MONITORING OSCILLATOR REFERENCE POWER ADJUSTMENT

TESTS

OVERALL SYSTEM

L4 CARRIER

A monitoring oscillator is associated with each repeater in an L4 line. Monitoring oscillators associated with a given line may be powered, in groups, ▶by control◀ from a main station. For an L4 system with a remote control system, monitoring oscillators are controlled from the control center. For an L4 system without a remote control system and for an L4S system, monitoring oscillators are controlled by means of pushbuttons on line protection patch and monitoring oscillator control panel J68877EH(MD) or J68877EK in the control connecting bay. Monitoring oscillator signals are applied to four lines at a time, two lines in each direction.

This section is reissued to add a procedure for locating defective dc-dc converters and to correct errors. Arrows are used to indicate significant changes. ***Equipment Test Lists are not affected.***

An L4S main section, depending on length, includes one or two groups of monitoring oscillators which are powered from the main stations. An L4 main section includes up to six groups of monitoring oscillators which are powered from the equalizing repeater and main station locations.

Monitoring oscillator signals received at a main station are measured to isolate a defective repeater in case of line trouble. Even a small gain change can be detected if the monitoring oscillator reference power has been properly adjusted.

CHART **PAGE**

CHART 1

PREPARATION FOR MONITORING OSCILLATOR ADJUSTMENT

Preparation for monitoring oscillator adjustment includes:

(a) Establishing a reference power record for each repeater in the line section

(b) Determining the required power of the 11.648-MHz pilot at the input to each repeater

(c) Determining the expected gain at 11.648 MHz for each repeater

(d) Determining the required monitoring oscillator reference power at the receiving main station.

STEP	PROCEDURE
	A. Reference Power Record
1	Establish a reference power record (Fig. 1) for each repeater ▶station◀ in the line section.
	B. 11.648-MHz Pilot Power at Repeater Input
	Note: The 11.648-MHz pilot must be at the proper power at the repeater input before the monitoring oscillator reference power adjustment is made. The nominal pilot power ▶at a repeater input◀ is −55.00 dBm at 55°F with 2-mile repeater spacing. The actual power depends on the following: (a) Month of year (b) Mean annual cable temperature (c) Length of regulating section (d) Repeater location within the regulating section (e) Deviation in dB from Table A, according to cumulative deviation in miles.
2	Determine the required 11.648-MHz pilot power at the repeater input ▶from the computer printout for the regulating section or by using ***Equation 1.***◀ ***Equation 1:*** Required 11.648-MHz pilot power at repeater input = nominal power (see ***Note 1***) ± deviation in dB (see ***Note 2***) ± correction for temperature (see ***Note 3***). ***Notes:*** 1. Nominal pilot power: −55.00 dBm at 55°F. 2. Deviation in dB: use line engineering records and Table A to convert the cumulative deviation in miles to deviation in dB. A ***plus*** cumulative deviation in miles requires a ***minus*** deviation in dB.

MONITORING OSCILLATOR
REFERENCE POWER ALIGNMENT RECORD

REPEATER STATION _____

ANNUAL MEAN TEMPERATURE _____

MONITORING OSCILLATOR FREQUENCY _____

TABLE LINE NO.	ITEMS RECORDED	L4 LINE													
1	DATE OF ALIGNMENT														
2	COMPUTED 11.648-MHZ PILOT POWER AT REPEATER IN JACK														
3	EXPECTED REPEATER GAIN AT 11.648 MHZ														
4	MEASURED 11.648-MHZ PILOT POWER AT REPEATER OUT JACK														
5	MEASURED 11.648-MHZ PILOT POWER AT REPEATER IN JACK														
6	ACTUAL REPEATER GAIN AT 11.648 MHZ (LINE 4 - LINE 5)														
7	MON OSC SIGNAL POWER AT OUTPUT OF 51A PAD														
8	MON OSC SIGNAL POWER AT INPUT TO 51A PAD (MEASURED VALUE)														
9	TERMINATED LOSS OF 51A PAD (LINE 8-LINE 7)														
10	MON OSC SIGNAL POWER AT REPEATER INPUT (LINE 8 - 30 DB*)														
11	MON OSC SIGNAL POWER AT REPEATER OUT JACK (MEASURED VALUE)														
12	REPEATER GAIN AT 18.500 MHZ (LINE 11-LINE 10)														
13	REQUIRED MON OSC SIGNAL POWER AT HF NB TST OR TST HYB OUT JACK														

* BRIDGING LOSS OF 51A PAD

Fig. 1—Monitoring Oscillator Reference Power Record

▶ TABLE A ◀

11.648-MHz PILOT POWER

MILE*	DB	MILE*	DB
0.01	0.135	0.26	3.510
0.02	0.270	0.27	3.645
0.03	0.405	0.28	3.780
0.04	0.540	0.29	3.915
0.05	0.675	0.30	4.050
0.06	0.810	0.31	4.185
0.07	0.945	0.32	4.320
0.08	1.080	0.33	4.455
0.09	1.215	0.34	4.590
0.10	1.350	0.35	4.725
0.11	1.485	0.36	4.860
0.12	1.620	0.37	4.995
0.13	1.755	0.38	5.130
0.14	1.890	0.39	5.265
0.15	2.025	0.40	5.400
0.16	2.160	0.41	5.535
0.17	2.295	0.42	5.670
0.18	2.430	0.43	5.805
0.19	2.565	0.44	5.940
0.20	2.700	0.45	6.075
0.21	2.835	0.46	6.210
0.22	2.970	0.47	6.345
0.23	3.105	0.48	6.480
0.24	3.240	0.49	6.615
0.25	3.375	0.50	6.750

* Cumulative deviation in miles is a plus or minus value. The 11.648-MHz pilot power at the input to a given repeater has a corresponding deviation in dB with the *opposite* sign. That is, a cumulative deviation of —0.01 mile equals a deviation of +0.135 dB. This results because a minus cumulative deviation means that the line from the preceding regulating or equalizing repeater is shorter than nominal and the input to the given repeater is higher than nominal.

CHART 1 (Contd)

STEP	PROCEDURE

3. Correction for temperature: obtain from Fig. 7, 8, or 9 according to the length of the regulating section.

Example 1:

Given:

(a) The month is February.

(b) The mean annual cable temperature is 42°F.

(c) The repeater is the first basic repeater preceding the regulating or equalizing repeater in a 12-mile regulating section.

(d) The cumulative deviation from the preceding regulating or equalizing repeater to this basic repeater is −0.06 mile.

Solution:

(a) Determine the deviation in dB from Table A; deviation is +0.81 dB for −0.06 mile.

(b) Determine the temperature correction:

(1) Locate basic repeater 1 (1 BASIC) at the bottom of the graph in Fig. 7 for a 12-mile regulating section.

(2) Go up vertically to the point of intercept with the oblique February line.

(3) Go left horizontally to the 40 to 45°F mean annual temperature scale.

(4) Read the correction: +1.07 dB.

(c) Calculate the required 11.648-MHz pilot power at the repeater input using ***Equation 1:***

−55.00 dBm +0.81 dB + 1.07 dB = −53.12 dBm.

3 Record the computed pilot power value on line 2 of the reference power record.

CHART 1 (Contd)

STEP	PROCEDURE
	C. Expected Repeater Gain at 11.648 MHz (Applicable to Line Repeaters Only)
4	Determine the expected repeater gain at 11.648 MHz from main station test records or by using ***Equation 2.***
	Equation 2: Expected gain at 11.648 MHz = nominal gain (see ***Note 4***) minus loss of LBO networks (see ***Note 5***).
	Notes:
	4. ▸A ***list 1 line*** includes list 1 basic repeaters, list 7 regulating repeaters, and list 2 equalizing repeaters. Nominal repeater gain at 11.648 MHz is 27 dB. A ***list 2 line*** includes list 2 basic repeaters, list 8 regulating repeaters, and list 3 equalizing repeaters. Nominal repeater gain at 11.648 MHz is 26.7 dB. A computer printout for a regulating section shows the 11.648-MHz pilot power values at repeater inputs and outputs at mean annual temperature and at temperatures in the range 20 degrees above and below mean annual temperature. This printout also shows the monitoring oscillator nominal signal input power for each repeater. Repeater gain at 18.5 MHz is 1.25 times the repeater gain at 11.648 MHz.◂
	5. For loss of LBO networks, see line engineering records for LBO networks used and Table B for loss of each network.
5	Record the expected repeater gain value on line 3 of the reference power record.
	D. Monitoring Oscillator Reference Power
	Note: The power of a monitoring oscillator signal at the HF NB TST jack on the control center or at the TST HYB OUT jack in the line receiving bay jack field is dependent on four factors:
	(a) Month of year
	(b) Mean annual cable temperature
	(c) Length of regulating section
	(d) Repeater location within the regulating section.
6	Apply factors (a) through (d) above to Fig. 10, 11, or 12 according to the length of the regulating section to determine the required monitoring oscillator signal power at the HF NB TST or TST HYB OUT jack.

