Compare modulation products tests with previous measurements and a normal system as given in Note 2. Any amplifier indicating a large change in modulation products measurements should be suspected.
- 7 If several amplifiers have increased modulation products, suspect the most distant amplifier with high-level products.
- 8 If the data recording form (Fig. 3) shows a moderate high-tone level throughout the system or if the whole line is difficult to balance during a routine PEARL tone balance, the line may require equalization before good PEARL results can be obtained. A modulation products test will not indicate this type of trouble.
- 9 If the data recording form (Fig. 3) shows a moderate high-tone level and moderate high-modulation products beginning at a certain repeater, suspect regulator trouble at that repeater. See Step 8 also.
- 10 Moderate high-tone levels and moderate high-modulation products may be caused by power supply troubles. Check the data recording form (Fig. 3) to determine if these symptoms begin or end at a power feed section.

CHART 5 (Contd)

STEP	PROCEDURE
11	If measurements indicate that the PEARL tone and modulation products are missing at one of the amplifiers, the PEARL oscillator may be defective.
12	If further tests indicate that the PEARL tones are missing from other amplifiers at the same auxiliary repeater location or are missing at the far receiving terminal of the coaxial pair for a commonly powered PEARL oscillator, the PEARL power supply may be defective.