

**L4 CARRIER
OVERALL SYSTEM
TESTS
TROUBLE ANALYSIS USING
REMOTE CONTROL SYSTEM**

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1. GENERAL

1.01 The remote control system enables a control center attendant to turn on equalizer test and monitoring oscillators which are located at L4 system repeaters. All signals received on L4 lines can be monitored at the control center.

1.02 Major troubles in the L4 system will be indicated by alarms at the main stations. In this section, however, troubles that may not cause alarms are also described.

1.03 A control center attendant must determine whether abnormal indications noted at a control center are caused by trouble in the control center, or by trouble in the remote control system circuits at other locations, or by trouble in the other L4 system circuits.

1.04 The block diagram in Fig. 1 is provided to aid in understanding the procedures explained in this section. Only the one-section control arrangement is shown. Basically, 2-section control and sideleg route control are very similar to one-section control. Differences, mainly in sideleg

route control, must be considered when isolating troubles. These differences are noted at the appropriate points in Chart A of this section.

1.05 In order to make a test by means of the remote control system, a program must be set up by depressing control center pushbuttons in the proper sequence. Section 359-220-300 describes the functions of all the control center controls and indicators. When it is not possible to completely program a control center, the dc logic should be checked in accordance with Section 359-220-501.

1.06 The A and B equalizer test oscillators and groups of monitoring oscillators are turned on and equalizers are adjusted by means of commands transmitted from a control center. Audio command signals and command carrier signals can be checked in accordance with Section 359-220-502.

1.07 Received equalizer test signal levels are indicated on control center meters, and received monitoring oscillator signals are displayed on a panoramic analyzer. The meters and the panoramic analyzer are part of the control center receiving circuit, which can be checked in accordance with Section 359-220-503.

1.08 Command signals are connected to the remote main and equalizing repeaters in the selected receive line via a loopback circuit, which can be checked in accordance with Section 359-220-504.

2. EQUALIZER TEST SIGNALS

2.01 The six A or ten B equalizer test signals at various locations may be turned on and connected to the control center receiving circuit by programming. These signals are selected,

