2400- OR 2600-CYCLE SINGLE-FREQUENCY SIGNALING CIRCUIT SD-56292-01
OUT-OF-SERVICE TESTS
USING SIGNALING TESTING CIRCUIT SD-56335-01

1. GENERAL

1.01 This section describes methods of making out-of-service tests of 2400- or 2600-cycle single-frequency signaling circuits per SD-56292-01 using the signaling testing circuit SD-56335-01. It should be used when service troubles are encountered or when "OVER-ALL" pulsing tests per 179-210-501 or routine tests per 179-312-502 "IN-SERVICE" practice cannot be met. It also describes when to make relay or potentiometer adjustments to compensate for normal variations in circuit elements and circuit modifications for improving over-all operation.

1.02 This section is reissued:

(a) To change the test of the CO relay and add a new test for the HL relay in Test B.

(b) To incorporate the cut-off current test of the R relay with the sensitivity test and add a new test for the RF relay in Test E.

(c) To add a new pulsing test for the RF relay and a release time test for the G relay in Test F.

(d) To revise Tests E and I to provide the proper test circuit attenuator setting for testing single-frequency signaling units associated with a bandpass network for 2-wire multifrequency outpulsing facilities (Fig. 8 of SD-56292-01, Issue 9B or later).

(e) To improve the method of performing the Voice Amplifier Gain Test, Test E.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The tests covered are:

*A. **Pulsing of Transmitter M Relay:*** This test checks that the M relay is properly following pulses and also provides a method for adjusting the M potentiometer to meet the requirement.

*B. **Release of Transmitter CO and HL Relays:*** This test checks that the CO and HL relays release within desired timing limits.

*C. **Transmitted Tone Level:*** This test checks the level of the transmitted single-frequency tone.

*D. **Gain of Receiver Voice Amplifier and Insertion of Band Elimination Filter:*** This test checks: (1) transmission of the voice signals through the receiver and provides a procedure to adjust the TL potentiometer to obtain the required transmission and, (2) blocking of the signal tone when present on the line.

*E. **Cut-Off Current of R and RF Relays and Sensitivity of Receiver:*** This test checks the current through the RF and R relay windings without and with signaling tone input and provides a method for adjusting the SS potentiometer to obtain the required sensitivity.

*F. **Operation of RF and R Relays and Release of G Relay:*** This test checks the operate and release times of the RF and R relays and also provides a method of adjusting the OT and RT potentiometers to meet the requirements. A check and method of adjusting the release time of the G relay is also made in this test.

G. Receiver Regulation: This test checks the limiting of high-level signal tones by the signaling amplifier.

H. Receiver Guard Action, Permanent Signal, and 2-Wire Controls: This test checks: (1) effectiveness of the receiver guard circuit in preventing operation by voice signals and, (2) operation of the permanent signal control to provide a failure alarm and of the 2-wire control for the insertion of the echo-eliminating network.

I. Final Adjustment of Receiver Sensitivity: This test provides a method for adjusting the SS potentiometer to obtain the sensitivity required for the particular application.

1.04 It is recommended that all 2400 or 2600-cycle single-frequency units be wired as covered in Part 5 when the plug-in units are removed for maintenance test.

1.05 The tests should be made in the order specified in this section. However, individual parts may be performed if troubles are localized by "OVER-ALL" or "IN-SERVICE" tests.

1.06 Adjustments specified in this section should not be attempted during periods of power supply irregularities.

1.07 ***Failure to Meet Tests Even After Adjustments:*** If the single-frequency signaling unit does not meet the requirements in this section, refer to Section 179-303-301 covering the analysis and clearance of trouble.

1.08 Adjustment of the 2A or 2B signaling test set for pulse per cent break values above 70 must be made ***slowly,*** otherwise the pulsing rate may drop suddenly to half that indicated by the PULSES PER SECOND meter. This condition will be indicated by the rate of vibration of the PER CENT BREAK meter pointer being half that of the pointer on the PULSES PER SECOND meter. When this occurs, normal operation is restored by turning the ADJ % BK control fully counterclockwise and then turning it ***slowly*** clockwise to produce the desired per cent break.

1.09 When placing a single-frequency signaling unit in position, on a bay or in the testing circuit, care must be exercised to prevent damage to the quick fastener springs in the upper supporting bracket and also damaging or losing the retaining ring on the lower positioning screw of the unit.

(a) ***When removing a unit*** first loosen the bottom positioning screw several turns, then loosen the quick fasteners at the top. Next fully unscrew the bottom positioning screw and then withdraw the unit from its mounting position.

(b) ***When mounting a unit*** first place it in position, then tighten the lower positioning screw several turns, but do not tighten fully. Next secure the two quick fasteners at the top of the unit, then fully tighten the bottom positioning screw.

1.10 Two values of power are specified in Tests C and D and six values of attenuator setting in Tests E and I. The value to be used is determined from the following, depending on the circuit transmission level, whether 4-wire or 2-wire (4W or 2W) line facility and with or without bandpass filter (Figure 8 of SD-56292-01, Issue 9B or later):

(a) ***+4 Line, −13 Line (4W or 2W):*** "+4 line" indicates that the signaling receiver connects to the circuit at a point where the transmission level is +4 dbm. "−13 line" indicates that the associated signaling transmitter connects to the circuit at a point where the transmission level is −13 dbm.

