LOOP SIGNALING REPEATER—LOOP-START ONLY/2-2 INTERMEDIATE (L-NL) REPEATER (J99343GD) COMBINED FUNCTION UNIT SD-7C050-( ) INSTALLATION AND TESTING METALLIC FACILITY TERMINAL

CONTENTS PAGE

1. GENERAL

1.01 This section provides the installation and testing procedures for the Metallic Facility Terminal (MFT) J99343GD combined function unit (CFU).

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

1.03 A detailed description of the J99343GD CFU is covered in Section 332-912-155. The equipment test list (ETL) is not affected by this issue.

2. CHARACTERISTICS

2.01 The J99343GD CFU incorporates the transmission functions of a 2-2 wire (loaded to nonloaded) intermediate repeater and the signaling functions of a loop signaling repeater/loop start only (LSR/LSO). The repeater (transmission) portion of the CFU performs the same function as the J99343PJ,L2 repeater (Section 332-912-117). The signaling portion (LSR/LSO) of the CFU performs the same functions of the J99343AD LSR (plus extended range, Section 332-912-101).

2.02 The J99343GD CFU is designed to supply adjustible gain and equalization between various gauges of H88 loaded facilities on the A-side and nonloaded facilities on the B-side. This unit is also designed to detect 20-Hz ringing from the CO or PBX, and reapply a local 20-Hz ringing source toward the station. This unit also regenerates dial pulses and dc signals received from the station side toward the CO or PBX.

2.03 The J99343GD CFU incorporates a canceler hybrid on the A-side (loaded side) and a transformer hybrid on the B-side (nonloaded side). An LBOC is required for the A-side which interfaces loaded cable. Balance for the A-side canceler is accomplished through the operation of eight miniature rocker switches (cable gauge switches) located on the printed wiring board. Also associated with the cable gauge switches are two switches labeled T. These two switches, when operated towards their labeled designation, will allow the J99343GD CFU to impedance match 900 ohms +2.15 μF equipment on the A-side.

2.04 Balance on the B-side (nonloaded) of the J99343GD CFU is accomplished by a precision balance network (PBN) (see Part 5).

2.05 The active equalizer network provides gain in addition to that provided by the flat gain circuit. A group of switches labeled SLOPE (8,4,2,1) set the equalization simultaneously for each direction of transmission. Application of the J99343GD CFU does not require the C switch which is provided on the older vintage equalizers (309D) slope switch group. The J99343GD CFU slope values (8,4,2,1) provide the same functions as the equivalent labeled 309D equalizer values with C=0 or OFF. Table A gives the slope values applicable to the J99343GD CFU based on measured loss data at 400 Hz and 2800 Hz.

3. APPLICATION GUIDELINES

3.01 Transmission levels of 2-wire circuits are limited by two factors: crosstalk and stability. Separate objectives are given for satisfactory stability and crosstalk performance.

3.02 For stability considerations, the maximum allowable gain across the J99343GD CFU is 12 dB. This gain is not the maximum available with the J99343GD CFU since the CFU is capable of producing more than 12 dB of gain for some equalizer and gain settings.

3.03 Crosstalk objectives determine the following level requirements with respect to the 0 transmission level point (TLP).

Maximum output Level: +6 dB (TLP)

Minimum Input Level: -9 dB (TLP).

3.04 The levels in the previous two paragraphs are based on the assumption that the J99343GD CFU is located in the central office (CO). The J99343GD CFU is not recommended for installation at customer locations due to repeater balance requirements which are better maintained at central offices. Also the impedance of most PBXs (considered to be 600 ohms +2.15 μF) does not match that of the J99343GD CFU (900 ohms +2.15 μF).

3.05 Roll-off objectives at 400 and 2800 Hz for the J99343GD CFU are shown in Table B. it is recommended, but not required, that the roll-off at 400 and 2800 Hz for both lines and trunks be greater than the 1-kHz loss.

3.06 The following objectives listed meet trunk requirements for roll-off. Since trunk requirements are more stringent than line requirements, these objectives will guarantee that line requirements are met also. The following are the trunk requirements for the J99343GD CFU:

- Total 1-kHz loss of the facility should be less than 9 dB for the loaded side and for the nonloaded side.

- Total 1-kHz loss of the facilities on both sides of the J99343GD CFU should not exceed 12 dB + ICL (inserted connection loss).

TABLE A

EQUALIZER SETTINGS FROM LOSS DATA

2800-HZ DIFFERENCE

400-HZ DIFFERENCE	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0
−1.0	0	0	0	1	1	2	2	3	3	4	4	5	6	7	7	7	7
− .5	0	0	1	1	2	2	3	3	4	4	5	6	7	7	8	9	9
0	0	1	1	2	2	3	3	4	4	5	6	7	7	8	9	10	11
.5					3	3	4	4	5	6	7	7	8	9	10	11	12
1.0								5	6	7	7	8	9	10	11	12	14
1.5								6	7	7	8	9	10	11	12	14	15
2.0								1	1	8	9	10	11	12	14	15	15
2.5								1	2	2	10	11	12	14	15	15	15
3.0											3	12	14	15	15	15	15
3.5												14	15	15	15	15	15
4.0													6	6	7	8	9
4.5															8	9	10
5.0																10	11
5.5																	12
6.0																	

400-HZ DIFFERENCE	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0
−1.0	7	8	9	9	10	11	12	13	14					
− .5	9	9	10	11	11	12	13	15	15	6				
0	11	11	11	12	13	14	15	6	6	7	7	8		
.5	13	13	13	13	15	15	15	6	7	8	8	9	10	
1.0	15	15	15	15	15	15	15	7	8	9	10	10	11	12
1.5	15	15	15	7	7	15	15	8	9	10	11	12	13	14
2.0	15	15	15	9	9	0	15	10	10	11	12	13	14	15
2.5	15	15	15	10	11	11	11	11	12	13	14	15	15	15
3.0	15	15	15	11	12	13	13	13	13	14	15	15	15	15
3.5	15	15	15	12	13	15	15	15	15	15	15	15	15	15
4.0	10	11	12	13	15	15	15	15	15	15	15	15	15	15
4.5	11	12	13	15	15	15	15	15	15	15	15	15	15	15
5.0	12	13	15	15	15	15	15	15	15	15	15	15	15	15
5.5	13	15	15	15	15	15	15	15	15	15	15	15	15	15
6.0	15	15	15	15	15	15	15	15	15	15	15	15	15	15

MEET TRUNK REQUIREMENTS (columns 9.5–13.0)

MEET LINE REQUIREMENTS (columns 13.5–16.0)

TABLE B

ATTENUATION DISTORTION ROLLOFF OBJECTIVES
FOR VOICEGRADE
SWITCHED SPECIAL SERVICES AND PBX CIRCUITS

CIRCUIT	ALLOWABLE DEVIATION FROM 1000-HZ LOSS	
	MEASURED AT 400 HZ (NOTE)	MEASURED AT 2800 HZ (NOTE)
Trunks	Within 3.0 dB more loss or 1.0 dB less loss	Within 1.5 dB more loss or 1.0 dB less loss
Lines	Within 5.0 dB more loss or 1.0 dB less loss	Within 7.5 dB more loss or 1.0 dB less loss

Note: Relative to 1-kHz loss

- Total length of the near-end section should not exceed 8 kft.
- Total length of the far-end section and associated bridged taps should not exceed 9 kft.
- The nonloaded facility should not contain any load coils.
- Load coil spacing for the loaded facility should be between 5.7 and 6.3 kft.

3.07 For circuits which include a single J99343GD CFU in the 2-wire facility, the equalization is on an end-to-end basis. Equalization should meet objectives outlined in paragraph 3.05.

3.08 Application guidelines for the J99343GD CFU are given in the discriptive Section 332-912-155. Figure 1 is a pictorial drawing of the J99343GD CFU showing the location of all switches needed for the installation of the unit.

4. ADJUSTMENT OF LINE BUILD-OUT CAPACITORS (LBOC)

4.01 The J99343GD CFU has an LBOC circuit on the A-side for interfacing loaded cable. The LBOC circuit builds out the A-side H88 loaded cable end section to an electrical equivalent of 6000 ft from the unit to the first loading coil. The LBOC must be set prior to adjusting the balancing network of the canceler hybrids.

4.02 The LBOC settings of the J99343GD CFU are controlled by six miniature switches (see Fig. 1) on the printed wiring board. These switches are labeled 002, 004, 008, 016, 032, and 064. These numbers indicate the capacitance value added when the switches are operated toward their labeled designations. For example, the switch labeled 004, when operated, applies 0.004 μF of capacitance across the 2-wire facility on the A-side. The capacitance of the LBOC is additive; for example, if the switches labeled 002, 006, and 016 are operated, 0.024 μF of capacitance is added to the A-side facility.

