

2400- OR 2600-CYCLE SINGLE-FREQUENCY SIGNALING CIRCUIT SD-56202-02

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section describes the method of applying potentiometer and filament resistor adjustments to the signaling circuit, J68602CH, and the blocking amplifier, J68602CF, of the single-frequency signaling circuit both units modified by SD-56202-02. These adjustments compensate for normal variations in the characteristics of electron tubes, varistors, capacitors, and certain relays.

1.02 The procedures for making these adjustments and the potentiometer used are:

- A. Adjustment of Filament Voltage
- B. Adjustment of Blocking Amplifier Gain - P Potentiometer
- C. Adjustment of Voice Amplifier Gain - P1 Potentiometer
- D. Adjustment of Signaling Amplifier Gain - P2 Potentiometer and Adjustment of Maximum Plate Current - P3 Potentiometer
- E. Adjustment of Output of Regenerative Relay RG - P6 Potentiometer

1.03 The adjustments, with the exception of those for the electron tube filaments, are made by varying the settings of the P to P6 potentiometers from the front of the unit. The adjustment of the filament voltage for the signaling circuit electron tubes is made at the rear of the unit by changing short-circuiting straps around the R22 and R23 resistors. The blocking amplifier filament voltage is adjusted by means of the R6 variable resistor at the rear of the unit.

1.04 Adjustment D, P2 and P3 potentiometers, is used where the receiver fails to meet its sensitivity requirements. These are the operate or nonoperate high sensitivity test or the test for maximum saturation of the receiver of Section 179-310-501.

1.05 All relay covers must be in place during the adjustment and during the heating periods specified in this section.

1.06 These adjustments are made at the miscellaneous jack equipment SD-56137-01, at the test jacks of the single-frequency

signaling bays, and at the test jacks of the blocking amplifier bays. Either the No. 2B signaling test set SD-56134-02 (J64730B) having positive lamp supervision, or the No. 2A signaling test set SD-56134-01 (J64730A) having negative lamp supervision, may be used.

1.07 Two values of signaling power in dbm are usually specified in this section. The selection of the correct value for the particular single-frequency signaling equipment under test is made as follows:

(a) +4 Line, -13 Line: Where the receiver connects at a transmission level point of +4 db and the transmitter connects at a transmission level point of -13 db, the value relating to the receiver is designated "+4 Line" and the value relating to the transmitter is designated "-13 Line."

(b) +7 Line, -16 Line: Where the receiver connects at a transmission level point of +7 db and the transmitter connects at a transmission level point of -16 db, the value relating to the receiver is designated "+7 Line" and the value relating to the transmitter is designated "-16 Line."

1.08 The gain of the test amplifier associated with the AMP IN and AMP OUT jacks of the miscellaneous jack equipment is approximately 30 db.

1.09 The loss of the test keyer associated with the KEYER IN and KEYER OUT jacks of the miscellaneous jack equipment is approximately 7.2 db.

1.10 The No. 13A transmission measuring set and the No. 40B transmission measuring system will be referred to in the text as TMS.

1.11 In the tables showing patching connections, the abbreviations used and their meanings are as follows:

(misc) - miscellaneous jack equipment

(sig) - signaling circuit under test

(tst set) - signaling test set

1.12 Where reference is made to the 2400 SEND or 2600 SEND jacks, use whichever frequency is required by the receiver of the circuit under adjustment unless otherwise specified.

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2. APPARATUS

2.01 The apparatus required for each test is shown in the following list. The details of each item are covered in the indicated paragraphs.