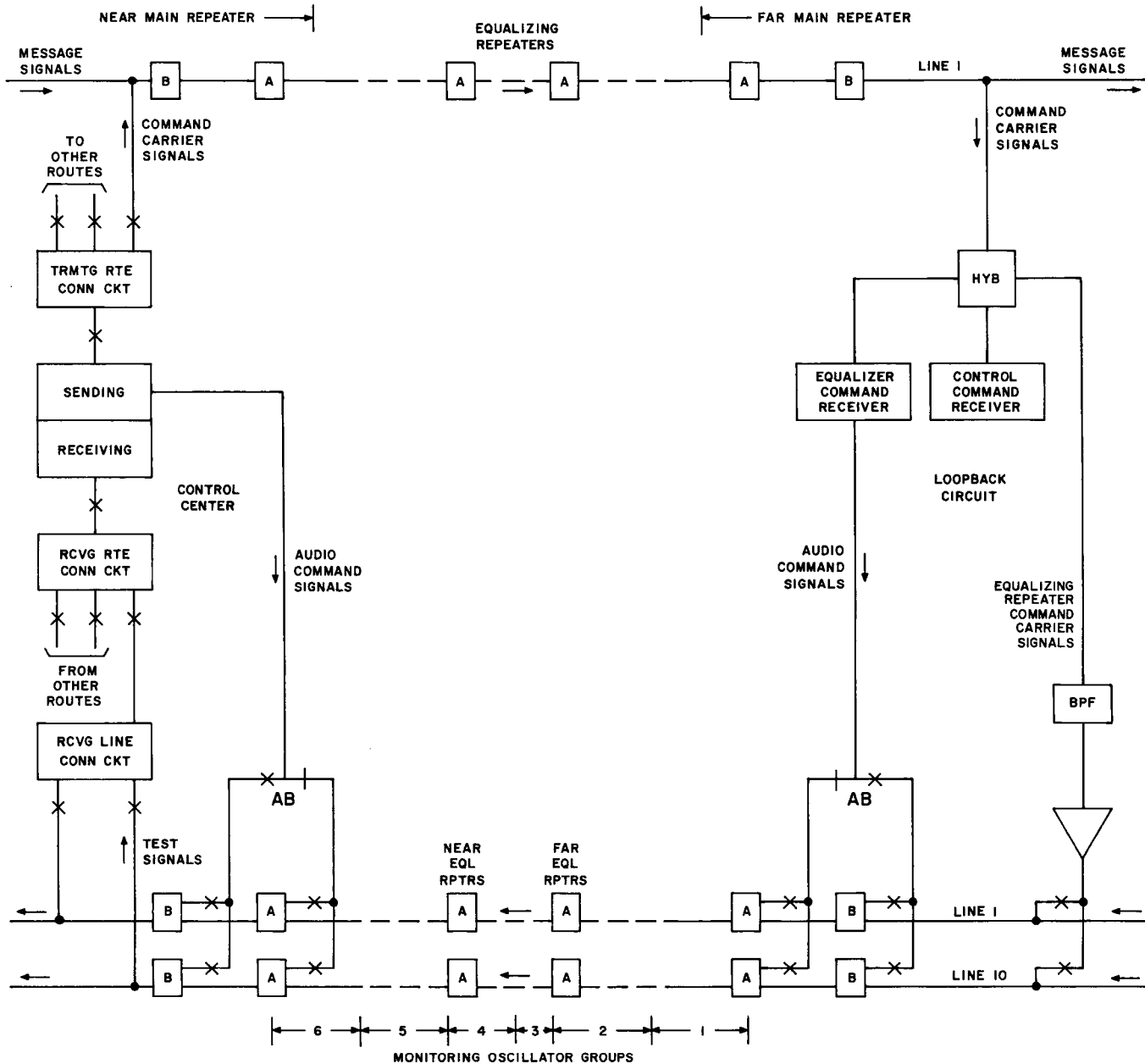


Fig. 1—Simplified Block Diagram of Remote Control System

amplified, and detected, and the level of each is individually displayed on the control center meters.

2.02 Equalizer test signals at a nominal power on the receive line under test will cause on-scale meter indications when the control center receiving circuit is arranged to provide nominal gain.

2.03 To measure equalizer test signals at nominal power, pads associated with the DB switches, CAL control, and INCR pushbuttons provide a total loss of approximately 20 dB in the path for each equalizer test signal.

2.04 Gain deviations of line sections and equalizing repeaters may be determined by connecting equalizer test signals at the *input* of the appropriate

line section or equalizing repeater and by making measurements as follows.

- (1) First, with the DB switches on 0, the INCR pushbuttons and CAL controls are operated to obtain indications of 0 on the equalizer adjust meters.
- (2) Next, the equalizer test signals are switched to the **output** of the line section or equalizing repeater and the DB switches are operated to obtain indications of 0 on the equalizer adjust meters.
- (3) Gain deviations of the line section or equalizing repeater at the various equalizer test signals now may be read directly from the DB switches.

3. MONITORING OSCILLATOR SIGNALS

- 3.01** Each basic, regulating, equalizing, and main repeater has an associated monitoring oscillator. These oscillators can be turned on, in groups, by commands from a control center.
- 3.02** The signals received from a group of monitoring oscillators may be observed on the control center panoramic analyzer. This display permits a control center attendant to locate defective line repeaters and can be useful for isolating other troubles.
- 3.03** The panoramic analyzer also can be used to check for noise on a receive line at 546 kHz or 18.53 MHz.

4. NOISE AND MESSAGE SIGNAL MEASUREMENTS

- 4.01** Noise and L4 message-band signals can be measured by connecting test equipment to

the BB TST (broadband test) jack and to the HF NB TST (high-frequency narrowband test) jack on the front panel of the control center.

- 4.02** The entire L4 frequency range (280 kHz to 20.448 MHz) appears at the BB TST jack. Each equalizer test signal has a nominal power of -40.7 dBm and each monitoring oscillator signal has a nominal power of -35.7 dBm at this jack.

- 4.03** Only the monitoring oscillator signals appear at the HF NB TST jack, and each signal has a nominal power of -5.7 dBm at this jack.

5. TROUBLE ISOLATION

- 5.01** Command carrier signals to and monitoring oscillator and equalizer test signals from remote locations are transmitted over the L4 lines. These signals also pass through circuits which are part of the remote control system only.
- 5.02** Abnormal indications at a control center may be due to trouble in the L4 lines or in the remote control system.
- 5.03** The quickest and easiest way to isolate trouble in the L4 system is to set up a series of similar programs on different lines and routes and compare the indications at the control center.
- 5.04** Chart A is provided to outline procedures which may be used to isolate some typical troubles. Letters are used in the chart to designate the troubles indicated. In the case of remote control system troubles, the letters also show which sections provide procedures for locating these troubles.

