# L4 CARRIER

# REPEATERS

# TESTS

# IN-SERVICE MAIN STATION EQUIPMENT

Performance tests for main station transmission equipment are usually made via the control center for L4 systems that include a remote control system. For other L4 systems, routine in-service tests are performed at the line transmitting bay, line receiving bay, and control connecting bay. For L4S systems, only the procedure in Chart 4 is required.

This section is reissued to include the transmitting repeater regulator adjustment procedure that was omitted in Issue 4 and to add the transmitting repeater nick filter adjustment procedure. Arrows are used to indicate significant changes. ***Equipment Test Lists are affected.***

Replacement procedures for main station equipment are explained in Section 359-205-301.

**CHART** **PAGE**



**APPARATUS:**

The tests in this section require suitable transmission measuring equipment. Refer to Section 356-010-500 and select, from available equipment, receiving units having the following capabilities:

**APPARATUS (Cont):**

***Receiving test equipment (RTE)*** capable of detecting, from 75-ohm circuits, signals between 500 kHz and 21 MHz at powers between −20 and −70 dBm.

***Note:*** Transmission measuring equipment calibration procedures are explained in Section 359-200-501.

## CHART 1

## A EQUALIZER TEST OSCILLATORS AND LOGIC J68877AS

The procedure in this chart applies to L4 systems that include a remote control system.

An A equalizer shelf (Fig. 1) includes three units: A equalizer, memory, and logic. The logic unit includes oscillators that produce the six A equalizer test signals. Test signal power must be properly adjusted to permit accurate adjustment of the A equalizer during line equalization.

| STEP | PROCEDURE |
|---|---|
| 1 | Request the control center attendant to apply the equalizer test signals at the input of the A equalizer under test. |
| 2 | Remove plug P15 from jack J8 on the logic unit.<br><br>***Note:*** Pull out the A equalizer shelf and raise the piano-hinged flap on the left side of the shelf. |
| 3 | Calibrate the RTE for a 75-ohm terminated measurement of 0.544 MHz at a power of −37.7 dBm. |
| 4 | Measure the power of the 0.544-MHz test signal at jack J8 (Fig. 1).<br><br>***Requirement:*** −37.7 dBm |
| 5 | Adjust the 0.544 MHZ ADJ control, if required, to meet the requirement. |
| 6 | Repeat Steps 3 through 5 at each of the other frequencies listed in Table A.<br><br>***Requirement:*** As specified in Table A, column 2 |
| 7 | Remove the test equipment. |
| 8 | Connect plug P15 to jack J8. |
| 9 | Request the control center attendant to turn off the equalizer test signals. |