Apparatus	Number Required for Adjustment				
	A	B	C	D	E
Meter (2.02)	1	-	-	-	-
Test set (2.03)	-	-	1	1	1
TMS (2.04)	-	1	1	1	1
Test equipment (2.05)	-	1	1	1	1
Patching cord (2.06)	-	2	2	3	4
Patching cord (2.07)	-	-	1	-	1
Patching cord (2.08)	-	-	-	-	1
Patching cord (2.09)	-	-	-	1	1
*Testing cord (2.10)	-	1	1	1	1
Testing cord (2.11)	-	-	-	-	1
Clip (2.12)	-	-	-	-	2
Plug (shorting) (2.13)	-	-	-	-	1
Plug (dummy) (2.14)	-	-	-	1	-
Screwdriver (2.15)	1	1	1	1	1
Tube puller (2.16)	-	-	-	1	-
Soldering equipment (2.17)	1	-	-	-	1

*Used with the No. 13A TMS. Omit when the No. 40B TMS is used.

2.02 No. M9B meter with a pair of KS-9291 test clip leads, or equivalent voltmeter with 30-volt scale.

2.03 No. 2B signaling test set J64730B (SD-56134-02) or No. 2A signaling test set J64730A (SD-56134-01).

2.04 No. 13A transmission measuring set, or No. 40B transmission measuring system, or equivalent capable of reading to -35 dbm or lower.

2.05 Test equipment on bay, including test amplifier, attenuator, and jacks as shown on SD-56137-01.

2.06 P4H cord, 6 feet long, equipped with two No. 327A plugs (4P18D).

Note: Although No. 4P18D cords (6 feet) are specified in the testing methods, it is intended that shorter cords such as the No. 4P18B cord (4 feet) and the No. 4P18A cord (2 feet) may be used where the mounting positions of the equipment make a short cord desirable.

2.07 P2A cord, 6 feet long, equipped with two No. 347A plugs (red shells) (2P1D).

2.08 P2A cord, 6 feet long, equipped with two No. 347B plugs (black shells) (2P3B).

2.09 P3K cord, 12 feet long, equipped with two No. 310 plugs (3P15B).

2.10 W2CA cord, 5 feet 6 inches long, equipped with one No. 327A plug at one end (2W36A).

2.11 893 cord, 6 feet long, equipped with two No. 360A tools (1W13A).

2.12 KS-6278 connecting clip for use with No. 1W8A and No. 1W13A cords.

2.13 No. 310 plug with tip and ring short-circuited.

2.14 No. 258D dummy plug (red).

2.15 Three-inch H cabinet screwdriver.

2.16 Tube puller, rubber tip sure grip, M.P. King Co.

2.17 Where strapping changes are necessary the following tools and materials are required.

(a) Soldering tools and materials as required.

(b) Bell System pliers as required.

(c) No. 22 gauge bare strap wire.

3. PREPARATION

All Adjustments

3.01 If not already arranged for, obtain from the toll testboard the release of the single-frequency signaling circuit upon which adjustments are to be made.

3.02 At the beginning of each adjustment, it is assumed that no patching or testing cords are connected to the test jacks or to the test set.

Adjustments C, D, and E

3.03 Restore all lever keys of the signaling test set to normal. Operate the SCALE SEL switch to the PPS position. Connect the TST BAT B (-24 +130) cord of the test set to the TST BAT B jack of the miscellaneous jack equipment. Connect the TST BAT A (-48) cord of the test set to the TST BAT A jack of the miscellaneous jack equipment.

3.04 Allow the test set to warm for one minute.

3.05 Observe that a reading other than 0 is obtained on the PULSES PER SECOND meter.

Note: Adjustments of the per cent break of pulses to values above 70 must be made slowly enough to allow the highly damped PER CENT BREAK meter to follow the adjustment since the maximum per cent break available from the signaling test set may be as low as 80. If an adjustment of 80 is exceeded, the pulsing rate may suddenly drop to half that indicated by the PULSES PER

SECOND meter. Once this has occurred, it may persist even though a very nominal per cent break is indicated by the PER CENT BREAK meter. This situation is easily recognized since it causes the rate of vibration of the pointer on the PER CENT BREAK meter to be half that of the pointer on the PULSES PER SECOND meter. Normal operation may be restored by turning the ADJ % BK control fully counterclockwise and then slowly turning it clockwise to produce the desired per cent break.