CHART 1 (Contd)

STEP	PROCEDURE

TABLE B

LINE BUILD-OUT NETWORKS

LBO NETWORK CODES		BUILD-OUT IN MILES	LOSS AT 11.648 MHZ (±0.15 DB)
LB01	LB02		
4100A	4100A	0.0	0.00
—	4100B	0.1	1.35
4100AC	4100C	0.2	2.71
4100AD	4100D	0.3	4.07
4100AE	4100E	0.4	5.42
4100AF	4100F	0.5	6.78
4100AG	4100G	0.6	8.14
4100AH	4100H	0.7	9.49
4100AJ	4100J	0.8	10.85
4100AK	4100K	0.9	12.20
4100AL	4100L	1.0	13.56

Example 2:

Given:

(a) The month is February.

(b) The mean annual cable temperature is 42°F.

(c) Repeater is in a 12-mile regulating section.

(d) The repeater is the first basic repeater preceding the regulating repeater.

CHART 1 (Contd)

STEP	PROCEDURE

Solution:

(a) Locate basic repeater 1 (1 BASIC) at the bottom of the graph in Fig. 10 (12-mile regulating section).

(b) Go up vertically to the point of intercept with the oblique February line.

(c) Go left horizontally to the 40 to 45°F mean annual temperature scale.

(d) Determine the required power: −13.3 dBm at the control center HF NB TST jack or −44.7 dBm at the TST HYB OUT jack in the line receiving bay jack field.

7 Record the required monitoring oscillator signal power determined in Step 6 on line 13 of the reference power record.

CHART 2

CHECKING FOR DEFECTIVE DC-DC CONVERTERS

Monitoring oscillator signal powers received at a main station change with time due to cable temperature variations, regulating action in repeaters, basic repeater gain variations, and changes due to equalizer adjustments. Large changes in the received signal powers can be due to trouble causing low current in the monitoring oscillator power loop. Defective dc-dc converters cause signal power changes which may be large enough to give false indications of troubles in line repeaters, or to mask real troubles.

The dc-dc converters which power the monitoring oscillators should be checked periodically. The following test procedure permits the control center attendant to locate defective dc-dc converters at the main stations and equalizing repeater stations. Section 359-205-301 explains the procedure for checking the main station dc-dc converters. Chart 4 explains the procedure for checking the dc-dc converters at an equalizing repeater station.

CHART 2 (Contd)

STEP	PROCEDURE
	Note: This procedure is used when at least four lines are equipped. If less than four lines are equipped, the monitoring oscillator loop current may be checked at the equalizing repeater stations per Chart 4 in this section.
	A. Prepare Spectrum Analyzer
	At control center in main station,
1	Operate the ON-OFF pushbutton on the monitoring signal indicator panel above the spectrum analyzer, if required, to light the MON SIG lamp.
2	Select the SINGLE SWEEP mode on the time base plug-in; prepare the storage oscilloscope for a slow sweep rate of approximately one second.
3	Select the STORE mode on the oscilloscope.
	B. Select the Desired Location
	On route and line select panel,
4	Operate the OFF-MAN-AUTO switch to MAN.
5	Depress the following pushbuttons, in turn: LINE RLS, route select for desired route, NEAR SECT or FAR SECT, and LINE SELECT for the line in which the dc-dc converter is to be checked.
6	Depress the REC OVRD pushbutton.
7	Depress the LINE SELECT - RECEIVE OVERRIDE pushbutton for the first receive line of the four lines to which monitoring oscillator signals will be applied.
	Note: Select receive override 1 when checking lines L401 and L403 or lines L402 and L404. Select receive override 5 when checking lines L409 and L411 or lines L410 and L412.
	C. Store Signal Displays
8	Turn on a group of monitoring oscillators powered from the main station or equalizing repeater station at which the dc-dc converter is to be checked.
	Note: The dc-dc converter is turned on in the first line of the four lines to which monitoring oscillator signals are applied.

CHART 2 (Contd)

STEP	PROCEDURE
9	Trigger the oscilloscope to store the first monitoring oscillator signal display.
10	Depress the LINE SELECT pushbutton for the other receive line in the set of four lines.
	Note: Do not change the receive override selection.
11	Change the horizontal position control on the oscilloscope slightly to the right.
12	Trigger the oscilloscope to store the second monitoring oscillator signal display.
	Note: The two displays are produced by the same group of monitoring oscillators, powered first by the converter for one line and then by the converter for the other line.
	D. Analyze Signal Displays
13	Observe the two displays obtained.
	Note: The signal amplitudes in the two displays should be nearly equal. A defective converter in one line is indicated when all signals in one display are noticeably lower in amplitude than the corresponding signals in the other display.

Fig. 2 shows recordings of signal powers, received at a main station, from monitoring oscillator groups powered from an equalizing repeater station.

Fig. 2A and 2B are the displays obtained for lines L401 and L403.

The ***initial*** displays in Fig. 2A show the signals received when the oscillators were powered, first by the dc-dc converter for line L401 and then by the converter for line L403. The unequal amplitudes indicate a loop current trouble.

Loop current measurements at the equalizing repeater station showed 10 mA (low) from the converter for line L401 and 14 mA (normal) from the converter for line L403. A defective converter usually results in a loop current of 7 mA or 10 mA, depending on which diode is defective in the converter. The converter for line L401 was replaced and a loop current of 14 mA was obtained.

The ***final*** displays in B show that equal-amplitude signals are received on line L401 regardless which converter is powering the monitoring oscillator group.

Note that one of the monitoring oscillator signals is at very low power and one is missing. The defective converter and defective monitoring oscillators were caused by lightning damage.

CHART 2 (Contd)

STEP	PROCEDURE

Note also that the fourth signal from the right is not at the correct frequency.

Fig. 2C and 2D are the displays obtained for lines L405 and L407, which revealed a defective converter for line L405.

CHART 3

MONITORING OSCILLATOR REFERENCE POWER ADJUSTMENT AT MAIN STATION

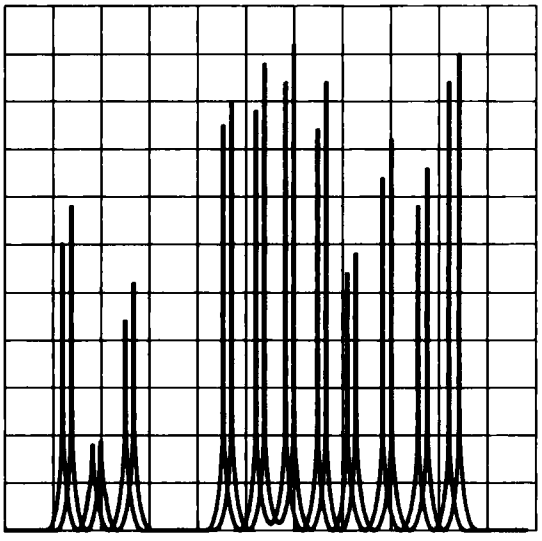
At main stations, a monitoring oscillator assembly is provided in the line receiving bay for the first line of four lines: two receive lines and two transmit lines. The assembly is mounted on the power separation filter shelf (Fig. 3). The four output jacks of the 4103A network serve the four lines.

Monitoring oscillator power adjustment at a main station consists of measuring the power of the signal at the HF NB TST or TST HYB OUT jack and adjusting to the required reference power. To establish reference powers for installation alignment of a replacement monitoring oscillator assembly, the signal power at each associated MON OSC OUT jack in the jack field is measured and recorded.

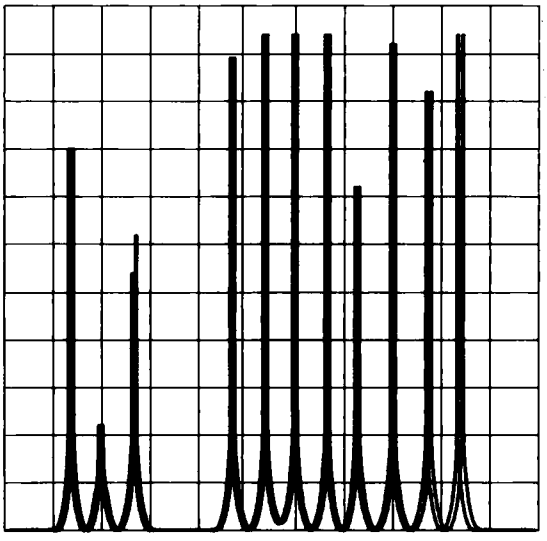
APPARATUS:

These tests require transmission measuring equipment normally provided at an L4 main station.