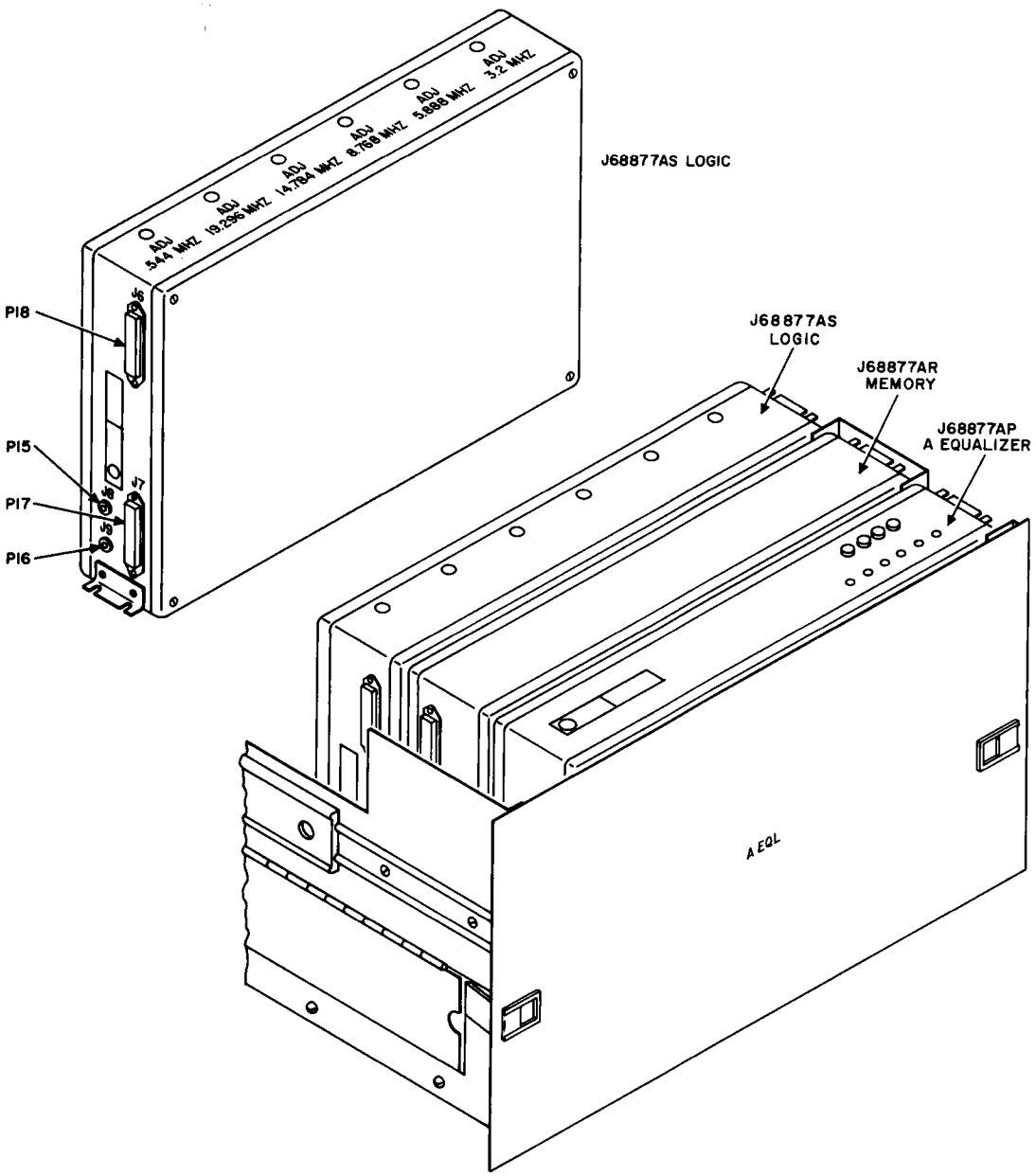



**Fig. 1—A Equalizer Shelf**

## CHART 2

## B EQUALIZER TEST OSCILLATORS AND CONNECTING ASSEMBLY J68877BT

The procedure in this chart applies to L4 systems that include a remote control system.

A control connecting bay includes ten B equalizer test oscillators and a connecting circuit for distributing test signals to all lines in the route served by the control connecting bay.

TABLE A

A EQUALIZER TEST SIGNALS

| (1) EQUALIZER TEST SIGNAL FREQUENCY (MHz) | (2) REQUIRED POWER AT JACK J8 AND/OR J9 ON LOGIC UNIT (dBm ±0.1 dB) | (3) TEST SIGNAL LEVEL CONTROL ON LOGIC UNIT |
|---|---|---|
| 0.544 | −37.7 | 0.544 MHZ ADJ |
| 3.200 | −36.2 | 3.200 MHZ ADJ |
| 5.888 | −35.1 | 5.888 MHZ ADJ |
| 8.768 | −34.0 | 8.768 MHZ ADJ |
| 14.784 | −32.5 | 14.784 MHZ ADJ |
| 19.296 | −31.3 | 19.296 MHZ ADJ |

**CHART 2 (Cont)**

Both the test oscillators and the connecting circuit are included in B equalizer test oscillators and connecting assembly J68877BT (Fig. 2). In earlier control connecting bays, these circuits are provided in two panels: B oscillators assembly J68877BB and B signals connecting assembly J68877BC, which are manufacture discontinued. These two units are covered in Chart 3.

| STEP | PROCEDURE |
|---|---|
| 1 | Request the control center attendant to apply equalizer test signals at either the input or output of the B equalizer in receive line 10 in the route served by the J68877BT panel.<br><br>***Note:*** When receive line 10 is selected, the B equalizer test signals appear at output jack J61 on the panel. |
| 2 | Remove plug P61 from jack J61 on the J68877BT panel (Fig. 2). |
| 3 | Calibrate the RTE for a 75-ohm terminated measurement of 1.056 MHz at a power of −33.95 dBm. |
| 4 | Measure the power of the 1.056-MHz test signal at jack J61.<br><br>***Requirement:*** As specified in Table B, column 3 |
| 5 | Adjust the appropriate LEVEL control on the oscillator under test, if required, to meet the requirement. |