- 3.06 On the No. 2B signaling test set, operate the CONT PLS key to the DIAL PLS position.
- 3.07 On the No. 2A signaling test set, operate the PPS key to the DIAL SUPV position.
- 3.08 Observe that the PER CENT BREAK meter reads 0 on its black scale. If it does not, carefully set it to 0 by means of the pointer adjustment screw of the meter.
- 3.09 Insert a No. 258D dummy plug (red) into the P jack of the test set and observe that the PER CENT BREAK meter reads 100 (full scale) on its black scale. If it reads other than 100, unlock the CAL % BK control and adjust this control to give a full scale reading. Relock the CAL % BK control, being careful not to disturb the full scale setting of the meter.
- 3.10 Remove the dummy plug and restore to normal the CONT PLS or PPS key depending upon which signaling test set is used.
Note: The 0 and 100 readings of the PER CENT BREAK meter shall be rechecked occasionally during the adjusting procedures.
- 3.11 These procedures are based upon the use of either the No. 13A or the No. 40B TMS.
- 3.12 If the No. 13A TMS is used, proceed with 3.13. If the No. 40B TMS is used, proceed with 3.15.
- 3.13 Connect the TMS to a power source of 105 to 125 volts (dc or 25 to 60 cycles ac) and turn the dial switch to the desired setting. Wait 5 minutes for the set to warm.
- 3.14 At the miscellaneous jack equipment of the signaling circuit being adjusted, make the following connections:

<u>From</u>	<u>Using Cord No.</u>	<u>To</u>
E TST) (misc)	2W36A	IN of
M TST)		No. 13A TMS

Note: Insert the No. 327A plug of the No. 2W36A cord into the left-hand vertical pair of jacks E TST and M TST. These two jacks connect to the tip conductors of the E and M jacks of the miscellaneous jack

equipment. Under Part 4 (Method), where connection to "JK to TMS" is indicated, insert the plug of the patching cord involved into these E and M jacks at the miscellaneous jack equipment.

- 3.15 At the jack appearance of an idle TMS, use patching cords to connect the TMS to a testing trunk that terminates in a SEND jack at the miscellaneous jack equipment of the signaling circuit being adjusted. Operate keys on the TMS as required for connection to the proper scale.

Note 1: Connection to the TMS may be made after all other patching connections have been set up to avoid tying up the TMS unduly.

Note 2: Under Part 4 (Method), where connection to "JK to TMS" is specified, insert the plug of the patching cord into the SEND jack.

4. METHOD

A. Adjustment of Filament Voltage

4.01 This covers the adjustments of the voltages across the filament terminals of the electron tubes of the signaling circuit (tubes V1, V2, V3) and when provided, the blocking amplifier (tube V).

4.02 Obtain the nominal battery voltage at the filament distributing fuse panel of the circuit being adjusted.

Note: For the purpose of this section, the nominal battery voltage is considered to be the voltage measured at the filament distributing fuse panel when the regulating contact of the filament battery voltage regulator is halfway between its two limiting contacts.

Signaling Circuit

4.03 On the No. M9B meter, operate the toggle switches to the DC and VM-AM positions. Using the meter, with its associated test clip leads connected to meter jacks -V and 30V, measure the voltage at the distributing fuse panel for the circuit being adjusted. Record the difference, if any, between this voltage and the nominal voltage for this distributing panel.

4.04 Using the No. M9B meter and its associated test clip leads, connect the 30V jack of the meter to punching 4 on the V1 tube card on the rear of the signaling unit. Connect the -V jack of the meter to punching 3 on the card of the V1 tube.

4.05 Allow the filaments of the V1, V2, and V3 tubes to heat for a minimum period of one minute where new tubes are required or if the filament supply has been opened for any reason. Observe that, for the deviation

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from the nominal value which was recorded in 4.03, the reading on the meter is in accordance with Table A.