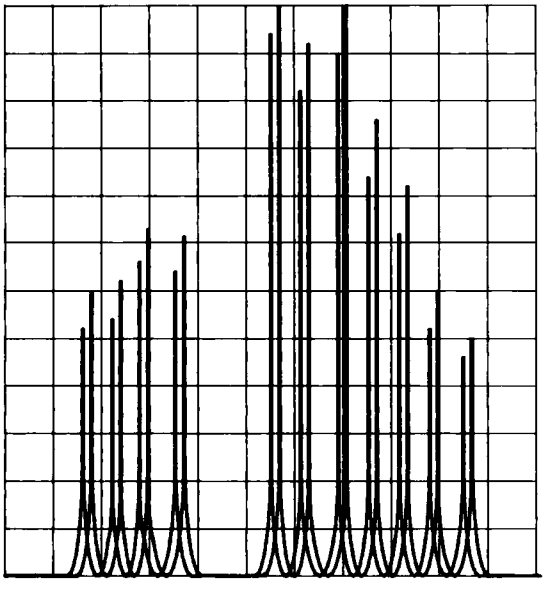
STEP	PROCEDURE
	A. Receiving Repeater
	At receiving main station,
1	Determine from the reference power record the required 11.648-MHz pilot power at the RPTR IN jack.



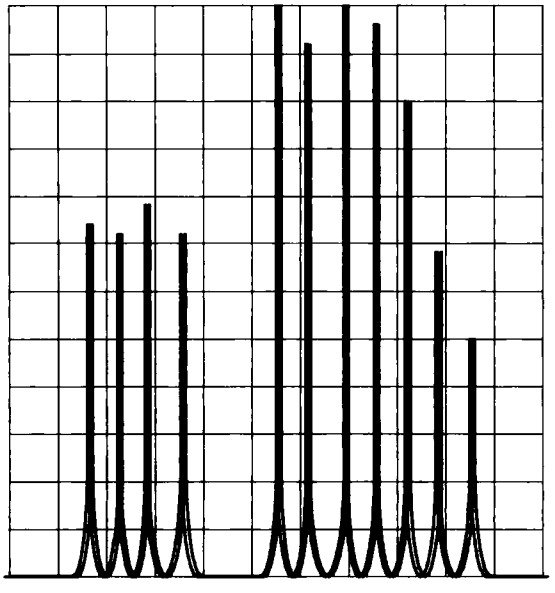
A. INITIAL SIGNALS ON LINE L401



B. FINAL SIGNALS ON LINE L401



C. INITIAL SIGNALS ON LINE L405



D. FINAL SIGNALS ON LINE L405

Fig. 2—Monitoring Oscillator Signal Displays

CHART 3 (Contd)

STEP	PROCEDURE

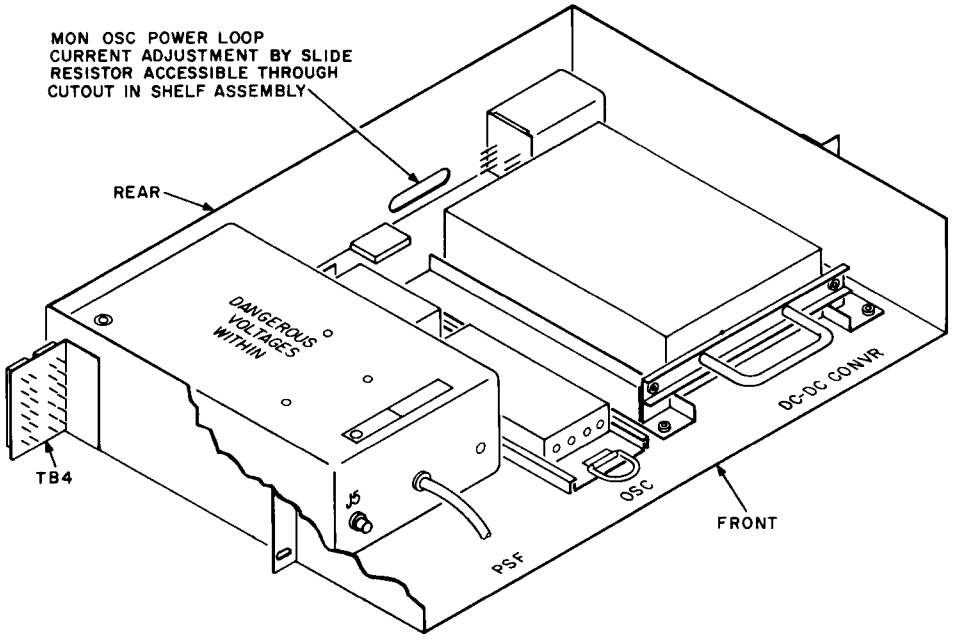


Fig. 3—Power Separation Filter Shelf Including Monitoring Oscillator Units

Note: This required power is 30 dB below the power computed in Part B of Chart 1 and recorded on line 2 of the reference power record. The loss of the pad in the power separation filter is 30 dB. Nominal 11.648 MHz pilot power at the RPTR IN jack is −85 dBm.

2 Prepare the receiving test equipment (RTE) for a 75-ohm terminated measurement of the 11.648-MHz pilot signal at the power determined in Step 1.

3 Connect the RTE to the RPTR IN jack in the line receiving bay jack field.

CHART 3 (Contd)

STEP	PROCEDURE
	Note: Remove the patch plug between the MON OSC OUT and RPTR IN jacks. If the RPTR IN jack is not provided, measure at jack J5 in the power separation filter shelf (Fig. 3) at the top of the bay.
4	Measure the 11.648-MHz pilot power. ***Requirement:*** Power is within ±1.0 dB of the power determined in Step 1. ***Note:*** Replace the patch plug between the MON OSC OUT and RPTR IN jacks.
5	Determine from the reference power record the frequency of the monitoring oscillator signal and the required reference power at the HF NB TST or TST HYB OUT jack.
6	Prepare the RTE for a 75-ohm terminated measurement of the monitoring oscillator signal (18.5xx MHz) at the required reference power.
7	Connect the RTE to the HF NB TST jack at the control center or to the TST HYB OUT jack in the line receiving bay jack field.
8	Apply power to the monitoring oscillator group that includes the oscillator under test.
9	Adjust the appropriate ADJ control on the 4103A network to obtain the required power.
10	Record the date of adjustment on the reference power record.
11	Transfer the RTE to the MON OSC OUT jack in the jack field. ***Note:*** Remove the patch plug between the MON OSC OUT and RPTR IN jacks.
12	Measure the power of the monitoring oscillator signal. ***Requirement:*** Power is between −40 and −30 dBm.
13	Record the measured monitoring oscillator signal power value on line 8 of the reference power record for the repeater under test.
14	Remove power from the monitoring oscillator group.
15	Remove the test equipment and replace the patch plug between the MON OSC OUT and RPTR IN jacks.

CHART 3 (Contd)

STEP	PROCEDURE
	B. Transmitting Repeater
	Note 1: The monitoring oscillator output power applied at the transmitting repeater is adjusted last, to provide the required power at the receiving main station.
	Note 2: The 11.648-MHz pilot power must be at the required value and the transmitting repeater gain must have been checked and adjusted.
	At receiving main station,
16	Determine from the reference power record the frequency of the monitoring oscillator signal and the required reference power of the signal ◗(line 13 in Fig. 1)◖ at the HF NB TST or TST HYB OUT jack.
17	Prepare the RTE for a 75-ohm terminated measurement of the monitoring oscillator signal (18.5xx MHz) at the required reference power.
18	Connect the RTE to the HF NB TST jack at the control center or to the TST HYB OUT jack in the line receiving bay jack field.
19	Apply power to the monitoring oscillator group that includes the oscillator under test.
	At transmitting main station,
20	Adjust the appropriate ADJ control on the 4103A network to obtain the required power at the receiving main station.
21	Record the date of adjustment on the reference power record at the receiving main station.
22	Prepare the RTE for a 75-ohm terminated measurement of the monitoring oscillator signal (18.5xx MHz) at a power of approximately −35 dBm.
23	Remove the patch plug between the MON OSC OUT and MON SIG IN jacks in the line transmitting bay jack field.
24	Connect the RTE to the MON OSC OUT jack.
25	Measure the power of the monitoring oscillator signal.
	Requirement: Power is between −40 and −30 dBm.

