EQUALIZATION PROCEDURES

TESTS

OVERALL SYSTEM

L4 CARRIER

CONTENTS PAGE

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1. GENERAL

1.01 This section provides procedures for equalizing L4 lines. Procedures are included for lines equipped only with ***stepped*** equalizers which are adjusted from a control center in a main station, for lines equipped only with ***manual*** equalizers, and for lines equipped with ***stepped*** equalizers at the main stations and ***manual*** A equalizers at equalizing repeater stations. Control center attendants must understand the operation of the remote control system and the equalization principles that are explained in Section 359-220-300. Only ***manual*** equalizers are provided in the main stations for L4S lines. Section 359-230-501 includes the equalization procedure for L4S lines.

1.02 This section is reissued to provide Warnings on the operation of the INCR pushbuttons and to provide information on maintenance limits for misalignment in the L4 system. Arrows are used to denote significant changes. Equipment Test Lists are not affected.

1.03 The A equalizer test signal modification (A and B tone access units added) permits the A equalizer test signals to be inserted ***before*** the B equalizer at a transmitting main station and to be inserted ***after*** the B equalizer at a receiving main station. This modification permits the gain deviations within the B equalizer to be corrected

when the A equalizer networks are adjusted. This modification (access unit ED-52390) is included in all List 3 and List 4 B equalizers at time of manufacture. The modification (access unit ED-52391) can be added to List 1 (MD) and List 2 B equalizers.

1.04 The equalization procedures explained in this section have the following features:

(a) It is not necessary to measure the equalizer gains.

(b) The DB switches on the control center are used to store information as to the amount of correction required.

(c) Equalizer adjust meters indicate the corrections as they occur so that a control center attendant is assured that commands are received and executed at the location selected.

(d) Interactions among equalizer networks are continuously indicated on the equalizer adjust meters during adjustments; corrections for these interactions occur as the adjustments are made.

1.05 For initial alignment, all equalizers should be at reset before beginning measurements and adjustments. At ***reset,*** the gain from equalizer input to output is 0 dB at the test frequency for each network.

(a) ***Manual*** equalizers are reset in the main station using the line repeater test set. After a manual equalizer is reset, measure the power at each of the six equalizer test frequencies at the EQL TEST IN and EQL TEST OUT jacks on the front panel. Differences between the measured values at a given frequency are due to the test jack arrangement. The six difference values computed from the EQL TEST OUT jack and the EQL TEST IN jack measurements should be posted on the equalizer. Recording these values facilitates resetting the equalizer. Similarly, after a manual equalizer is installed and adjusted, the six difference values for the adjusted equalizer can be recorded to permit checking for changes in equalizer performance.

(b) ***Stepped*** equalizers are reset by a command pulse from a control center.

1.06 After all equalizer networks have been adjusted once, a second cycle of adjustment may be required to refine the precision of network adjustments. For subsequent adjustments at periodic intervals, one cycle of adjustment should provide the required precision of adjustment.

1.07 The following procedure may be used to determine if reequalization of L4 lines is required.

(a) Check the gain deviations over an equalizing section at the A equalizer test frequencies once a week. Deviation greater than 0.5 dB, but less than 1.0 dB from 0, at one or more frequencies indicates the need for reequalization. Deviations greater than 1 dB occurring within a week indicate trouble. This trouble should be cleared instead of trying to compensate for the trouble by reequalizing the line.

(b) Check the gain deviations over an equalizing section at the B equalizer test frequencies once a month, on an out-of-service basis if possible. Deviation greater than 0.5 dB, but less than 1.0 dB from 0, at one or more frequencies indicates the need for reequalization. Deviations greater than 1 dB occurring within a month indicate trouble.

Experience will indicate how often the lines must be reequalized.

1.08 An equalization procedure includes four main actions, as follows:

(1) ***Measure*** the gain of each equalizing section

(2) ***Calculate*** DB switch settings to store the required corrections

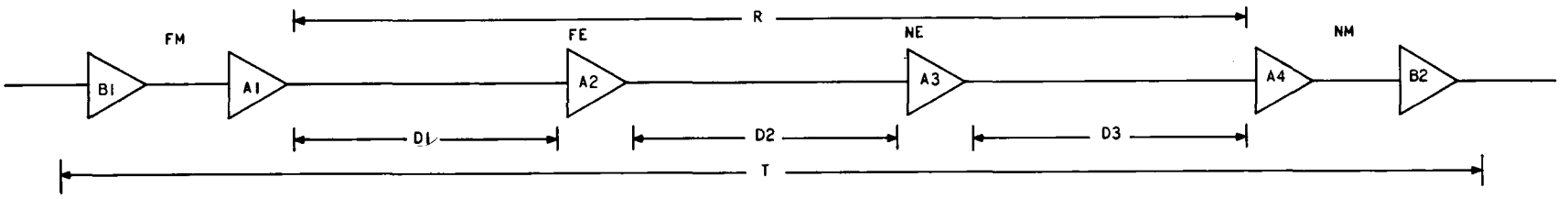
(3) ***Adjust*** the equalizer networks

(4) ***Correct*** the residual gain deviations over the entire line section.

1.09 Sample forms with measured values entered are shown in Fig. 1 and 2. Blank forms are provided in Fig. 8 through 10.

2. PREPARATION FOR EQUALIZING LINE

2.01 Perform the following steps at the control center before making equalizer measurements.



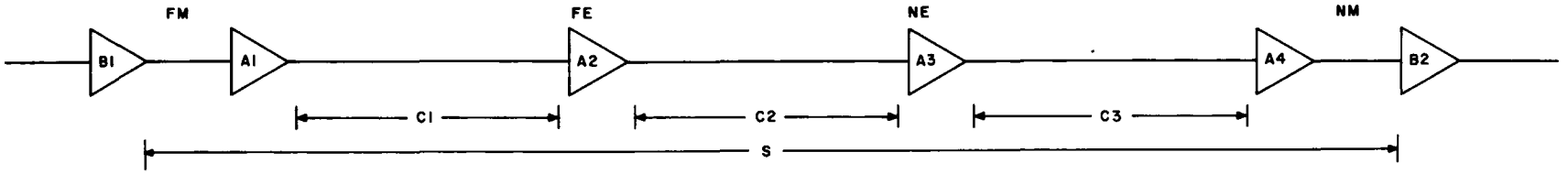
SET DB SWITCHES	RECORD	EQUALIZER ADJUST METERS 1	2	3	4	5	6
	R		-12.6		+9.8		
FE IN	-R/3		+4.2		-3.3		
NE IN	-R/3		+4.2		-3.3		
FM IN	R/6		-2.1		+1.6		
NM IN	R/6		-2.1		+1.6		
	T		-2.3		-3.3		
FM IN	T/2		-1.2		-1.7		
NM IN	T/2		-1.1		-1.6		

DATE: 7-22-73 BY: PMH
ROUTE: BOONE
LINE: 407
SECTION: (NEAR) FAR
REMARKS:

EQUALIZER ADJUST METERS 7	8	9	10

NOTES:
1. D1, D2, AND D3 REPRESENT GAIN AT A EQUALIZER TEST SIGNALS FROM OUTPUT OF ONE A EQUALIZER TO INPUT OF NEXT A EQUALIZER.
2. R REPRESENTS SECTION GAIN AT A EQUALIZER TEST SIGNALS FROM OUTPUT OF A EQUALIZER AT FM TO INPUT OF A EQUALIZER AT NM WHEN MANUAL EQUALIZERS A2 AND A3 ARE AT RESET.
3. T REPRESENTS SECTION GAIN AT B EQUALIZER TEST SIGNALS FROM INPUT OF B EQUALIZER AT FM TO OUTPUT OF B EQUALIZER AT NM.
4. GAIN AT THE A AND B EQUALIZER TEST SIGNALS IS RECORDED TO NEAREST TENTH. WHERE THERE IS AN ODD NUMBER OF TENTHS, INSERT GREATER CORRECTION AT MORE DISTANT EQUALIZER.

Fig. 1—Sample Form for Line with Manual Equalizers



SET DB SWITCHES	RECORD	EQUALIZER ADJUST METERS 1	2	3	4	5	6
FM IN	1/2 C1	-2.2				+1.3	
	C1	-4.4				+2.6	
	1/2 C1	-2.2				+1.3	
	1/2 C2	-2.4				+0.9	
FE IN	TOTAL	-4.6				+2.2	
	C2	-4.7 (NOTE 3)			(NOTE 3) +1.7		
	1/2 C2	-2.3				+0.8	
	1/2 C3	-1.6				-1.4	
NE IN	TOTAL	-3.9				-0.6	
	C3	-3.1				-2.8	
NM IN	1/2 C3	-1.5				-1.4	
	S	-2.3				-3.2	
FM IN	1/2 S	-1.2				-1.6	
NM IN	1/2 S	-1.1				-1.6	

DATE: 7-22-74 BY: RPO
ROUTE: MUDDY GAP
LINE: 403
SECTION: NEAR (FAR)
REMARKS:

EQUALIZER ADJUST METERS 7	8	9	10

NOTES:
1. C1, C2, AND C3 REPRESENT GAIN AT A EQUALIZER TEST SIGNALS FROM OUTPUT OF ONE A EQUALIZER TO INPUT OF NEXT A EQUALIZER.
2. S REPRESENTS SECTION GAIN AT B EQUALIZER TEST SIGNALS FROM OUTPUT OF B EQUALIZER AT FM TO INPUT OF B EQUALIZER AT NM.
3. GAIN AT THE A AND B EQUALIZER TEST SIGNALS IS RECORDED TO NEAREST TENTH. WHERE THERE IS AN ODD NUMBER OF TENTHS, INSERT GREATER CORRECTION AT MORE DISTANT EQUALIZER.

Fig. 2—Sample Form for Line with Stepped Equalizers Only

A. Check Receiving Circuit

Note: In the following steps, the six A and ten B equalizer test signals are applied at the output of an equalizer in the near main station to check for normal operation of the control center receiving circuit.

(1) Check that all ten equalizer adjust meter needles are on 0 when all route and line select pushbuttons are released.

(2) Depress the following pushbuttons in turn: LINE RLS, route select for the desired route, NEAR SECT, line select for the desired line, and NEAR MAIN REP OUTPUT.

(3) Depress the INCR pushbuttons, as required, so that the INCR 5DB pushbutton indicator lamps are lighted and the INCR 10DB pushbutton indicator lamps are extinguished.

(4) Operate all DB switches to 0.

(5) Depress the SELECT B pushbutton.

(6) Adjust the CAL control associated with each meter to obtain an indication of 0 on each of the ten meters.

(7) Depress the SELECT A pushbutton.

(8) Adjust the CAL controls to obtain an indication of 0 on each of the first six meters.

(9) Proceed with equalizer measurements and adjustments, as required.

B. Calibrate Measuring Circuits

2.02 The equalizer adjust meters indicate only ***reference*** levels. The input or output of any equalizer can be selected to serve as the reference point for gain-deviation measurements. Equalizer test signals are applied at this point and the gains in the control center measuring circuits are adjusted until the equalizer adjust meters indicate 0. This procedure calibrates the measuring circuits:

(1) Operate all DB switches to 0.