TABLE A

Deviation From Nominal Battery Voltage at Distributing Fuse Panel	Voltage
+0.5	20.0 to 21.0
+0.4	19.9 to 20.9
+0.3	19.8 to 20.8
+0.2	19.7 to 20.7
+0.1	19.6 to 20.6
0	19.5 to 20.5
-0.1	19.4 to 20.4
-0.2	19.3 to 20.3
-0.3	19.2 to 20.2
-0.4	19.1 to 20.1
-0.5	19.0 to 20.0

4.06 If the reading is not within the above limits, rearrange the strapping of the R22 and R23 resistors, which are mounted on the rear of the signaling unit, until the proper voltage is obtained. Use No. 22 gauge bare strap wire for the strapping.

Blocking Amplifier

4.07 On the No. M9B meter, operate the toggle switches to the DC and VM-AM positions. Using the meter, with its associated test clip leads connected to meter jacks -V and 30V, measure the voltage at the distributing fuse panel for the circuit being adjusted. Record the difference, if any, between this voltage and the nominal voltage for this distributing panel.

4.08 Using the No. M9B meter and its associated test clips leads, connect the 30V jack of the meter to terminal 4 of the V tube socket on the rear of the blocking amplifier unit. Connect the -V jack of the meter to terminal 3 of the V tube socket.

4.09 Allow the filament of the V tube to heat for one minute where a new electron tube is required or if the filament supply has been opened for any reason. Observe that, for the deviation from the nominal value which was recorded in 4.07, the reading on the meter is in accordance with Table B.

TABLE B

Deviation From Nominal Battery Voltage at Distributing Fuse Panel	Voltage
+0.5	20.25 to 20.75
+0.4	20.15 to 20.65
+0.3	20.05 to 20.55
+0.2	19.95 to 20.45
+0.1	19.85 to 20.35
0	19.75 to 20.25
-0.1	19.65 to 20.15
-0.2	19.55 to 20.05
-0.3	19.45 to 19.95
-0.4	19.35 to 19.85
-0.5	19.25 to 19.75

4.10 If the reading is not within the above limits, use a screwdriver to readjust the band on the R6 resistor, mounted on the rear of the blocking amplifier unit, until the proper voltage is obtained.

**B. Adjustment of Blocking Amplifier Gain -
P Potentiometer**

4.11 This is an adjustment of the blocking amplifier, V tube, to provide a gain of approximately 0 db at 1000 cycles.

4.12 If the No. 13A TMS is used, proceed with 4.13. If the No. 40B TMS is used, proceed with 4.18.

4.13 Connect the TMS to a power source of 105 to 125 volt (dc or 25 to 60 cycles ac). Turn the dial switch to the desired setting. Wait 5 minutes for the set to warm.

4.14 At the test jack equipment of the blocking amplifier circuit being adjusted, make the following connections:

From	Using Cord No.	To
SEND 1 MW (misc)	2W36A	IN of No.13A TMS

4.15 At the TMS, measure the level of the power received. Observe that the reading of the TMS is 0 ± 1.0 dbm. Record the actual reading.

4.16 At the test jack equipment, remove the plug of the cord from the SEND 1 MW jack and make the following connections to the circuit under test:

From	Using Cord No.	To
OUT	2W36A	IN of No.13A TMS
SEND 1 MW (misc)	4P18D	IN

4.17 Observe that the TMS reads within ± 0.1 db of the value recorded in 4.15. If it does not, use a screwdriver to adjust the P potentiometer on the front of the blocking amplifier unit so that the level of power in dbm recorded in 4.15 is obtained.

4.18 At the test jack equipment associated with the blocking amplifier being adjusted, make connection to a testing trunk extending to an appearance of a No. 40B TMS as follows:

From	Using Cord No.	To
SEND 1 MW (misc)	4P18D	SEND (misc)

4.19 At the TMS reached via this testing trunk, use patching cords to connect the testing trunk to an idle TMS. Using keys as required at the TMS to select the desired scale, measure the level of the power received. Observe that the reading of the TMS is 0 ± 1.0 dbm. Record the actual reading.