CHART 3 (Contd)

STEP	PROCEDURE
26	Report the measured power to the receiving main station for recording on line 8 of the reference power record.
27	Remove power from the monitoring oscillator group.
28	Remove the test equipment and replace the patch plug between the MON OSC OUT and MON SIG IN jacks.

CHART 4

MONITORING OSCILLATOR REFERENCE POWER ADJUSTMENT AT LINE REPEATER STATION

The monitoring oscillator assembly arrangements at a line repeater apparatus case are shown in Fig. 4. The arrangements for adjusting the output signal power are shown in Fig. 5. The arrangements for basic, regulating, and equalizing repeaters are the same except for the outputs used. The 4103A network outputs used at the different line repeater stations are listed in Table C.

Section 620-140-501 contains the procedures for entering an L4 line repeater station; Section 640-440-205 contains the procedures for opening and closing a repeater apparatus case.

Assume that:

(a) The repeater station has been opened per Section 620-140-501.

(b) Communication with the main station has been established.

(c) The station has been ventilated.

(d) The apparatus case has been depressurized and opened per Section 640-440-205.

The power of the 11.648-MHz pilot is measured at the input and output of a repeater to determine if the pilot power is correct at the repeater input and if the repeater gain is within limits. The monitoring oscillator outputs are adjusted to provide the required power. Additional measurements are made and recorded at the receiving main station to establish references for future trouble analysis and alignment of replacement monitoring oscillator assemblies.

CHART 4 (Contd)

APPARATUS:

At line repeater station,

Wandel-Goltermann selective level meter AT463 (Section 103-406-000)

L4 high-voltage isolation test probe ED-51073

Volt-Ohm-Milliammeter (VOM) KS-14510 List 1

Adapter 185A (monitoring oscillator extender tool)

Extractor tool KS-20141 List 1 for removal of 51A pads

Jack 491A (dual jack) with cord and 75-ohm terminating plug for preferred method of monitoring oscillator signal power adjustment

At main station,

Transmission measuring equipment normally provided at the L4 main station.

STEP	PROCEDURE
	A. Check Repeater Gain at 11.648 MHz
	Warning: Hazardous voltages up to 1800 volts may be present within the apparatus case.
1	Prepare the TMS for measurement of the 11.648-MHz pilot at approximately −60 dBm.
	Note: The monitoring oscillator signal is connected to the repeater IN jack as indicated by patches (1) and (2) in Fig. 5.
	Caution: Make patch first to the repeater jack and then connect to the TMS. This will prevent a voltage pulse that can damage the test equipment.
2	Insert the L4 isolation test probe into the OUT jack of the repeater under test [patch (3), Fig. 5].
3	Connect the test probe to the input of the TMS [patch (4), Fig. 5].

CHART 4 (Contd)

STEP	PROCEDURE
4	Measure and record the power of the 11.648-MHz pilot signal from the repeater OUT jack.
5	Disconnect the L4 isolation test probe from the TMS.
6	Remove the L4 isolation test probe from the OUT jack of the repeater.
7	Use extractor tool KS-20141, List 1 to remove the 51A pad from the repeater IN jack.
8	Prepare the TMS for measurement of the 11.648-MHz pilot at approximately −85 dBm.
9	Insert the L4 isolation test probe into the repeater IN jack [patch (5), Fig. 5].
10	Connect the test probe to the input of the TMS [patch (4), Fig. 5].
11	Measure and record the power of the 11.648-MHz pilot signal from the repeater IN jack.
12	Disconnect the L4 isolation test probe from the TMS.
13	Remove the L4 isolation test probe from the IN jack of the repeater.
14	Report the output and input pilot power values recorded in Steps 4 and 11 to the receiving main station.
15	Request confirmation that the input pilot power and repeater gain are within limits. ***Requirement:*** Gain is within ±1.5 dB of the expected gain computed in Part C of Chart 1 and recorded on line 3 of the reference power record. ***Note:*** The repeater gain equals the difference between the power measured in Step 11 and the power measured in Step 4. A faulty repeater must be replaced before continuing with this procedure.
	B. Check Monitoring Oscillator Power Loop Current
16	Advise the attendants at both ends of the control section ***not*** to apply power to the group that includes the monitoring oscillator under test.
17	Remove the patch cords from the output jacks of the monitoring oscillator assembly.
18	Loosen the fastener on the monitoring oscillator assembly retaining bar.

CHART 4 (Contd)

STEP	PROCEDURE
19	Remove the monitoring oscillator assembly from the apparatus case mounting slot.
20	Insert a 185A adapter in place of the assembly (Fig. 3).
21	Connect the 185A adapter ground clip to the apparatus case.
22	Perform the following steps at the equalizing repeater locations to check the direct current for each monitoring oscillator power loop. For other locations, proceed to Step 28.
23	Set the VOM function switch to the 120 DC MA position.
24	Connect the VOM leads to jacks A and F on the connector of the 185A adapter.
	Note: Connect the black lead to the A (−) jack and connect the red lead to the F (+) jack.
25	Request that the main station attendant apply power to the monitoring oscillator group that includes this repeater location.
	Requirement: VOM indicates 15 mA direct current.
26	Request that the main station attendant remove power from this monitoring oscillator group.
27	Remove the VOM leads from the connector of the 185A adapter.
	C. Check Monitoring Oscillator Signal Power
28	Connect the connector of the 185A adapter to the plug on the 66-type oscillator on the monitoring oscillator assembly.
	Note: An adapter with a long cord will permit signal measurements and adjustments outside the line repeater station.
29	Reconnect the patch cords to the appropriate output jacks on the monitoring oscillator assembly.
30	Request that the attendant apply power to the loop supplying the monitoring oscillator assembly under test.
31	Preceed to Step 32 for the preferred method of monitoring oscillator signal power adjustment or proceed to Step 38 for the alternate method.

CHART 4 (Contd)

STEP	PROCEDURE
	Preferred Method
32	Use a test arrangement as shown in Fig. 6.
33	Measure and record the signal power at the A (J4) output of the 4103A network by connecting a patch cord directly to the TMS [patch (1), Fig. 6].
	Requirement: Power is between −40 and −25 dBm.
34	Measure the signal power by connecting the A (J4) output to the TMS via the patch cord, a 51A pad, and the 491A jack [patches (2) through (5), Fig. 6].
	Note: The 75-ohm terminating plug simulates the impedance of the L4 line.
	Requirement: Power is 30.0 ±0.3 dB below the power measured in Step 33.
35	Adjust the ADJ A control on the network to obtain the power required at the repeater IN jack served by this output.
36	Repeat Steps 33 through 35 to adjust the signal power at the other 4103A network outputs to be used.
37	Proceed to Step 50.
	Alternate Method
38	Patch the monitoring oscillator signal via a 51A pad to the repeater IN jack [patches (1) and (2), Fig. 5].
39	Request the attendant at the receiving main station to measure the power of the monitoring oscillator signal under test.
	Requirement: Reference power determined in Part D of Chart 1.
40	Proceed to Step 41 if the requirement is met. Otherwise, adjust the appropriate ADJ control on the 4103A network to meet the requirement.
41	Prepare the TMS for a measurement of the monitoring oscillator output signal at a power of approximately −60 dBm.

CHART 4 (Contd)

STEP	PROCEDURE
42	Use extractor tool KS-20141, List 1 to remove the 51A pad from the repeater IN jack.
43	Connect the 51A pad directly into the TMS input jack [patch (6), Fig. 5].
44	Measure the power of the monitoring oscillator signal.
45	Report the measured value to the attendant at the receiving main station for recording in the reference power record.
46	Remove the 51A pad from the test set and cord assembly.
47	Connect the cord from the monitoring oscillator assembly directly into the TMS input jack [patch (7), Fig. 5].
48	Measure the power of the monitoring oscillator signal. ***Requirement:*** Power is between −40 and −25 dBm.
49	Report the measured value to the attendant for recording in the reference power record. ***Note:*** The difference between the values measured in Step 44 and Step 48 is the ***terminating*** loss of the 51A pad. The ***bridging*** loss of a 51A pad is 30 dB.
50	Request that the attendant remove power from the power loop supplying the monitoring oscillator.
51	Remove the 185A adapter from the mounting slot in the apparatus case.
52	Install the monitoring oscillator assembly in the mounting slot of the apparatus case.
53	Ensure that each required output jack is connected via a cord and 51A pad to the appropriate repeater IN jack per Table C.
54	Request that the attendant apply power to the loop supplying the monitoring oscillator assembly under test.
55	Insert the L4 high-voltage isolation test probe into the repeater OUT jack [patch (3), Fig. 5].
56	Connect the test probe to the TMS input [patch (4), Fig. 5].