(2) Program to apply equalizer test signals at the input or output of the selected equalizer.

Warning: Care must be taken when operating the INCR pushbutton so that only 5 dB of loss is removed at a time, since excessive signal power can damage the crystal filters which select the equalizer test signals.

(3) The following procedure is recommended when operating the INCR and CAL controls to calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0 if possible. If an indication of 0 cannot be obtained, continue this procedure removing ***only*** 5 dB of loss at a time.

Note: Calibration establishes the power of the equalizer test signals received as reference levels.

2.03 The measuring circuits are now calibrated. Gain deviations are determined by applying equalizer test signals at another point and operating the DB switches to cause the meter indications to return to 0. The procedure for measuring gain deviations follows.

C. Measure Gain Deviations

2.04 Measurements and adjustments are made starting at the more distant main repeater in a section and proceeding toward the nearer main repeater in that section.

2.05 By comparing the equalizer test signal powers received from two points, a control center attendant can determine the gain deviation (misalignment) which is caused by the line and equipment between these two points. Thus, an attendant can determine the amount and direction the adjustable equalizer networks must be changed to give a flat, zero-gain frequency response.

2.06 Gain deviations between two points are measured by calibrating the measuring circuits using equalizer test signals applied at the ***upstream*** point and then determining the relative power received when equalizer test signals are applied at the ***downstream*** point.

D. Adjust Equalizers

2.07 The A and B equalizer networks can be adjusted by means of command pulses sent from the control center. Commands to adjust an equalizer network are sent by means of two pushbuttons, marked + and -, mounted to the right of each meter. Each time a + or - pushbutton is depressed, the EQL ADJ PULSE lamp lights and then extinguishes to indicate that the next adjust command can be sent. The + pushbutton increases the gain of its associated equalizer network one step each time it is depressed, and the - pushbutton decreases the gain one step.

2.08 The A equalizer at an equalizing repeater provides correction for one-half the gain deviation due to the line and equipment on each side of the equalizing repeater. The A equalizer at a main station provides correction for one-half the gain deviation due to the line and equipment between the main station repeater and the adjacent equalizing location.

2.09 Under certain conditions, there may not be enough adjustment range in an equalizing repeater A equalizer. This is most likely to occur at the lower A equalizer test frequencies, during periods of extreme temperature, and where there are long distances between the equalizing locations. If the end of equalizer adjustment range is reached, any additional correction required should be made by adjusting the A equalizers at the main stations on each side of the equalizing repeater, half at each main station.

2.10 Part 3 explains an adjustment procedure for L4 lines that includes ***manual*** A equalizers at the equalizing repeater stations and manual ***or*** stepped equalizers at the main stations. During equalizer adjustments for these lines, an attendant at an equalizing repeater location makes adjustments at the direction of the main station attendant. The main station attendant adjusts the main station ***manual*** equalizers by means of front-panel controls or adjusts the ***stepped*** equalizers by means of the control center pushbuttons.

2.11 Part 4 explains an adjustment procedure for L4 lines that includes ***stepped*** equalizers only. The control center attendant adjusts these equalizers by means of the control center pushbuttons.

2.12 Part 5 explains an adjustment procedure for L4 lines that includes the A equalizer test signal modification.

2.13 Part 6 explains some special considerations that affect equalization procedures.

2.14 Part 7 explains equalization for mastergroups that are transmitted through several main sections.

3. EQUALIZING LINE INCLUDING MANUAL EQUALIZERS

3.01 Figure 8 shows a form which can be used for recording values during equalization. This form illustrates the abbreviations used in this explanation of the equalization procedure.

3.02 Gain deviations are designated ***D1***, ***D2***, and ***D3*** for the A equalizing sections. The total gain deviation over the main section is designated ***R*** for the A equalizer frequencies and ***T*** for the B equalizer frequencies.

3.03 Each equalizer must correct for the gain deviation in the adjacent equalizing sections. That is, equalizer A1 corrects for one-half ***D1***; equalizer A2 corrects for one-half ***D1*** plus one-half ***D2***, etc. An equalizing repeater compensates for one-half the gain deviation in the ***preceding*** equalizing section and for one-half the gain deviation in the ***succeeding*** equalizing section.

3.04 Assuming approximately equal spacing between the A equalizers, the required gain corrections are accomplished as follows. Equalizer A1 provides a gain correction equal to ***R***/6, equalizer A2 provides a gain correction equal to 2***R***/6 or ***R***/3, etc. For a main section with only ***one*** equalizing repeater location, the manual A equalizer at the equalizing repeater provides a gain correction equal to ***R***/2 and the A equalizer at each main station provides a gain correction equal to ***R***/4.

3.05 Proceed to Part A for a line with manual equalizers only or proceed to Part B for a line with stepped equalizers at the main stations.

A. Manual Equalizers Only

At transmitting main station,

(1) Measure the 11.648-MHz pilot power at the TRMTG LINE TST jack in the line bay for the line to be equalized.

Requirement: -52.9 dBm ±0.1 dB.

Note: If the requirement is ***not*** met, check line pilot insertion per Section 359-215-509.

At receiving main station,

(2) Measure the 11.648-MHz pilot power at the RCVG LINE TST jack in the line bay for the line to be equalized.

Requirement: -40.0 dBm ±0.2 dB.

Note: If the requirement is ***not*** met, check the receiving amplifier per Section 359-215-513.

At transmitting main station,

(3) Apply the first equalizer test signal listed in Table A, 0.544 MHz, at approximately -33.8 dBm to the LOOP SIG IN jack in the jack field.

Caution: For a working line, do not change the sending test equipment frequency while the sending test equipment is connected to the LOOP SIG IN jack. Disconnect the test equipment, tune to the required frequency, and reconnect the test equipment.

(4) Measure the 0.544-MHz test signal power at the TRMTG LINE TST jack in this line bay.

(5) Adjust the test signal power applied until the signal at the TRMTG LINE TST jack is -52.9 dBm.

At receiving main station,

(6) Measure and record the 0.544-MHz test signal power at the RCVG LINE TST jack in the line bay for the line to be equalized.

Note 1: Nominal power for this test signal is -40.0 dBm at the RCVG LINE TST jack. The gain deviation to be corrected is the difference between -40.0 dBm and the measured power of the equalizer test signal.

Note 2: The manual A equalizer at an equalizing repeater station is adjusted only upon the first equalization of a line. During reequalization, only the main station equalizers are adjusted.

(7) Direct the attendant at the far equalizing repeater location to adjust the 0.544-MHz control on the A equalizer for this line to correct for ***one-third*** the recorded gain deviation.

(8) Direct the attendant at the near equalizing repeater location to adjust the 0.544-MHz

TABLE A

A EQUALIZER ADJUSTMENTS

ADJUSTMENT SEQUENCE	FREQUENCY IN MHz	ADJUSTMENT CONTROL	EQUALIZER NETWORK
1	0.544	ADJ 0.544 MHz	1
2	3.200	ADJ 3.2 MHz	2
3	19.296	ADJ 19.296 MHz	6
4	5.888	ADJ 5.888 MHz	3
5	14.784	ADJ 14.784 MHz	5
6	8.768	ADJ 8.768 MHz	4

control on the A equalizer for this line to correct for ***one-third*** the recorded gain deviation.

(9) Direct the attendant at the far main station to adjust the ADJ 0.544-MHz control on the A equalizer for this line to correct for ***one-sixth*** the recorded gain deviation.

(10) Adjust the ADJ 0.544-MHz control, at the near main station, on the A equalizer for this line to correct the remaining gain deviation.

Note: After adjustment at the receiving main station, the equalizer test signal power at the RCVG LINE TST jack should be -40.0 dBm.

At all stations,

(11) Repeat Steps 3 through 10 for the next equalizer test frequency listed in Table A.

Note: The adjustments sequence and test frequencies for the six A equalizer networks are listed in Table A.

(12) Continue this procedure until all networks in the A equalizers for this line have been adjusted.

(13) Repeat this procedure for the main station B equalizers for this line.

Note: See ***Caution*** in Step 3. The adjustments sequence and test frequencies for the ten B equalizer networks are listed in Table B. Adjust each B equalizer network to correct for ***one-half*** the recorded gain deviation.

(14) Repeat Steps 3 through 13 to refine the adjustments of the A and B equalizers at the main stations.

B. Stepped Equalizers at Main Stations

Warning: Care must be taken when performing meter calibration in the following procedures, so that only 5 dB of loss is removed at a time, since excessive signal power can damage the crystal filter which selects the equalizer test signals.

3.06 ***Measuring Equalizing Section R:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at FAR MAIN REP OUTPUT.

TABLE B

B EQUALIZER ADJUSTMENTS

ADJUSTMENT SEQUENCE	FREQUENCY IN MHz	ADJUSTMENT CONTROL	EQUALIZER NETWORK
1	1.552	ADJ 1.55	2
2	1.056	ADJ 1.05	1
3	2.080	ADJ 2.08	3
4	4.256	ADJ 4.25	4
5	7.008	ADJ 7.00	5
6	9.888	ADJ 9.88	6
7	12.896	ADJ 12.80	7
8	16.032	ADJ 16.00	8
9	17.792	ADJ 17.70	9
10	20.200	ADJ 20.20	10

Note: For two-section and sideleg route control, begin with the near section.

(3) ▶Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at NEAR MAIN REP INPUT.

(5) Operate the DB switches to cause indications to return to 0 on the six meters.

▶***Note 1:*** Do ***not*** operate the CAL control or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by operating the DB switches.◀

Note 2: The DB switches now indicate the gain (R) between the far main repeater equalizer output and the near main repeater equalizer input.

(6) Record the values indicated by the DB switches opposite R on a form similar to that in Fig. 8. For example, if the DB switches are on +2 and 0.4, record +2.4. If the DB switches are on -2 and 0.4, record -1.6.

(7) Calculate values for R/3 and record the ***negative*** of these values opposite the two places -R/3 appears on the form.

Note: See sample values in Fig. 1. The -R/3 values must be used so the required +R/3 gain corrections at the manual A equalizer will result when the equalizer adjust meter indications are at 0.

(8) Calculate values for R/6 and record opposite the two places R/6 appears on the form.

3.07 ***Adjusting Manual A Equalizer at FAR EQL REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at FAR MAIN REP OUTPUT.

(3) ▶Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Operate the DB switches to provide the values recorded opposite FE IN -R/3 on the form.

Note: Do ***not*** operate the CAL controls or INCR pushbuttons. ▶Doing so will cause a wrong readout of equalizer test signal gain deviation. The CAL control and the INCR pushbuttons are used for calibration. Measurements are made by operating the DB switches.◀

(5) Request the attendant at the far equalizing repeater to adjust the manual A equalizer controls to cause indications to return to 0 on the six meters.

This completes the adjustment of the A equalizer at the far equalizing repeater.

3.08 ***Adjusting Manual A Equalizer at NEAR EQL REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at FAR MAIN REP OUTPUT.

(3) ▶Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the

INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Operate the DB switches to provide the values recorded opposite NE IN -R/3 on the form.

▶***Note:*** Do ***not*** operate the CAL control or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by operating the DB switches.◀

(5) Request the attendant at the near equalizing repeater to adjust the manual A equalizer controls to cause indications to return to 0 on the six meters.