CHART A — TROUBLE ANALYSIS USING REMOTE CONTROL SYSTEM

PROGRAM TO APPLY A EQUALIZER TEST SIGNALS AT OUTPUT OF NEAR MAIN REPEATER IN RECEIVE LINE UNDER TEST

OBSERVE EQUALIZER ADJUST METERS AND ADJUST CAL CONTROLS TO OBTAIN INDICATIONS OF 0 DB ON METERS 1 THROUGH 5

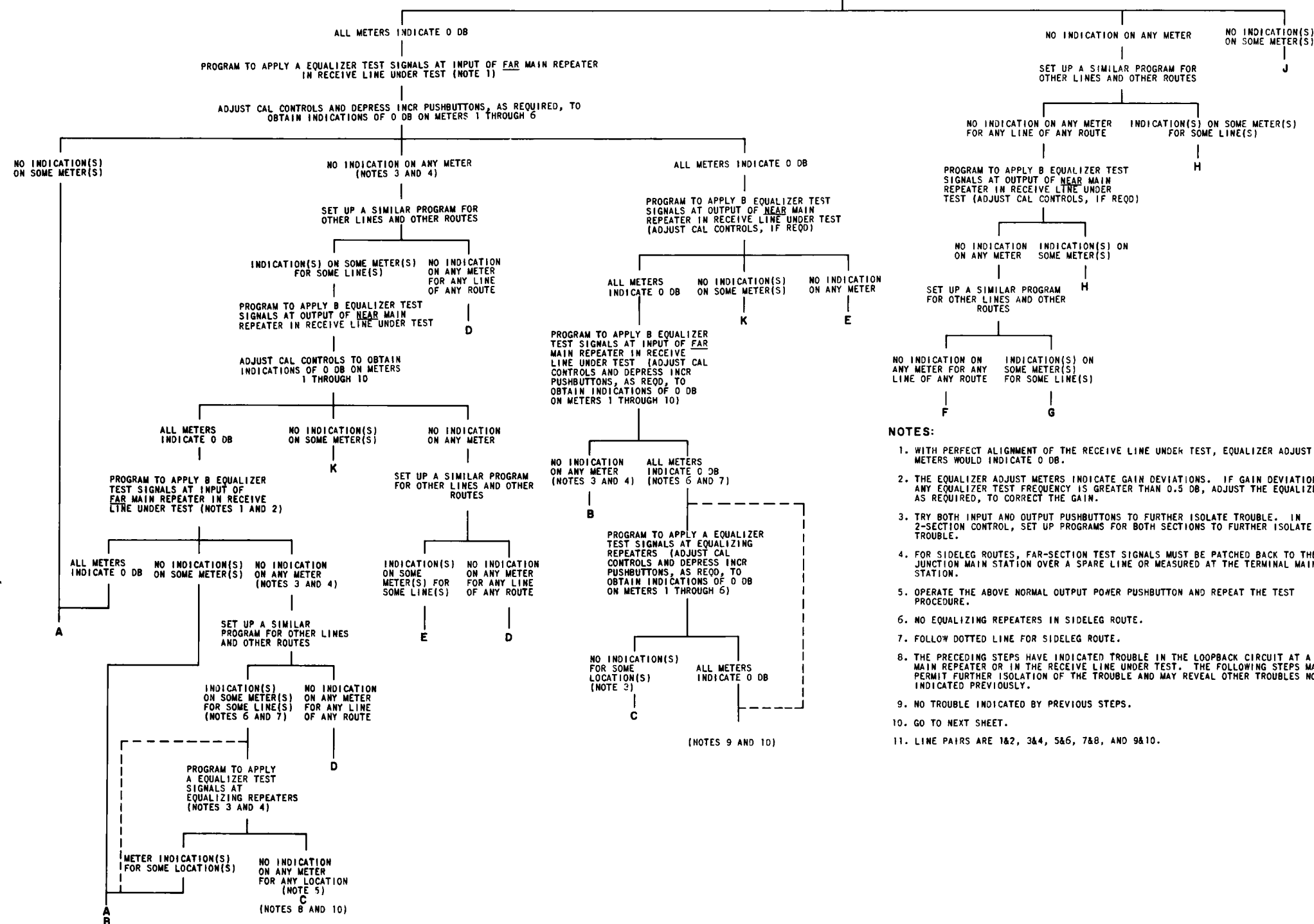


Diagram illustrating the restriction sites for three DNA sections:

- SECTION 359-220-502:** Restriction sites D, E, F, G, R, T.
- SECTION 359-220-503:** Restriction sites H, J, K, Q.
- SECTION 359-220-504:** Restriction sites A, B, C, N, S, U.