CHART 4 (Contd)

STEP	PROCEDURE
57	Measure the power of the monitoring oscillator signal.
58	Report the measured value to the attendant for recording in the reference power record.

Note: The repeater gain at the monitoring oscillator frequency can be determined from the values measured in Steps 48 and 57.

Example 3:

Power at 4103A network output measured in Step 48:	−32.0 dBm
Loss due to 51A pad:	−30.0 dB
Power at repeater IN jack (Step 48 power minus loss in 51A pad):	−62.0 dBm
Power at repeater IN jack:	−62.0 dBm
Power at repeater OUT jack measured in Step 57:	−33.0 dBm
Repeater gain (difference between powers at repeater IN and OUT jacks):	−29.0 dB.

59	Remove power from the monitoring oscillator group.
60	Remove all test equipment.
61	Close the apparatus case and repeater station as prescribed in Sections 640-440-205 and 620-140-501.

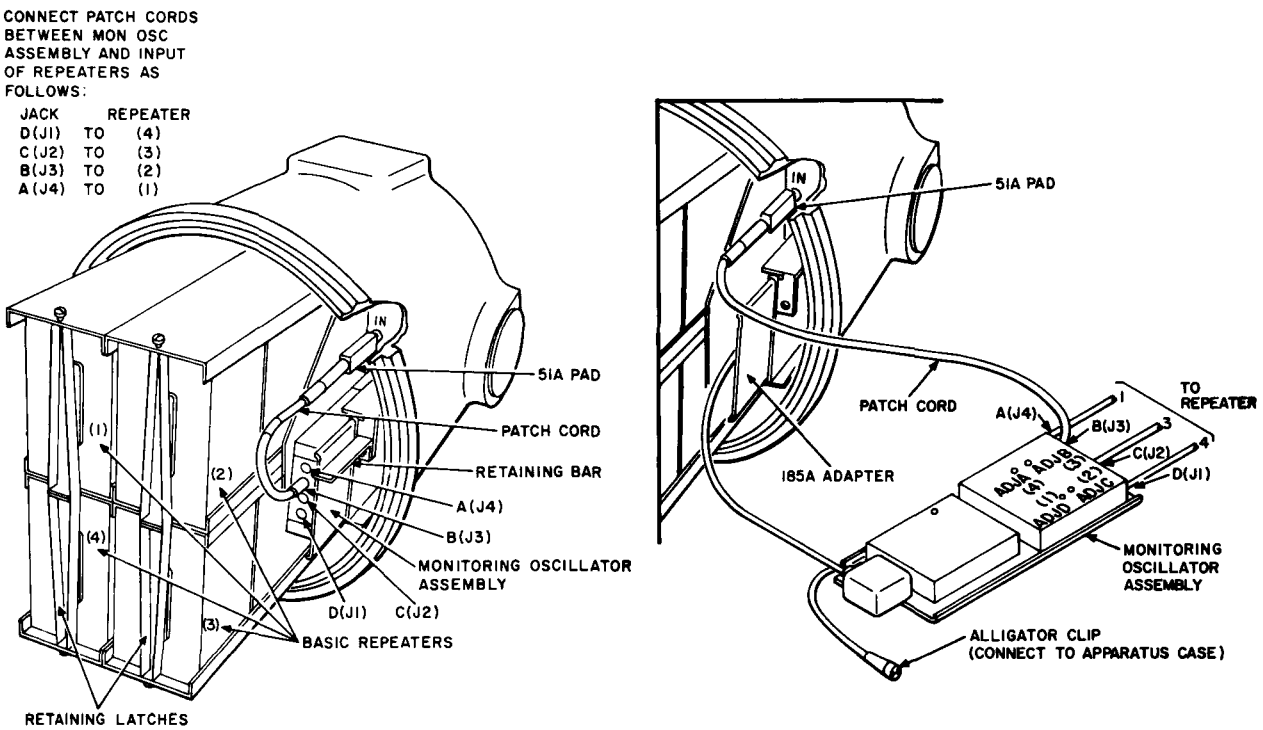


Fig. 4—Equipment Arrangements at Line Repeater Stations

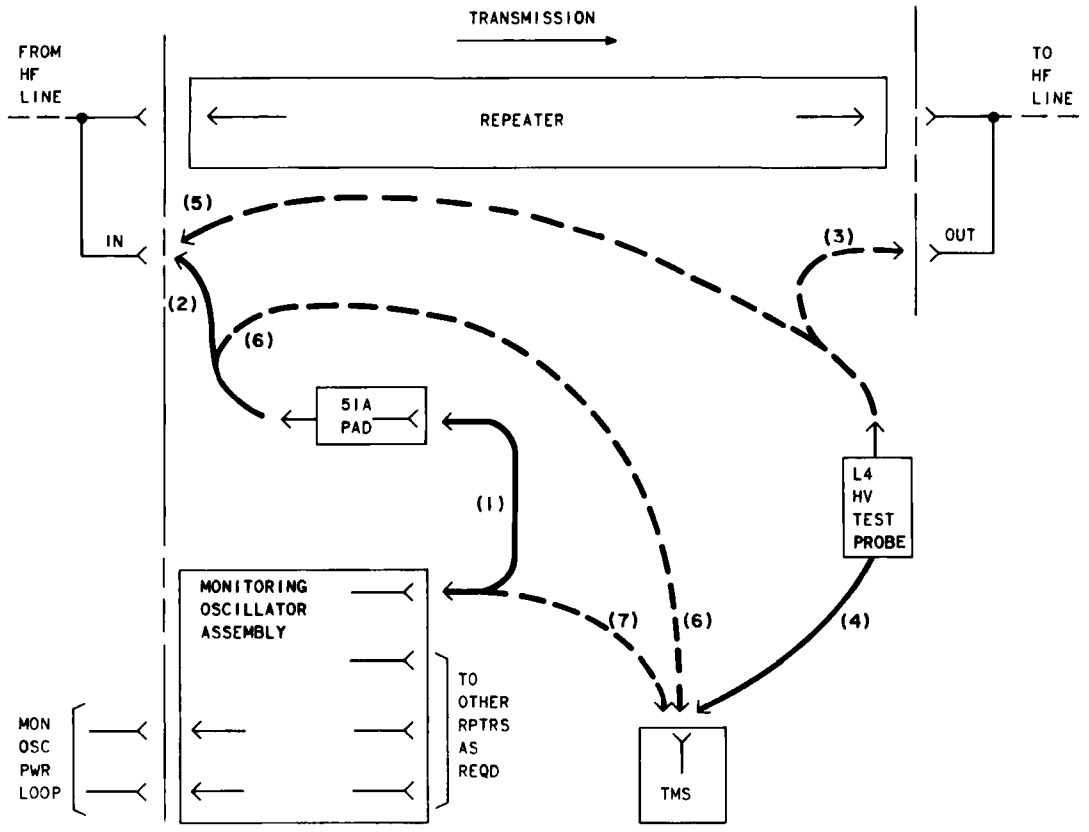


Fig. 5—Test Arrangements at Line Repeater Stations

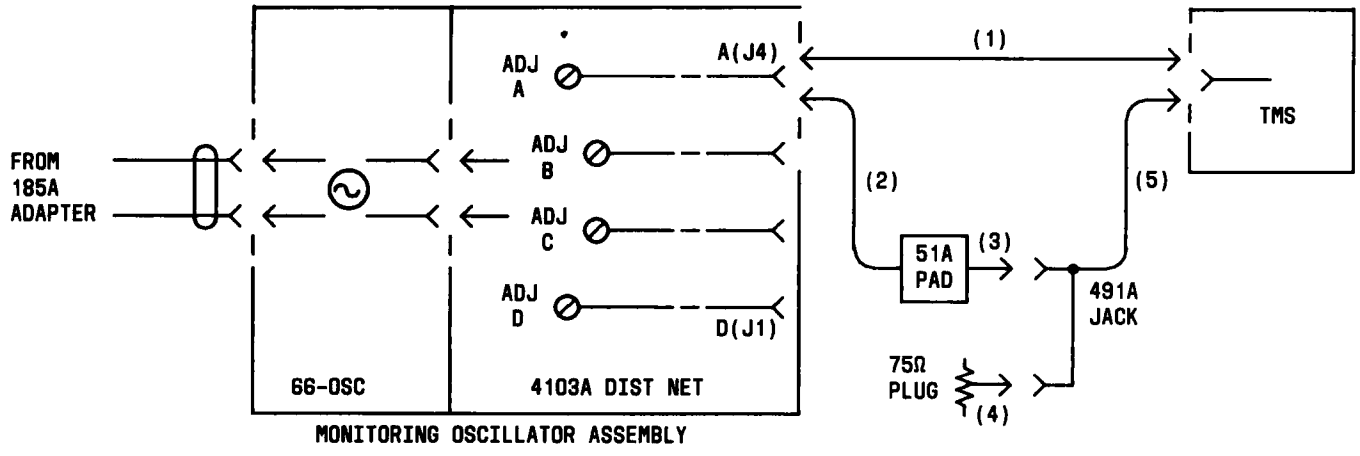
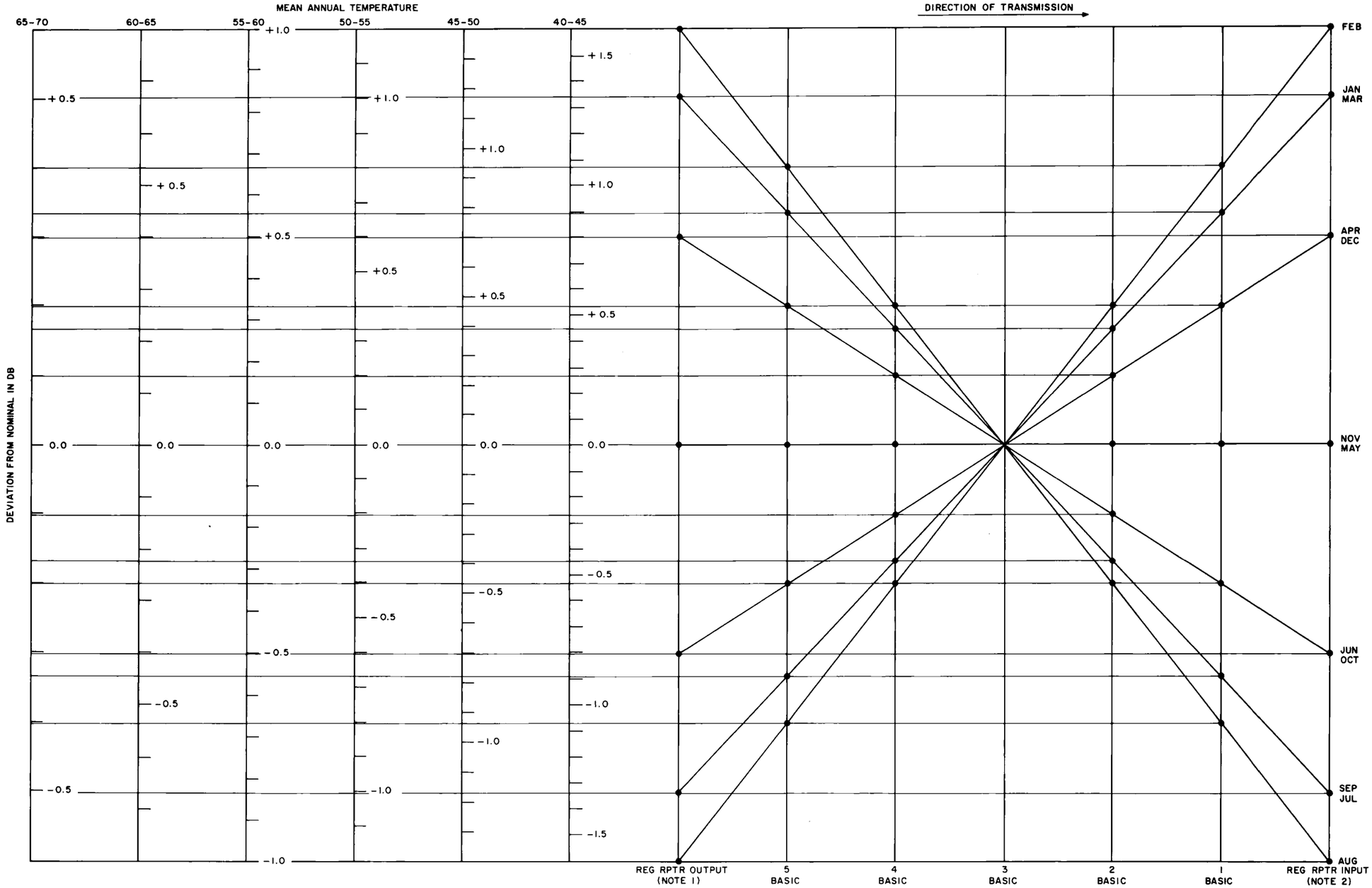


Fig. 6—Test Arrangement for Preferred Method

TABLE C

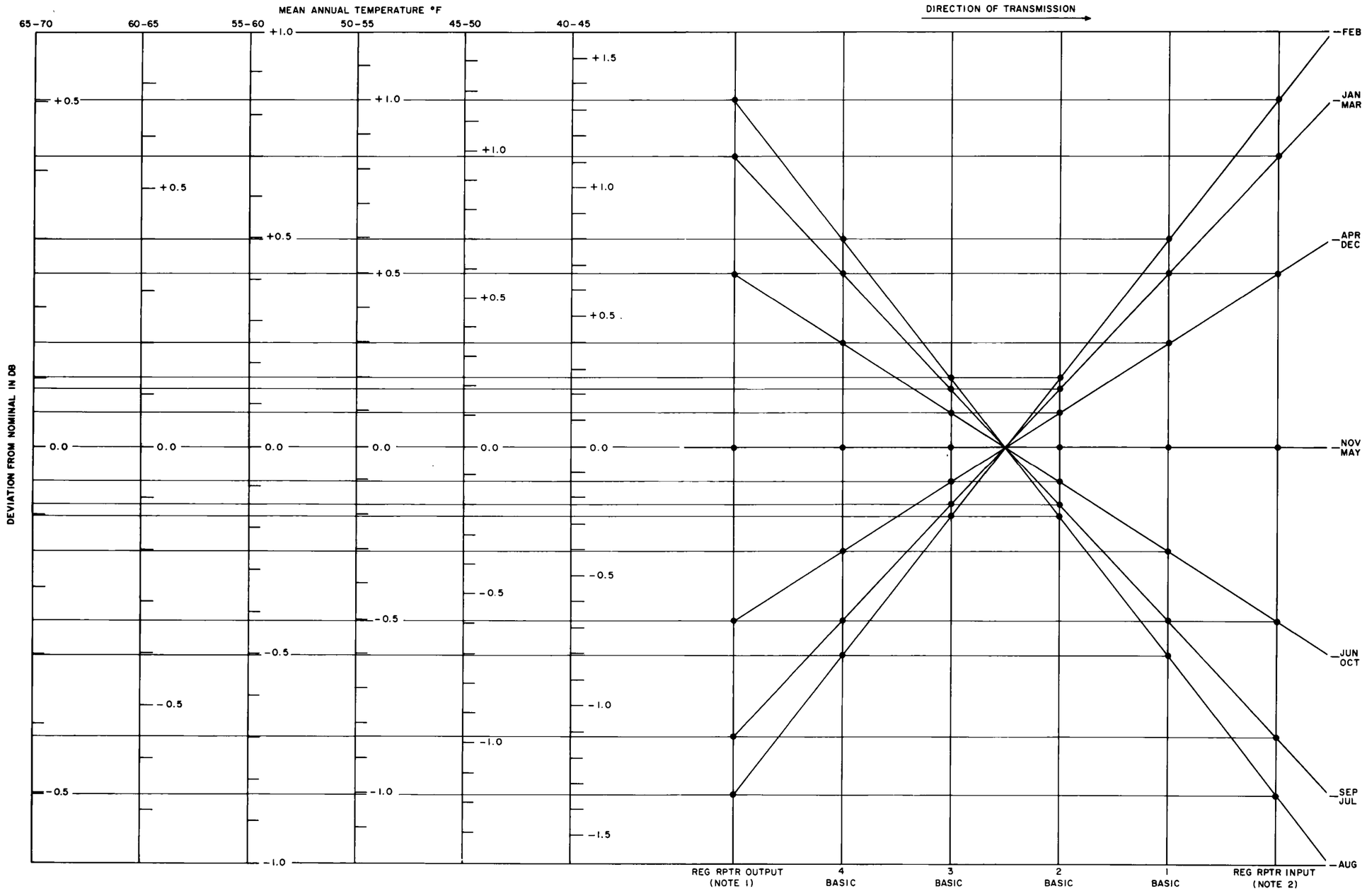
4103A NETWORK OUTPUT ASSIGNMENT

4103A NETWORK OUTPUT JACKS MAY BE MARKED PER EITHER OF THE FOLLOWING			LINE REPEATER		
			BASIC	REGULATING	EQUALIZING
J4	A (J4)	A	1	2	1
J3	B (J3)	B	2	Not Used	Not Used
J2	C (J2)	C	3	Not Used	Not Used
J1	D (J1)	D	4	1	Not Used