(b) ***+7 Line, −16 Line (4W or 2W):*** "+7 line" indicates that the signaling receiver connects to the circuit at a point where the transmission level is +7 dbm. "−16 line" indicates that the associated signaling transmitter connects to the circuit at a point where the transmission level is −16 dbm.

1.11 The transmission measuring set is referred to in this section as TMS.

1.12 The 2A and 2B signaling test sets are referred to in this section as 2A or 2B test set.

1.13 The 2400- or 2600-cycle single-frequency signaling circuit is referred to in this section as SF unit.

1.14 The signaling testing circuit SD-56335-01 is referred to in this section as testing circuit.

1.15 If, in any test, the succeeding step pertains to the same test set or circuit, no mention will be made of it.

1.16 The single-frequency signaling units are all tested at a +4 dbm receiving level, that is with TL key of the testing circuit in position 4. When a unit is used on a 2-wire line, or with a +7 dbm receiving level, the proper receiver sensitivity adjustment is provided for by Test I.

1.17 The attached Fig. 1 is a simplified sketch of the wiring side of the unit showing location of C11 per modification listed in Part 5.

1.18 ***Lettered Steps:*** A letter a, b, c, etc, added to a step number in Part 3, 4, or 5 of this section, indicates an action which may or may not be required depending on local conditions. The condition under which a lettered step or a series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

2. APPARATUS

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

APPARATUS	NO. REQUIRED FOR TEST								
	A	B	C	D	E	F	G	H	I
Test Circuit (2.02)	1	1	1	1	1	1	1	1	1
Test Set (2.03)	1	1	1	1	1	1	1	1	1
Test Set (2.04)	–	–	1	1	–	–	–	1	–
Testing Cord (2.05)	–	–	1	1	–	–	–	1	–
Patching Cord (2.06)	–	–	–	–	1	–	1	–	1
Patching Cord (2.07)	1	1	1	1	1	1	1	1	1
Patching Cord (2.08)	1	1	1	1	1	1	1	1	1
258D Plug	1	1	1	1	1	1	1	1	1
Testing Cord (2.09)	–	–	–	–	1	–	–	–	–
607A Tools	–	–	–	–	2	–	–	–	–
Patching Cord (2.10)	–	–	–	1	–	–	–	–	–

2.02 Signaling Testing Circuit J68602CS (SD-56335-01).

2.03 No. 2B Signaling Test Set J64730B (SD-56134-02) or 2A Signaling Test Set J64730A (SD-56134-01).

2.04 No. 13A, 21A, or 40B Transmission Measuring Set or equivalent set having the same dynamic characteristic.

2.05 W2CA cord, 5 feet 6 inches long, equipped with a 327A plug (2W36A cord) (for connecting testing circuit to 13A TMS) see 2.10 when using 21A.

2.06 P2BM cord assembly, 3 feet long, equipped with one 310 plug and one KS-14520 plug (provided with signaling testing circuit SD-56335-01) (for connecting SF unit PLT CUR test points to MA jack of 2A or 2B test set).

2.07 P2A cord, 6 feet long, equipped with two 347A plugs (2P1D cord) (for connecting M jack of testing circuit to M jack of 2A or 2B test set).

2.08 P2A cord, 6 feet long, equipped with two 347B plugs (2P3B cord) (for connecting E jack of testing circuit to E jack of 2A or 2B test set).

2.09 W2W cord, 6 feet long, equipped with one 310 plug and two 360 tools (2W17A cord) (for connecting RF relay winding to VM jack of 2A or 2B test set).

2.10 P2AA cord, 6 feet long, equipped with two 241A plugs (2P13B cord), for Test D or for Tests E, G, and I.

3. PREPARATION

STEP	ACTION	VERIFICATION
Tests A through I		
1	Obtain release of SF unit to be tested in accordance with approved procedures.	
2	Remove SF unit from its mounting (see 1.09).	
3a	If SF unit is not wired per Issue 11B or later of SD-56292-01 — Modify SF unit in accordance with Part 5 of this section.	
4	At testing circuit — Plug SF unit to be tested into testing circuit connector (see 1.09).	
5	At 2A or 2B test set — Set all lever keys to normal.	
6	Connect TST BAT cords A (−48) and B (−24 +130) to testing circuit A and B battery supply jacks respectively, as follows.	
	TEST SET — **BATTERY SUPPLY JACKS** 2A — 2A or 2B "V" Option 2B "V" Option — 2A or 2B "V" Option 2B "W" Option (or later) — 2B "W" Option	
7	Set SCALE SEL switch to 20 MA, adjust, if necessary, pointer adjustment screw of PULSES PER SECOND meter to obtain 0 reading.	PULSES PER SECOND meter reads 0.
8	Set SCALE SEL switch to PPS.	PULSES PER SECOND meter reads other than 0.
9b	If using 2A test set — Operate PPS key to DIAL SUPV.	PULSES PER SECOND meter reads 0 to 0.5. PER CENT BREAK meter reads 0 on ***black*** scale (see Step 11d).
10c	If using 2B test set — Operate CONT PLS key to DIAL PLS.	PULSES PER SECOND meter reads 0 to 0.5. PER CENT BREAK meter reads 0 on ***black*** scale (see Step 11d).
11d	If requirement of Step 9b or 10c is not met — For PER CENT BREAK meter — Adjust pointer adjustment screw. For PULSES PER SECOND meter — Check 2A or 2B test set.	