4.20 At the test jack equipment of the blocking amplifier bay, remove the plug of the patching cord from the SEND jack of the testing trunk and make the following connections to the circuit under test:

<u>From</u>	<u>Using Cord No.</u>	<u>To</u>
SEND 1 MW (misc)	4P18D	IN
OUT	4P18D	SEND (misc)

4.21 Observe that the TMS reads within ± 0.1 db of the value recorded in 4.19. If it does not, use a screwdriver to adjust the P potentiometer on the front of the blocking amplifier unit so that the value of power in dbm recorded in 4.19 is obtained. Remove all patching cords.

C. Adjustment of Voice Amplifier Gain - P1 Potentiometer

4.22 This is an adjustment of the voice amplifier gain, V1 tube, to provide a gain of approximately 0 db at 1000 cycles.

4.23 At the miscellaneous jack equipment of the signaling circuit being adjusted, make the following connections:

<u>From</u>	<u>Using Cord No.</u>	<u>To</u>
SEND 1 MW (misc)	4P18D	JK to TMS (misc)

4.24 At the TMS, observe that the level of the power received is 0 ± 1.0 dbm. Record the actual reading.

4.25 On the signaling test set, operate the TWD L key to ON HK. Using a No. 2P1D cord, patch the M jack to the EQ M jack of the signaling circuit being adjusted. Operate the TWD L key of the signaling test set to OFF HK.

4.26 At the miscellaneous jack equipment, remove the plug of the patching cord from the "JK to TMS" and make the following connections:

<u>From</u>	<u>Using Cord No.</u>	<u>To</u>
SEND 1 MW (misc)	4P18D	LINE REC (misc)
EQ REC (misc)	4P18D	JK to TMS (misc)

4.27 Observe that the TMS reads within ± 0.1 db of the value recorded in 4.24. If it does not, use a screwdriver to adjust the P1 potentiometer so that the level of power in dbm recorded in 4.24 is obtained. Remove all patching cords and restore to normal the TWD L key of the signaling test set.

D. Adjustment of Signaling Amplifier Gain - P2 Potentiometer and Adjustment of Maximum Plate Current - P3 Potentiometer

4.28 This procedure covers the adjustment of the sensitivity of the receiver (operate and nonoperate at high sensitivity and maximum saturation of the receiver).

4.29 On the miscellaneous jack equipment, turn the controls of the attenuator fully counterclockwise. On the signaling test set, turn the SCALE SEL to 20 MA. On the signaling circuit, turn the P2 and P3 potentiometers fully clockwise by use of a screwdriver. Insert a No. 258D dummy plug (red) into the R jack. Make the following connections:

<u>From</u>	<u>Using Cord No.</u>	<u>To</u>
MA (tst)	3P15B	DC (sig)
LINE REC (misc)	4P18D	ATTEN IN (misc)

4.30 Observe that the milliammeter of the signaling test set indicates a value which is less than 0.3 ma. If a value greater than 0.3 ma is indicated, remove the V3 tube from its socket with the tube puller and replace the tube.

Note: It may be necessary to try several tubes in order to obtain one that will meet these requirements. Tubes that are unsuitable for this use may still be satisfactory for use as a voice or signaling amplifier.

4.31 At the miscellaneous jack equipment of the signaling circuit being adjusted, remove the plug of the patching cord from the LINE REC jack and make the following connections:

<u>From</u>	<u>Using Cord No.</u>	<u>To</u>
2400 SEND or 2600 SEND (misc)	4P18D	ATTEN IN (misc)
ATTEN OUT (misc)	4P18D	AMP IN (misc)
AMP OUT (misc)	4P18D	JK to TMS (misc)

4.32 Adjust the controls of the attenuator so that the TMS indicates the following values.

<u>+4 Line</u>	<u>+7 Line</u>
-4 ± 0.1 dbm	-1 ± 0.1 dbm

Record the setting now shown by the controls of the attenuator in order that these controls may be reset later to the same position.