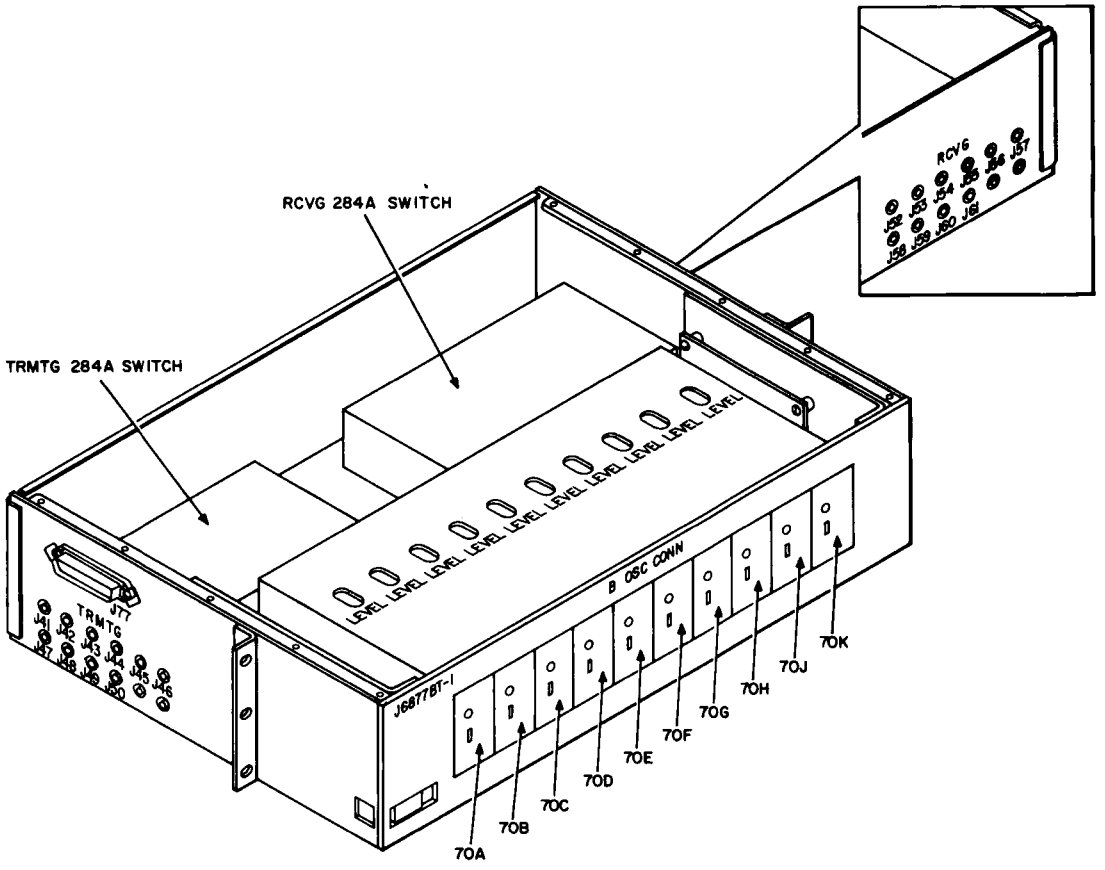



**Fig. 2—B Equalizer Test Signal Panel J68877BT**

**CHART 2 (Cont)**

| STEP | PROCEDURE |
|---|---|
| | ***Note:*** Unlatch the drawer and pull forward to gain access to the LEVEL controls. |
| 6 | Repeat Steps 3 through 5 at each of the other frequencies listed in Table B. |
| 7 | Close and latch the drawer. |
| 8 | Remove the test equipment. |
| 9 | Reconnect plug P61 to jack J61. |
| 10 | Request the control center attendant to turn off the equalizer test oscillators. |

TABLE B

B EQUALIZER TEST SIGNALS

| (1) OSCILLATOR | (2) FREQUENCY (MHZ) | REQUIRED POWER DBM | |
|---|---|---|---|
| | | (3) JACK J61 ON J68877BC OR J68877BT | (4) JACK J36 ON J68877BB |
| 70A | 1.056 | −33.95 | −19.33 |
| 70B | 1.552 | −33.58 | −18.92 |
| 70C | 2.080 | −33.21 | −18.52 |
| 70D | 4.256 | −31.95 | −17.22 |
| 70E | 7.008 | −30.85 | −16.06 |
| 70F | 9.888 | −29.81 | −14.95 |
| 70G | 12.896 | −29.02 | −14.05 |
| 70H | 16.032 | −28.28 | −13.16 |
| 70J | 17.792 | −27.92 | −12.73 |
| 70K | 20.200 | −27.46 | −12.21 |

## CHART 3

## B EQUALIZER TEST OSCILLATOR ASSEMBLY J68877BB AND B SIGNAL CONNECTING ASSEMBLY J68877BC

The procedure in this chart applies to L4 systems that include a remote control system.

| STEP | PROCEDURE |
|---|---|
| 1 | Request the control center attendant to apply equalizer test signals at either the input or output of the B equalizer in one of the receive lines in the route served by the J68877BB unit.<br><br>***Note:*** When a ***receive*** line is selected, the B equalizer test signals appear at output jacks J52 through J61 on the J68877BC unit. |
| 2 | Remove plug P61 on the J68877BC unit.<br><br>***Note:*** Access to output jack J61 and to the 70-type plug-in oscillators is from the rear of the bay. |

**CHART 3(Cont)**

| STEP | PROCEDURE |
|---|---|
| 3 | Calibrate the RTE for a 75-ohm terminated measurement of 1.056 MHz at a power of −33.95 dBm. |
| 4 | Measure the power of the 1.056-MHz test signal at jack J61.<br><br>***Requirement:*** As specified in Table B, column 3 |
| 5 | Proceed to Step 11 if the requirement is met. Otherwise, proceed to Step 6 to adjust the oscillator. |
| 6 | Remove the appropriate plug-in oscillator using extractor tool KS-19099 List 1. |
| 7 | Insert this oscillator in the 186A adapter and insert the 186A adapter with oscillator in the oscillator mounting position. |
| 8 | Adjust the oscillator LEVEL ADJ control to obtain the required output power.<br><br>***Requirement:*** As specified in Table B, column 3<br><br>***Note:*** The oscillator LEVEL ADJ control is on the side of the unit and is accessible through a hole in the side of the 186A adapter. |
| 9 | Remove the adapter with oscillator. |
| 10 | Reinstall the oscillator in the J68877BB unit. |
| 11 | Repeat Steps 3 through 10 for each of the other oscillators, as required. |
| 12 | Remove the test equipment. |
| 13 | Reconnect plug P61 to jack J61 on the J68877BC unit. |
| 14 | Request the control center attendant to turn off the equalizer test oscillators. |