STEP	ACTION	VERIFICATION
12	Insert 258D plug into P jack.	PER CENT BREAK meter reads 100 on ***black*** scale (see Step 13e).
	Note: Repeat Steps 12, 13e if necessary, and 14 if testing interval extends beyond 30 minutes.	
13e	If requirement of Step 12 is not met — Unlock CAL % BK control and adjust to obtain reading of 100 and then relock control taking care not to change reading.	
14	Remove 258D plug from P jack.	PER CENT BREAK meter reads 0 on ***black*** scale.
15b	If using 2A test set — Restore PPS key to normal.	
	Note: The proper performance of the tests covered in this section depends upon the correct pulse-per-second calibration and range of the 2A or 2B test set. See Section 100-263-501 for calibration if accuracy of 2A or 2B test set is not known.	
16c	If using 2B test set — Restore CONT PLS key to normal.	
	Note: The proper performance of the tests covered in this section depends upon the correct pulse-per-second calibration and range of the 2A or 2B test set. See Section 100-263-501 for calibration if accuracy of 2A or 2B test set is not known.	
17	Patch E jack of 2A or 2B test set to E jack of testing circuit using 2P3B cord.	
18	Patch M jack of 2A or 2B test set to M jack of testing circuit using 2P1D cord.	
19	At testing circuit — Set SF key to 2400 or 2600 depending on receiver frequency of SF unit under test.	
20	Set TL key to +4 (see 1.16).	
	Note: If Test C, D, or H is to be performed in conjunction with other tests, the preparation (Steps 21 through 23) for Tests C, D, and H should be performed at this time to permit TMS to warm up.	

STEP	ACTION	VERIFICATION
Tests C, D, and H		
21	At TMS — Connect 2W36A cord to IN terminals of TMS.	
22	Connect power cord to power receptacle.	
23	Operate power supply switch to ON and allow 5 minutes for heating of set before proceeding with either calibrating, if necessary, or making measurements.	
24	Connect TMS to SF SUP jack of test circuit.	TMS reads —13 LINE: −12.6 ±.5 —16 LINE: −15.6 ±.5 Record for Test D (see 1.10).
25f	If requirement of Step 24 is not met — Verify SF tone supply circuit level, adjust per Section 179-301-501, if necessary.	
26	Disconnect TMS from SF SUP jack, connect to TMS jack of test circuit.	

4. METHOD

STEP	ACTION	VERIFICATION
	A. Pulsing of Transmitter M Relay	
21	At 2A or 2B test set — SCALE SEL switch should be set at PPS — Adjust ADJ PPS control to obtain reading of 10 pps on PULSES PER SECOND meter (0 to 20 scale).	
22	Set coarse ADJ % BK switch to M.	
23	Adjust ADJ % BK control to obtain reading of 45 on ***black*** scale of PER CENT BREAK meter.	
24	At testing circuit — Set KEYERS switch to 1 ADJ.	
25	At 2A or 2B test set — Operate TWD L key to OFF HK, operate PLS and MEAS % BK keys to LINE.	PER CENT BREAK meter reads 46 on ***black*** scale (see Step 26f).
26f	If requirement in Step 25 is not met — At SF unit — Adjust M potentiometer to obtain reading of 46 on ***black*** scale of PER CENT BREAK meter on 2A or 2B test set.	

STEP	ACTION	VERIFICATION
27	At 2A or 2B test set — Restore PLS, MEAS % BK, and TWD L keys to normal.	

B. Release of Transmitter CO and HL Relays

CO Relay

21	Remove relay cover from signaling unit.	
22	On test set — Set KEYERS SW1 to 1 ADJ.	
23	At 2A or 2B Test Set — Adjust ADJ PPS control to obtain reading of 3 PPS on PULSES PER SECOND meter.	
24	Set Coarse ADJ % BK switch to L.	
25	Adjust ADJ % BK control to 40 on ***red*** scale.	
26	Operate TWD L key to OFF HK, PLS and MEAS % BK keys to LINE.	M relay pulses while CO and HL relays remain operated.
27	Turn ADJ % BK control slowly counterclockwise until CO relay just starts to release on each pulse. ***Note:*** This condition is met when the armature just begins to break away from the core. The contacts do not have to move and the armature should not release fully.	PER CENT BREAK meter should read between 46 and 63 (153-210 MS) on ***red*** scale (see Step 28f).
28f	If requirement of Step 27 is not met — Meet readjust requirement by adjusting CO relay. Hold and Release requirements are waived if timing requirement is met. When rechecking per cent break requirement — Always turn ADJ % BK control clockwise until CO relay is operated before turning counterclockwise to point at which CO relay just starts to release on each pulse.	Readjust requirement — PER CENT BREAK meter reads between 47 and 60 (157-200 MS) on ***red*** scale.