4.03 Table C gives the LBOC settings for end sections up to 5 kft.

4.04 For end-section lengths not listed in Table C, the required capacitance value can be calculated. Two formulas are given for calculation of the capacitance value required, one for high-capacitance (0.083 μF/mile) cable and one for low-capacitance (0.064 μF/mile) Metropolitan Area Trunk (MAT) cable. These formulas are:

- High-capacitance (19, 22, 24, 26)

$$C = 0.016\ (6\text{-}N)$$

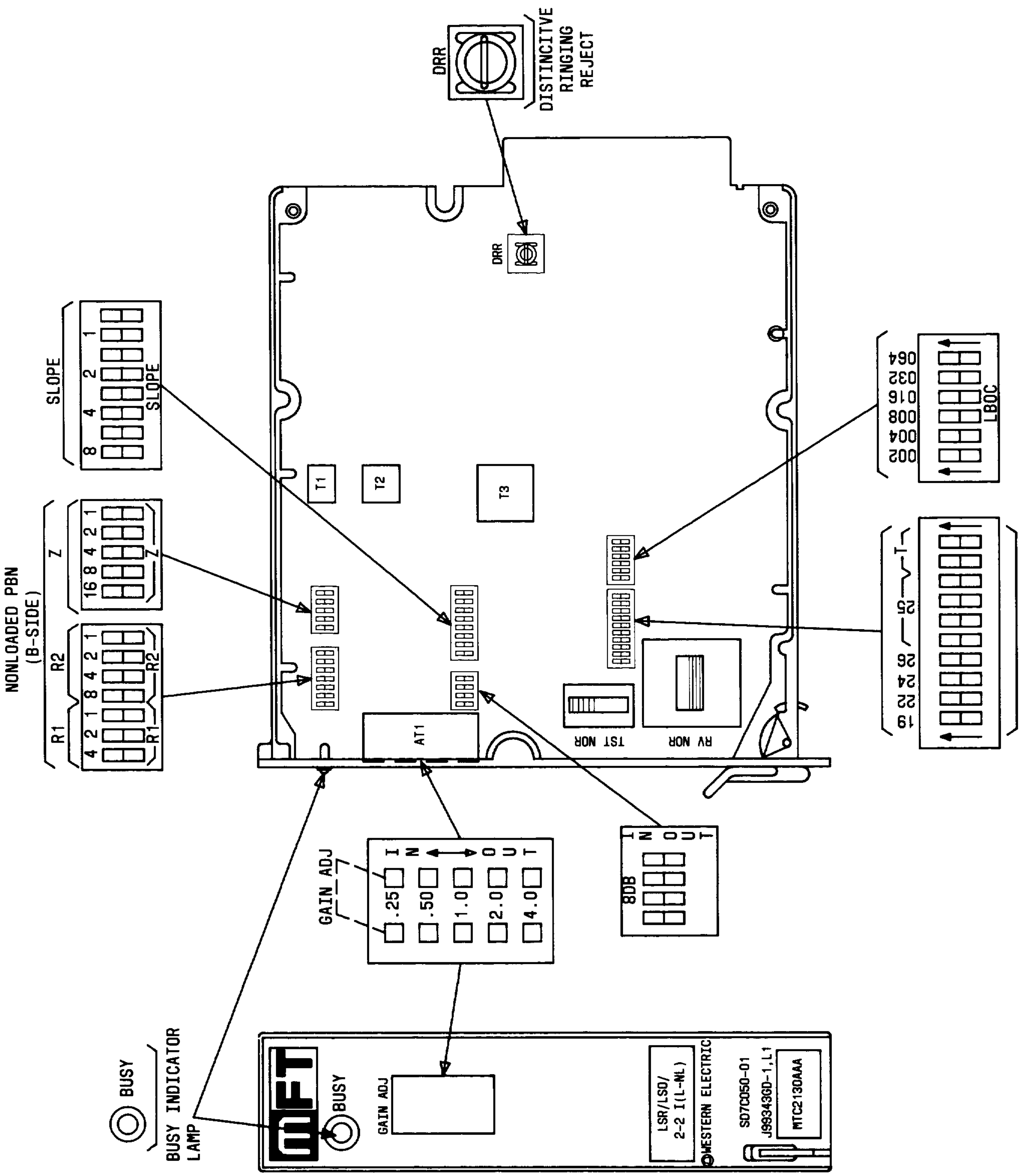


Fig. 1—J99343GD CFU

TABLE C

LBOC SETTINGS (CANCELER HYBRID-TYPE REPEATERS [NOTE])

END-SECTION LENGTH (FEET)	CAPACITANCE VALUE HI-CAP	SWITCHES OPERATED TO "ON"	CAPACITANCE VALUE MAT	SWITCHES OPERATED TO "ON"
1450 — 1549	.072	.008 + .064	.058	.002+.008+.016+.032
1550 — 1649	.070	.002+.004+.064	.056	.008+.016+.032
1650 — 1749	.068	.004 + .064	.054	.002+.004+.016+.032
1750 — 1849	.068	.004 + .064	.054	.002+.004+.016+.032
1850 — 1949	.066	.002 + .064	.052	.004+.016+.032
1950 — 2049	.064	.064	.052	.004+.016+.032
2050 — 2149	.062	.002+.004+.008+.016+.032	.050	.002+.016+.032
2150 — 2249	.060	.004+.008+.016+.032	.048	.016+.032
2250 — 2349	.060	.004+.008+.016+.032	.048	.016+.032
2350 — 2449	.058	.002+.008+.016+.032	.046	.002+.004+.008+.032
2450 — 2549	.056	.008+.016+.032	.046	.002+.004+.008+.032
2550 — 2649	.054	.002+.004+.016+.032	.044	.004+.008+.032
2650 — 2749	.052	.004+.016+.032	.042	.002+.008+.032
2750 — 2849	.052	.004+.016+.032	.042	.002+.008+.032
2850 — 2949	.050	.002+.016+.032	.040	.008+.032
2950 — 3049	.048	.016 + .032	.040	.008 + .032
3050 — 3149	.046	.002+.004+.008+.032	.038	.002+.004+.032
3150 — 3249	.044	.004+.008+.032	.036	.004+.032
3250 — 3349	.044	.004+.008+.032	.036	.004+.032
3350 — 3449	.042	.002+.008+.032	.034	.002+.032
3450 — 3549	.040	.008 + .032	.034	.002+.032
3550 — 3649	.038	.002+.004+.032	.032	.032
3650 — 3749	.036	.004 + .032	.030	.002+.004+.008+.016
3750 — 3849	.036	.004 + .032	.030	.002+.004+.008+.016
3850 — 3949	.034	.002 + .032	.028	.004+.008+.016
3950 — 4049	.032	.032	.026	.002+.008+.016
4050 — 4149	.030	.002+.004+.008+.016	.026	.002+.008+.016
4150 — 4249	.030	.002+.004+.008+.016	.024	.008+.016
4250 — 4349	.028	.004+.008+.016	.024	.008+.016
4350 — 4449	.026	.002+.008+.016	.022	.002+.004+.016
4450 — 4549	.024	.008+.016	.020	.004+.016

Note: When replacing a 2-2 wire MFT repeater containing a transformer hybrid(s) interfacing loaded cable with a 2-2 MFT repeater containing a canceler(s), the LBOC value of the replaced repeater will be reduced by 0.008 μF when LBOC settings are used with high-capacitance loaded cable and .006 μF when used with low-capacitance H88 MAT cable. For example: a 2-2 MFT repeater having an LBOC value of 0.080 with a transformer hybrid interfacing with high-capacitance loaded cable is being replaced with a 2-2 MFT repeater with canceler. The new LBOC value used with the canceler will be 0.072 μF.

- Low-capacitance (MAT)

  $C = .002 + 0.0122\ (6\text{-}N)$

  where: C is the capacitance in microfarads, N is the length of near-end section in kilo feet.

  where: C is the capacitance in microfarads, N is the length of Near-end Section in kilo feet.

5. ADJUSTMENT OF BALANCING NETWORKS

A. General

5.01 The procedures in this section cover the adjustments for the balancing networks of the J99343GD CFU.

5.02 The J99343GD CFU contains two types of balancing networks, a canceler hybrid on the A-side facing the loaded facility and a two-transformer hybrid with a precision balance network (PBN) on the B-side facing the nonloaded facility. The following paragraphs discuss the adjustment of the canceler hybrid and the transformer hybrid with the PBN.

B. Canceler Hybrid (Loaded Facilities)

5.03 Adjustment of the balancing network of the canceler hybrid on the loaded facility side (A-side) of the J99343GD CFU is controlled by eight miniature cable GAUGE switches located on the printed wiring board. Four of these switches are labeled 19, 22, 24, and 26 and four are collectively labeled 25. The numbers correspond to the gauge of cable connected to the A-side of the J99343GD CFU. Only one gauge setting should be selected for each application. To set the unit for 25-gauge MAT cable, all four switches labeled 25 must be operated toward the 25 designation. In mixed gauge application, the predominant gauge of the repeatered section determines the cable gauge setting. Two additional rocker switches, labeled T, provide "compromise" balance to accommodate application where the loaded side facility is 900 ohms or 900 ohms + 2.15 μF (eg, a test set). None of the cable gauge switches should be operated for this mode of operation. This arrangement also permits the unit to be used as a nonloaded terminal repeater in applications that require maximum equalization.

C. Two-Transformer Hybrid (Nonloaded Facilities)

5.04 Adjustment of the PBN for the transformer hybrid on the B-side is done through the operation of twelve switches located on the printed wiring board. The switches are labeled as follows: three switches labeled R1 (designated 4,2,1); four switches labeled R2 (designated 8,4,2,1); and five switches labeled Z (designated 16,8,4,2,1). (See Fig. 1.)