**▶CHART 4◀**

**TRANSMITTING REPEATER J68877AM**

A transmitting repeater includes a regulator that must be adjusted at three-month intervals to maintain the required 11.648-MHz pilot power on the L4 transmit line. A List 2 transmitting repeater includes an adjustable narrowband filter (nick filter) at the 11.648-MHz pilot frequency. The nick filter must be adjusted on an ***out-of-service*** basis.

▶CHART 4◀ (Cont)

| STEP | PROCEDURE |
|---|---|

***Note:*** Proceed to Part A for a transmitting repeater ***with*** a NICK ADJ control. Proceed to Part B for a transmitting repeater ***without*** a NICK ADJ control.

**A. Adjusting Nick Filter to Zero Loss**

***Note:*** The nick filter must be adjusted for 0 dB loss so the filter will not affect the 11.648-MHz power during the regulator adjustment in Part B. The nick filter is readjusted in Part C to obtain the required 11.648-MHz power.

***Caution: Verify that the transmitting repeater is out of service before proceeding.***

1 Measure and record the power of the 11.648-MHz pilot signal at the TRMTG LINE TST jack.

2 Remove the patch plug between the LOOP BACK OUT and LOOP SIG IN jacks.

3 Apply an 11.400-MHz test signal at approximately −33.8 dBm to the LOOP SIG IN jack.

4 Adjust the test signal power until the signal at the TRMTG LINE TST jack is at the same power as the 11.648-MHz power recorded in Step 1.

5 Measure and record the 11.400-MHz power at the RPTR OUT TST jack.

***Note:*** If the RPTR OUT TST jack is not provided, measure at jack J5 in the power separation filter shelf.

6 Repeat Steps 3 through 5 for an 11.892-MHz test signal.

7 Determine the ***average*** power of the 11.400-MHz and the 11.892-MHz signals at the RPTR OUT TST jack.

8 Adjust the NICK ADJ control on the transmitting repeater until the 11.648-MHz power at the RPTR OUT TST jack is equal to the ***average*** power determined in Step 7.

***Note:*** The NICK ADJ control is located on the bottom of the repeater. Withdraw the shelf and tip up the repeater to reach the control. A hole may be made in the shelf bottom to facilitate this adjustment.

**B. Adjusting Regulator**

9 Determine from office records the information necessary to compute the ***required*** 11.648-MHz pilot power at the RPTR OUT TST jack for the ***time of year*** the adjustment is being made.

***Note:*** The required 11.648-MHz pilot power depends on the mean annual cable temperature, the time of year, the length of the section to the first regulating repeater, the code of

◆CHART 4◆ (Cont)

| STEP | PROCEDURE |
|---|---|

the LBO network in the LBO2 position on the repeater, and the list number of the repeater. Table C lists nominal 11.648-MHz pilot power values. Figure 3 shows expected gain deviations throughout the year according to regulating section length and mean annual cable temperature.

10 Compute the required 11.648-MHz pilot power (see ***Example 1***).

***Example 1:***

Assume a List 1 transmitting repeater with a 4100F LBO network in the LBO2 position, a mean annual cable temperature of 42°F, the length of the section to the first regulating repeater 12 miles, and the time of adjustment is July.