HL Relay

29	At 2A or 2B test set — Slowly turn ADJ % BK control clockwise until CO relay remains operated and HL relay just starts to release on each pulse (see Note, Step 27), or until reading of 18 on PER CENT BREAK meter ***red*** scale is obtained.	

STEP	ACTION	VERIFICATION
30g	If HL relay is pulsing — At 2A or 2B test set — Restore all keys to normal.	PER CENT BREAK meter reads between 19 and 34 (220-270 MS) on ***red*** scale (see Step 32j).
31h	If reading is 18 on PER CENT BREAK meter — At 2A or 2B test set — Restore all keys to normal.	
32j	If requirement of Step 30 is not met, or if reading of 18 is obtained before HL relay starts to release — Meet readjust requirement (see Step 34j) by adjusting the HL relay. Hold and Release requirements are waived if timing requirement is met.	
33j	At 2A or 2B test set — Operate TWD L key to OFF HK, PLS and MEAS % BK keys to LINE. Always turn ADJ % BK control counterclockwise until CO and HL relays remain operated before finding new point at which HL relay just begins to release on each pulse.	
34j	At 2A or 2B test set — Restore all keys to normal.	Readjust requirement — PER CENT BREAK meter reads between 23 and 33 (224-256 MS) on ***red*** scale.
35	Set coarse ADJ % BK switch to M.	
36	Replace relay cover on signaling unit.	

C. Transmitted Tone Level

27	At TMS — Set dial switch to 20.	
28	At 2A or 2B test set — Operate TWD L key to OFF HK.	
29	At testing circuit — Set KEYERS switch to 2 SIG PLS.	At TMS — No reading.
30	While watching TMS meter — At testing circuit — Turn KEYERS switch to 3 SIG ON. ***Note:*** The KEYERS switch may be operated back and forth between positions 2 SIG PLS and 3 SIG ON, as required, to observe that reading is correct.	TMS reads peak (kick) reading when oscillator supplying testing circuit is arranged for −13 line or −16 line (see 1.10) as follows. **−13 LINE**: −20.5 ± 1.0 db **−16 LINE**: −23.5 ± 1.0 db

STEP	ACTION	VERIFICATION
31	At TMS — Set dial switch to 30 or 35 as required to read final verification value.	Final TMS reading when oscillator supplying testing circuit is arranged for −13 line or −16 line as follows. −13 LINE: −33 ± 1.0 db −16 LINE: −36 ± 1.0 db
32	At testing circuit — Set KEYERS switch to 4 SIG OFF.	TMS reads less power than −45 db.
33	At 2A or 2B test set — Restore TWD L key to normal.	
34	At TMS — Set dial switch to +5 or +10.	

D. Gain of Receiver Voice Amplifier and Insertion of Band Elimination Filter

Note: The SF unit under test shall have been connected to the testing circuit connector for at least 5 minutes before this test is made, to allow electron tubes to warm up.

27	At testing circuit — Patch from SF TONE TST jack to 1 MW SUP jack using 2P13D cord.	
28	Set KEYERS switch to 8 SIG PLS. Set RECEIVER switch to 6 MEAS 1 KC IN.	
29	Add to reading recorded in Step 24, the following (see 1.10). −13 LINE: 6 −16 LINE: 3 Set ATT (attenuator) switches for this sum.	At TMS — Output level reads ***exactly*** as follows (see Step 30g). −13 LINE: +4 db −16 LINE: +7 db
30g	If requirement in Step 29 is not met — At testing circuit — Adjust GAIN potentiometer of V3 test amplifier to obtain TMS reading ***exactly*** as required in Step 29.	
31	Set RECEIVER switch to 7 M OPR.	At TMS — Output level reads ***exactly*** as follows (see Step 32h). −13 LINE: +4 db −16 LINE: +7 db
32h	If requirement in Step 31 is not met or if maximum gain of voice amplifier is to be measured — At SF unit — Adjust TL potentiometer to maximum clockwise position.	At TMS — Output level reads greater power than: −13 LINE: +5.5 db −16 LINE: +8.5 db

STEP	ACTION	VERIFICATION
33	Adjust TL potentiometer to obtain exact TMS reading as follows. —13 LINE: +4 db —16 LINE: +7 db	
34	At testing circuit — Remove patch between 1 MW SUP jack and SF TONE TST jack.	
35	Set KEYERS switch to 6 SIG ON, set RECEIVER switch to 1 MEAS INPUT.	
36	Set ATT (attenuator) switches for 10.0 db.	At TMS — Output level reads 0 ±0.2 db (see Step 37j).
37j	If requirement in Step 36 is not met — At testing circuit — Adjust GAIN potentiometer of V3 test amplifier to obtain TMS reading of 0 ±0.2 db.	
38	At SF unit — Turn SS potentiometer fully counterclockwise.	
39	At testing circuit — Set RECEIVER switch to 2 M OPR.	F lamp lighted.
40	At SF unit — Turn SS potentiometer clockwise until F lamp of testing circuit is just extinguished and record TMS reading.	At TMS — Output level indicated shall be less power than −29 db.
41	At testing circuit — Set RECEIVER switch to 3 M RLS.	
42	At SF unit — Turn SS potentiometer fully counterclockwise. *Note:* Whenever the SS potentiometer is changed as above, it must be readjusted per Test E or Test I.	At TMS — Output level indicated shall be same as noted in Step 40.
43	At TMS — Set dial switch to 0.	