This completes the adjustment of the A equalizer at the near equalizing repeater.

3.09 *Adjusting Stepped A Equalizer At FAR MAIN REP:*

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at FAR MAIN REP OUTPUT.

(3) ▶Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at FAR MAIN REP INPUT.

(5) Operate the DB switches to provide the values recorded opposite FM IN R/6 on the form.

▶***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by operating the DB switches.◀

(6) Depress the + and - pushbuttons, as required, to cause indications to return to 0 on the six meters.

Note: Allow enough time for the equalizer networks to stabilize after adjustments.

This completes the first adjustment of the A equalizer at the far main repeater.

3.10 *Adjusting Stepped A Equalizer at NEAR MAIN REP:*

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at NEAR MAIN REP OUTPUT.

(3) ▶Calibrate the meters:

Adjust the CAL controls to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at NEAR MAIN REP INPUT.

(5) Operate the DB switches to provide the values recorded opposite NM IN R/6 on the form.

▶***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.◀

(6) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

This completes the first adjustment of the A equalizer at the near main repeater.

3.11 *Correcting Residual Gain Deviations:*

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at NEAR MAIN REP OUTPUT.

(3) ◗Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◖

(4) Program to apply the A equalizer test signals at FAR MAIN REP INPUT.

Note: Meters indicate the residual gain deviations; on-scale indications should be obtained on the six meters. Because of the step intervals of the DB switches and of the equalizer adjustments, there will be some residual deviation over the line section.

(5) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

Note: If ***two*** adjustment steps are required for an equalizer network, insert only one step at the far main repeater. Then, program NEAR MAIN REP INPUT and insert the other step. If ***more than two*** adjustment steps are required, recheck the alignment.

3.12 *Measuring Equalizing Section I:*

(1) Operate all DB switches to 0.

(2) Program to apply the B equalizer test signals at FAR MAIN REP INPUT.

(3) ◗Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◖

(4) Program to apply the B equalizer test signals at NEAR MAIN REP OUTPUT.

(5) Operate the DB switches to cause indications to return to 0 on all ten meters.

◗***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.◖

(6) Record the values indicated by the DB switches opposite T on the form.

(7) Calculate values for T/2 and record opposite the two places T/2 appears on the form.

3.13 *Adjusting Stepped B Equalizer at FAR MAIN REP:*

(1) Operate all DB switches to 0.

(2) Program to apply the B equalizer test signals at FAR MAIN REP OUTPUT.

(3) Calibrate the meters:

◗Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◖

(4) Program to apply the B equalizer test signals at FAR MAIN REP INPUT.

(5) Operate the DB switches to provide the values recorded opposite FM IN T/2 on the form.

▶***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.◀

(6) Depress the + and - pushbuttons to cause indications to return to 0 on all ten meters.

3.14 *Adjusting Stepped B Equalizer at NEAR MAIN REP:*

(1) Operate all DB switches to 0.

(2) Program to apply the B equalizer test signals at NEAR MAIN REP OUTPUT.

(3) Calibrate the meters:

▶Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the B equalizer test signals at NEAR MAIN REP INPUT.

(5) Operate the DB switches to provide the values recorded opposite NM IN T/2 on the form.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.

(6) Depress the + and - pushbuttons to cause indications to return to 0 on all ten meters.

3.15 *Correcting Residual Gain Deviations:*

(1) Operate all DB switches to 0.

Note: The meters at this time are calibrated to B equalizer test signals at NEAR MAIN REP OUTPUT.

(2) Program to apply the B equalizer test signals at FAR MAIN REP INPUT.

Note: Meters indicate the residual gain deviations; on-scale indications should be obtained on the ten meters.

(3) Depress the + and - pushbuttons to cause indications to return to 0 on the ten meters.

Note: If ***two*** adjustment steps are required, insert one at FAR MAIN REP and one at NEAR MAIN REP.

This completes the adjustment of the near-section equalizers.

3.16 *Adjusting Far-Section Equalizers:*

Note: Adjusting far-section equalizers in a ***sideleg route*** involves some special considerations which are explained in Part 6.

(1) Measure and adjust the far-section A equalizers as described for the near-section A equalizers.

Note: When ***far-section*** A equalizers are adjusted, little or no response will be noted on meter 1 because of the 512-kHz bandedge regulator at the intermediate main station. To adjust network 1 in the far-section A equalizers, send the number of pulses required to cause the calculated correction, based on 0.5-dB change per pulse for equalizers with 32 steps or 0.25-dB change per pulse for equalizers with 64 steps. To adjust network 1 in a manual A equalizer, use the turns-versus-gain value recorded when the equalizer was tested per Section 359-205-512. Measure again after making adjustments.

(2) Adjust the far-section B equalizers as described for the near-section B equalizers.

3.17 *Correcting Deviations Over Two Sections:*

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at ***near section*** NEAR MAIN REP OUTPUT.

(3) Calibrate the meters:

▶Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at ***far section*** FAR MAIN REP INPUT.

Note: On-scale indications probably will be obtained on all six meters.

(5) Correct deviations remaining at this time by equal adjustments of the ***far-section*** NEAR MAIN REP and of the ***near-section*** FAR MAIN REP equalizers.

Exception: Equalizer adjust meter 1 indicates the deviation at the lowest A equalizer test frequency. This deviation must be corrected ***wholly*** by adjusting the ***near-section*** FAR MAIN REP equalizer.

(6) Correct the gain deviations over both sections at the B equalizer test frequencies in a similar manner.

3.18 Table C provides a summary of the equalizer measurements and adjustments sequence for lines including manual equalizers at equalizing repeater locations and stepped equalizers at main stations.

4. EQUALIZING LINE INCLUDING STEPPED EQUALIZERS ONLY

4.01 Figure 9 shows a form which can be used for recording values during equalization. This form illustrates the abbreviations used in this explanation of the equalization procedure.

4.02 Gain deviations are designated ***C1***, ***C2***, and ***C3*** for the A equalizing sections and ***S*** for the B equalizing section.

4.03 ***Measuring Equalizing Section C1 and Adjusting Stepped A Equalizer at FAR MAIN REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at FAR MAIN REP OUTPUT.

Note: For two-section and sideleg route control, begin with the near section.

(3) ▶Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

Note: When the A equalizers are in the reset condition, it may not be possible to obtain an on-scale indication on some meters. In this case, insert a few steps of gain correction at each equalizing location to adjust the gain so that on-scale indications can be obtained. Gain will be adjusted to the proper value later in this procedure.

(4) Program to apply the A equalizer test signals at FAR EQL REP INPUT.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons. Measurements are made by operating the DB switches, which provide a direct readout of equalizer test signal gain deviations.

(5) Operate the DB switches to cause indications to return to 0 on all six meters.

▶***Note 1:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL controls and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.◀

Note 2: The DB switches now indicate the gain (C1) between the far main repeater

TABLE C

EQUALIZATION PROCEDURE FOR LINE INCLUDING MANUAL EQUALIZERS

		SECTION	EQUALIZER	PROCEDURE
TWO-SECTION CONTROL	ONE-SECTION CONTROL	NEAR	A	Measure and Record R Calculate and Record—R3 and R6 Adjust A2 Adjust A3 Adjust A1 Adjust A4 Correct Deviation over Entire Section
			B	Measure and Record T Calculate and Record T/2 Adjust B1 Adjust B2 Correct Deviation over Entire Section
		FAR	A and B	Repeat Above for Far-Section A and B Equalizers
		NEAR and FAR	A and B	Correct Deviation over Both Sections

equalizer output and the far equalizing repeater equalizer input.

(6) Record the values indicated by the DB switches opposite C1 on a form similar to that in Fig. 9. For example, if the DB switches are on +2 and 0.4, record +2.4. If the DB switches are on -2 and 0.4, record -1.6.

Note 1: Misalignment greater than ±5 dB indicates a trouble which should be investigated before an attempt is made to equalize the line.

Note 2: A similar procedure is followed to obtain values for C2 and C3 at the A equalizer test signals and for S at the B equalizer test signals.

(7) Calculate values for 1/2 C1 and record opposite the two places 1/2 C1 appears on the form.

(8) Program to apply the A equalizer test signals at FAR MAIN REP INPUT.

Note: The gain of the control center receiving circuit is the same now as when the equalizer adjust meters were calibrated for measurement of C1. Therefore, it is not necessary to recalibrate prior to adjusting the equalizer at the far main repeater.

(9) Operate the DB switches to provide the values recorded opposite FM IN 1/2 C1 on the form.

Note: Do not operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL controls and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.

(10) Depress the + and - pushbuttons, as required, to cause indications to return to 0 on the six meters.

Note 1: Allow enough time for the equalizer networks to stabilize after adjustments.

Note 2: The A equalizer at the far main repeater compensates for one-half the gain deviation due to the line and equipment between the far main repeater and the far

equalizing repeater. The A equalizer at the far equalizing repeater compensates for the other one-half of this gain deviation ***plus*** one-half the gain deviation due to the line and equipment between the far and near equalizing repeaters.

This completes the first adjustment of the A equalizer at the far main repeater.

4.04 ***Measuring Equalizing Section C2 and Adjusting Stepped A Equalizer at FAR EQL REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at FAR EQL REP OUTPUT.

(3) ▶Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at NEAR EQL REP INPUT.

(5) Operate the DB switches to cause indications to return to 0 on the six meters.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL controls and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.

(6) Record the values indicated by the DB switches opposite C2 on the form.

(7) Calculate values for 1/2 C2 and record opposite the two places 1/2 C2 appears on the form.

(8) Add 1/2 C1 and 1/2 C2, observing the + and - signs, and enter the values opposite FE IN TOTAL.

(9) Program to apply the A equalizer test signals at FAR EQL REP INPUT.

(10) Operate the DB switches to provide the values recorded opposite FE IN TOTAL on the form.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons.

(11) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

Note: An equalizing repeater compensates for one-half the gain deviation in the ***preceding*** equalizing section and for one-half the gain deviation in the ***succeeding*** equalizing section.

This completes the adjustment of the A equalizer at the far equalizing repeater.

4.05 ***Measuring Equalizing Section C3 and Adjusting Stepped A Equalizer at NEAR EQL REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at NEAR EQL REP OUTPUT.

(3) ▶Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at NEAR MAIN REP INPUT.

(5) Operate the DB switches to cause indications to return to 0 on the six meters.

▶***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL controls and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.

(6) Record the values indicated by the DB switches opposite C3 on the form.

(7) Calculate 1/2 C3 and record opposite the two places 1/2 C3 appears on the form.

(8) Add 1/2 C2 and 1/2 C3 and record as the NE IN TOTAL values on the form.

(9) Apply the A equalizer test signals at NEAR EQL REP INPUT.

(10) Operate the DB switches to provide the values recorded opposite NE IN TOTAL on the form.

▶***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons.

(11) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

This completes the adjustment of the A equalizer at the near equalizing repeater.

4.06 ***Adjusting Stepped A Equalizer at NEAR MAIN REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at NEAR MAIN REP OUTPUT.

(3) Calibrate the meters:

▶Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at NEAR MAIN REP INPUT.