From Table C, the nominal 11.648-MHz pilot power is −63.95 dBm

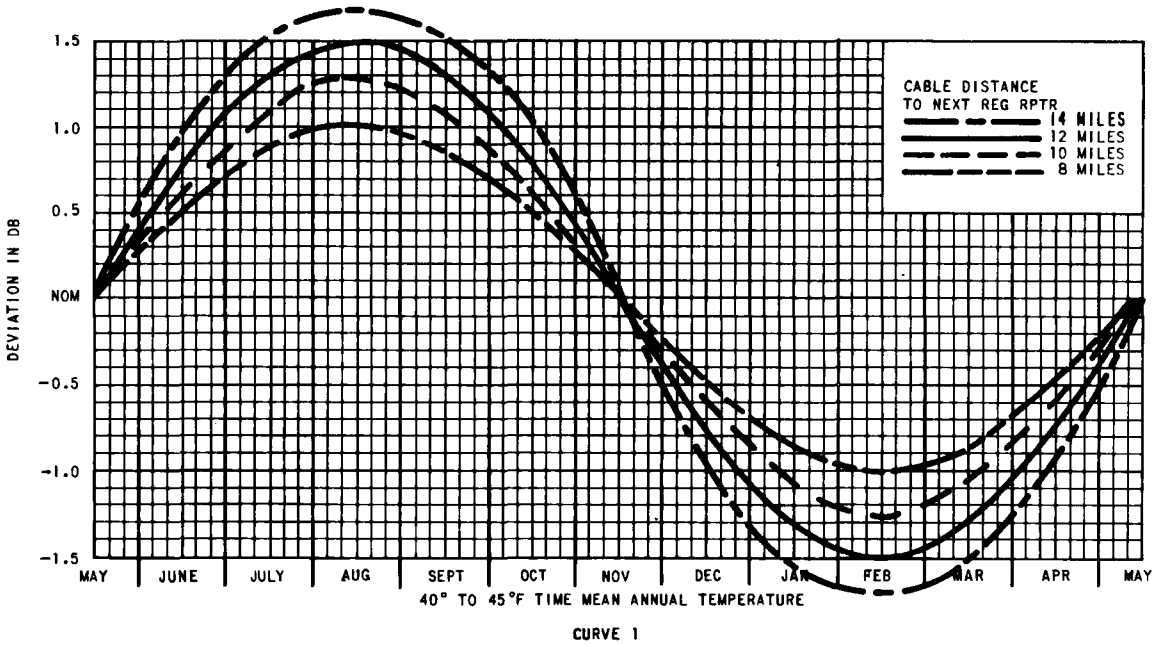
From curve 1 of Fig. 3, correction for a mean annual cable temperature of 42°F for a 12-mile regulating section in July is +1.30 dB

The required 11.648-MHz pilot power at RPTR OUT TST jack is −62.65 dBm.

◆TABLE C◆

NOMINAL 11.648-MHZ PILOT POWER VALUES

| TRANSMITTING REPEATER J68877AM LB02 CODE | | NOMINAL 11.648-MHz PILOT POWER (DBM) AT RPTR OUT TST JACK |