E. Cut-Off Current of R and RF Relays and Sensitivity of Receiver

Note: The SF unit under test shall have been connected to the testing circuit connector for at least 5 minutes before this test is made. Also, it is important to have the V3 test amplifier properly adjusted per Test D, Steps 35 to 37j, inclusive.

21	At 2A or 2B test set — Patch MA jack to PLT+ and −CUR test points of SF unit using P2BM cord assembly.	

STEP	ACTION	VERIFICATION
22	Set SCALE SEL switch to 20 ma.	
R Relay		
23	At testing circuit — Set KEYERS switch to 5 SIG OFF.	At 2A or 2B test set — MILLIAMPERES meter reads not more than 0.3 ma.
24	At 2A or 2B test set — Set SCALE SEL switch to 20V.	
25	Remove relay cover from signaling unit.	
26	Connect two 607A tools to 360B, 360C tools on 2W17A cord.	
27	Using 607A tools, connect tip conductor (white) to bottom terminal and ring conductor (black) to top terminal respectively of RF relay winding.	
RF Relay		
28	At 2A or 2B test set — Insert 310 plug of 2W17A cord into VM jack.	VOLTS meter reads 1.5 volts or less.
29	Set SCALE SEL switch to 20 ma.	
30	At testing circuit — Set KEYERS switch to 6 SIG ON, set RECEIVER switch to 3 M RLS. ***Note:*** If Test D, Step 42 has just been performed (SS potentiometer at full counterclockwise position), readjust the SS potentiometer to full clockwise position before going to Step 31 of this test.	
31	Depending on transmission level and 4W or 2W line condition (see 1.10), set ATT (attenuator) switches to the following.	R and RF relays operate. At 2A or 2B test set — MILLIAMPERES meter reads 5.5 ma or more.
RF Relay		
32	With ATT setting as in Step 31 — At 2A or 2B test set — Set SCALE SEL switch to 200V.	VOLTS meter reads 18 volts or more.

LEVEL	LINE	OPTION PROVIDED	ATT
+4	2W	Fig. 8	39 db
+4	2W	—	37 db
+4	4W	—	35 db
+7	2W	Fig. 8	36 db
+7	2W		34 db
+7	4W		32 db

STEP	ACTION	VERIFICATION
33	At testing circuit — Set ATT switches for 35 db.	
34	At 2A or 2B test set — Set SCALE SEL switch to 20 ma.	
35	At SF unit — Adjust SS potentiometer to obtain reading of 5.5 ma on MILLIAMPERES meter of 2A or 2B test set.	R and RF relays remain operated.
R Relay		
36	At testing circuit — Set ATT switches for 26 db.	At 2A or 2B test set — MILLIAMPERES meter reads at least 7.6 ma.
RF Relay		
37	At 2A or 2B test set — Set SCALE SEL switch to 200V.	VOLTS meter reads 38 volts or more.
38	Remove 607A tools from relay winding and 310 plug from VM jack of 2A or 2B test set. ***Note:*** Test I must be performed before returning unit to service. If no other tests are to be performed, replace the relay cover and go directly to Test I.	
39	Remove patch between PLT+ and −CUR test points and MA jack.	
40f	If Test F is to be performed — Relay cover may be left off.	

F. Operation of RF and R Relays and Release of G Relay

Note: The SF unit under test shall have been connected to the testing circuit connector for at least 5 minutes before this test is made. Also, it is important to have the V3 test amplifier properly adjusted per Test D, Steps 35 to 37j, inclusive.

21	At 2A or 2B test set — Set SCALE SEL switch to PPS.	
22	Adjust ADJ PPS control to obtain reading of 10 pps on PULSES PER SECOND meter (0 to 20 scale). ***Note:*** If testing interval has extended beyond 30 minutes, see Step 12 of test preparation.	
23	Adjust ADJ % BK control first fully counterclockwise, then slowly clockwise to obtain reading of 55 on ***black*** scale of PER CENT BREAK meter.	
24	At testing circuit — Set KEYERS switch to 7 CAL.	

STEP	ACTION	VERIFICATION
25	At 2A or 2B test set — Operate TWD L key to OFF HK, then PLS and MEAS % BK keys to LINE.	
26	At testing circuit — Adjust M potentiometer to obtain reading of 55 on ***black*** scale of PER CENT BREAK meter on 2A or 2B test set.	
27	Set ATT switches for 14.0 db.	
28	Remove relay cover from signaling unit.	
29	At 2A or 2B test set — Set coarse ADJ % BK switch to S.	
30	Set ADJ % BK control fully counterclockwise.	
31	At test set — Set KEYERS SW1 to 8 SIG PLS.	**RF relay should be released.**
RF Relay		
32	At 2A or 2B test set — Slowly increase ADJ % BK control until RF relay contact 1 top just begins to break.	
33	At test set — Set KEYERS SW1 to 7 CAL.	At 2A or 2B test set — PER CENT BREAK meter reading should not exceed 28 on ***black*** scale (see Step 34f).
34f	If requirement of Step 33 cannot be met — Check requirements of amplifier V2.1 per Test E or check requirements of RF relay.	
R Relay		
35	At 2A or 2B test set — Set coarse ADJ % BK switch to M.	
36	Adjust ADJ % BK control to obtain reading of 34 on ***black*** scale of PER CENT BREAK meter.	
37	Turn ADJ PPS control fully counterclockwise.	
38	At testing circuit — Set KEYERS switch to 8 SIG PLS. Set RECEIVER switch to 3 M RLS.	At 2A or 2B test set — No kick of the pointer of the PER CENT BREAK meter (see Step 44g).
39	Set KEYERS switch to 7 CAL.	
40	At 2A or 2B test set — Adjust ADJ PPS control to obtain reading of 10 pps on PULSES PER SECOND meter.	