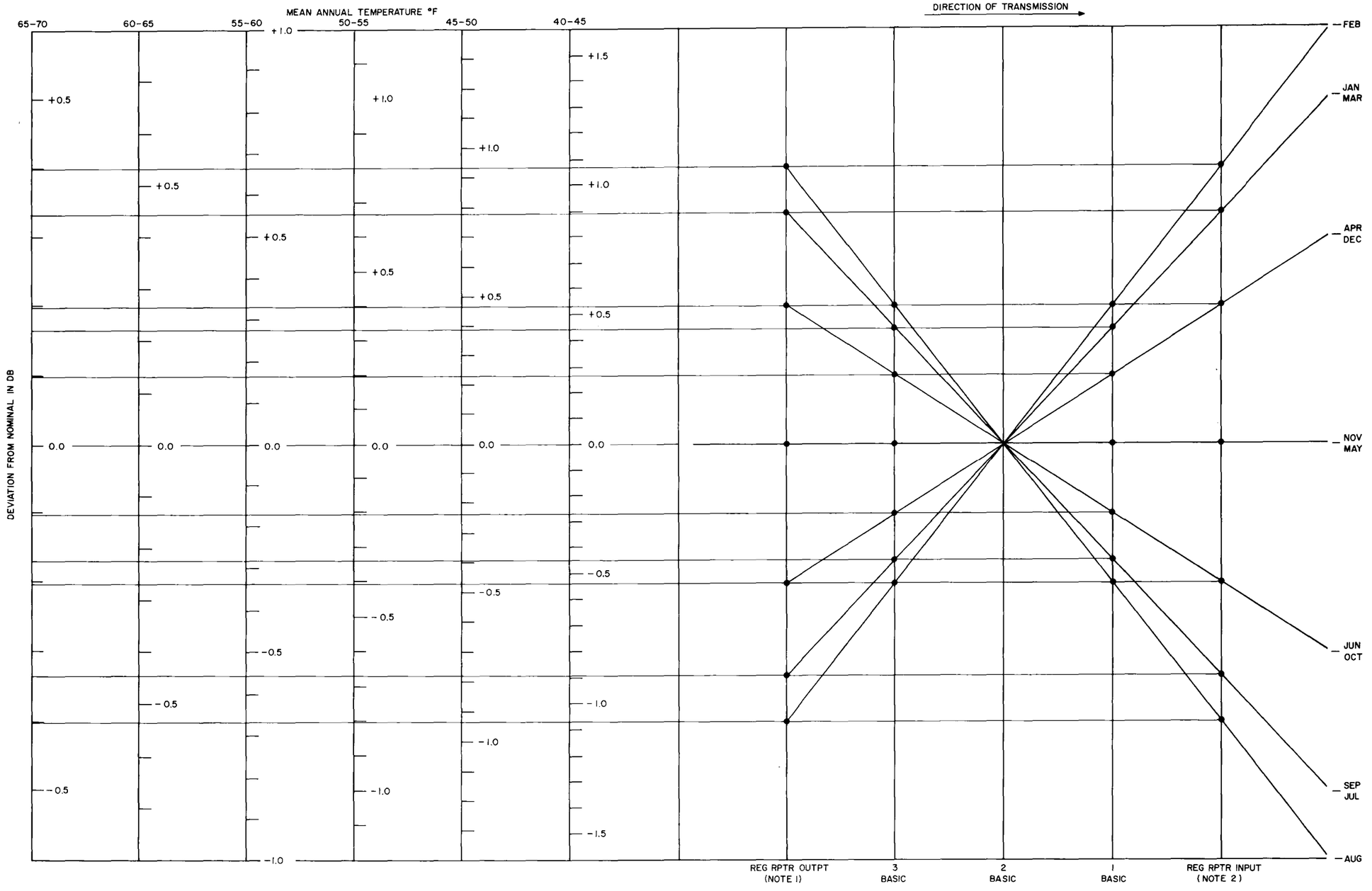
NOTES:
1. NOMINAL 11.648-MHZ PILOT POWER AT REPEATER OUTPUT: -28 DBM ± CUMULATIVE DEVIATION. (SEE LINE ENGINEERING INFORMATION.)
2. NOMINAL 11.648-MHZ PILOT POWER AT REPEATER INPUT: -55 DBM ± CUMULATIVE DEVIATION. (SEE LINE ENGINEERING INFORMATION.)

Fig. 7—Pilot Power for 12-Mile Regulating Section



NOTES:
1. NOMINAL 11.648-MHZ PILOT POWER AT REPEATER OUTPUT: -28 DBM ± CUMULATIVE DEVIATION. (SEE LINE ENGINEERING INFORMATION.)
2. NOMINAL 11.648-MHZ PILOT POWER AT REPEATER INPUT: -55 DBM ± CUMULATIVE DEVIATION. (SEE LINE ENGINEERING INFORMATION.)

Fig. 8—Pilot Power for 10-Mile Regulating Section



NOTES

1. NOMINAL 11.648-MHZ PILOT POWER AT REPEATER OUTPUT: -28DBM ± CUMULATIVE DEVIATION (SEE LINE ENGINEERING INFORMATION.)
2. NOMINAL 11.648-MHZ PILOT POWER AT REPEATER INPUT: -55DBM ± CUMULATIVE DEVIATION (SEE LINE ENGINEERING INFORMATION.)