|---|---|---|
| LIST 1 | LIST 2 | |
| 4100B | 4100A | −58.53 |
| 4100C | 4011B | −59.88 |
| 4100D | 4100C | −61.24 |
| 4100E | 4100D | −62.60 |
| 4100F | 4100E | −63.95 |
| 4100G | 4100F | −65.31 |
| 4100H | 4100G | −66.67 |
| 4100J | 4100H | −68.02 |
| 4100K | 4100J | −69.38 |
| 4100L | 4100K | −70.73 |



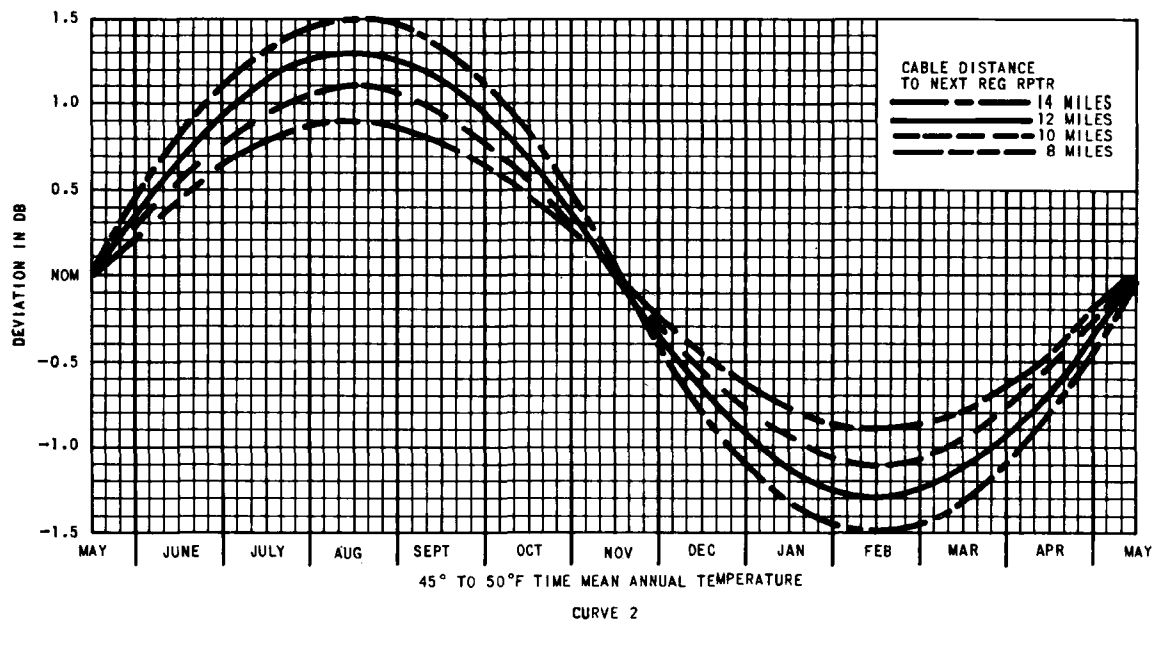
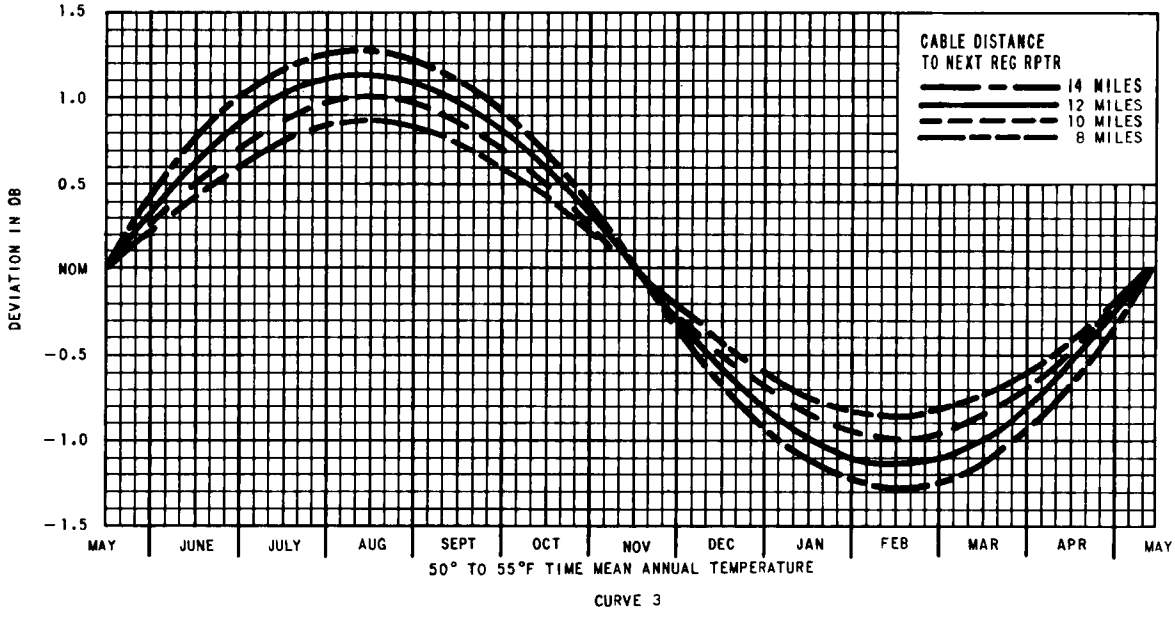




