

## 2400- OR 2600-CYCLE SINGLE-FREQUENCY SIGNALING CIRCUITS SD-56292-01

### IN SERVICE TESTS

### TOLL SYSTEMS

#### 1. GENERAL

1.01 This section describes a method of testing 2400- or 2600-cycle single-frequency signaling (electron tube type) circuits while in service.

1.02 This section is reissued to incorporate a quick test, Test A, Steps 8 through 12, which by themselves can be used to test the electron tube performance, and to specify a receiver sensitivity adjustment procedure which can be made on an out-of-service but in-position basis. The order of the tests has been revised. Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The tests covered are:

**A. Over-All Receiver Operation:** This test checks that the transmission and conversion to dc of the single-frequency tone in the receiver provides suitable operating currents to the R and RF relays. It also specifies a procedure for readjusting the receiver gain if it is marginal. See 1.09.

**B. Received Tone Level:** This test checks the level of the single-frequency tone received from the distant office.

**C. Insertion of Band Elimination Network:** This test checks that, when the single-frequency tone is present on the line, the band elimination network is inserted and has the required loss to block the tone.

**D. Transmitted Tone Level:** This test checks the level of the single-frequency tone as sent on the line.

**E. Monitoring:** This test gives a quick check of the condition of the circuit, whether idle (tone on) or seized (tone off), or other conditions.

**F. Signal Monitoring:** This test checks that the supervisory signals and dial pulses are passed to and received from the drop thereby indicating that the signal circuit is operating properly.

1.04 When the results of these tests indicate the need of a more complete check or readjustment of the signaling circuit, it should be removed to the 2600-cycle signaling testing position J68602CS for out-of-service tests and readjustments per Section A220.272.

1.05 Two values of signaling power in dbm are 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."

1.06 The transmission measuring set will be referred to in this section as TMS.

1.07 The 2B signaling test set will be referred to in this section as 2B test set.

**1.08** Calibration of the monitoring circuit V3 amplifier is provided in Part 3, Steps 2 through 7. This is an adjustment of the V3 and its associated high-impedance input circuit to provide zero gain at signaling frequencies when bridged across a 600-ohm circuit.

**1.09** When it is desirable to routine a whole bay of units, Test A, Steps 8 through 12 allow checking the RF relay current in every unit in a bay and then checking the R relay current in every unit in the bay. The RF relay current is most easily tested from the back of the bay since the top front coil terminal is not accessible unless the relay cover is removed. This procedure allows for very rapid testing of the current being supplied by the V2 and V3 407A tubes. Units failing to pass either the RF (Test A, Steps 8 through 10, inclusive) relay test or R (Test A, Steps 11 and 12) relay test can be tagged and adjusted in position all at the same time. However, before any adjustment is made, Test B should be performed to insure that the unit is receiving the proper level of SF tone. The busy (tone off) test is not as important as the idle (tone on) test and may be omitted on a "quickie basis."

**1.10 Lettered Steps:** A letter a, b, c, etc, added to a step number in Part 3 or 4 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 Table A. The details of each item are covered in the paragraph indicated by the number in parentheses.

TABLE A

APPARATUS	TESTS					
	A	B	C	D	E	F
Monitoring circuit (2.02)	1	1	1	1	1	1
Signaling test set (2.03)	-	-	-	-	-	1
13A transmission measuring set or equivalent (TMS)	1	1	1	1	1	1
5A attenuator or equivalent (ATT)	1	-	-	-	-	-
KS-14510 L1 volt-ohm-milliammeter	1	-	-	-	-	-
Operator telephone set	-	-	-	-	1	1
Testing cord (2.04)	2	1	1	1	1	1
Testing cord (2.05)	1	-	-	-	-	-
Testing cord (2.06)	1	1	1	1	1	1
Patching cord (2.07)	1	1	1	1	1	1
<b>2.02</b> Monitoring circuit per J68602CP (SD-56339-01).						
<b>2.03</b> No. 2B signaling test set J64730B (SD-56134-02).						
<b>2.04</b> W2BP cord, 2 feet, 6 inches long, equipped with a 241A plug (2W15A cord) (for connecting monitoring circuit to TMS and 5A ATT).						
<b>2.05</b> W2DY cord, 4 feet long equipped with a KS-14520 plug and two KS-14530 connectors (for connecting the KS-14510 volt-ohm-milliammeter to the signaling unit PLT CUR test points).						
<b>2.06</b> P2BN cord, 13 feet long, equipped with a KS-14520 plug and a 327A plug (for connecting signaling unit test points LINE REC, LINE TRS, or EQ REC to monitoring circuit or 5A ATT, or for connecting E and M test points of signaling unit to E and M jacks of 2B test set).						
<b>2.07</b> P2AA cord, 2 feet long, equipped with two 241A plugs (2P13D cord) (for patching between monitoring circuit jacks and patching monitoring circuit jacks to 5A ATT).						