STEP	ACTION	VERIFICATION
41	Adjust ADJ % BK control to obtain reading of 36 on ***black*** scale of PER CENT BREAK meter.	
42	Turn ADJ PPS control fully counterclockwise.	
43	At testing circuit — Set KEYERS switch to 8 SIG PLS.	At 2A or 2B test set — Steady kicks of pointer of the PER CENT BREAK meter (see Step 44g).
44g	If requirement in Step 38 or 43 is not met — Set KEYERS switch to 7 CAL.	
45g	At 2A or 2B test set — Adjust ADJ PPS control to obtain reading of 10 pps on PULSES PER SECOND meter.	
46g	Adjust ADJ % BK control to obtain reading of 35 on ***black*** scale of PER CENT BREAK meter.	
47g	Turn ADJ PPS control fully counterclockwise.	
48g	At testing circuit — Set KEYERS switch to 8 SIG PLS.	
49g	At SF unit — Adjust OT potentiometer until pointer of PER CENT BREAK meter just gives slight kicks.	
50g	At testing circuit — Set KEYERS switch to 7 CAL.	
51g	At 2A or 2B test set — Adjust ADJ PPS control to obtain reading of 10 pps on PULSES PER SECOND meter.	
52g	Repeat Steps 36 through 43.	
53	Set KEYERS switch to 7 CAL.	
54	At 2A or 2B test set — Adjust ADJ PPS control to obtain reading of 10 pps on PULSES PER SECOND meter.	
55	Adjust ADJ % BK control to obtain reading of 45 on ***black*** scale of PER CENT BREAK meter.	

STEP	ACTION	VERIFICATION
56	At testing circuit — Set KEYERS switch to 8 SIG PLS.	At 2A or 2B test set — PER CENT BREAK meter reads between 50 and 52 on ***red*** scale (see Step 57h).
57h	If requirement in Step 56 is not met — At SF unit — Turn RT potentiometer fully counterclockwise, then turn clockwise until reading of 51 is obtained on PER CENT BREAK meter of 2A or 2B test set.	
58	At testing circuit — Set KEYERS switch to 7 CAL.	
59	At 2A or 2B test set — Adjust ADJ % BK control ***slowly*** to obtain reading of 70 on ***black*** scale of PER CENT BREAK meter.	
60	At testing circuit — Set KEYERS switch to 8 SIG PLS.	At 2A or 2B test set — PER CENT BREAK meter reading should not exceed 70 on ***red*** scale.
G Relay		
61	At 2A or 2B test set — Adjust ADJ PPS control to obtain reading of 3 PPS on PULSES PER SECOND meter.	
62	Set coarse ADJ % BK switch to L.	G relay should be operated.
63	Slowly adjust ADJ % BK control clockwise until G relay just begins to release on each pulse. ***Note:*** This condition is met when the armature just begins to break away from the core. The contacts do not have to move and the armature should not release fully.	PER CENT BREAK meter should read between 42 and 54 on ***red*** scale (140 to 180 MS) (see Step 64i).
64i	If requirement of Step 63 is not met — Meet readjust requirement by adjusting G relay. Hold and release requirements are waived if timing requirement is met. Always turn ADJ % BK control counterclockwise until G relay remains operated before turning clockwise to point at which G relay just starts to release on each pulse.	Readjust requirement — PER CENT BREAK meter reads between 42 and 52 on ***red*** scale. (140 to 173 MS)
65	At 2A or 2B test set — Adjust ADJ % BK control counterclockwise to approximately midposition.	
66	Set coarse ADJ % BK switch to M.	
67	Adjust ADJ PPS control to obtain reading of 10 PPS on PULSES PER SECOND meter.	
68	Replace relay cover on signaling unit.	

STEP	ACTION	VERIFICATION
Rering Response of Receiver		
69	At testing circuit — Set KEYERS switch to 7 CAL.	
70	At 2A or 2B test set — Adjust ADJ % BK control to obtain reading of 60 on ***black*** scale of PER CENT BREAK meter.	
71	Adjust ADJ PPS control to obtain reading of 4 pps on PULSES PER SECOND meter.	PER CENT BREAK meter reads 24 on ***black*** scale (see Step 72j).
72j	If requirement of Step 71 is not met — Adjust ADJ PPS control until reading of 24 on ***black*** scale of PER CENT BREAK meter is obtained.	
73	At testing circuit — Set KEYERS switch to 8 SIG PLS, set RECEIVER switch to 2 M OPR.	At 2A or 2B test set — PER CENT BREAK meter reads between 26 and 48 on ***red*** scale (65 to 120 MS).
74	Set KEYERS switch to 7 CAL.	
75	At 2A or 2B test set — Adjust ADJ % BK control to obtain reading of 50 on ***black*** scale of PER CENT BREAK meter.	
76	At testing circuit — Set KEYERS switch to 8 SIG PLS.	At 2A or 2B test set — PER CENT BREAK meter reading should not exceed 56 on ***red*** scale (140 MS).
77	At 2A or 2B test set — Set lever keys to normal.	