**Fig. 3—Repeater Gain Deviations Versus Temperature Changes (Sheet 1 of 3)**



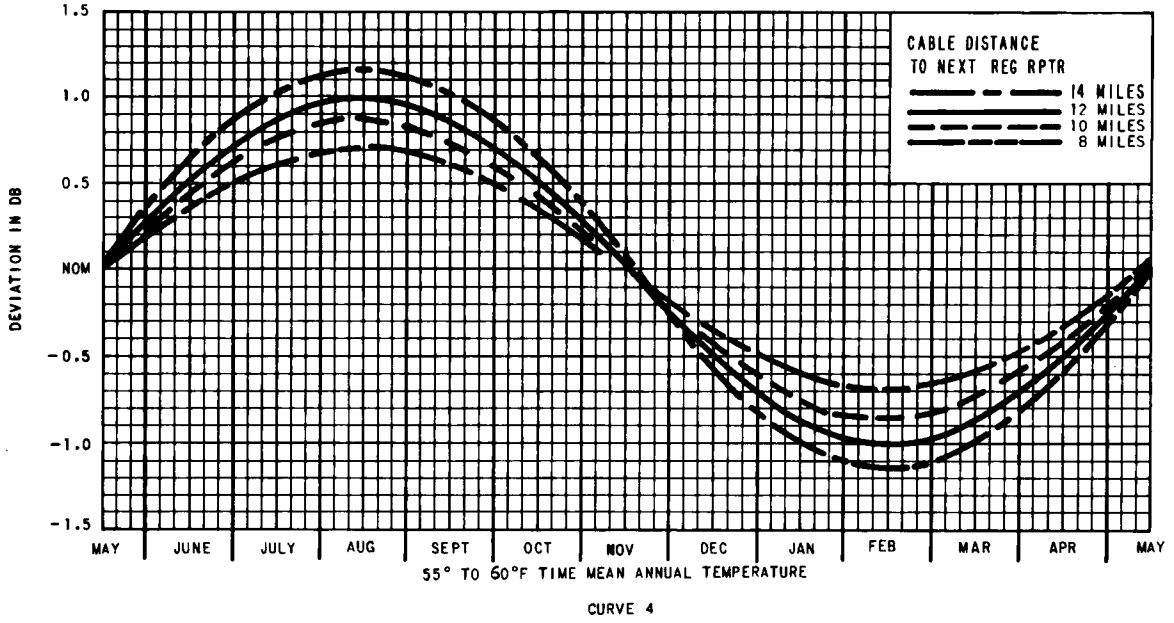
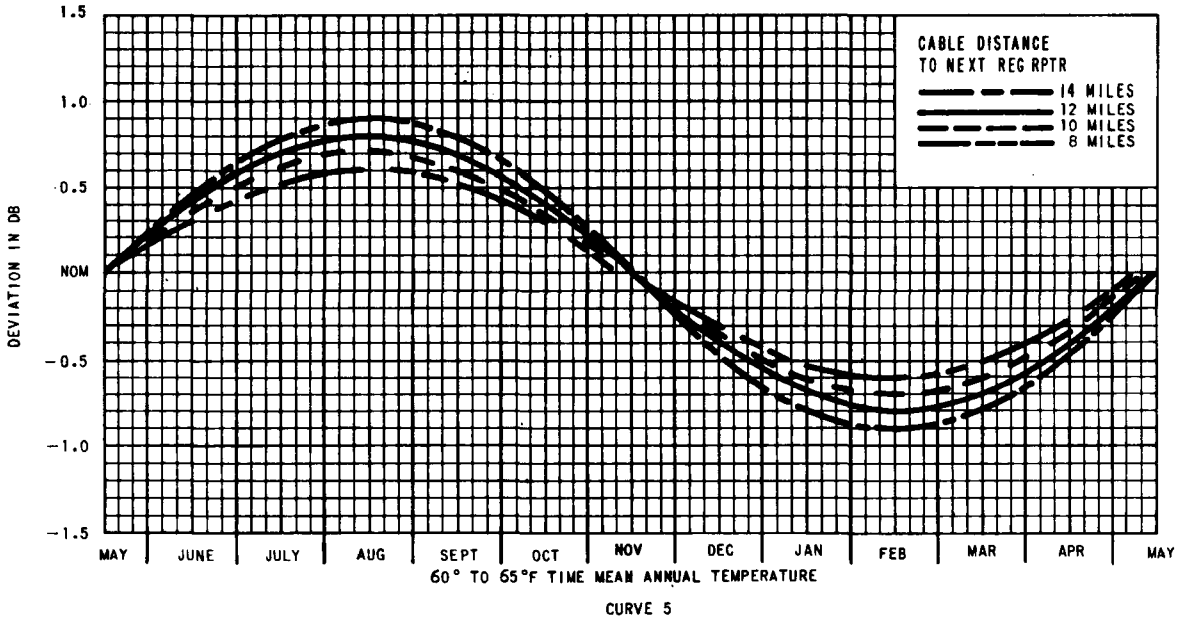




**Fig. 3—Repeater Gain Deviations Versus Temperature Changes (Sheet 2 of 3)**



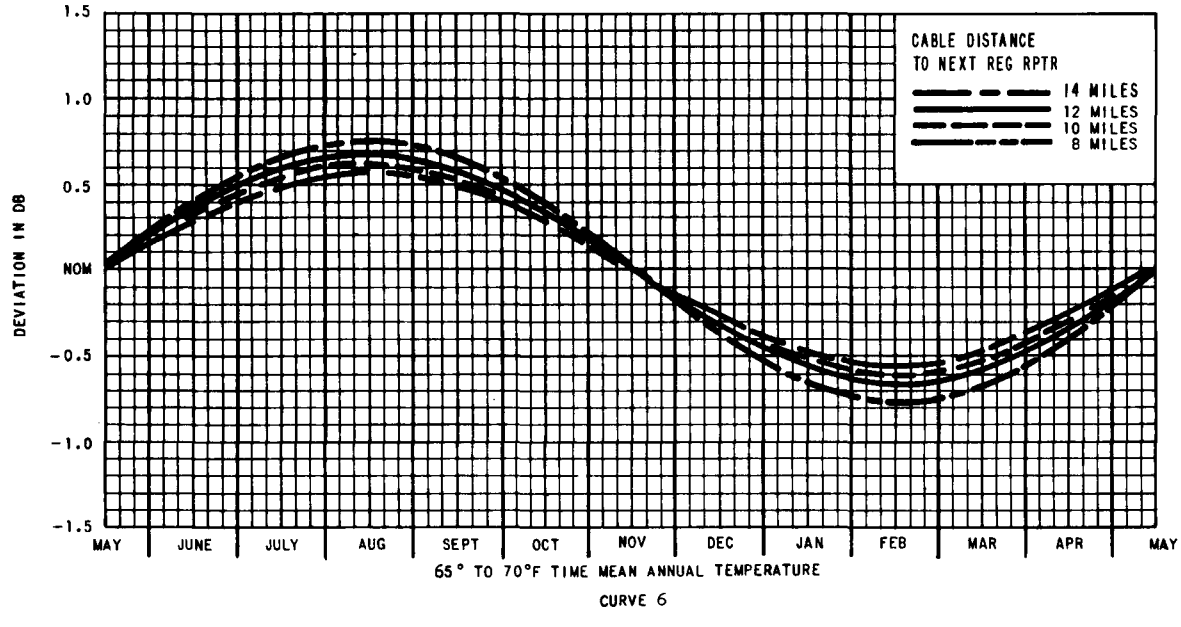




**Fig. 3—Repeater Gain Deviations Versus Temperature Changes (Sheet 3 of 3)**

CHART 4 (Cont)