**3. PREPARATION**

STEP	ACTION	VERIFICATION
<b>All Tests</b>		
1	Calibrate TMS in accordance with appropriate practice (see Section A702.612 for 13A).	
2	Connect CAL MEAS jack of monitoring circuit to IN terminals of TMS.	Observe, record TMS reading.
3	Disconnect cord from CAL MEAS jack.	
4	Patch CAL OUT jack of monitoring circuit to MON IN jack.	
5	Connect AMP OUT jack of monitoring circuit to IN terminals of TMS.	
6	Adjust GAIN potentiometer of V3 amplifier in monitoring circuit to obtain reading recorded in Step 2 on TMS.	
7	Remove cord from CAL OUT, MON IN jacks.	
<b>Test F</b>		
8	Restore all keys of 2B test set to normal.	
9	Plug power cords of 2B test set in TEST BAT A, TEST BAT B jacks of monitoring circuit.	

**4. METHOD**

STEP	ACTION	VERIFICATION
<b>A. Over-All Receiver Operation</b>		
8	Set switch of KS-14510 meter to 300 volts.	
9	Attach test leads, connecting negative lead to ground, positive lead to +130 volts (bottom coil terminal of RF relay, B5).	Meter reads $+130 \pm 5$ volts. Record reading.
10	Connect positive lead to top coil terminal of RF relay (T7).  <i>Note:</i> If busy condition reading is doubtful, a more accurate reading can be obtained by connecting the positive lead to B5 and negative lead to T7 of RF relay with meter switch set to 12 volts.  <i>Caution:</i> <i>Tone must be off for this measurement or the meter may be damaged by excess voltage.</i>	When circuit is idle (tone on), meter reads 90 volts or less. When circuit is busy (tone off), meter reads 2 volts or less than reading recorded in Step 9. (See note.)

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STEP	ACTION	VERIFICATION																				
11	Set switch of KS-14510 meter to 12 ma.																					
12	Connect PLT CUR test points of signaling unit to KS-14510 meter, using W2DY cord. (See 1.09.)	When circuit is idle (tone on), reading on meter is at least 8.5 ma. When circuit is busy (tone off), reading on meter is at most 0.35 ma. (See Steps 13a through 20b).																				
13a	If requirements of Steps 10 or 12 are not met — Perform Test B, then continue with Test A.																					
14b	If requirements of Test B are met — Readjust SS potentiometer as covered in Steps 15b through 20b.																					
15b	From toll testboard — Connect to trunk associated with unit under test.																					
16b	Dial termination at the far end that returns off-hook supervision.																					
17b	Connect apparatus as shown in Fig. 1.																					
18b	Adjust ATT for reading on TMS for particular office condition.	<table border="1"> <thead> <tr> <th>LINE</th> <th>OPERATION</th> <th>ATT SETTING SHOULD BE</th> <th>TO GET TMS READING</th> </tr> </thead> <tbody> <tr> <td>+4</td> <td>4W</td> <td>6 ±1 db</td> <td>-25 ±.5 db</td> </tr> <tr> <td>+4</td> <td>2W</td> <td>8 ±1 db</td> <td>-27 ±.5 db</td> </tr> <tr> <td>+7</td> <td>4W</td> <td>3 ±1 db</td> <td>-22 ±.5 db</td> </tr> <tr> <td>+7</td> <td>2W</td> <td>5 ±1 db</td> <td>-24 ±.5 db</td> </tr> </tbody> </table>	LINE	OPERATION	ATT SETTING SHOULD BE	TO GET TMS READING	+4	4W	6 ±1 db	-25 ±.5 db	+4	2W	8 ±1 db	-27 ±.5 db	+7	4W	3 ±1 db	-22 ±.5 db	+7	2W	5 ±1 db	-24 ±.5 db
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19b	Adjust SS potentiometer on signal unit to obtain reading of 6 ma on KS-14510 meter.																					
20b	Return unit to service, repeat Steps 8 through 12.  <i>Note:</i> If requirements of Steps 10 and 12 are not met, then replacement of V2 or V3 is indicated. Section A220.272 (out-of-service) or Section A320.668 (trouble) should be followed.																					