(5) Operate the DB switches to provide the values recorded opposite NM IN 1/2 C3 on the form.

▶***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.◀

(6) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

This completes the first adjustment of the A equalizer at the near main repeater.

4.07 ***Correcting Residual Gain Deviations:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at NEAR MAIN REP OUTPUT.

(3) Calibrate the meters:

▶Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at FAR MAIN REP INPUT.

Note: Meters indicate the residual gain deviations; on-scale indications should be obtained on the six meters. Because of the step intervals of the DB switches and of the equalizer adjustments, there will be some residual deviation over the line section.

(5) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

Note: If ***two*** adjustment steps are required for an equalizer network, insert only one step at the far main repeater. Then, program NEAR MAIN REP INPUT and insert the other step. If ***more than two*** adjustment steps are required, recheck the alignment.

4.08 ***Adjusting Stepped B Equalizers:***

(1) Operate all DB switches to 0.

(2) Program to apply the B equalizer test signals at FAR MAIN REP OUTPUT.

(3) Calibrate the meters:

▶Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the B equalizer test signals at NEAR MAIN REP INPUT.

(5) Operate the DB switches to cause indications to return to 0 on all ten meters.

▶***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.◀

(6) Record the values indicated by the DB switches opposite S on the form.

(7) Calculate values for 1/2 S and record opposite the two places 1/2 S appears on the form.

(8) Program to apply the B equalizer test signals at FAR MAIN REP INPUT.

(9) Operate the DB switches to provide the values recorded opposite FM IN 1/2 S on the form.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons.

(10) Depress the + and - pushbuttons to cause indications to return to 0 on all ten meters.

(11) Operate all DB switches to 0.

(12) Program to apply the B equalizer test signals at NEAR MAIN REP OUTPUT.

(13) Calibrate the meters:

▶Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(14) Program to apply the B equalizer test signals at NEAR MAIN REP INPUT.

(15) Operate the DB switches to provide the values recorded opposite NM IN 1/2 S on the form.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons.

(16) Depress the + and - pushbuttons to cause indications to return to 0 on all ten meters.

4.09 ***Correcting Residual Gain Deviations:***

(1) Operate all DB switches to 0.

Note: The meters at this time are calibrated to B equalizer test signals at NEAR MAIN REP OUTPUT.

(2) Program to apply the B equalizer test signals at FAR MAIN REP INPUT.

Note: On-scale indications should be obtained on the ten meters.

(3) Depress the + and - pushbuttons to cause indications to return to 0 on the ten meters.

Note: If ***two*** adjustment steps are required, insert one at FAR MAIN REP and one at NEAR MAIN REP.

This completes the adjustment of the near-section equalizers. For far-section equalizers in a line ***with*** the A equalizer test signal modification, follow the procedure beginning at 5.12.

4.10 ***Adjusting Far-Section Equalizers:***

Note: Adjusting far-section equalizers in a ***sideleg route*** involves some special considerations which are explained in Part 6.

(1) Measure and adjust the far-section A equalizers as described for the near-section A equalizers.

Note: When ***far-section*** A equalizers are adjusted, little or no response will be noted on meter 1 because of the 512-kHz bandedge regulator at the intermediate main station. To adjust network 1 in the far-section A equalizers, send the number of pulses required to cause the calculated correction, based on 0.5-dB change per pulse for equalizers with 32 steps or 0.25-dB change per pulse for equalizers with 64 steps. Measure again after making adjustments.

(2) Adjust the far-section B equalizers as described for the near-section B equalizers.

(3) Proceed to paragraph 4.11 to correct gain deviations over both sections.

4.11 ***Correcting Deviations Over Two Sections:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at ***near section*** NEAR MAIN REP OUTPUT.

(3) Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at ***far section*** FAR MAIN REP INPUT.

Note: On-scale indications probably will be obtained on all six meters.

(5) Correct deviations remaining at this time by equal adjustments of the ***far-section*** NEAR MAIN REP and of the ***near-section*** FAR MAIN REP equalizers.

Exception: Equalizer adjust meter 1 indicates the deviation at the lowest A equalizer test frequency. This deviation must be corrected ***wholly*** by adjusting the ***near-section*** FAR MAIN REP equalizer.

(6) Correct the gain deviation over both sections at the B equalizer test frequencies in a similar manner.

4.12 Table D provides a summary of the equalizer measurements and adjustments sequence for lines including stepped equalizers only.

5. EQUALIZING LINE INCLUDING A EQUALIZER TEST SIGNAL MODIFICATION

5.01 Figure 10 shows a form which can be used for recording values during equalization. This form illustrates the abbreviations used in this explanation of the equalization procedure.

5.02 Gain deviations are designated ***G1, G2,*** and ***G3*** for the A equalizing sections and ***S*** for the B equalizing section.

5.03 ***Resetting Main Station A and B Equalizers:***

(1) Program to reset the A and B equalizers at all main stations in the line to be equalized.

5.04 ***Measuring Equalizing Section G1 and Adjusting Stepped A Equalizer at FAR MAIN REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at FAR MAIN REP OUTPUT.

Note: For two-section and sideleg route control, begin with the near section.

(3) ▶Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss.

TABLE D

EQUALIZATION PROCEDURE FOR LINE INCLUDING STEPPED EQUALIZERS ONLY

		SECTION	EQUALIZER	PROCEDURE
TWO-SECTION CONTROL	ONE-SECTION CONTROL	NEAR	A	Measure and Record C1 Calculate and Record ½C1 Adjust A1 Measure and Record C2 Calculate and Record ½C2 Calculate and Record FE IN TOTAL Adjust A2 Measure and Record C3 Calculate and Record ½C3 Calculate and Record NE IN TOTAL Adjust A3 Adjust A4 Correct Deviation over Entire Section
			B	Measure and Record S Calculate and Record ½S Adjust B1 Adjust B2 Correct Deviation over Entire Section
		FAR	A and B	Repeat Above for Far-Section A and B Equalizers
		NEAR and FAR	A and B	Correct Deviation over Both Sections

Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

Note: When the A equalizers are in the reset condition, it may not be possible to obtain an on-scale indication on some meters. In this case, insert a few steps of gain correction at each equalizing location to adjust the gain so that on-scale indications can be obtained. Gain will be adjusted to the proper value later in this procedure.

(4) Program to apply the A equalizer test signals at FAR EQL REP INPUT.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons. Measurements are made by operating the DB switches, which provide a direct readout of equalizer test signal gain deviations.

(5) Operate the DB switches to cause indications to return to 0 on all six meters.

▶***Note 1:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.◀

Note 2: The DB switches now indicate the gain (G1) between the far main repeater equalizer output and the far equalizing repeater equalizer input.

(6) Record the values indicated by the DB switches opposite G1 on a form similar to

that in Fig. 10. For example, if the DB switches are on +2 and 0.4, record +2.4. If the DB switches are on -2 and 0.4, record -1.6.

Note: A similar procedure is followed to obtain values for G2 and G3 at the A equalizer test signals and for S at the B equalizer test signals.

(7) Calculate values for 1/2 G1 and record opposite 1/2 G1 on the form.

(8) Calculate values for (1/2 G1) + 3.3 and record opposite (1/2 G1) + 3.3 on the form.

Note: These values take into account the 3.3-dB loss in the hybrid in the B equalizer.

(9) Program to apply the A equalizer test signals at FAR MAIN REP INPUT.

Note: The gain of the control center receiving circuit is the same now as when the equalizer adjust meters were calibrated for measurement of G1. Therefore, it is not necessary to recalibrate prior to adjusting the equalizer at the far main repeater.

(10) Operate the DB switches to provide the values recorded opposite FM IN (1/2 G1) + 3.3 on the form.

Note: Do ***not*** operate the CAL controls or INCR pushbuttons.

(11) Depress the + and - pushbuttons, as required, to cause indications to return to 0 on the six meters.

Note 1: Allow enough time for the equalizer networks to stabilize after adjustments.

Note 2: The A equalizer at the far main repeater compensates for one-half the gain deviation due to the line and equipment between the far main repeater and the far equalizing repeater. The A equalizer at the far equalizing repeater compensates for the other one-half of this gain deviation ***plus*** one-half the gain deviation due to the line and equipment between the far and near equalizing repeaters.

This completes the first adjustment of the A equalizer at the far main repeater.

5.05 ***Measuring Equalizing Section G2 and Adjusting Stepped A Equalizer at FAR EQL REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at FAR EQL REP OUTPUT.

(3) ◗Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◖

(4) Program to apply the A equalizer test signals at NEAR EQL REP INPUT.

(5) Operate the DB switches to cause indications to return to 0 on the six meters.

◗***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.◖

(6) Record the values indicated by the DB switches opposite G2 on the form.

(7) Calculate values for 1/2 G2 and record opposite the two places 1/2 G2 appears on the form.

(8) Add 1/2 G1 and 1/2 G2, observing the + and - signs, and enter the values opposite FE IN TOTAL.

(9) Program to apply the A equalizer test signals at FAR EQL REP INPUT.

(10) Operate the DB switches to provide the values recorded opposite FE IN TOTAL on the form.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons.

(11) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

Note: An equalizing repeater compensates for one-half the gain deviation in the ***preceding*** equalizing section and for one-half the gain deviation in the ***succeeding*** equalizing section.

This completes the adjustment of the A equalizer at the far equalizing repeater.

5.06 ***Measuring Equalizing Section G3 and Adjusting Stepped A Equalizer at NEAR EQL REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at NEAR EQL REP OUTPUT.

(3) ⧫Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.⧫

(4) Program to apply the A equalizer test signals at NEAR MAIN REP INPUT.

(5) Operate the DB switches to cause indications to return to 0 on the six meters.

⧫***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.⧫

(6) Record the values indicated by the DB switches opposite G3 on the form.

(7) Calculate 1/2 G3 and record opposite 1/2 G3 on the form.

(8) Calculate values for (1/2 G3) - 3.3 and record opposite (1/2 G3) - 3.3 on the form.

(9) Add 1/2 G2 and 1/2 G3 and record as the NE IN TOTAL values on the form.

(10) Apply the A equalizer test signals at NEAR EQL REP INPUT.

(11) Operate the DB switches to provide the values recorded opposite NE IN TOTAL on the form.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons.

(12) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

This completes the adjustment of the A equalizer at the near equalizing repeater.

5.07 ***Adjusting Stepped A Equalizer at NEAR MAIN REP:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at NEAR MAIN REP OUTPUT.

(3) Calibrate the meters:

⧫Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.⧫

(4) Program to apply the A equalizer test signals at NEAR MAIN REP INPUT.

(5) Operate the DB switches to provide the values recorded opposite NM IN (1/2 G3) - 3.3 on the form.

⧫***Note:*** Do ***not*** operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the

INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.◀

(6) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

This completes the first adjustment of the A equalizer at the near main repeater.

5.08 ***Correcting Residual Gain Deviations:***

(1) Operate all DB switches to 0.

(2) Program to apply the A equalizer test signals at NEAR MAIN REP OUTPUT.

(3) Calibrate the meters:

▶Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at FAR MAIN REP INPUT.

Note: Meters indicate the residual gain deviations; on-scale indications should be obtained on the six meters. Because of the step intervals of the DB switches and of the equalizer adjustments, there will be some residual deviation over the line section.