| STEP | PROCEDURE |
|---|---|
| 11 | Calibrate the RTE for a 75-ohm terminated measurement of the 11.648-MHz pilot at the power computed in Step 10. |
| 12 | Measure the power of the 11.648-MHz pilot signal at the RPTR OUT TST jack in the line transmitting bay jack field.<br><br>***Note:*** If the RPTR OUT TST jack is not provided, measure at jack J5 in the power separation filter shelf.<br><br>***Requirement:*** Within $\pm$0.1 dB of the value computed in Step 10. |
| 13 | Adjust the REG ADJ control on the repeater, if required, to meet the requirement.<br><br>***Note:*** The REG ADJ control is accessible through a large hole in the repeater top cover near the power plug end. Slowly adjust the control and wait for the repeater gain to stabilize between adjustments. |
| 14 | Remove the test equipment.<br><br>***Note:*** Proceed to Part C for a transmitting repeater ***with*** a NICK ADJ control. Proceed to Step 28 for a transmitting repeater ***without*** a NICK ADJ control. |

**C. Adjusting Nick Filter to Required Loss**

***Note:*** ***Near*** main station refers to the main station at which the transmitting repeater is to be tested. ***Far*** main station refers to the adjacent main station which is receiving signals from the transmitting repeater to be tested.

***At far main station,***

| | |
|---|---|
| 15 | Measure and record the 11.648-MHz power at the RCVG LINE TST jack.<br><br>***Note:*** Nominal 11.648-MHz power at this jack is $-40.0$ dBm. |

***At near main station,***

| | |
|---|---|
| 16 | Measure and record the 11.648-MHz power at the TRMTG LINE TST jack.<br><br>***Note:*** Nominal 11.648-MHz power at this jack is $-52.9$ dBm. |
| 17 | Remove the patch plug between the LOOP BACK OUT and LOOP SIG IN jacks in the line transmitting bay jack field. |
| 18 | Apply an 11.400-MHz test signal at approximately $-33.8$ dBm to the LOOP SIG IN jack. |

▶CHART 4◀ (Cont)

| STEP | PROCEDURE |
|---|---|

19 Adjust the test signal power until the signal at the TRMTG LINE TST jack is at the same power as the 11.648-MHz power recorded in Step 16.

***At far main station,***

20 Measure and record the 11.400-MHz power at the RCVG LINE TST jack.

21 Repeat Steps 18 through 20 for an 11.892-MHz test signal.

22 Determine the ***average*** power of the 11.400-MHz and the 11.892-MHz signals at the RCVG LINE TST jack (see ***Example 2***).

***Example 2:***

RCVG LINE TST jack at far main station:

(a) Step 20 power at 11.400 MHz = −38.9 dBm

(b) Step 21 power at 11.892 MHz = −39.2 dBm

(c) Step 22 average power measured = (a + b)/2 = c = −39.05 dBm.

23 Determine the ***difference*** between this average power and the 11.648-MHz power at the RCVG LINE TST jack measured in Step 15 (see ***Example 3***).

***Example 3:***

RCVG LINE TST jack at far main station:

(d) Step 15 power at 11.648 MHz = −38.6 dBm

(e) Step 22 average power measured = c = −39.05 dBm

(f) Step 23 difference between average power and 11.648-MHz power = −0.45 dB.

***Note:*** The difference is the amount of loss at 11.648 MHz, which must be provided by adjusting the NICK ADJ control in the transmitting repeater.

***At near main station,***

24 Measure and record the 11.648-MHz power at the RPTR OUT TST jack in the jack field.

***Note:*** Do not remove the receiving test equipment. If the RPTR OUT TST jack is not provided, measure at jack J5 in the power separation filter shelf.

▶CHART 4◀ (Cont)

| STEP | PROCEDURE |
|---|---|
| 25 | Adjust the NICK ADJ control on the transmitting repeater to ***reduce*** the 11.648-MHz power at the RPTR OUT TST jack by difference determined in Step 23 (see ***Example 4***).<br><br>***Example 4:***<br><br>RPTR OUT TST jack at near main station:<br><br>(g) Step 23 difference between average power and 11.648-MHz power = f = −0.45 dB<br><br>(h) Step 24 original power at 11.648 MHz = −57.2 dBm<br><br>(i) Step 25 adjusted power at 11.648 MHz = −57.65 dBm.<br><br>***Note:*** The NICK ADJ control is located on the bottom of the repeater. Withdraw the shelf and tip up the repeater to reach the control. A hole may be made in the shelf bottom to facilitate this adjustment. |
| 26 | Secure the repeater shelf. |
| 27 | Restore the patch plug between the LOOP BACK OUT and LOOP SIG IN jacks in the line transmitting bay. |
| 28 | Remove all test equipment. |