D. Procedures

5.05 A diagram showing the test setup for the adjustment of the B-side PBN is shown in Fig. 2, and the A-side canceler arrangement for gauge switch optimizing is shown in Fig. 3.

5.06 The procedures in Charts 1 and 2 are used for the adjustment of the gauge switches in the canceler hybrid. The procedures in Charts 1 and 3 are used for adjustment of the precision balance network used with the transformer hybrid. The test equipment required for these procedures are:

- J99343TB test extender
- Return loss measuring set (RLMS), KS-20501,L3 or equivalent
- Circuit layout record (CLR).

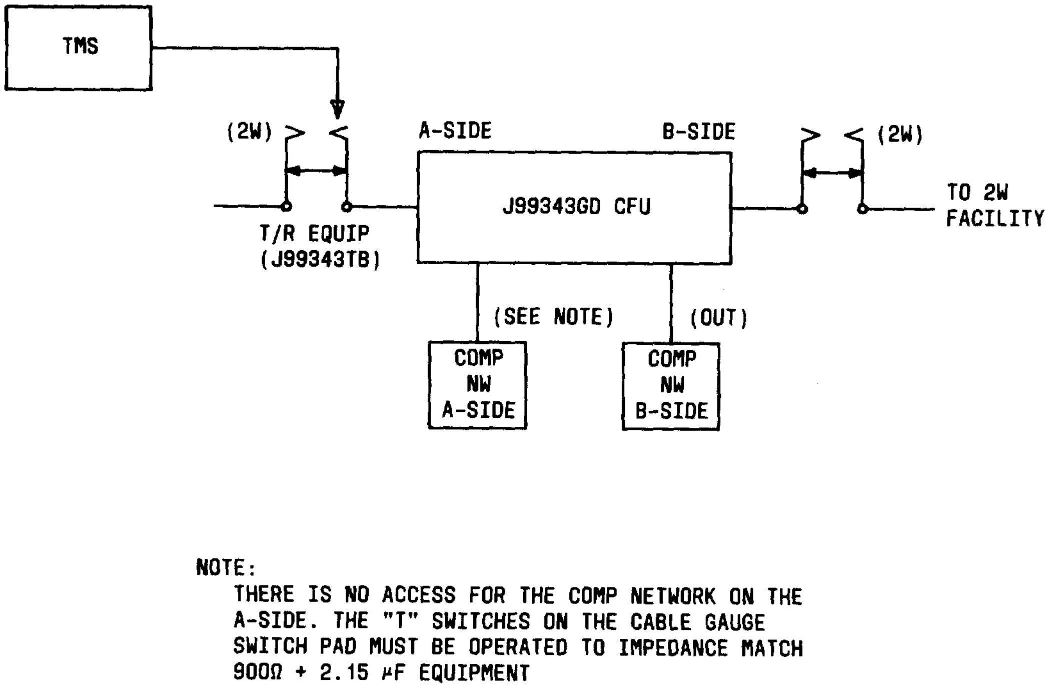


Fig. 2—Typical Test Configuration for Setting B-Side Precision Balance Network

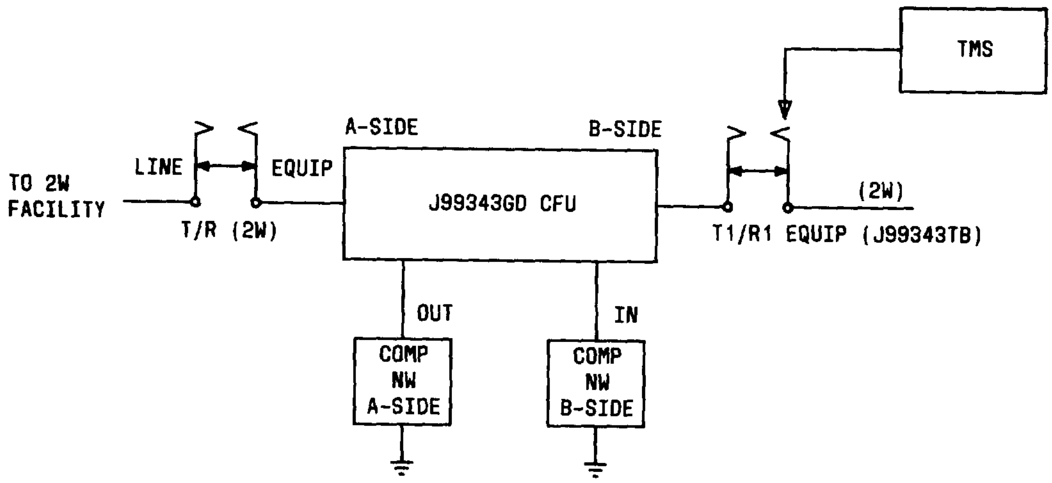


Fig. 3—Typical Test Configuration for Setting A-Side Gauge Switches

CHART 1

INITIAL PROCEDURES FOR ADJUSTMENT OF BALANCE NETWORK (CANCELER OR TRANSFORMER HYBRID)

STEP	PROCEDURE
1	Terminate the far end of the circuit in its nominal impedance. If the far end is a switch or PBX, a compromise network (600 or 900 ohms + 2.16 μF) should be used. If the far end terminates in a telephone set, use a 4066H network (Section 332-852-108) to simulate the teleset.
2	Insert the J99343GD CFU into the slot on the side of the J99343TB test extender. Plug the cable extender card of the J99343TB into the mounting slot.
3	Set the repeater options as follows: (a) Integrated circuit equalizers—all switches to off. (b) If B-side network is to be adjusted, remove A-side LBOC if present. ***Note:*** The LBOC settings must be set prior to adjusting the A-side canceler hybrid. (c) Signaling options as specified on CLR (NOR/RV). (d) TST/NOR switch to TST position. (e) Gain switches to approximately midrange. This is done to improve the sensitivity of the measurements; the gain settings are not critical.
4	Set switches on the J99343TB test extender as follows (See notes 1 and 2.): (a) For adjustment of B-side network:

A-Side	B-Side
600/900 to 900	600/900 to 900
2W/4W to 2W	2W/4W to 2W
COMP NET IN/OUT to IN	COMP NET IN/OUT to OUT (See Note 2.)

(b) For adjustment of A-side network:

A-Side	B-Side
600/900 to 900	600/900 to 900

CHART 1 (Contd)

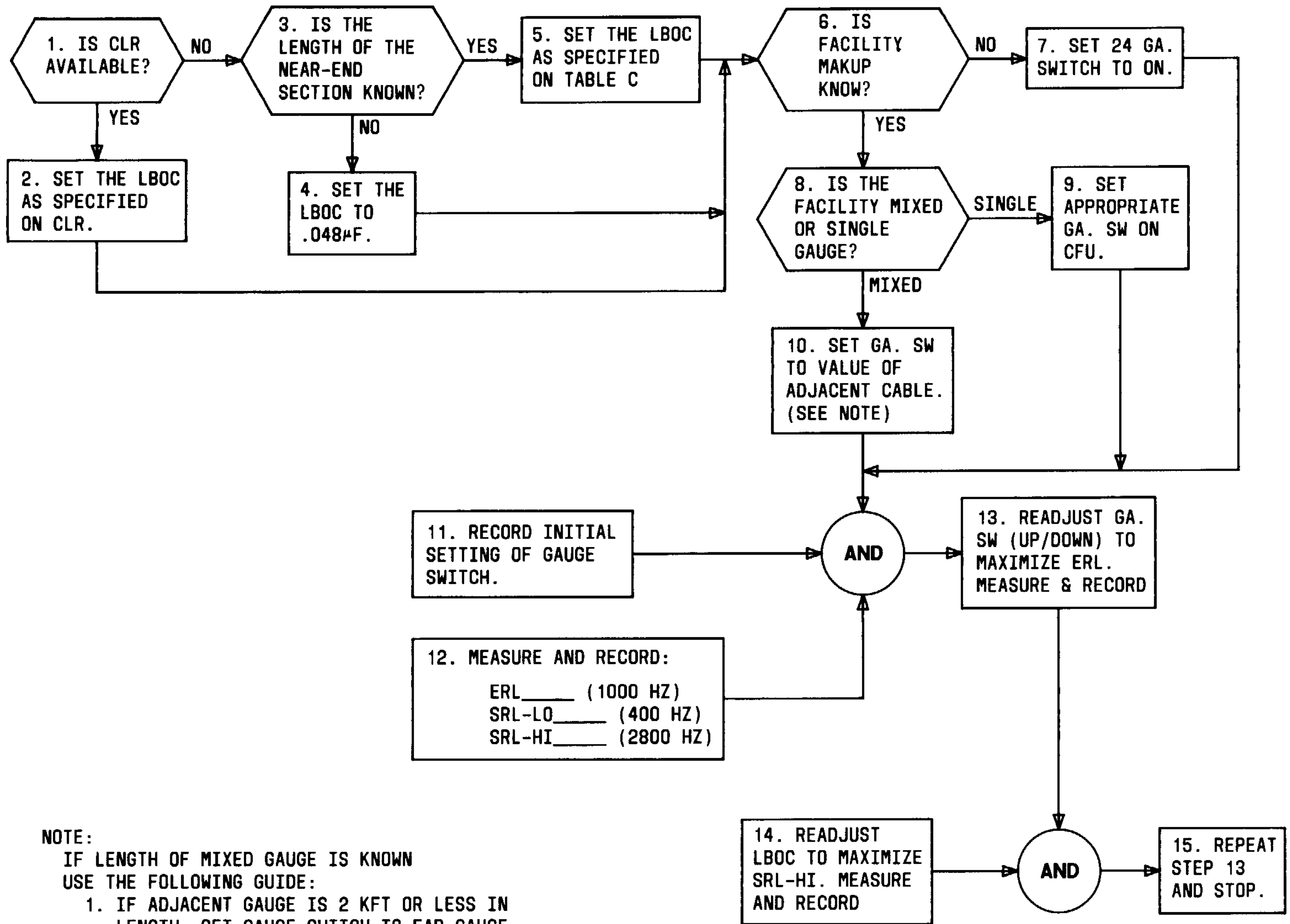
STEP	PROCEDURE
	2W/4W to 2W — 2W/4W to 2W
	COMP NET IN/OUT to OUT — COMP NET IN/OUT to IN
	Note 1: The 900-ohm test equipment must be used for interconnections on the cable facility side of a canceler network because the test extender has no compromise network access connection to the canceler circuit. (See Note 2.)
	Note 2: The COMP NET IN/OUT switch has no effect in connection with the A-side canceler circuit. Both T switches must be operated to the IN (on) position for the canceler side (A) requiring a compromise network to impedance match 900-ohm test equipment.
5	See Section 103-106-115 for operation of the KS-20501,L3, RLMS.
6	Set the RLMS to 900-ohm 2-wire and switch in the internal network (900 + 2.16 μF).
7	Connect the TRMT jack (2-wire) of the RLMS to the A-side 2W EQUIP jack on the J99343TB test extender to set a B-side network, or the B-side 2W EQUIP jack to set the A-side network. See Fig. 2 for example test setup to set B-side PBN.
	Note: After completion of adjustments for balancing networks, all T switches operated to IN, in conjunction with canceler circuits, must be operated to the OUT (off) position.
8	After completing Step 7, proceed to Chart 2 for adjustment of the A-side canceler or Chart 3 for the B-side transformer hybrid.