TROUBLES INDICATED:

- A - FAR MAIN REPEATER A EQUALIZER LOGIC OR EQUALIZER TEST SIGNAL CIRCUIT.
- B - FAR MAIN REPEATER B EQUALIZER LOGIC OR EQUALIZER TEST SIGNAL CIRCUIT.
- C - LOOPBACK CIRCUIT, EQUALIZING REPEATER, OR RECEIVE LINE UNDER TEST.
- D - CONTROL CENTER COMMAND CARRIER TRANSMISSION PATH.
- E - NEAR MAIN REPEATER B EQUALIZER TEST SIGNAL CIRCUIT OR AUDIO COMMAND TRANSMISSION PATH.
- F - AUDIO COMMAND TRANSMISSION PATH AT NEAR MAIN REPEATER.
- G - AUDIO COMMAND TRANSMISSION PATH OR CONTROL CENTER RECEIVING CIRCUIT.
- H - NEAR MAIN REPEATER A EQUALIZER TEST SIGNAL CIRCUIT.
- J - NEAR MAIN REPEATER A EQUALIZER TEST SIGNAL CIRCUIT OR CONTROL CENTER RECEIVING CIRCUIT.
- K - NEAR MAIN REPEATER B EQUALIZER TEST SIGNAL CIRCUIT OR CONTROL CENTER RECEIVING CIRCUIT.
- L - MISSING MON OSC SIGNALS IN DISPLAY FOR RECEIVE LINE UNDER TEST INDICATE WHICH REPEATER IS DEFECTIVE.
- M - MISSING MON OSC SIGNAL INDICATES A DEFECTIVE MON OSC AT THE REPEATER INDICATED.
- N - EQUALIZER CONTROL PORTION OF THE LOOPBACK CIRCUIT.
- P - NEAREST BASIC REPEATER IN MON OSC GROUP 5 IN RECEIVE LINE UNDER TEST IS DEFECTIVE.
- Q - MON OSC CONTROL CIRCUIT IN THE NEAR MAIN REPEATER FOR THE RECEIVE LINE UNDER TEST.
- R - CONTROL CENTER AUDIO COMMAND SIGNAL CIRCUIT OR IN THE MON OSC PORTION OF THE CONTROL CENTER RECEIVING CIRCUIT.
- S - LOOPBACK CIRCUIT AT THE TERMINAL MAIN REPEATER.
- T - COMMAND CARRIER TRANSMISSION PATH OR IN THE LOOPBACK CIRCUIT AT THE TERMINAL MAIN REPEATER.
- U - NEAR EQUALIZING REPEATER.

NOTES:

1. WITH PERFECT ALIGNMENT OF THE RECEIVE LINE UNDER TEST, EQUALIZER ADJUST METERS SHOULD INDICATE 0 DB.
2. THE EQUALIZER ADJUST METERS INDICATE GAIN DEVIATIONS. IF GAIN DEVIATION AT ANY EQUALIZER TEST FREQUENCY IS GREATER THAN 0.5 DB, ADJUST THE EQUALIZERS, AS REQUIRED, TO CORRECT THE GAIN.
3. TRY BOTH INPUT AND OUTPUT PUSHBUTTONS TO FURTHER ISOLATE TROUBLE. IN 2-SECTION CONTROL, SET UP PROGRAMS FOR BOTH SECTIONS TO FURTHER ISOLATE TROUBLE.
4. FOR SIDELEG ROUTES, FAR-SECTION TEST SIGNALS MUST BE PATCHED BACK TO THE JUNCTION MAIN STATION OVER A SPARE LINE OR MEASURED AT THE TERMINAL MAIN STATION.
5. OPERATE THE ABOVE NORMAL OUTPUT POWER PUSHBUTTON AND REPEAT THE TEST PROCEDURE.
6. NO EQUALIZING REPEATERS IN SIDELEG ROUTE.
7. FOLLOW DOTTED LINE FOR SIDELEG ROUTE.
8. THE PRECEDING STEPS HAVE INDICATED TROUBLE IN THE LOOPBACK CIRCUIT AT A MAIN REPEATER OR IN THE RECEIVE LINE UNDER TEST. THE FOLLOWING STEPS MAY PERMIT FURTHER ISOLATION OF THE TROUBLE AND MAY REVEAL OTHER TROUBLES NOT INDICATED PREVIOUSLY.
9. NO TROUBLE INDICATED BY PREVIOUS STEPS.
10. GO TO NEXT SHEET.
11. LINE PAIRS ARE 1&2, 3&4, 5&6, 7&8, AND 9&10.

CHART A (CONT)