G. Receiver Regulation

Note: The SF unit under test shall have been connected to the testing circuit connector for at least 5 minutes before this test is made. Also, it is important to have the V3 test amplifier properly adjusted per Test D, Steps 35 to 37j, inclusive.

21	At testing circuit — Set ATT switches for 26.0 db.	
22	Set KEYERS switch to 7 CAL.	
23	At 2A or 2B test set — Operate TWD L key to OFF HK. Operate PLS and MEAS % BK keys to LINE.	
24	Adjust ADJ PPS control to obtain reading of 5 pps on PULSES PER SECOND meter (0 to 20 scale).	
25	Adjust ADJ % BK control to obtain reading of 75 on ***black*** scale of PER CENT BREAK meter.	

STEP	ACTION	VERIFICATION
26	Patch MA jack to PLT+ and −CUR test points of SF unit using P2BM cord assembly.	
27	Set SCALE SEL switch to 20 ma.	
28	At testing circuit — Set KEYERS switch to 8 SIG PLS, set RECEIVER switch to 3 M RLS.	At 2A or 2B test set — Average deflection of the fluctuating pointer of the MILLIAMPERES meter not less than 6.5 ma.
29	Set ATT switches for 0.0 db.	Average deflection of MILLIAMPERES meter not less than that obtained in Step 28.
30	Set ATT switches for 26.0 db.	
31	Move RECEIVER switch to 2 M OPR.	Average deflection of MILLIAMPERES meter not less than 6.5 ma.
32	Set ATT switches for 0.0 db.	Average deflection of MILLIAMPERES meter not more than 0.6 ma below that obtained in Step 31.
33	Set ATT switches for 26.0 db.	
34	Set KEYERS switch to 6 SIG ON, set RECEIVER switch to 3 M RLS.	MILLIAMPERES meter reads not less than 7.6 ma.
35	Set ATT switches for 0.0 db.	MILLIAMPERES meter reads not less than reading obtained in Step 34.
36	At 2A or 2B test set — Remove patch between MA jack and PLT+ and −CUR test points.	
37	Restore PLS, MEAS % BK, and TWD L keys to normal.	

H. Receiver Guard Action, Permanent Signal, and 2-Wire Controls

Note: The SF unit under test shall have been connected to the testing circuit connector for at least 5 minutes before this test is made. Also, it is important to have the V3 test amplifier properly adjusted per Test D, Steps 35 to 37j, inclusive.

27	At testing circuit — Set ATT switches for 42.0 db, TL key should be set at +4 (see 1.16), set KEYERS switch to 5 SIG OFF, set RECEIVER switch to 6 MEAS 1KC IN.	
28	At TMS — Set dial switch to 20.	TMS reads 22 ±0.5 db

STEP	ACTION	VERIFICATION
29	At testing circuit — Set RECEIVER switch to 5 M RLS.	At testing circuit — F lamp extinguished. PS lamp lighted. If using 2A test set — L lamp lighted. If using 2B test set — L lamp extinguished.
30	Move KEYERS switch to 6 SIG ON.	If using 2A test set — L lamp lighted. If using 2B test set — L lamp extinguished.
31	Set ATT switches for 28 db.	At testing circuit — F and PS lamps extinguished. If using 2A test set — L lamp extinguished. If using 2B test set — L lamp lighted.
32	Set KEYERS switch to 5. SIG OFF, set RECEIVER switch to 7 M OPR.	At testing circuit — F lamp lighted. PS lamp extinguished. If using 2A test set — L lamp lighted. If using 2B test set — L lamp extinguished.
33	Set ATT switches for 26 db.	
34	Move KEYERS switch to 6 SIG ON.	If using 2A test set — L lamp lighted. If using 2B test set — L lamp extinguished.
35	Set ATT switches for 18 db.	At testing circuit — F and PS lamps extinguished. If using 2A test set — L lamp extinguished. If using 2B test set — L lamp lighted.

I. Final Adjustment of Receiver Sensitivity

Note: If Test F has been performed and the SF unit is to be used on a 4-wire line with a +4 dbm receiving level, the SF unit has been adjusted to the correct sensitivity, and readjustment per this test is not required.

21	At 2A or 2B test set — Patch MA jack to PLT+ and −CUR test points of SF unit using P2BM cord assembly.	
22	Set SCALE SEL switch to 20 ma.	

STEP	ACTION	VERIFICATION
23	At testing circuit — Set ATT switches for value shown below depending on transmission level and 4W or 2W line condition (see 1.10).	