4.33 Remove the plug of the patching cord from "JK to TMS" and insert it into the LINE REC jack of the signaling circuit under test.

4.34 Observe that the milliammeter of the signaling test set indicates a value greater than 11.5 ma on its 0 to 20 scale. Wait 3 minutes to allow the circuit to stabilize. Observe that the reading is still greater than 11.5 ma. Adjust the signaling circuit P3 potentiometer, with a screwdriver, so that the meter of the signaling test set indicates 10.5 ma.

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4.35 Remove the plug of the patching cord from the LINE REC jack of the signaling circuit and connect it to the "JK to TMS." Adjust the controls of the attenuator so that the TMS indicates the following values.

<u>+4 Line</u>	<u>+7 Line</u>
-24 ±0.1 dbm	-21 ±0.1 dbm

Record the setting now shown by the controls of the attenuator in order that these controls may be reset later to the same position.

4.36 At the miscellaneous jack equipment, remove the plug of the patching cord from "JK to TMS" and insert it into the LINE REC jack of the signaling circuit. Allow the circuit to stabilize for one minute. Using a screwdriver, adjust the P2 potentiometer so that the milliammeter of the signaling test set indicates 7 ma on its 0 to 20 scale.

4.37 Set the attenuator to the reading that was recorded in 4.32 and again check for 10.5 ma, adjusting the P3 potentiometer with a screwdriver, if necessary, to obtain this value. Then set the attenuator to the reading that was recorded in 4.35 and again check for 7 ma, adjusting the P2 potentiometer with a screwdriver, if necessary, to obtain this value. Repeat this procedure until these values are obtained.

4.38 Remove all patching cords. Remove the dummy plug from the R jack of the signaling circuit. Restore the SCALE SEL switch of the test set to the PPS position.

E. Adjustment of Output of Regenerative Relay RG - P6 Potentiometer

4.39 This adjustment covers the release time of the RG relay. The RG relay controls the per cent break of the pulses on the E lead. In addition, a check and an adjustment of the R relay is provided which must be made before applying the RG relay potentiometer adjustment. Furthermore, before adjustment E is applied, either the receiver should meet the operate high sensitivity, the nonoperate high sensitivity, and the maximum saturation tests covered in Section 179-310-501, or the receiver should meet adjustment D of this section which covers the sensitivity adjustment.

R Relay Check and Adjustment

4.40 On the miscellaneous jack equipment, make the following connections:

<u>From</u>	<u>Using Cord No.</u>	<u>To</u>
2400 SEND or 2800 SEND (misc)	4P18D	KEYER IN (misc)
KEYER OUT (misc)	4P18D	ATTEN IN (misc)
ATTEN OUT (misc)	4P18D	AMP IN (misc)
AMP OUT (misc)	4P18D	JK to TMS (misc)
M (tst)	2P1D	M (KEYER) (misc)
L (tst)	3P15B	R (sig)

4.41 On the signaling test set, operate the TWD L key to ON HK.

4.42 On the miscellaneous jack equipment, adjust the controls of the attenuator so that the TMS indicates the following:

<u>+4 Line</u>	<u>+7 Line</u>
-4 ±0.1 dbm	-1 ±0.1 dbm

4.43 On the signaling test set, operate the TWD L key to OFF HK. At the miscellaneous jack equipment, remove the plug from the "JK to TMS" and insert it into the LINE REC jack of the signaling circuit.

4.44 On the signaling test set, adjust the ADJ PPS control so that the PULSES PER SECOND meter reads 10 on its 0 to 20 scale. Operate the ADJ % BK switch to the M position. Adjust the ADJ % BK control so that the PER CENT BREAK meter reads 60 on its black scale.