(5) Depress the + and - pushbuttons to cause indications to return to 0 on the six meters.

Note: If ***two*** adjustment steps are required for an equalizer network, insert only one step at the far main repeater. Then, program NEAR MAIN REP INPUT and insert the other step. If ***more than two*** adjustment steps are required, recheck the alignment.

5.09 ***Adjusting Stepped B Equalizers:***

(1) Operate all DB switches to 0.

(2) Program to apply the B equalizer test signals at FAR MAIN REP OUTPUT.

(3) Calibrate the meters:

▶Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the B equalizer test signals at NEAR MAIN REP INPUT.

(5) Operate the DB switches to cause indication to return to 0 on all ten meters.

Note: Do not operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL controls and INCR pushbuttons are used only for calibration. Measurements are made by the DB switches.

(6) Record the values indicated by the DB switches opposite S on the form.

(7) Calculate values for 1/2 S and record opposite the two places 1/2 S appears on the form.

(8) Program to apply the B equalizer test signals at FAR MAIN REP INPUT.

(9) Operate the DB switches to provide the values recorded opposite FM IN 1/2 S on the form.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons.

(10) Depress the + and - pushbuttons to cause indications to return to 0 on all ten meters.

(11) Operate all DB switches to 0.

(12) Program to apply the B equalizer test signals at NEAR MAIN REP OUTPUT.

(13) Calibrate the meters:

▶Adjust the CAL controls to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(14) Program to apply the B equalizer test signals at NEAR MAIN REP INPUT.

(15) Operate the DB switches to provide the values recorded opposite NM IN 1/2 S on the form.

Note: Do ***not*** operate the CAL controls or the INCR pushbuttons.

(16) Depress the + and - pushbuttons to cause indications to return to 0 on all ten meters.

5.10 *Correcting Residual Gain Deviations:*

(1) Operate all DB switches to 0.

(2) Program to apply the B equalizer test signals at NEAR MAIN REP OUTPUT.

(3) Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the B equalizer test signals at FAR MAIN REP INPUT.

Note: On-scale indications should be obtained on the ten meters.

(5) Depress the + and - pushbuttons to cause indications to return to 0 on the ten meters.

Note: If ***two*** adjustment steps are required, insert one at FAR MAIN REP and one at NEAR MAIN REP.

5.11 *Correcting Interactions Between A and B Equalizers:*

(1) Repeat the procedure in paragraph 5.08 to refine the adjustment of the A equalizers.

(2) Repeat the procedure in paragraph 5.10 to refine the adjustment of the B equalizers.

This completes the adjustment of the near-section equalizers. For far-section equalizers in a line ***without*** the A equalizer test signal modification, follow the procedure beginning at paragraph 4.10.

5.12 *Adjusting Far-Section Equalizers in a Line with A Equalizer Test Signal Modification:*

Note: Adjusting far-section equalizers in a ***sideleg route*** involves some special considerations which are explained in Part 6.

(1) Measure and adjust the far-section A equalizers as described for the near-section A equalizers.

Note: When adjusting ***far-section*** A equalizers, little or no response will be noted on meter 1 because of the 512-kHz bandedge regulator at the intermediate main station. To adjust network 1 in the far-section A equalizers, send the number of pulses required to cause the calculated correction, based on 0.5-dB change per pulse for equalizers with 32 steps or 0.25-dB change per pulse for equalizers with 64 steps. Measure again after making adjustments.

(2) Adjust the far-section B equalizers as described for the near-section B equalizers.

5.13 *Correcting Deviations Over Two Sections:*

(1) Operate all DB switches to 0.

Note: If only the ***far section*** has the A equalizer test signal modification, operate the DB switches to -3.3. If only the ***near section*** has the A equalizer test signal modification, operate the DB switches to +3.3.

(2) Program to apply the A equalizer test signals at ***near section*** NEAR MAIN REP OUTPUT.

(3) Calibrate the meters:

▶Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Program to apply the A equalizer test signals at ***far section*** FAR MAIN REP INPUT.

Note: On-scale indications probably will be obtained on all six meters.

(5) Correct deviations remaining at this time by equal adjustments of the ***far-section*** NEAR MAIN REP and of the ***near-section*** FAR MAIN REP equalizers.

Exception: Equalizer adjust meter 1 indicates the deviation at the lowest A equalizer test frequency. This deviation must be corrected ***wholly*** by adjusting the ***near-section*** FAR MAIN REP equalizer.

(6) Correct the gain deviations over both sections at the B equalizer test frequencies in a similar manner.

5.14 ***Correcting Interactions Between A and B Equalizers:***

(1) Repeat the procedure in paragraph 5.13 to correct residual gain deviations over two sections.

5.15 Table E provides a summary of the equalizer measurements and adjustments sequence for lines including the A equalizer test signal modification.

6. SPECIAL CONSIDERATIONS

▶***Warning: Care must be taken when performing calibration of the meters in the following procedures, so that only 5 dB of loss is removed at a time, since excessive signal power can damage the crystal filter which selects the equalizer test signals.***◀

A. Turning Down Line Power

6.01 Under certain conditions line power must be turned down. Line power does not affect manual equalizers or main station stepped equalizers. The ***stepped*** A equalizers in equalizing repeaters automatically ***reset*** to midrange when line power is turned up and the lines must be reequalized. The two control center attendants involved can save time and effort by the following procedure:

(1) Determine and record the stepped equalizer gain settings at each equalizing repeater in the affected lines ***before*** turning down line power.

(2) Step the proper gains into each equalizing repeater after turning up line power.

6.02 To determine equalizer gain settings before power turndown:

(1) Apply equalizer test signals at an equalizer output.

(2) ▶Operate all DB switches to 0.

(3) Calibrate the meters:

Adjust the CAL control to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.

(4) Apply equalizer test signals at the equalizer input.◀

(5) Operate the DB switches to obtain an indication of 0 on each meter.

▶***Note:*** Do not operate the CAL controls or the INCR pushbuttons. Doing so will cause a wrong readout of equalizer test signal gain deviations. The CAL control and the INCR

TABLE E

EQUALIZATION PROCEDURE FOR LINE INCLUDING A EQUALIZER TEST SIGNAL MODIFICATION

		SECTION	EQUALIZER	PROCEDURE
TWO-SECTION CONTROL	ONE-SECTION CONTROL	NEAR	A	Measure and Record G1 Calculate and Record ½G1 Calculate and Record (½G1) + 3.3 Adjust A1 Measure and Record G2 Calculate and Record ½G2 Calculate and Record FE IN TOTAL Adjust A2 Measure and Record G3 Calculate and Record ½G3 Calculate and Record (½G3) —3.3 Calculate and Record NE IN TOTAL Adjust A3 Adjust A4 Correct Deviation over Entire Section
			B	Measure and Record S Calculate and Record ½S Adjust B1 Adjust B2 Correct Deviation over Entire Section
			A and B	Correct Interactions Between Equalizers
		FAR	A and B	Repeat Above for Far-Section A and B Equalizers *Note:* For far-section lines *without* the A equlaizer test signal modification, follow the procedure in Part 4.
		NEAR and FAR	A and B	Correct Deviation over Both Sections Correct Interactions Between Equalizers

pushbuttons are used only for calibration. Measurements are made by the DB switches.◀

(6) Record the DB switch settings.

(7) Repeat Steps 1 through 5 for each equalizing repeater which will be affected by turning down line power.

6.03 To reequalize after power is turned up again:

(1) Apply equalizer test signals at the equalizer output.

(2) ▶Operate all DB switches to 0.

(3) Calibrate the meters:

Adjust the CAL controls to obtain a meter indication of 0, if possible. If an indication of 0 cannot be obtained, turn the CAL control fully counterclockwise. Depress the INCR pushbutton to remove 5 dB of loss. Adjust the CAL control to obtain an indication of 0, if possible. If an indication of 0 cannot be obtained, continue this procedure removing only 5 dB of loss at a time.◀

(4) Apply equalizer test signals at the equalizer input.

(5) Operate the DB switches to the positions recorded in Step 5 in 6.02.

(6) Depress the + and - pushbuttons to obtain indications of 0 on all meters.

(7) Repeat Steps 1 through 5 for each equalizing repeater affected.

B. Equalizing Sideleg Line

6.04 Equalization of sideleg lines is similar to that for two-section control, with the following considerations:

(a) Present control system arrangements are not designed to control equalizing repeaters in sideleg lines, and this explanation assumes that there are no equalizing repeaters in sideleg lines. Therefore, half the required gain correction is inserted at the ***junction station*** and half at the ***terminal station.***

(b) The ***far-section*** lines carry signals from the junction station, where the control center is located, to the terminal station which does not have a control center. Thus, equalizer test signals turned on in far-section lines must be looped back to the junction station. The ***near-section*** lines carry signals from the terminal station to the junction station.

(c) The ***terminal*** station loopback circuit is arranged so that when a ***far-section*** line is selected, a signal path is completed from that far-section line to the near-section protection line. This signal path includes amplifiers and filters which pass the equalizer test signals only. The control center attendant can select the protection line by use of the receive override pushbuttons.

6.05 Equalize the ***near-section*** lines by inserting half the required gain correction at the terminal transmitting main repeater and the other half at the junction receiving main repeater. Adjust the A equalizers first, then adjust the B equalizers.

6.06 Equalize the ***far-section*** lines by inserting half the required gain correction at the junction transmitting main repeater and the other half at the terminal receiving main repeater. Adjust the A equalizers first, then adjust the B equalizers.

7. MASTERGROUP EQUALIZATION

A. General

7.01 Mastergroup equalization must be checked to ensure that the basic mastergroup signal at the output of an MMX-2C receiving bay does not have excessive gain deviations, slope, or ripple. That is, the received signal should not differ significantly from the basic mastergroup signal at the input of the MMX-2C transmitting bay.

7.02 Mastergroup equalization is accomplished by equalizing each L4 main section, equalizing over two main sections for two-section control arrangements, adjusting mastergroup equalizers at frogging points, and using mastergroup equalizers at the MMX-2C receiving bay, if required.

7.03 Mastergroup equalization requirements are specified for each of the L4 sections in the mastergroup transmission path. These ***sections*** are defined where first introduced in this part.

7.04 All gain deviation requirements in this part specify the maximum allowed difference between each supergroup pilot power and the associated mastergroup pilot power.

B. Mastergroup Section

7.05 ***Mastergroup section*** refers to the entire transmission path for a given mastergroup. A mastergroup section is up to 4000 miles in length and includes the equipment and L4 lines between the MMX-2C transmitting bay at which the basic mastergroup signal is added and the MMX-2C receiving bay at which the basic mastergroup signal is dropped to an L multiplex terminal.

7.06 A ***main section*** includes the equipment and coaxial line between two adjacent main stations. A ***control section*** includes one or two main sections and a control center is provided in the main station at each end of a control section. A mastergroup ***frogging section*** (Fig. 3) includes several control sections, and an MMX-2C terminal is provided in the main station at each end of a frogging section.