LEVEL	LINE	OPTION PROVIDED	ATT
+4	2W	Fig. 8	39 db
+4	2W	–	37 db
+4	4W	–	35 db
+7	2W	Fig. 8	36 db
+7	2W	–	34 db
+7	4W	–	32 db

24	Set KEYERS switch to 6 SIG ON, set RECEIVER switch to 3 M RLS.	
25	At SF unit — Adjust SS potentiometer to obtain reading of 5.5 ma on MILLIAMPERES meter of 2A or 2B test set.	
26	Remove patch between PLT+ and −CUR test points and MA jack of 2A or 2B test set.	
27	Remove SF unit from testing circuit jacks and install in its signaling bay location (see 1.09).	
28	Restore SF unit to service in accordance with approved procedures.	
29f	If other SF units are not to be tested — Restore all test equipment to normal.	

5. MODIFICATIONS

STEP	ACTION	VERIFICATION
SF Units per J68602CL-1 — Relocation of C11 Capacitor to Prevent Frequency Radiation		
1	Check location of C11 capacitor.	Lead of C11 should be connected to ground lug E on the test point jack mounting located to the left of the V2 electron tube (see Fig. 1).
2a	If lead of C11 capacitor is connected to terminal 4 of V1 electron tube — Disconnect lead of C11 (see Fig. 1).	
3a	Position body of C11 capacitor in air space between V2 and V3 electron tubes (see Fig. 1). ***Note:*** The R19 resistor may require a disconnection from terminal 3 of the SS potentiometer and reconnection in order to relocate the C11 capacitor.	

STEP	ACTION	VERIFICATION
4a	Connect lead of C11 capacitor to ground lug E on the test point jack mounting located to the left of the V2 electron tube (see Fig. 1).	

SF Units per J68602CL-1 and J68602CL-2 Not Wired per Issue 11B of SD-56292-01 or Later — Wiring and Apparatus Changes

5	Check wiring at resistance R6 and R7.	Wiring at R6 and R7 should agree with "U" wiring as shown on Issue 6B or later, or Fig. B as shown on Issue 9B or later, of SD-56292-01.
6	Check 1T and 2T of HL relay, on wiring side of SF unit, for "S" option provided on Issue 8B or later of SD-56292-01.	No wiring at 1T and 2T of HL relay.
7	Check terminals 30 and 32 of resistor mounting card for "M" option provided on Issue 11B or later of SD-56292-01.	No wiring between terminals 30 and 32 of resistor mounting card (no connection between C15 capacitor and R34 resistor).
8	Check VR4 varistor and R35 resistor for proper match, "N" or "P" option shown on Issue 10D or later of SD-56292-01.	VR4 varistor and R35 resistor provided as follows. "N" OPTION: VR4 420D; R35 47,000 ohms KS-13490 L1 "P" OPTION: VR4 41A; R35 33,000 ohms KS-13490 L1
9	Perform Tests, A through I on modified SF unit.	

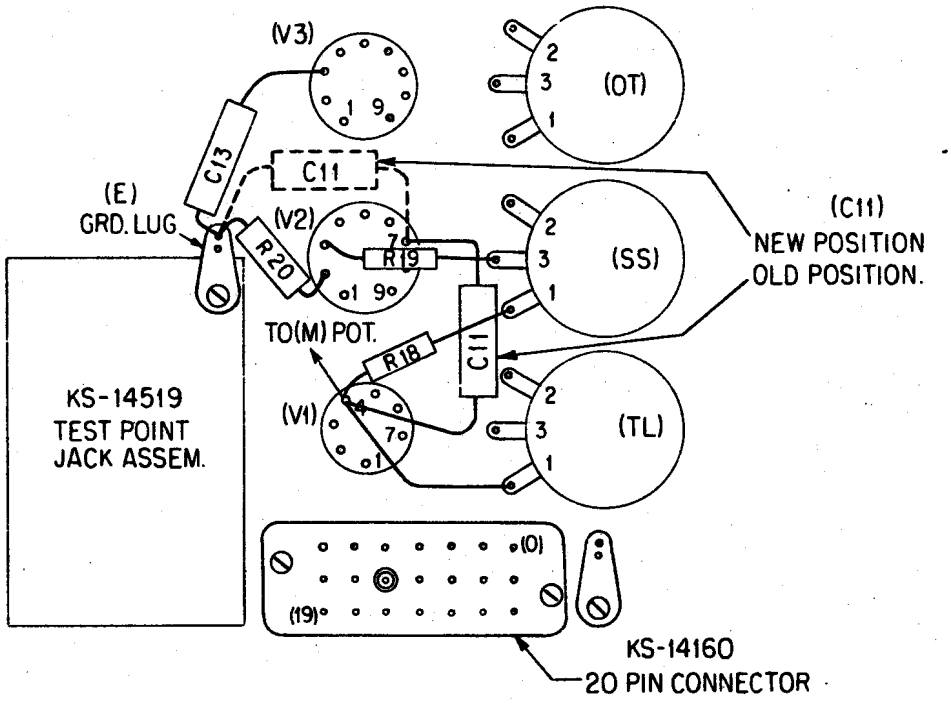

Fig. 1 – Relocation of C11 Capacitor (wiring side of SF unit)