6. GAIN ADJUSTMENT

A. Setting Specified Gain

6.01 The J99343GD CFU contains integrated circuits which provide gain and equalization for each direction of transmission. Five miniature switches located on the front panel (see Fig. 1) of the J99343GD CFU and four rocker switches located on the printed wiring board (labeled 8 dB) control the gain which is applied simultaneously to both directions of transmission. The five miniature gain switches on the front panel are labeled 4, 2, 1, 0.5, and 0.25, which correspond to gain in dB set by operating the switch(es) to the IN position. The four 8-dB rocker switches are used to control the 8 dB of gain. When all four switches are operated toward the 8 dB label, 8 dB of gain is supplied in both directions of transmission. (See Note.) When gain less than 8 dB is desired, it should be provided by the five miniature gain switches on the front panel. When gain over 8 dB is desired, it must be provided by the 8-dB rocker switches in conjunction with the front panel switches. The maximum gain of the J99343GD CFU is a total of 7.75 dB (4 + 2 + 1 + 0.5 + 0.25) plus 8 dB equaling 15.75 dB. However, due to stability requirements, total 1-kHz gain is limited to a maximum of 12 dB.

Note: The four 8-dB switches should always be in the same position. If 0-dB gain is required, all four switches should be operated away from the 8-dB label. If 8 dB is required,



NOTE:
IF LENGTH OF MIXED GAUGE IS KNOWN
USE THE FOLLOWING GUIDE:
1. IF ADJACENT GAUGE IS 2 KFT OR LESS IN LENGTH, SET GAUGE SWITCH TO FAR GAUGE.
2. IF ADJACENT GAUGE IS 6 KFT OR MORE, SET GAUGE SWITCH TO GAUGE.
3. IF ADJACENT GAUGE IS BETWEEN 2 AND 6 KFT, SET GAUGE SWITCH TO PREDOMINATE GAUGE.

Chart 2—Procedure for Optimum Gauge Switch Setting of the Canceler Hybrid

then all four switches should be toward the label.

6.02 The total 1-kHz gain provided by the J99343GD CFU, which includes active equalization, is the sum of the flat gain and the gain of the equalizer. The J99343GD CFU must have the equalizer setting installed prior to adjusting the gain. If the equalizer settings are unknown, they may be determined by the simpler of two following methods:

(1) If the cable makeup is known, the simplest method is to use the equalizer prescription setting table for the type cable(s) found in Section 332-912-212. (See Note.)

(2) However, if the makeup is not known, the manual procedures given in Part 8 of this section can be used.

Note: Areas which subscribe to the Universal Cable Circuit Analysis Program (UNICCAP) may want to use this source for equalizer settings in lieu of the prescription setting tables.

6.03 The additional 1-kHz gain (or loss) for all equalizer settings is listed in Table D.

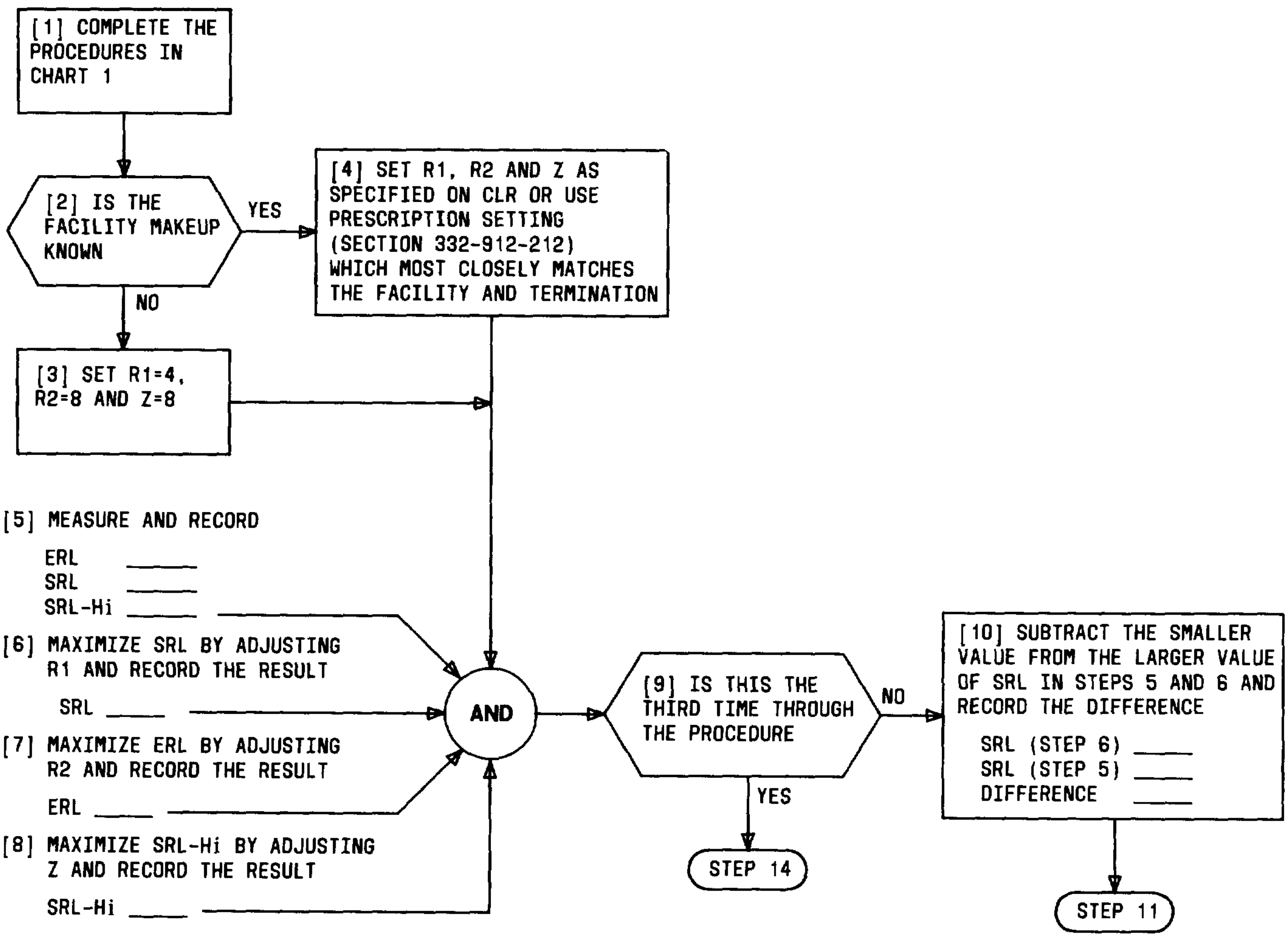


Chart 3—Procedures for Adjustment of the B-Side PBN (Sheet 1 of 2)