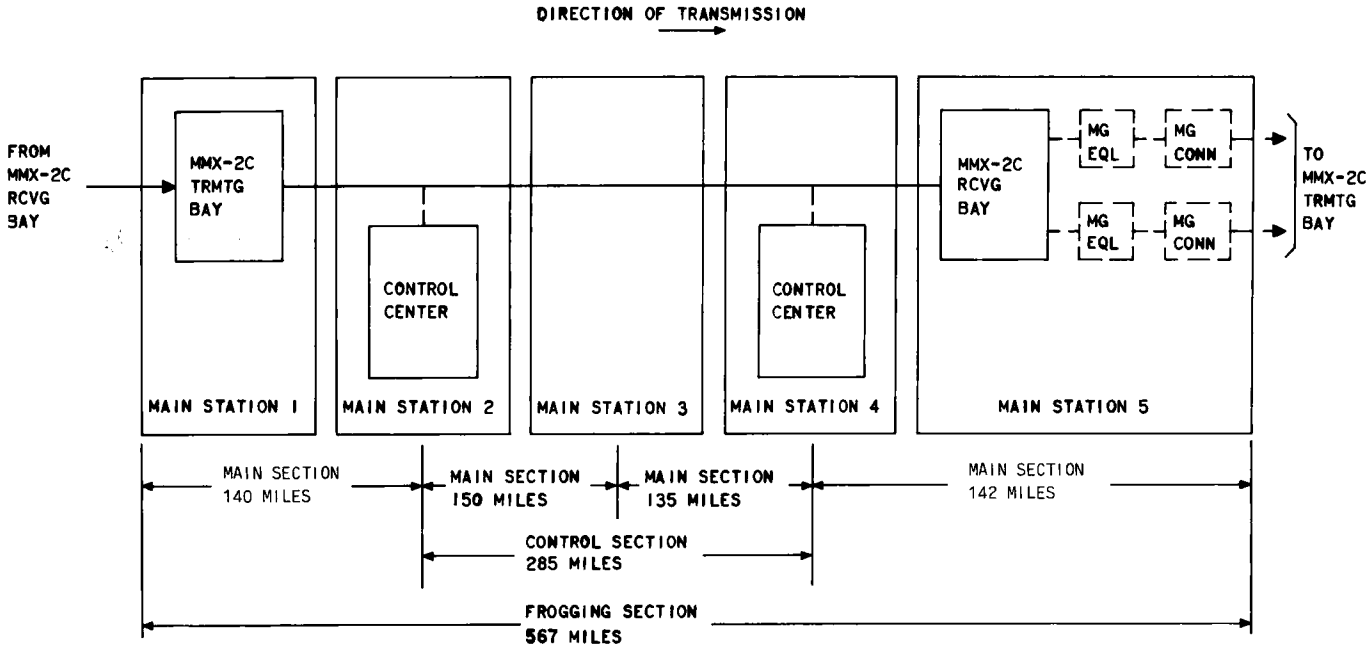


Fig. 3—Frogging Section

7.07 Each L4 line must be equalized in order to provide a zero-gain frequency transmission path. This equalization is accomplished first on a main-section basis, next on a control-section basis if two-section control is provided, then on a frogging-section basis, and finally over the mastergroup section.

7.08 After each main section, control section, and frogging section have been equalized, the mastergroup section should be checked to determine if the mastergroup section equalization requirements are met.

Mastergroup Section Requirements

7.09 These requirements apply to L4 transmission paths including two or more frogging sections. These requirements do ***not*** apply where the frogging sections are not adjacent but are connected via a facility other than an L4 line.

7.10 Mastergroup section requirements are determined as follows:

(1) Refer to Fig. 4 to determine the requirement for each frogging section.

(2) List these frogging section requirements, in descending order, as indicated in Test Record 1.

(3) Multiply each frogging section requirement by the proper constant, as listed in Test Record 1.

(4) Add the allowed deviation values to obtain the mastergroup section requirements.

TEST RECORD 1

DETERMINING MASTERGROUP SECTION REQUIREMENT

Frogging Section Requirement from Fig. 4		times	constant	equal	Allowed deviation
(largest deviation)	dB	X	1	=	dB
	dB	X	1/3	=	dB
	dB	X	1/4	=	dB
	dB	X	1/5	=	dB
	dB	X	1/5	=	dB
(smallest deviation)	dB	X	1/5	=	dB
Mastergroup section requirement				=	dB

Test Record 1—Determining Mastergroup Section Requirement

Example:

Consider a mastergroup section that includes four frogging sections with mastergroup assignments and section lengths as follows. The mastergroup signal is transmitted as mastergroup 3 for 450 miles, frogged to mastergroup 1 for 600 miles, frogged to mastergroup 4 for 700 miles, and frogged to mastergroup 6 for 760 miles.

The requirements, from Fig. 4, for these four frogging sections are 1.75 dB, 2.55 dB, 2.27 dB, and 3.00 dB, respectively. List these section requirements in descending order, multiply each requirement by the proper constant, and add the values obtained to determine the mastergroup section requirement. That is, 3.00 dB times 1 plus 2.55 dB times 1/3 plus 2.27 dB times 1/4 plus 1.75 dB times 1/5 equals 4.77 dB. This means that, at the MMX-2 receiving bay, the power of each supergroup pilot in this mastergroup must be within ±4.77 dB of the mastergroup pilot power.

Trouble Locating

7.11 Excessive gain deviation in a mastergroup section indicates that each frogging section should be checked as explained in Part C.

7.12 Gain deviations may be due to a number of factors which affect different mastergroups.

7.13 Excessive gain deviation between the supergroup 27 pilot and the mastergroup pilot indicates that the power of these pilots should be checked at the MMX-2C transmitting bay. Nominal power of these pilots is -55 dBm at the TST jack and -65 dBm at the TST TRMTG jack in the transmitting patch and test panel.

7.14 ***Ripple*** across several mastergroups usually is due to the cumulative effects of small gain deviations. Mastergroup equalizers should be provided where necessary to correct this condition. ***Slope*** across one mastergroup usually is due to an incorrect setting of the cable equalizer in the mastergroup connector at a frogging point.

7.15 Correct any problems within each frogging section. Check the adjustment of the mastergroup equalizers at the frogging points per Section 356-524-501. Check the adjustment of the cable equalizer in a mastergroup connector per Section 356-027-502.

C. Frogging Section

7.16 A ***frogging section*** is up to 800 miles in length or a maximum of six main sections,

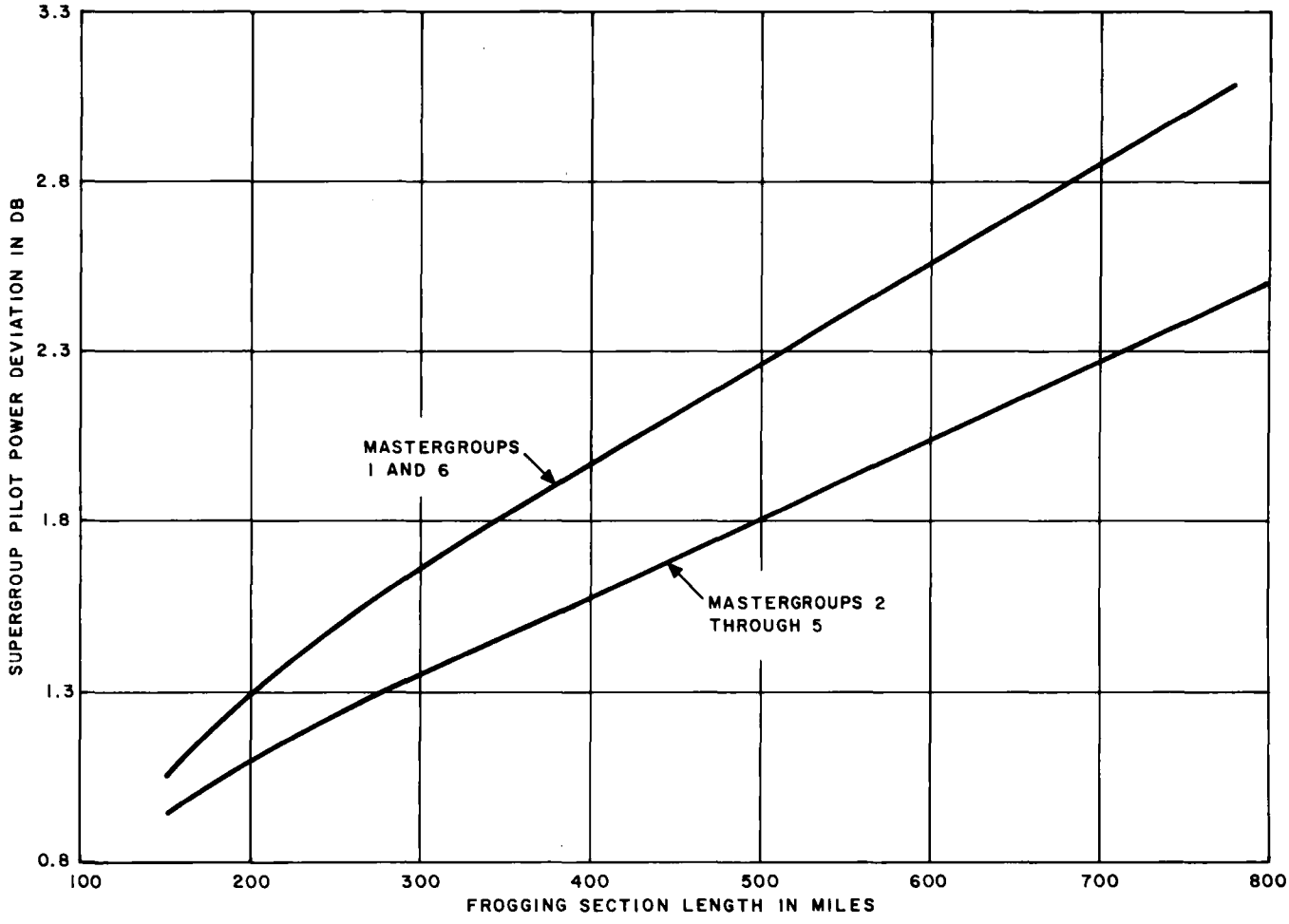


Fig. 4—Frogging Section Requirements

whichever is shorter. Frogging is accomplished at an L4 main station. The signal on an L4 receive line is demodulated in an MMX-2C receiving bay to recover the original basic mastergroup bands. These basic mastergroup signals are modulated in an MMX-2C transmitting bay to place each mastergroup at a different place in the spectrum on an L4 transmit line.

7.17 A mastergroup equalizer J68882BP is provided at a frogging point for each mastergroup in the MMX-2C receiving bay. This equalizer includes three adjustable networks for correcting gain deviations in the basic mastergroup band: 564 to 3084 kHz. Mastergroup equalizer adjustment procedures are provided in Section 356-524-501.

7.18 A mastergroup connector J68882AP is provided at a frogging point for each mastergroup. This mastergroup connector includes an adjustable cable equalizer for correcting slope in the trunk between the MMX-2C receiving bay and the MMX-2C transmitting bay. Mastergroup connector adjustment procedures are provided in Section 356-027-502.