4.45 On the signaling test set, operate the MEAS % BK key to LINE. Operate the PLS key to LINE. Observe that the PER CENT BREAK meter indicates not less than 30 nor more than 44 on its black scale. If these limits are met, proceed as described in 4.55. If they are not met, check the electrical adjustment of relay R as covered in 4.46 to 4.51, inclusive.

4.46 Record the setting now shown by the controls of the attenuator in order that these controls may be reset later to the same position.

4.47 On the signaling test set, restore the PLS key and the MEAS % BK key to normal. Operate the TWD L key to ON HK. Turn the SCALE SEL control to 20 MA.

4.48 Remove the cord connecting the R jack of the signaling circuit to the L jack of the signaling test set. Insert into the R jack of the signaling circuit the No. 310 plug which has the tip and ring short-circuited. Using the No. 1W13A cord equipped with a KS-6278 connecting clip at each end, strap terminals 7 and 8 of the RF relay. Make the following connections:

<u>From</u>	<u>Using Cord No.</u>	<u>To</u>
MA (tst)	3P15B	DC (sig)
E (tst)	2P3B	EQ E (misc)

4.49 If a No. 2B signaling test set is used, at the miscellaneous jack equipment, turn the 0.1 DB ATTEN control fully counterclockwise. Turn the 2 DB ATTEN control slowly in a counterclockwise direction until the L lamp of the signaling test set is extinguished. Then, slowly turn the 0.1 DB ATTEN control in a clockwise direction until the L lamp of the signaling test set is lighted. This indicates that the R relay of the signaling circuit has operated. If the L lamp is

not lighted by the time the 0.1 DB ATTEN control reaches its fully clockwise position, return this control to its fully counterclockwise position and turn the 2 DB ATTEN control one step in the clockwise direction. Again slowly advance the 0.1 DB ATTEN control clockwise until the L lamp is lighted. Repeat if necessary until the L lamp is lighted.

4.50 If a No. 2A signaling test set is used, at the miscellaneous jack equipment, turn the 0.1 DB ATTEN control fully counterclockwise. Turn the 2 DB ATTEN control slowly in a counterclockwise direction until the L lamp of the signaling test set is lighted. Then, slowly turn the 0.1 DB ATTEN control in a clockwise direction until the L lamp of the signaling test set is extinguished. This indicates that the R relay of the signaling circuit has operated. If the L lamp is not extinguished by the time the 0.1 DB ATTEN control reaches its fully clockwise position, return this control to its fully counterclockwise position and turn the 2 DB ATTEN control one step in a clockwise direction. Again slowly advance the 0.1 DB ATTEN control clockwise until the L lamp is extinguished. Repeat if necessary until the L lamp is extinguished.

4.51 When a satisfactory lamp indication is obtained, the current indicated on the 0 to 20 scale of the milliammeter should be between 5.9 and 7 ma. If it is not, readjust the R relay in accordance with Section 040-514-701 before proceeding, using the current flow requirements given in the circuit requirements table.

4.52 Remove the No. 310 plug from the R jack of the signaling circuit and remove the strap between terminals 7 and 8 of the RF relay. At the miscellaneous jack equipment, reset the attenuator control to the positions noted in 4.46. Remove the cord connecting the E jack of the signaling test set to the EQ E jack of the signaling circuit. Remove the cord connecting the MA jack of the signaling test set to the DC jack of the signaling circuit. Using a No. 3P15B cord, patch the R jack of the signaling circuit to the L jack of the signaling test set. On the signaling test set, operate the TWD L key to OFF HK and turn the SCALE SEL control to PPS.

4.53 Now proceed as in 4.44 and 4.45 to check whether the 30 to 44 per cent break limit can be obtained. If the limit is met, proceed as described in 4.55. If the limit still cannot be met, proceed as covered in 4.54.