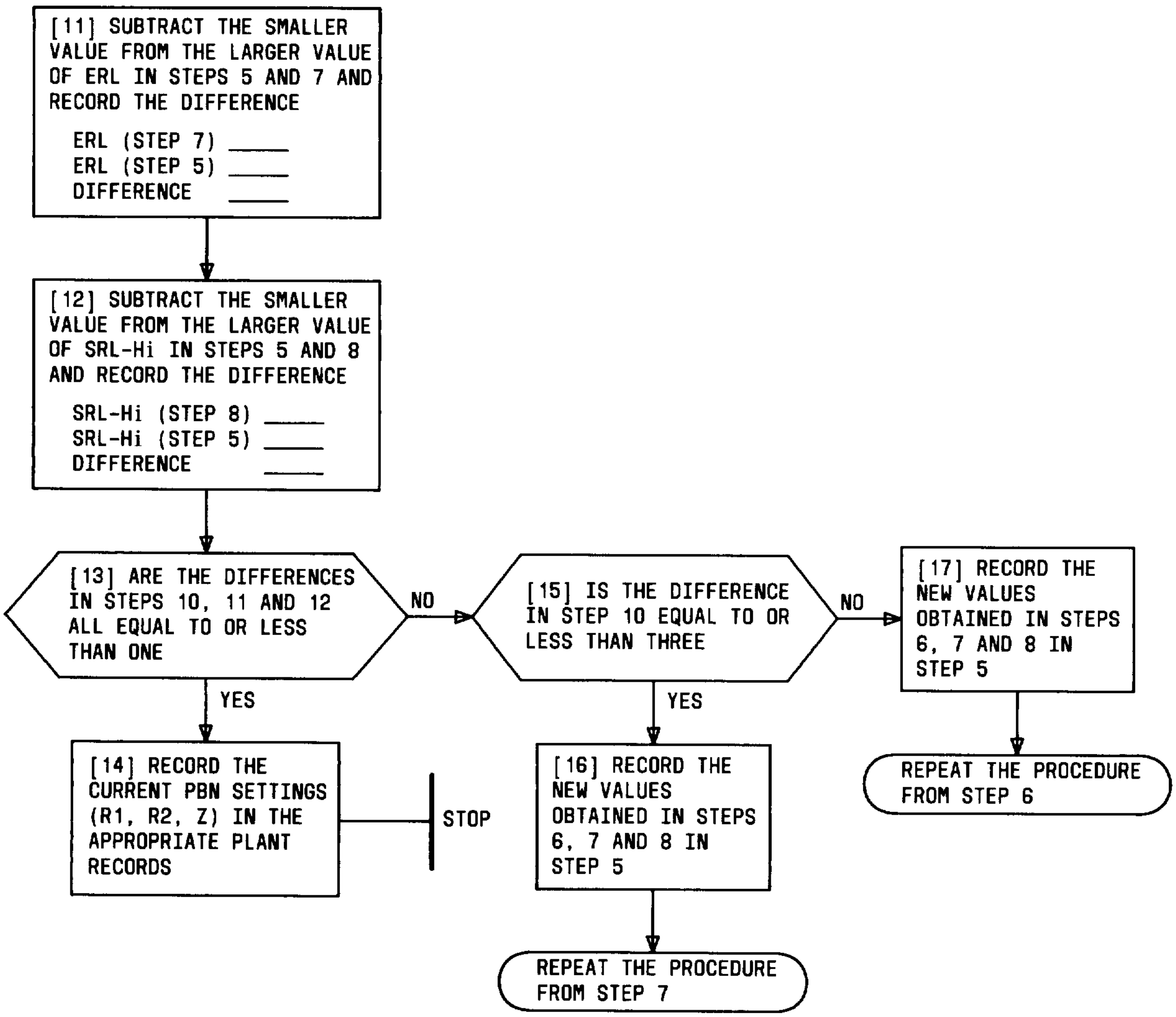


Chart 3—Procedures for Adjustment of the B-Side PBN (Sheet 2 of 2)

TABLE D

EQUALIZER GAIN AT 1 KHZ

SWITCH SETTING	EQUALIZER GAIN
0	0
1	+0.2
2	+0.5
3	+0.8
4	+1.2
5	+1.5
6	+1.9
7	+2.3
8	+2.7
9	+3.1
10	+3.6
11	+4.0
12	+4.4
13	+4.7
14	+5.1
15	+5.5

B. Setting Specified Output Level

6.04 The J99343GD CFU contains integrated amplifier circuit which have switched gain adjustment with specified labeled values (see paragraph 6.01). With these specified values, the J99343GD CFU gain may be set directly by using the CLR.

Note: In cases where 1-kHz cable loss is not known, measurements on the cable(s) should be made prior to the installation of the CFU unit. This measured data would then be used in determining what the gain setting should be on the J99343GD unit.

7. FREQUENCY RESPONSE MEASUREMENTS

7.01 Frequency response measurements as described in Chart 4 are used to check circuit frequency response against requirements or as an input for the procedures in Part 8 for determining the equalizer settings.

7.02 The following procedure is given for the J99343GD CFU when used in an intermediate location. Figure 4 is the test arrangement showing the three locations involved which has the B-side of the repeater under adjustment.

7.03 The following equipment, by location, will be required for frequency response tests on circuits utilizing the J99343GD CFU.

(a) Transmitting Location: Voice frequency oscillator with selectable 600- and 900-ohm output impedances and variable frequency selection for 400, 1000, and 2800 Hz.

(b) Receiving Location: Transmission measuring set (detector) with 900-ohm input impedance.

(c) Intermediate (J99343GD CFU) Location: J99343TB test extender.

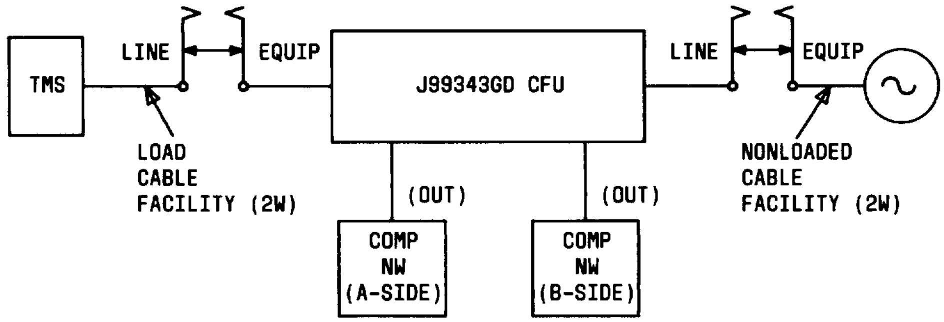


Fig. 4—Typical Test Configuration for Frequency Response Measurements

CHART 4

FREQUENCY RESPONSE MEASUREMENTS

STEP	PROCEDURE
	At the Transmitting Location:
1	Connect oscillator to line with an output of 1 kHz at 0 dBm and set the oscillator impedance as follows (see note):

TRANSMITTING LOCATION	OSCILLATOR IMPEDANCE
Central Office	900 ohms
600-ohm PBX	600 ohms
900-ohm PBX	900 ohms
Station Set	600 ohms

Note: Actual transmission of 1-kHz tone will be initiated in Step 7.

STEP	PROCEDURE
	At the Receiving Location:
2	Connect the transmission measuring set (TMS) to the line with the input impedance determined by the receiving location.
	At the Intermediate Location:
3	Remove the J99343GD CFU associated with circuit under test from its shelf location.
4	Insert the CFU into test extender and insert test extender into the CFU shelf location slot.

CHART 4 (Contd)

STEP	PROCEDURE
5	Set the J99343GD CFU as follows: (a) Equalizer switches to OFF. (b) PBNs to proper values per CLR or by measurement as in Chart 2. (c) All gain switches to OUT. (d) LBOC to its final value. (e) Signaling options (NOR/RV) as specified on CLR. (f) TST/NOR switch to TST.
6	Set the J99343TB test extender as follows: **A-Side**: 2W/4W to 2W; 600/900 to 900; COMP NET IN/OUT to OUT **B-Side**: 2W/4W to 2W; 600/900 to 900; COMP NET IN/OUT to OUT
7	Instruct the transmitting location to send a 1-kHz tone at 0 dBm (setup of Step 1) and adjust amplifier gain until receiving location receives -5 dBm.
8	After adjusting the gain, have the transmitting location send 400 Hz at 0 dBm and record the level read at the receiving location.
9	Have the transmitting location send 2800 Hz at 0 dBm and record the level read at the receiving location.
10	For calculation of equalizer settings, use the received levels for 400, 1000, and 2800 Hz in the procedures in Part 8.
11	After computing the equalizer settings, set them in the equalizer.
12	Remeasure the circuit at 1000 Hz and readjust the amplifier gain until the receive location receives the level specified on the CLR.
13	Remeasure the circuit at 400 and 2800 Hz, and compare the results to the circuit objectives. Refer to Table B.

CHART 4 (Contd)

STEP	PROCEDURE
14	Set the TST/NOR switch to the TST position.
15	Disconnect test extender from shelf and remove repeater from test extender.
16	Insert the CFU into its proper shelf location.
17	Have transmitting and receiving locations remove the test equipment and restore the circuit to the normal condition.
18	Record the equalizer and gain settings in the appropriate plant records.
19	This completes the procedure for frequency response measurements for the J99343GD CFU.

8. EQUALIZER SETTINGS FROM CABLE LOSS DATA

8.01 The procedures in Chart 5 are used to obtain equalizer settings, for the J99343GD CFU, by actual circuit loss measurements at 400, 1000, and 2800 Hz. This procedure is used when the equalizer settings can not be determined from the prescription settings table in Section 332-912-212. The circuit loss measurements are made using the procedures in Chart 4.