Frogging Section Requirements

7.19 Figure 4 shows the gain deviation requirements for frogging sections of various lengths. These requirements apply to measurements made between the TST jack in the MMX-2C transmitting patch and test panel, where the nominal power of the mastergroup pilot and supergroup pilots is -55 dBm, and the MG OUT B jack in the MMX-2C receiving patch and test panel, where the nominal power of these pilots is -34 dBm.

7.20 Gain deviation requirements for combinations of control sections are obtained by adding the requirements for the individual control sections.

7.21 A frogging section including three control sections is shown in Fig. 3. Gain deviation requirements for the four main sections may be obtained directly from Fig. 5. Also, the gain deviation requirements for the control section between main stations 2 and 4 can be obtained from Fig. 5. The 285-mile requirement shown, as well as the 150-mile and 135-mile main section requirements, apply to this control section.

Example:

The gain deviation requirement for mastergroup 3 in the frogging section shown in Fig. 3 is determined as follows:

Requirements:

For 140-mile control section = 0.84 dB

For 285-mile control section = 1.32 dB

For 142-mile control section = 0.81 dB

For 567-mile frogging section = 2.97 dB.

7.22 Gain deviation requirements for any combination of control sections within the frogging section must be met.

Example:

The gain deviation requirement for mastergroup 3 from main station 1 to main station 4, shown in Fig. 5, is determined as follows:

Requirements:

For 140-mile control section = 0.84 dB

For 285-mile control section = 1.32 dB

For the two control sections = 2.16 dB.

Trouble Locating

7.23 Gain deviations in a frogging section may affect all mastergroups or only certain mastergroups. Various items should be checked according to the mastergroup affected.

All Mastergroups Affected

7.24 ***Slope*** across two or more adjacent mastergroups usually is due to an incorrect cable equalizer in the multimastergroup trunk between the MMX-2C transmitting bay and the L4 line bay. Do ***not*** provide mastergroup equalizers to correct for slope; this is a cable equalizer problem.

7.25 Missing A and B tone access units ED-52391-30 at the main stations usually cause a ***slope*** across mastergroup 1 and ***bulge*** (maximum gain deviation near the center of the band) for other mastergroups.

7.26 Incorrect A and B equalizer test signal power may cause ***slope*** and ***bulge*** effects as explained for missing A and B tone access units.

7.27 Excessive gain deviations in a frogging section indicate that each control section should be checked as explained in Part D.

D. Control Section

7.28 A ***control section*** is up to 300 miles in length and includes one or two main sections. Control refers to the remote control system in which a control center is provided at certain main stations for control over one or two main sections.

Control Section Requirements

7.29 Figure 5 shows the gain deviation requirements for control sections of various lengths. These requirements apply to measurements made at the L4 line bays between the TRMTG LINE TST jack in one main station and the RCVG LINE TST jack in the other main station.

7.30 Part E provides a procedure for determining gain deviations.

Trouble Locating

7.31 Excessive gain deviations in a control section usually indicate that incorrect deviation equalizers are installed. The 963A deviation equalizers are required in equalizing and receiving repeaters in a line equipped with List 1 basic repeaters. The 943F and 943G deviation equalizers are required in equalizing and regulating repeaters in a line equipped with List 2 basic repeaters.

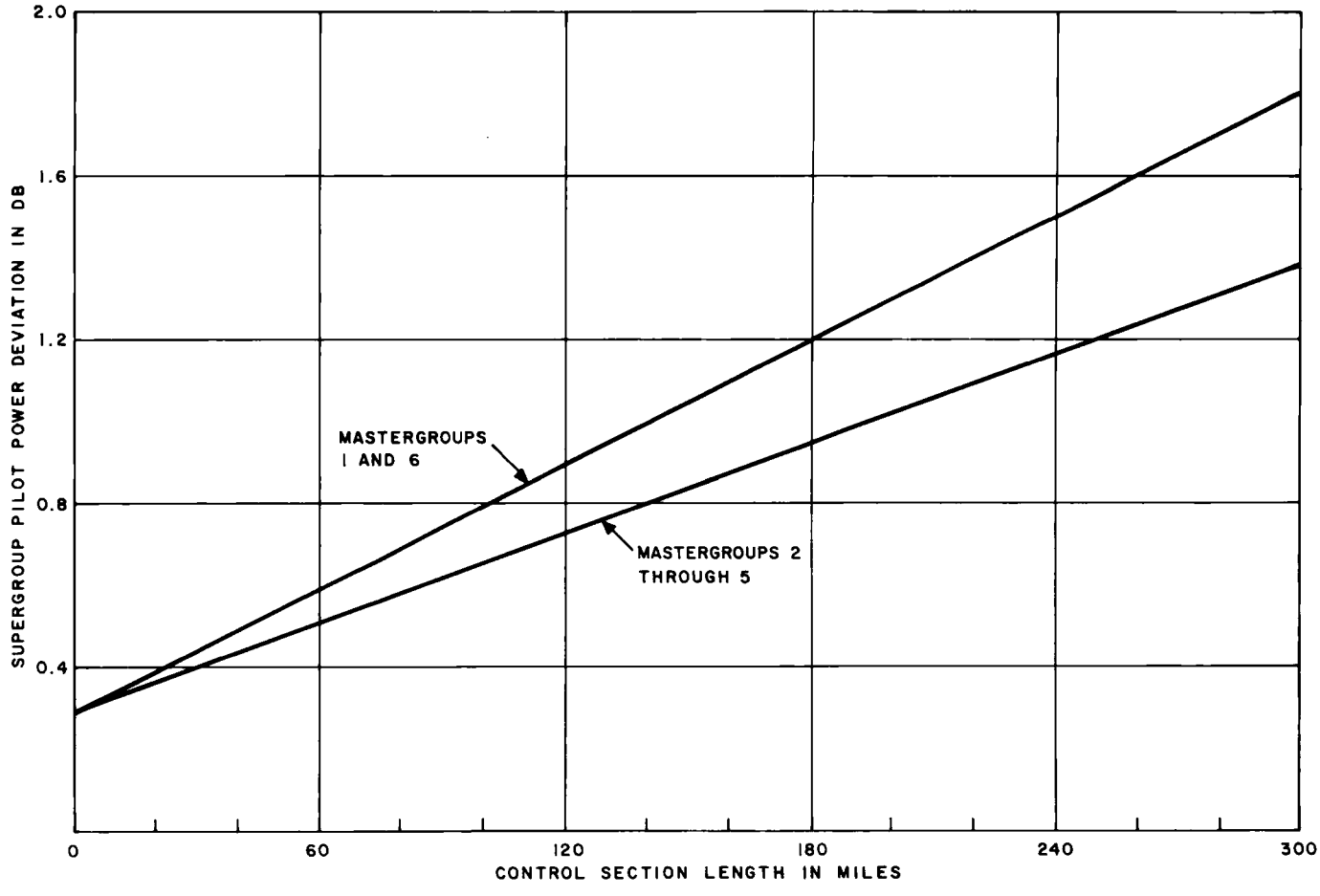


Fig. 5—Control Section Requirements

Mastergroup 3 Affected

7.32 Excessive gain deviation in mastergroup 3 usually indicates missing 959A line building-out network in the LB02 position of a receiving repeater in a line equipped with List 2 basic repeaters.

Mastergroups 4 and 5 Affected

7.33 Excessive gain deviation in mastergroup 4 and mastergooup 5 may indicate incorrect adjustment of the nick filter in a transmitting repeater. Check the transmitting repeater adjustments per Section 359-200-501.

Mastergroup 6 Affected

7.34 Excessive gain deviation in mastergroup 6 with line equalization records showing more than 2-dB adjustment of any A equalizer in a 2-month period indicates a repeater may be defective. Perform the intermodulation tests per Section 359-200-507.

7.35 Excessive gain deviation in a two-section control section may result from cross-office slope due to an incorrect cable equalizer in the intermediate main station. Check cross-office equalization per Section 359-200-501.

E. Determining Gain Deviations

7.36 Gain deviations between main stations are determined by the following procedure. An ***L4 misalignment calculator ED-52500-50,*** shown in Fig. 6, greatly simplifies the calculations and reduces the errors.

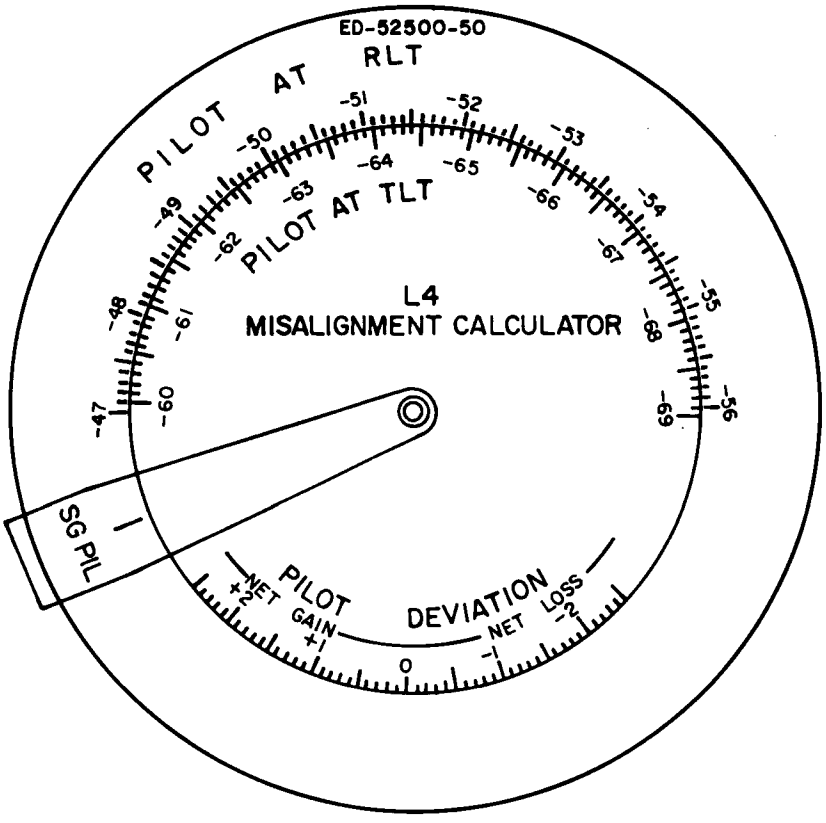


Fig. 6—L4 Misalignment Calculator

At transmitting main station,

(1) Measure and record the mastergroup pilot power and the supergroup pilot powers for the mastergroup under test at the TRMTG LINE TST jack.

(2) Report these pilot power values to the receiving main station.

At receiving main station,

(3) Record the pilot power values measured at the TRMTG LINE TST (TLT) jack as reported by the transmitting main station.

(4) Measure and record the mastergroup pilot power and the supergroup pilot powers for the mastergroup under test at the RCVG LINE TST (RLT) jack.

(5) Rotate the inner disc on the L4 misalignment calculator until the mastergroup pilot power value at the TLT jack on the inner black scale is opposite the mastergroup pilot power value at the RLT jack on the outer black scale.

Note: Assume the measured mastergroup pilot power is -65.1 dBm at the TLT jack and -52.2 dBm at the RLT jack. The L4 misalignment calculator should be set as shown in Fig. 6.