Fig. 9—Pilot Power for 8-Mile Regulating Section

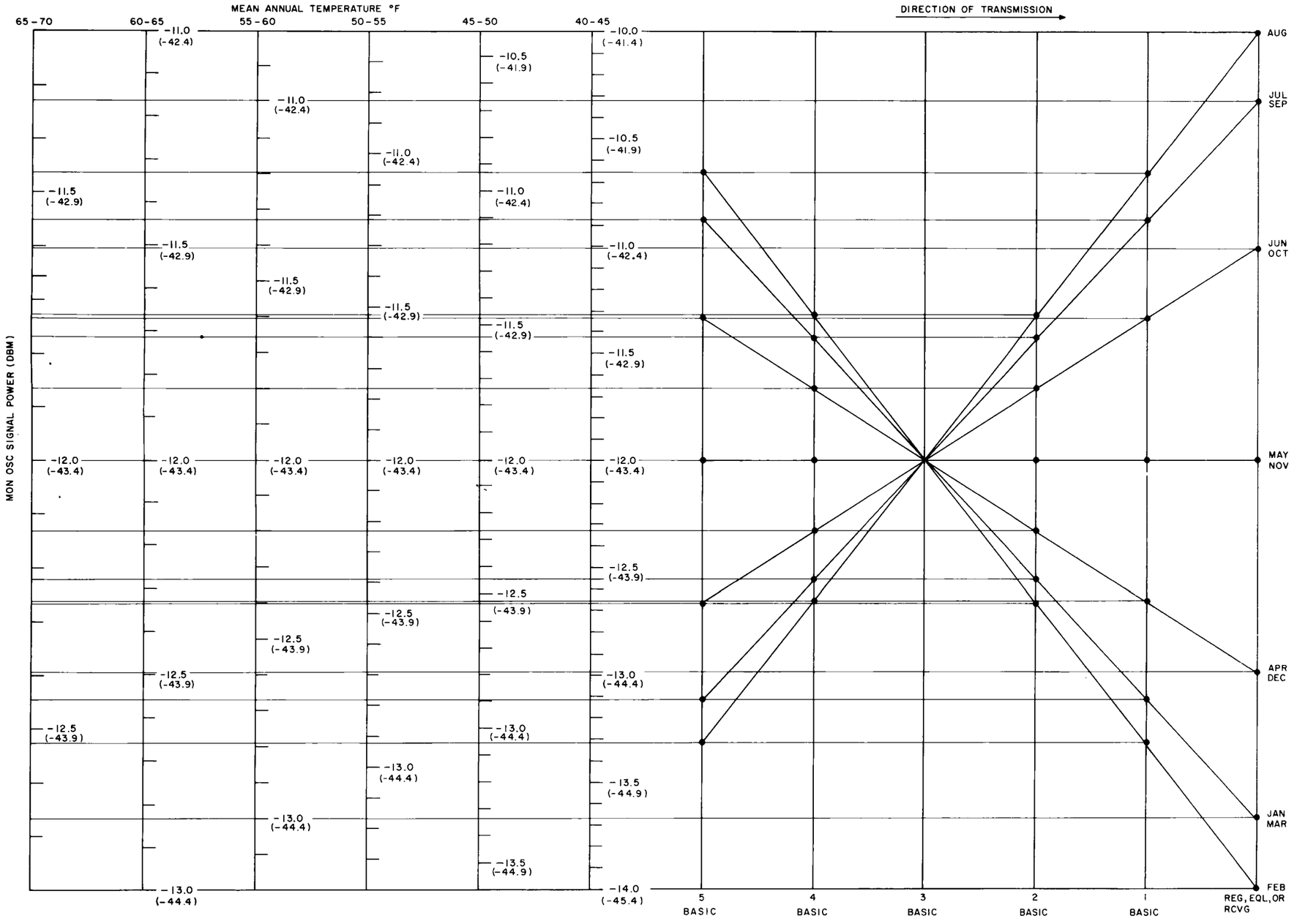


Fig. 10—Monitoring Oscillator Signal Power for 12-Mile Regulating Section

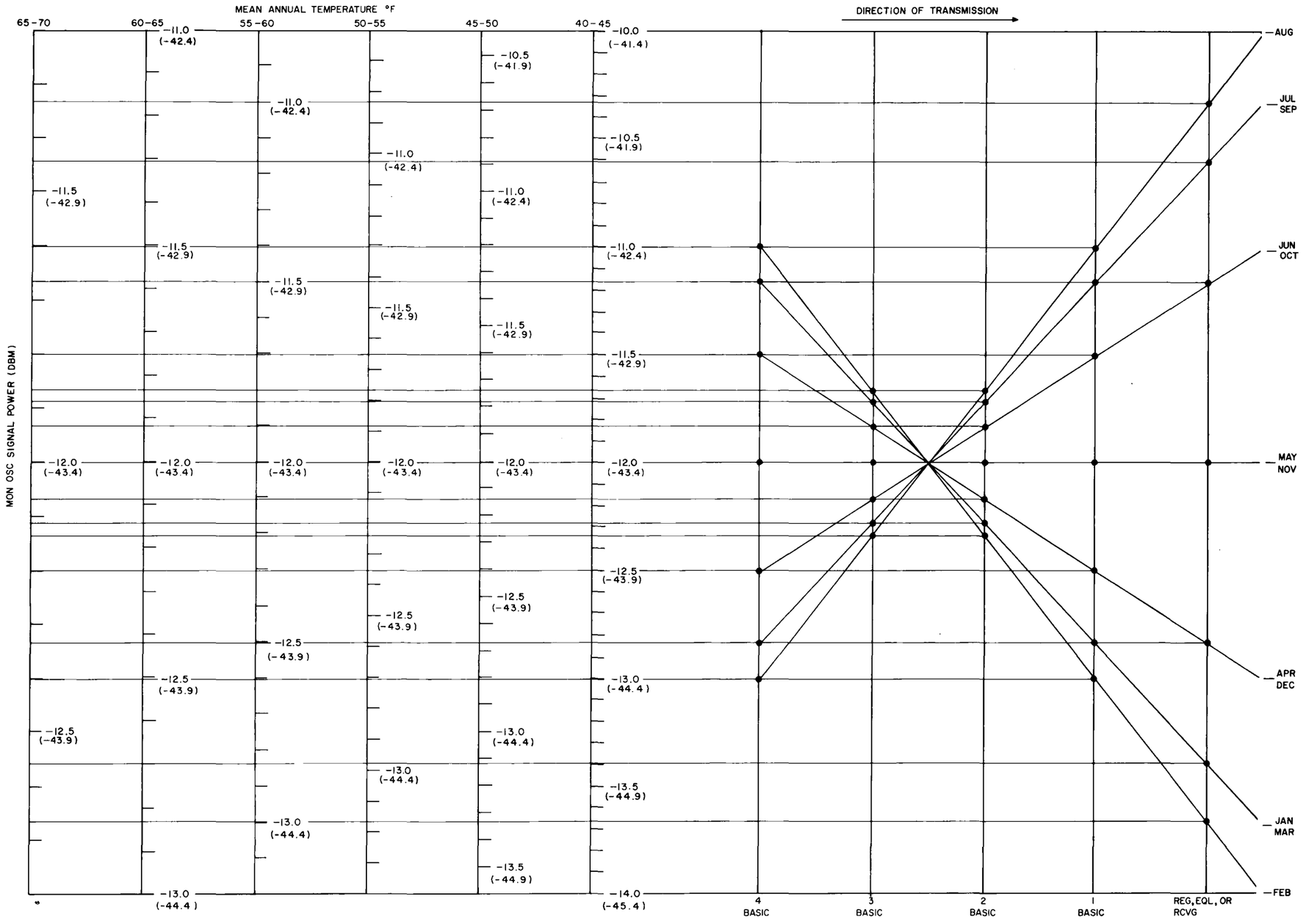


Fig. 11—Monitoring Oscillator Signal Power for 10-Mile Regulating Section

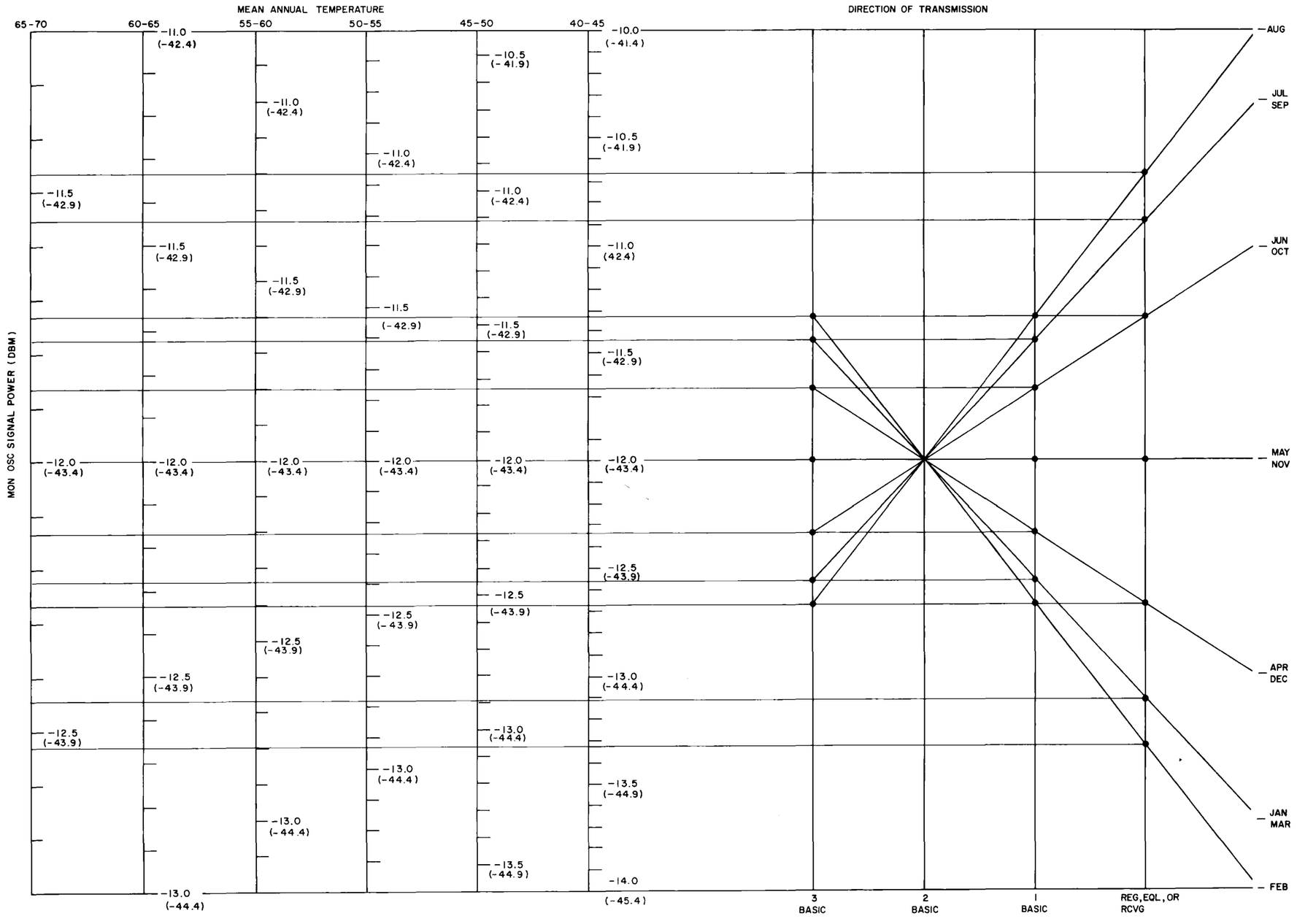


Fig. 12—Monitoring Oscillator Signal Power for 8-Mile Regulating Section