8.02 The differences computed in Chart 5 are rounded to the nearest 0.5 dB and located in Table A. Table A also indicates whether the facility will meet trunk or line objectives.

8.03 After setting the equalizer to the values determined in the procedures, the 1-kHz gain must be readjusted to correct for the additional gain introduced by the equalizer.

8.04 The use of Table A to find equalizer settings is straightforward. Locate the 400-Hz difference on the left side and read across to the column that contains the 2800-Hz difference. The value in the block represents the equalizer setting.

8.05 The following is an example of using the procedures in Chart 5 for obtaining equalizer settings by measurement:

Example: Tests level is 0 dBm at 1 kHz.

1. Measure and record the 1000-, 400-, and 2800-Hz loss.

   1000-Hz loss *-5*

   400-Hz loss -3.5

   2800-Hz loss -13.5

2. Is the 400-Hz measurement more positive than the level being sent? No—go to Step 4.

4. Is the 400-Hz loss more negative than the 1000-Hz loss? No-go to Step 6.

6. Subtract the 400-Hz loss from the 1000-Hz loss. Go to Step 8.

   1000-Hz loss *-5*

   400-Hz loss *-3.5*

   Difference *-1.5*

8. Round the difference in Step 3 or 6 (6) to the nearest 1/2 dB and enter this value as the 400-Hz difference in Step 11.

   Difference *-1.5*

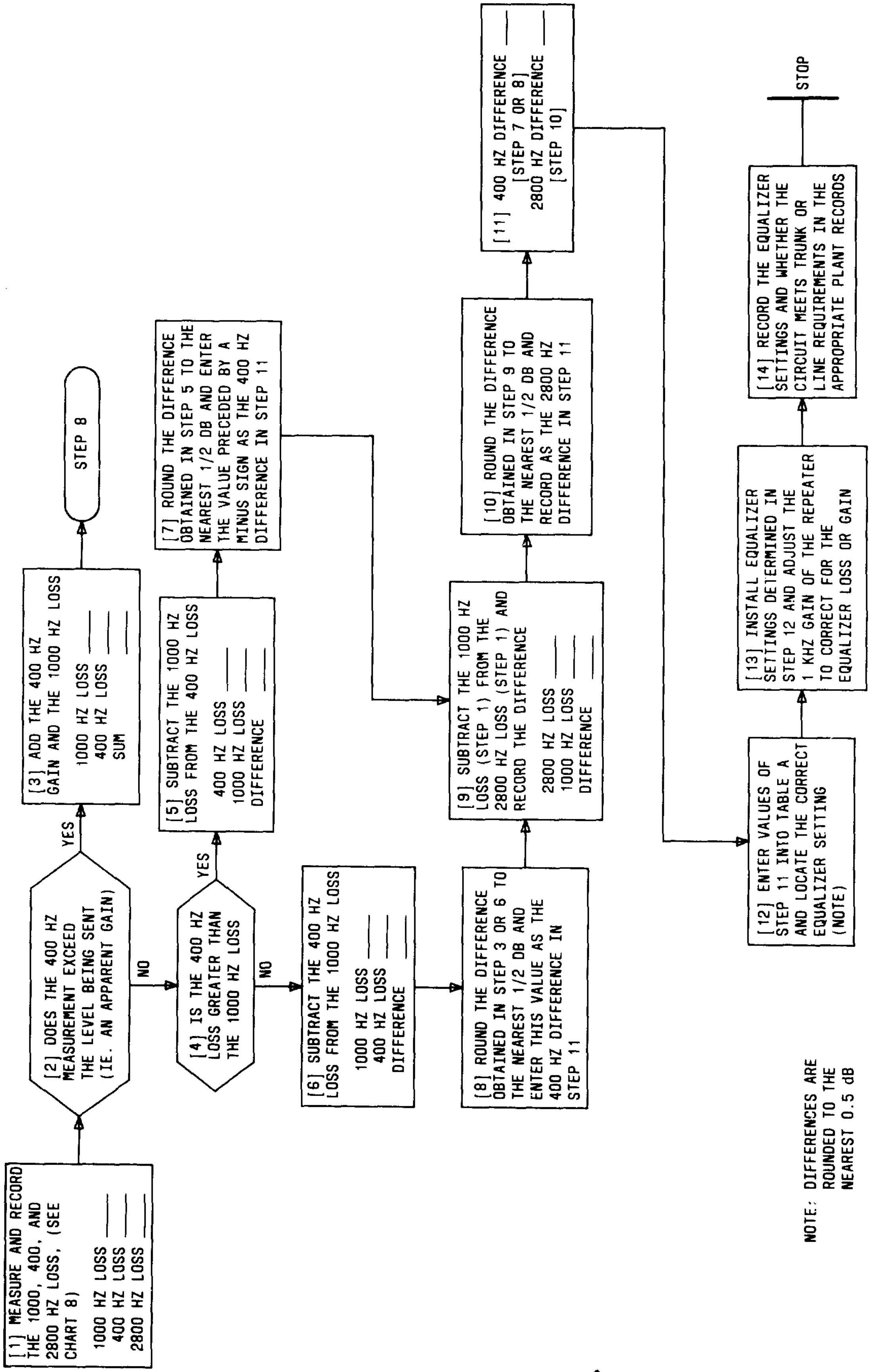


Chart 5—Obtaining Equalizer Settings by Measurement

9. Subtract the 1000-Hz loss (Step 1) from the 2800-Hz loss (Step 1) and record the difference.

   2800-Hz loss -*13.5*

   1000-Hz loss -*5*

   Difference -*8.5*

10. Round the difference obtained in Step 9 to the nearest 1/2 dB and record as the 2800-Hz difference in Step 11.

    Difference -*8.5*

11. 400-Hz difference (Step 7 or 8) -*1.5*

    2800-Hz difference (Step 10) -*8.5*

12. Enter values of Step 11 into Table A and locate the correct equalizer setting.

    Equalizer setting from Table A *14*

13. Install equalizer setting determined in Step 12 and adjust the 1-kHz gain of the unit to correct for equalizer loss or gain from Table D.

14. Record the equalizer setting and whether the circuit meets trunk or line requirements in the appropriate plant records.

9. STABILITY TESTS

9.01 After the J99343GD CFU has been installed and lined up, stability tests may be used as an indicator of circuit performance.

9.02 Two types of stability tests can be made: (1) talk state, which is made with nominal termination on both ends of the circuit; and (2) idle state, which is made with the associated station and switching equipment in the idle condition. Table E lists actual and nominal terminations for use in stability tests.

9.03 The following equipment is required for stability tests:

- J99343TB test extender
- High impedance monitoring device (1014A handset or equivalent in MON position or a high impedance meter).

9.04 The extent of these tests will depend on whether the circuit is equipped with idle circuit terminations at neither end, at one end, or at both ends.

9.05 It is assumed that the J99343GD CFU has been adjusted to its final settings and all options are set as specified on the CLR. Idle state stability test procedures are given in Chart 6 and an example test setup is shown in Fig. 5.

TABLE E

COMPARISON OF ACTUAL vs NOMINAL TERMINATIONS

ACTUAL TERMINATION	NOMINAL TERMINATION
Central Office (switch)	900 ohms + 2.15 μF
600 ohm PBX (switch)	600 ohms + 2.15 μF
900 ohm PBX (switch)	900 ohms + 2.15 μF
Station Set (Telephone)	Off-hook station set with loop current or 4066H network

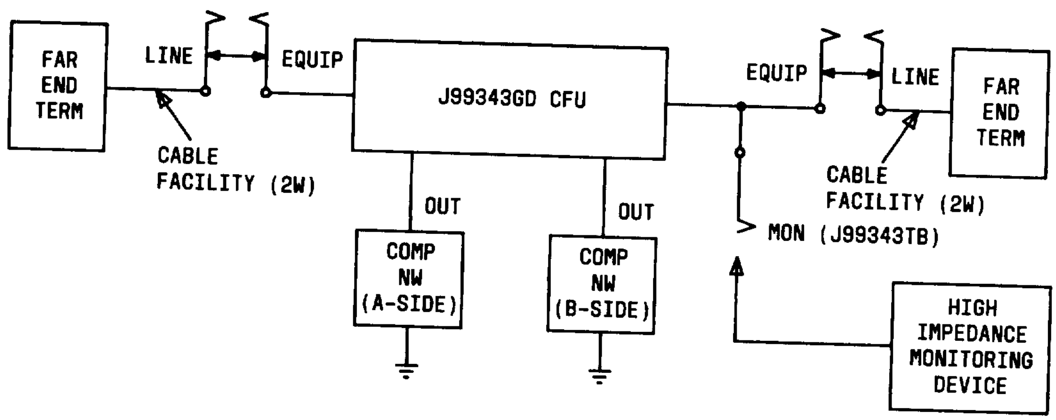


Fig. 5—Typical In Circuit Configuration for Stability Margin Tests

CHART 6

STABILITY TESTS

STEP	PROCEDURE
1	Remove J99343GD CFU under test from its shelf location.
2	Insert repeater into the test extender and connect test extender into the repeater shelf location.
3	Set the TST/NOR switch on the J99343GD CFU TO TST.
4	Set the switches on the J99343TB test extender as follows:

A-Side	B-Side
2W/4W to 2W	2W/4W to 2W
600/900 to 900	600/900 to 900
COMP NET IN/OUT to OUT	COMP NET IN/OUT to OUT

STEP	PROCEDURE
5	Connect the high impedance monitoring device to the monitor jack (MON) on the B-side of the J99343TB test extender. (See Fig. 5.)
6	Monitor the CFU for singing using the high impedance monitoring device with the following combinations of terminations:

CHART 6 (Contd)

STEP	PROCEDURE

Note: With the monitoring device connected as shown in Fig. 5, no sound other than battery noise should be audible.