**B. Received Tone Level**

8	Connect LINE REC test points of signaling unit to MON IN jack of monitoring circuit.	When circuit is idle (tone on), steady reading on TMS as follows:  +4 LINE                      -16 ±4 db +7 LINE                      -13 ±4 db  Record reading.
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STEP	ACTION	VERIFICATION								
<b>C. Insertion of Band Elimination Network</b>										
8	When requirement of Test B has been met — Connect EQ REC test points of signaling unit to MON IN jack of monitoring circuit.	With circuit in idle condition (tone on), reading on TMS is at least 30 db below reading recorded in Test B, Step 8. <i>Exception:</i> A reading under -45 db is satisfactory if Test B reading is -16 db or less.								
<b>D. Transmitted Tone Level</b>										
8	Connect LINE TRS test points of signaling unit to MON IN jack of monitoring circuit.	When circuit is idle (tone on), steady reading on TMS as follows: <table border="0" data-bbox="1036 716 1503 779"> <tr> <td>-13 LINE</td> <td>-33 ±1 db</td> </tr> <tr> <td>-16 LINE</td> <td>-36 ±1 db</td> </tr> </table> <p>The above values assume that the equipment side of the signaling unit is terminated in 600 ohms. If the equipment side is open, the following readings will be obtained:</p> <table border="0" data-bbox="1036 957 1503 1016"> <tr> <td>-13 LINE</td> <td>-27.5 ±1 db</td> </tr> <tr> <td>-16 LINE</td> <td>-30.5 ±1 db</td> </tr> </table>	-13 LINE	-33 ±1 db	-16 LINE	-36 ±1 db	-13 LINE	-27.5 ±1 db	-16 LINE	-30.5 ±1 db
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<b>E. Monitoring</b>										
8	Plug operator telephone set in MON OUT jack of monitoring circuit.									
9	Connect LINE TRS or LINE REC test points of signaling unit to MON IN jack of monitoring circuit.	When circuit is idle — Tone is heard. It should be louder in LINE REC than in LINE TRS. When circuit is seized — Tone disappears. On-hook signal causes spurt of louder tone preceding normal lower steady tone. During dialing, pulses of louder tone heard.								
<b>F. Signal Monitoring</b>										
10	When requirements of Test B have been met — Connect E and M test points of signaling unit to E and M jacks of 2B test set.									
11	Plug operator telephone set in MON OUT jack of monitoring circuit, monitor to observe progress of call in succeeding steps.									

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STEP	ACTION	VERIFICATION		
12	Connect LINE TRS test points of signaling unit to MON IN jack of monitoring circuit.	Circuit functions in accordance with following lamp indications of 2B test set during progress of an outgoing service or testboard call.		
		LINE CONDITION	LAMP L	LAMP D
		Idle	ON	ON
		Seizure	ON	OFF
		Stop Dial	OFF	OFF
		Start Dial	ON	OFF
		Dial	ON	OFF + PLS
		Intercept	ON	OFF
		Busy Back (60 ipm)	FL	OFF
		Reorder (120 ipm)	FL	OFF
		Called Party Answers	OFF	OFF
		Called Party Hangs Up	ON	OFF
		Calling Party Hangs Up	ON	ON
13	Connect LINE REC test points of signaling unit to MON IN jack of monitoring circuit.	Circuit functions in accordance with following lamp indications of 2B test set during progress of an incoming service or distant testboard call.		
		LINE CONDITION	LAMP L	LAMP D
		Idle	ON	ON
		Seizure	OFF	ON
		Stop Dial	OFF	OFF
		Start Dial	OFF	ON
		Dial	OFF	ON + PLS
		Intercept	OFF	ON
		Busy Back (60 ipm)	OFF	FL
		Reorder (120 ipm)	OFF	FL
		Called Party Answers	OFF	OFF
		Called Party Hangs Up	OFF	ON
		Calling Party Hangs Up	ON	ON

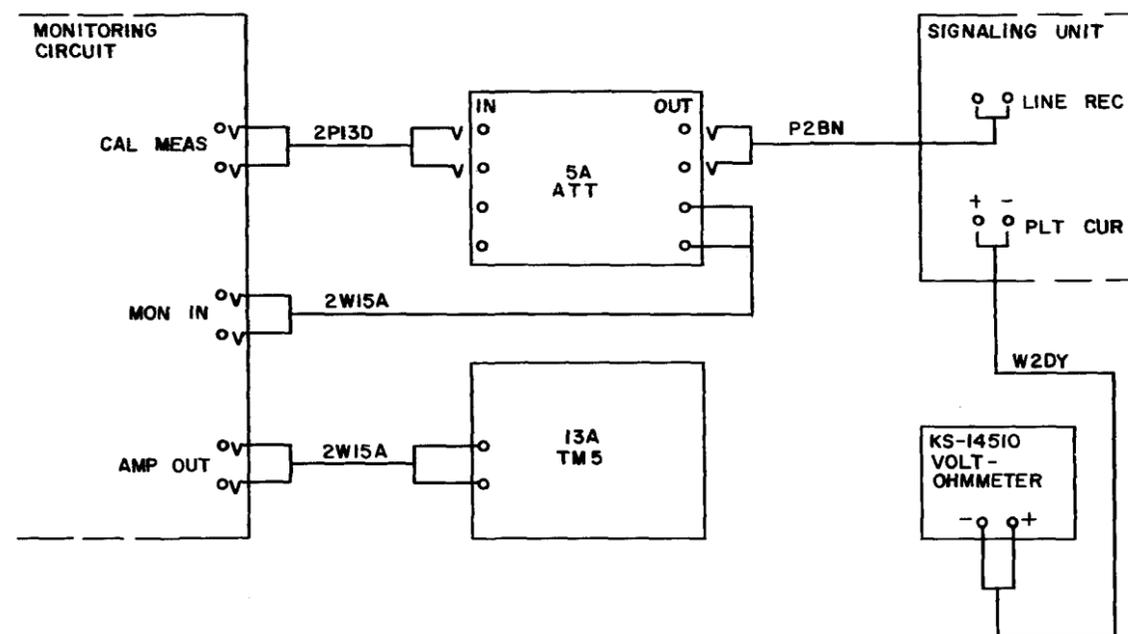


Fig. 1 - Apparatus Setup for Test A