(6) Set the ***SG PIL*** index mark on the plastic cursor over the 0 dB pilot deviation mark on the red scale.

(7) Hold the calculator so that the cursor does not move with respect to the outer disc.

(8) Rotate the inner disc until the first supergroup pilot power value at the TLT jack on the inner black scale is opposite the first supergroup pilot power value at the RLT jack on the outer black scale.

Example:

Assume the supergroup pilot power is -64.6 dBm at the TLT jack and -51.0 dBm at the RLT jack. The calculator should be set as shown in Fig. 7.

(9) Record the supergroup pilot power deviation shown on the red pilot deviation scale under the ***SG PIL*** index mark on the cursor.

Note: Figure 7 indicates a supergroup pilot power deviation of -0.2 dB with respect to the mastergroup pilot power for the values given in the ***Example.***

(10) Repeat Steps 8 and 9 to determine the gain deviation at each of the other supergroup pilots.

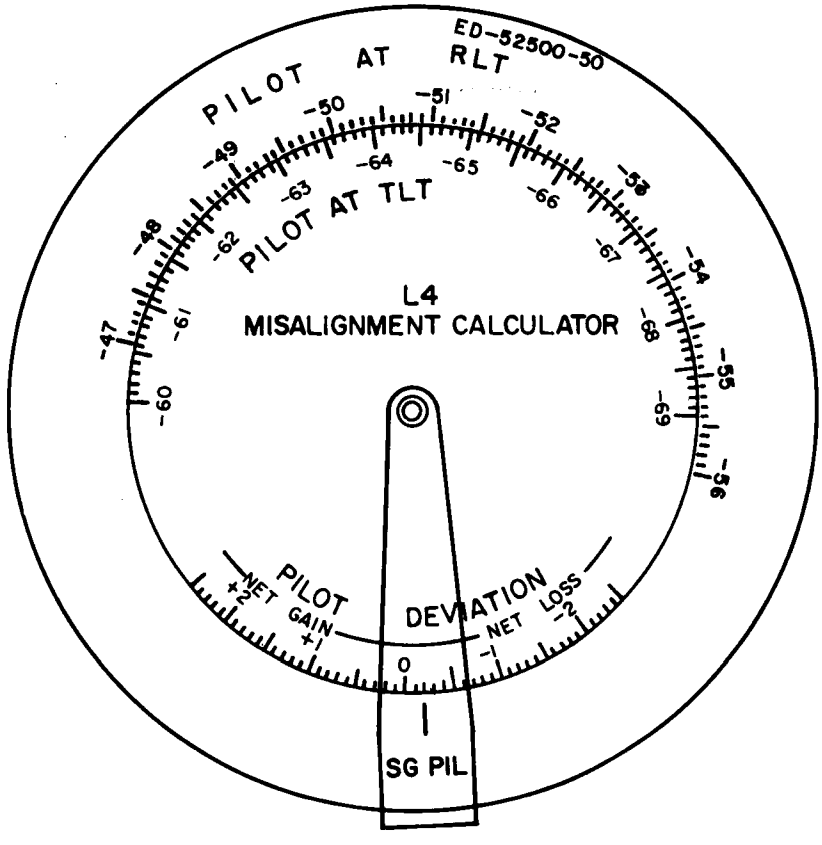
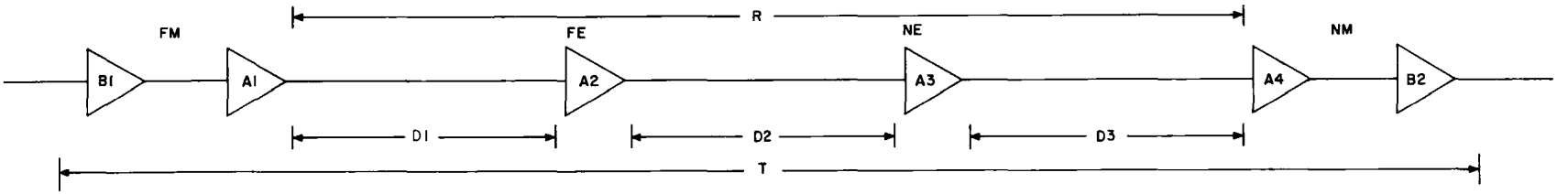


Fig. 7—L4 Misalignment Calculator Setting



SET DB SWITCHES	RECORD	EQUALIZER ADJUST METERS 1	2	3	4	5	6
	R						
FE IN	− R/3						
NE IN	− R/3						
FM IN	R/6						
NM IN	R/6						
	T						
FM IN	T/2						
NM IN	T/2						

DATE: BY:

ROUTE:

LINE:

SECTION: NEAR FAR

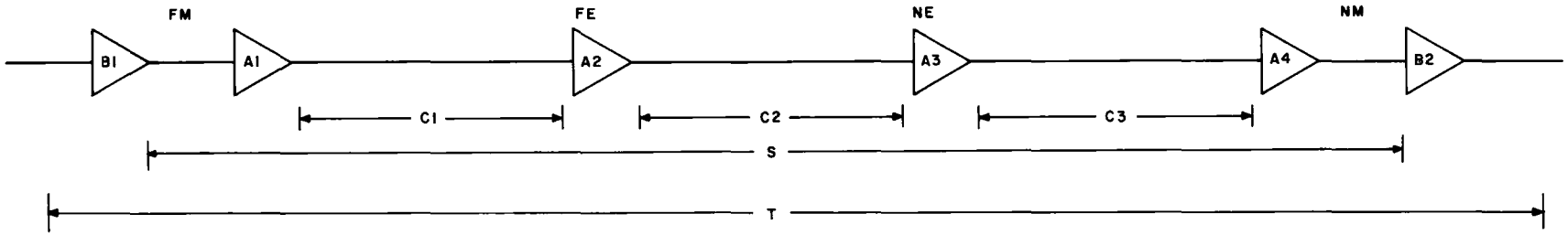
REMARKS:

EQUALIZER ADJUST METERS 7	8	9	10

NOTES:

1. D1, D2, AND D3 REPRESENT GAIN AT A EQUALIZER TEST SIGNALS FROM OUTPUT OF ONE A EQUALIZER TO INPUT OF NEXT A EQUALIZER.
2. R REPRESENTS SECTION GAIN AT A EQUALIZER TEST SIGNALS FROM OUTPUT OF A EQUALIZER AT FM TO INPUT OF A EQUALIZER AT NM WHEN MANUAL EQUALIZERS A2 AND A3 ARE AT RESET.
3. T REPRESENTS SECTION GAIN AT B EQUALIZER TEST SIGNALS FROM INPUT OF B EQUALIZER AT FM TO OUTPUT OF B EQUALIZER AT NM.
4. GAIN AT THE A AND B EQUALIZER TEST SIGNALS IS RECORDED TO NEAREST TENTH. WHERE THERE IS AN ODD NUMBER OF TENTHS, INSERT GREATER CORRECTION AT MORE DISTANT EQUALIZER.

Fig. 8—Form for Line Including Manual Equalizers



SET DB SWITCHES	RECORD	EQUALIZER ADJUST METERS 1	2	3	4	5	6
FM IN	1/2 C1						
	C1						
	1/2 C1						
	1/2 C2						
FE IN	TOTAL						
	C2						
	1/2 C2						
	1/2 C3						
NE IN	TOTAL						
	C3						
NM IN	1/2 C3						
	S						
FM IN	1/2 S						
NM IN	1/2 S						

DATE: BY:

ROUTE:

LINE:

SECTION: NEAR FAR

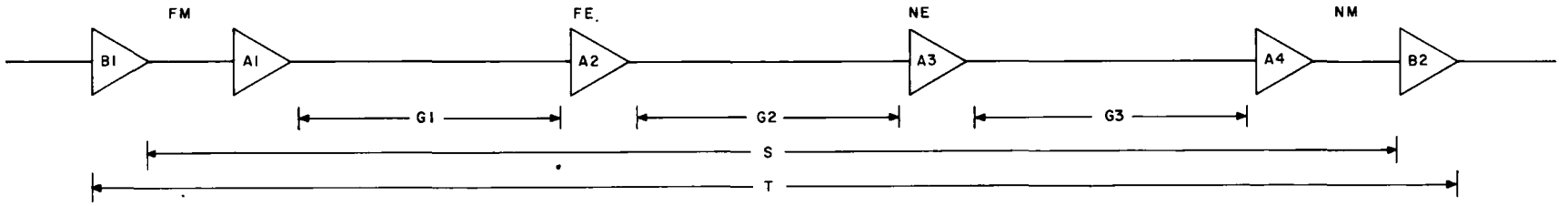
REMARKS:

EQUALIZER ADJUST METERS 7	8	9	10

NOTES:

1. C1, C2, AND C3 REPRESENT GAIN AT A EQUALIZER TEST SIGNALS FROM OUTPUT OF ONE A EQUALIZER TO INPUT OF NEXT A EQUALIZER.
2. S REPRESENTS SECTION GAIN AT B EQUALIZER TEST SIGNALS FROM OUTPUT OF B EQUALIZER AT FM TO INPUT OF B EQUALIZER AT NM.
3. GAIN AT THE A AND B EQUALIZER TEST SIGNALS IS RECORDED TO NEAREST TENTH. WHERE THERE IS AN ODD NUMBER OF TENTHS, INSERT GREATER CORRECTION AT MORE DISTANT EQUALIZER.
4. T REPRESENTS SECTION GAIN AT B EQUALIZER TEST SIGNALS FROM INPUT OF B EQUALIZER AT FM TO OUTPUT OF B EQUALIZER AT NM.

Fig. 9—Form for Line Including Stepped Equalizers Only



SET DB SWITCHES	RECORD	EQUALIZER ADJUST METERS 1	2	3	4	5	6
FM IN	(1/2 G1) + 3.3						
	G1						
	1/2 G1						
	1/2 G2						
FE IN	TOTAL						
	G2						
	1/2 G2						
	1/2 G3						
NE IN	TOTAL						
	G3						
NM IN	(1/2 G3) - 3.3						
	S						
FM IN	1/2 S						
NM IN	1/2 S						

DATE: BY:
ROUTE:
LINE:
SECTION: NEAR FAR
REMARKS:

EQUALIZER ADJUST METERS 7	8	9	10

NOTES:
1. G1, G2 AND G3 REPRESENT GAIN AT A EQUALIZER TEST SIGNALS FROM OUTPUT OF ONE A EQUALIZER TO INPUT OF NEXT A EQUALIZER.
2. S REPRESENTS SECTION GAIN AT B EQUALIZER TEST SIGNALS FROM OUTPUT OF B EQUALIZER AT FM TO INPUT OF B EQUALIZER AT NM.
3. GAIN AT THE A AND B EQUALIZER TEST SIGNALS IS RECORDED TO NEAREST TENTH. WHERE THERE IS AN ODD NUMBER OF TENTHS, INSERT GREATER CORRECTION AT MORE DISTANT EQUALIZER.
4. T REPRESENTS SECTION GAIN AT A EQUALIZER TEST SIGNALS FROM INPUT OF B EQUALIZER AT FM TO OUTPUT OF B EQUALIZER AT NM.

Fig. 10—Form for Line Including A Equalizer Test Signal Modification