ORIGINATING END	TERMINATING END
Circuit not equipped with idle-circuit terminations or repeater disabler (far-end)	
(1) 900 (600) ohms	900 (600) ohms
(2) Open circuit	Open circuit
(3) Open circuit	Short circuit
(4) Short circuit	Open circuit
(5) Short circuit	Short circuit
Circuit equipped with idle-circuit terminations at both ends or repeater disabler (far-end)	
(1) 900 (600) ohms	900 (600) ohms
(2)* Idle condition	Idle condition
(3) 900 (600) ohms	Open circuit

*For circuit with idle-circuit terminations

ORIGINATING END	TERMINATING END
Circuit with idle-circuit terminations at one end	
(1) 900 (600) ohms	900 (600) ohms
(2)* Idle	condition Idle condition
(3) 900 (600) ohms	Open circuit

*Either open circuit or with idle-circuit termination

CHART 6 (Contd)

STEP	PROCEDURE
7	If the J99343GD CFU sings, check the following conditions for possible troubles: (a) Improper test connections have been installed. (b) Insertion loss has been incorrectly measured and is less than permissible. (c) Makeup of the facility is outside limits.
8	Disconnect test extender from shelf and remove CFU from test extender.
9	Insert the J99343GD CFU into its proper shelf locations.

10. GUIDELINES FOR EQUALIZER TOUCH-UP

10.01 These touch-up procedures assume that the initial equalizer settings were determined by using the prescription setting tables in Section 332-912-212 and are used to improve the initial settings.

10.02 When the procedure calls for increasing or decreasing the equalizer setting, it refers to the numerical sum of the operated switches.

10.03 All measurements in the procedures are end-to-end as described in Part 8.

10.04 Over equalization at either high or low frequencies could cause the circuit to become unstable/sing.

10.05 The procedures for equalizer touch-up assumes that option, balancing network settings, and 1-kHz levels have been set to their proper values. It is also assumed that frequency response measurements have been made and circuit requirements are ***not*** met.

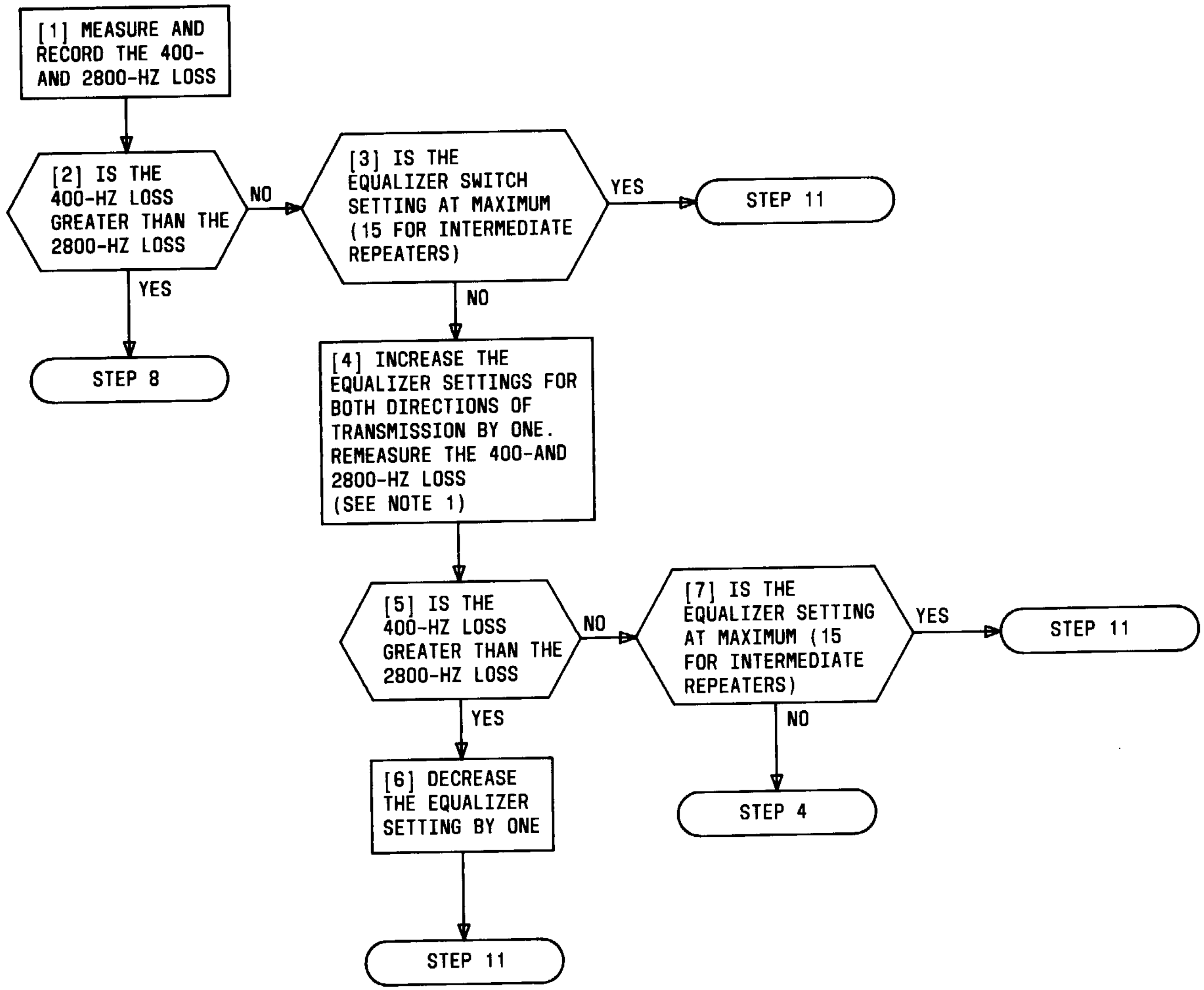
> ***Note:*** The facility is considered to be properly equalized when the 2800-Hz loss is slightly more but as close as possible to the 400-Hz loss.

10.06 The procedure for equalizer touch-up is given in Chart 7. If Step 11 of Chart 7 is repeated twice without satisfactory results, the circuit cannot be properly equalized and should be referred to the proper personnel.

11. PROCEDURES FOR CIRCUITS REQUIRING TERMINAL BALANCE

11.01 The J99343GD CFU in combination with 837- or J99380-type impedance compensators may be used for circuits with terminal balance requirements. The procedures in Chart 8 describe manual lineup of the J99343GD CFU on circuits requiring terminal balance.

11.02 The procedures in Chart 8 should be used for manual adjustment of the J99343GD CFU when used with 837A, B, E, F, G, or J or the J99380AB or AC networks.



NOES:

1. FOR EACH THREE TIMES THROUGH THIS STEP, THE 1-KHZ GAIN MUST BE READJUSTED TO THE LEVEL SPECIFIED ON THE CLR.
2. ACCESSING STEP 11 TWICE WITHOUT SATISFACTORY RESULTS IMPLIES THE FACILITY CANNOT BE PROPERLY EQUALIZED.

Chart 7—Procedure for Equalizer Touch-Up (Sheet 1 of 2)