4.54 If the indication is below 30 on the signaling circuit, remove the strap ("X" wiring) connecting terminal punchings W and X where they are provided. Where these punchings are not provided, remove this strap ("X" wiring) at the R9 resistor of the signaling circuit. If the indication is above 44, connect terminal punchings W and X, where they

are provided, by means of No. 24 gauge bare strap wire. Where these punchings are not provided, connect a short circuiting strap around the R9 resistor using No. 24 gauge bare strap wire. If the preceding wiring changes are already made or if when the limits still cannot be met, a trouble condition may exist in the receiver. When the correct per cent break is obtained, proceed as covered in 4.55.

Note: Removal of the "X" strap causes an increase of approximately 5 per cent in the per cent break output of the R relay.

RG Relay Adjustment

4.55 Remove the cord connecting the L jack of the signaling test set to the R jack of the signaling circuit. Insert into the R jack of the signaling circuit a No. 310 plug with tip and ring short-circuited. Using a No. 2P3B cord, patch the E jack of the signaling test set to the EQ E jack of the signaling circuit. On the signaling test set, restore the PLS and MEAS % BK keys to normal.

4.56 On the signaling test set, check that the PULSES PER SECOND meter reads 10 on its 0 to 20 scale and that the PER CENT BREAK meter reads 60 on its black scale. Note that the TWD L key is in the OFF HK position. Operate the MEAS % BK key to LINE. Operate the PLS key to LINE. On the signaling circuit, using a screwdriver, turn the P6 potentiometer so that the PER CENT BREAK meter reads 58 on its red scale. If this adjustment can be made by means of the P6 potentiometer, proceed as described in 4.58. If the adjustment cannot be made, straps at terminal punchings E, F, and G ("V" and "W" wiring) of the signaling circuit should be changed as covered in 4.57.

4.57 If the nearest reading obtained in 4.56 is less than 58 on the red scale, restrap terminal punchings E, F, and G to add capacitance to the circuit. If the nearest reading obtained in 4.56 is more than 58 on the red scale, restrap terminal punchings E, F, and G to remove capacitance from the circuit. Capacitance should be added or removed in steps of one mf in accordance with the following table until, by means of the P6 potentiometer, a reading of 58 can be obtained on the PER CENT BREAK meter.

<u>Capacitance</u>	<u>Strap Punchings</u>	<u>Wiring Option</u>
1 mf	E to F	V
2 mf	G to F	W
3 mf	E to F & G to F	V & W

If the capacitance is changed and potentiometer P6 still cannot be correctly set, replace the RG relay. When the correct per cent break is obtained, proceed as in 4.58.

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Check of Pulsing Performance

4.58 On the signaling test set, restore the PLS and MEAS % BK keys to normal. Note that the PULSES PER SECOND meter reads 10 on its 0 to 20 scale. Adjust the ADJ % BK control so that the PER CENT BREAK meter reads 45 on its black scale. Operate the MEAS % BK key to LINE. Operate the PLS key to LINE. Check that the PER CENT BREAK meter reads between 50 and 60, inclusive, on its red scale.

4.59 On the signaling test set, again restore the PLS and MEAS % BK keys to normal. Note that the PULSES PER SECOND meter still reads 10 on its 0 to 20 scale. Adjust the ADJ % BK control so that the PER CENT BREAK meter reads 70 on its black scale. Operate the PLS key to LINE. Operate the MEAS % BK key to LINE. Check

that the PER CENT BREAK meter reads between 58 and 68, inclusive, on its red scale.

4.60 If the requirements in 4.58 and 4.59 are not met, recheck the adjustment covered in 4.56 and 4.57 using a different "V" and "W" strapping, if possible, since another combination of the strapping of "V" and "W" wiring, together with the setting of the P6 potentiometer, may permit meeting these requirements.

4.61 Remove all patching cords and the No. 310 plug from the R jack. Restore all test set keys to normal.

5. REPORTS

5.01 The required record of the tests should be entered on the proper form.