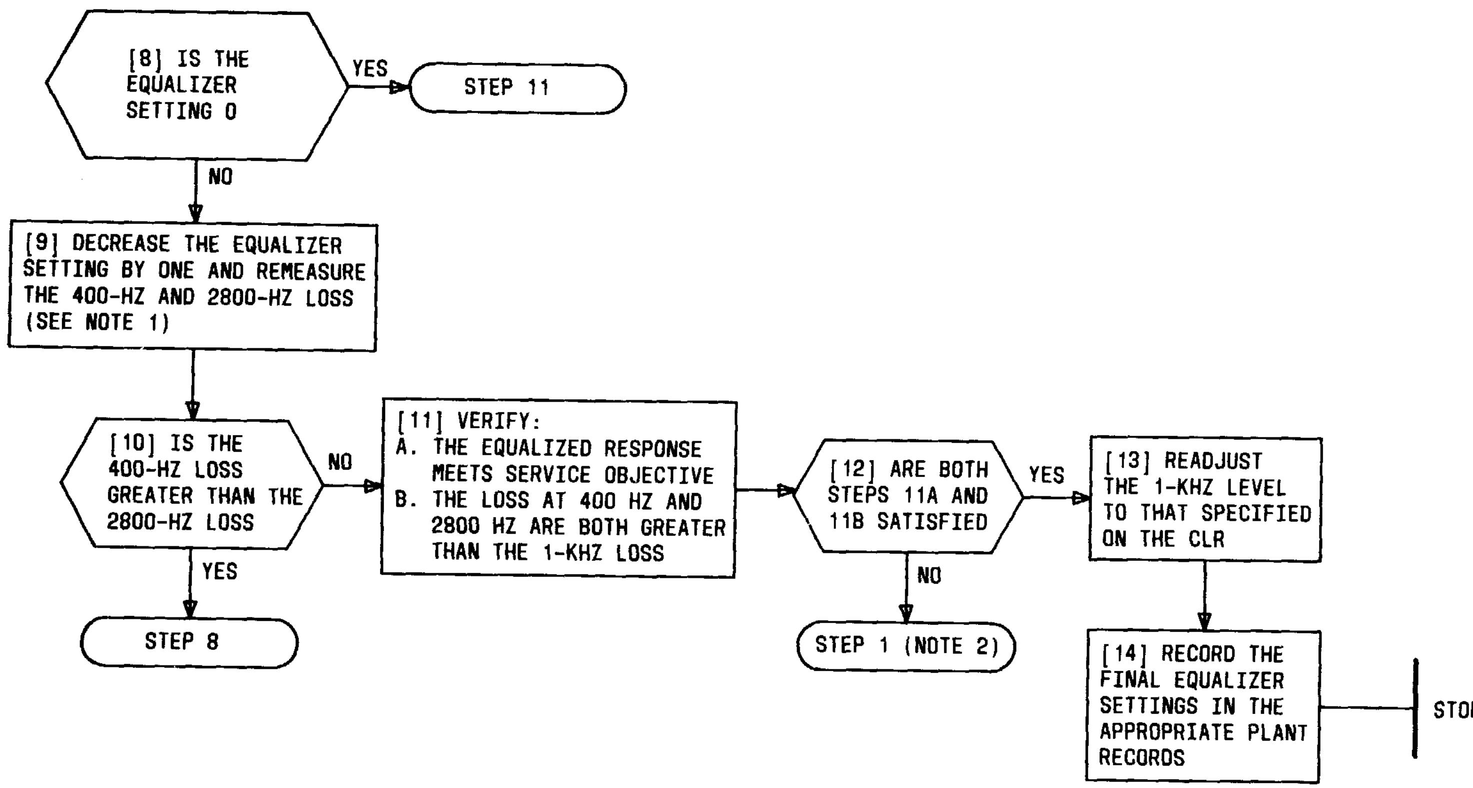


Chart 7—Procedure for Equalizer Touch-Up (Sheet 2 of 2)

CHART 8

ADJUSTMENT OF J99343GD REPEATER (NL) AND 837D OR J99380AA NETWORK

STEP	PROCEDURE
1	If the facility does not fit the prescription setting tables, initial settings should be chosen using an equivalent gauge and length which most closely resembles the actual facility. (See Section 332-912-212; Tables showing prescription settings for 2-2 terminal (NL) repeaters and impedance compensators).
2	Remove the 2-2 terminal (NL) repeater under adjustment from its shelf location.
3	Insert test extender into the repeater's shelf location.
4	Set the switches on the J99343TB test extender as follows: **A-Side**: 2W/4W to 2W; 600/900 to 900; COMP NET IN/OUT to OUT **B-Side**: 2W/4W to 2W; 600/900 to 900; COMP NET IN/OUT to OUT Set the switch(es) on the J99380TB test extender as follows: S2 to NORMAL
5	Insert a 310 dummy plug into the T1/R1 2W EQUIP jack on the B-side of the J99343TB test extender to terminate the cable facility in 900 ohms + 2.16 μF. This termination will permit positive identification of the 2-wire pair under adjustment at the impedance compensator. (See Section 332-205-500.)
6	Have the 837D or J99380AA settings optimized using the procedures in Section 332-205-500 or 311-100-551.
7	After obtaining satisfactory terminal balance on the drop side of the 837D or J99380AA: (a) Remove the 310 dummy plug from the J99343TB test extender. (b) Insert the repeater into the test extender. (c) Terminate the drop side of the 837D or J99380AA in the proper impedance (600 or 900 ohms +2.16 μF).
8	Optimize the PBN using the procedures in Part 5 of this section.

CHART 8 (Contd)

STEP	PROCEDURE
9	Determine equalizer settings using the procedures in Part 8 (Chart 5 of this section).
10	After installing the equalizer settings, set the levels of the amplifier units using the procedures in Part 6 of this section.
11	Ensure that circuit requirements are met, and touch-up the 837D or J99380AA R potentiometer as required to improve the terminal balance.

12. SIGNALING UNIT SECTION

A. Performance Information

12.01 The signaling section of the J99343GD CFU is a loop signaling repeater which functionally resembles the J99343AD LSR/LSO. It regenerates 20-Hz ringing in one direction and DC signals or dial pulses in the opposite direction. The J99343GD signaling unit section provides a 72-Vdc supply for supervisory range extension on the station-side loop. This supply is independent of the talk battery arrangement (48- or 72-Vdc) provided by the associated MFT shelf. The switching-side internal impedance is approximately 400 ohms. The J99343GD does not require build-out resistors (BOR) to limit current flow in short loops as do some LSR units. The signaling unit section limits current on the station side to 42 mA maximum and on the switching side to 30 mA maximum.

B. Voltage Measurements

12.02 The DC-DC converter in the signaling unit section provides the floating station-side talk battery and floating switching-side circuitry. A polarity guard on the switching-side line circuit allows proper operation of the signaling unit section regardless of the office battery polarity. Since these line circuits are floating, voltage measurements should be made across the appropriate 2-wire interface (T, R or T1, R1). Measurements made between one conductor and ground will be erroneous. In the idle state, the voltage measured across the station-side line circuit (terminals T1, R1 if the NOR-RV switch is in the NOR position) is approximately 85 Vdc.

C. Distinctive Ringing Option

12.03 The distinctive ringing option is controlled by the DRR screw switch (Fig. 1). With the DRR switch down (turned in), all distinctive ringing patterns, such as those generated by the DIMENSION® PBX, are converted to a 2-second interval. Ringing intervals shorter than 150 ms, such as the "ring-ping" signal from the DIMENSION PBX, will be ignored. With the DRR switch up (turned out), all input ringing signals, including "ring-ping" will be regenerated by the J99343GD unit.

D. Signaling Incompatibilities

12.04 The J99343GD signaling unit section is incompatible with some circuits due to the floating talk battery on the station-side. Circuits monitoring idle or busy conditions with voltages referenced to ground (rather than with loop currents) will not function properly on the J99343GD station loop. Such circuits include the D3 2FX0 (J98718BE), the D4 2FX0 (J98726BE) and the D4 2FX0/GT (J98726SK), the A-side of the MFT LSR (J99343AF), and the line status indicators CPS-RDI. See 332-912-155 for more detailed information on this compatibility problem.

E. Range Information

12.05 Table F lists the maximum ringing ranges. Table G lists the maximum signaling ranges.

TABLE F

REGENERATED RINGING RANGE FOR J99343GD

RINGING LOAD	MAXIMUM CONDUCTOR LOOP RESISTANCE IN OHMS BETWEEN LSR/LSO CFU AND STATION SET OR PBX	
	STIFF NOTCH SETTING 50 V RMS AT RINGER (NOTE)	WEAK NOTCH SETTING 43 V RMS AT RINGER (NOTE)
1 C4A*	5220	6540
3 C4A*	2880	4050
3 C4A*	1820	2650
PBX Ringing Detector†	3600	
PBX Ringing Detector† and 1 C4A Ringer*	2300	3300
PBX Ringing Detector† and 2 C4A Ringers *	1750	2450

Note: Regenerated ranges assume a ringing source of 20 Hz, 84- to 88-volts AC RMS and a series 13L-type resistance lamp.

* Ringing ranges to station sets with C4A ringers assume a 0.5 μF series capacitor.

† Ringing ranges to PBXs are based on typical PBX relay ringing detectors.

TABLE G

MAXIMUM RANGE FOR SUPERVISION AND DIAL PULSING FOR J99343GD

CIRCUIT BATTERY	RANGE BETWEEN			
	SWITCHING MACHINE AND LSR/LSO CFU*	2 LSR/LSO CFUs (16 mA LOOP CURRENT)	LSR/LSO CFU AND STATION	
			23 mA	36 mA
-42.5	CO or PBX limit minus 475 ohms	3200 Maximum	2350 Minus station Resistance	1300 Minus station Resistance
-48	CO or PBX limit minus 410 ohms	3770 Maximum	2760 Minus station resistance	1570 Minus station resistance
-52	CO or PBX limit minus 370 ohms	4100 Maximum	3100 Minus station resistance	1790 Minus station resistance

* Assumes switching machine provides a nominal -48 volts.

13. REFERENCES

13.01 The following list of references contain additional information which may be helpful.

REFERENCE	TITLE
103-106-115	WECo Model KS-20501 RLMS Description and Operation
332-910-100	General Description of MFT
332-910-180	General Application Information for MFT
332-910-102	MFT Test Extender
332-911-101	MFT Loop Signaling Repeater—Description
332-911-201	MFT Signaling Units—Installation and Test
332-912-155	MFT J99343GD CFU—Description
332-912-212	Prescription Setting for 2-2 Repeaters
332-912-215	MFT 2-2 Intermediate Repeaters Installation and Testing
SD-1C359-01	MFT Circuit
CD-1C359-01	Common Systems—MFT Circuit