DATA SET 105C

USED ON PRIVATE SERVICE SYSTEMS

SWITCHING SYSTEM NO. 307

TEST PROCEDURES

Contents

1. GENERAL

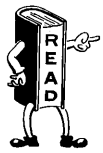
1.01 This section covers test procedures on development models. Tests and test procedures may differ from the production models. These differences will be corrected in later issues of this section.

1.02 This section presents some of the test procedures used for installation tests and also test procedures for locating defective units.

1.03 Obvious TTY defects such as nonreversing ribbon, stiff keyboards, and broken copyholders are not included. These may be cleared by referring to the appropriate plant series sections.

1.04 It can be assumed that, where possible, central office equipment trouble has been located and cleared before dispatching to the station. On transmission problems, tests may require coordination between the station and central office or the local test center.

1.05 The following precautions should be observed when testing the data set.



Remove card before opening or closing card-mounted screw switches.

- When making voltage readings on the test points (TPs) of data set cards, measure to GRD on rectifier unless otherwise indicated, using Northeast Electronics test set TTS-28 or equivalent.
- Set TTS-28 FUNCTION switch to voltage scale prescribed in the tables when making connections for tests. Lower voltage scales should be used for more accurate reading after it has been determined that this will not cause needle on meter to go off scale or otherwise damage meter.
- Northeast Electronics test set model No. TTS-28 must be in a vertical position to ensure accurate measurements.
- Never use a 1011B handset or test picks in the TPs of data set except as specified. Components of the card units in data set may be damaged.
- When making tests, data set should be in off-hook condition unless otherwise specified.

- Data set should be restored to normal or on-hook condition following each complete test.

2. TESTING EQUIPMENT

2.01 The following test equipment is needed at each station.

Teletypewriter maintenance tools

Northeast Electronics test set model No. TTS-28

6A impulse counter

164C4 transmission measuring set or 164C3 modified for the 100-wpm, 8-level code

Carrying case for data set cards

Spare set of data set cards

907A data test set J-79907A, List 1, associated List 4 test card and List 2 and List 3 connector cards. *

CD and SD-3D017-01 (Data Set 105C)

CD and SD-3D018-01 (Attendant Set)

* See Section 107-301-100 for detailed information on the 907A data test set.

3. INSTALLATION TESTS

3.01 The following installation tests should be performed before calling local test center for over-all tests.

POWER GROUND NOISE TEST (USING 6A IMPULSE COUNTER

(1) Calibrate and line-up 6A per Section 103-620-100.

(2) Connect business machine ground to the top IN binding post of the 6A.

(3) Connect data set ground to the bottom IN binding post of the 6A.

Do not ground 6A for this test.

(4) Set WTG switch to VOICEBAND.

(5) Set REF LEV DBRN toggle switch to ADD 30.

(6) Set REF LEV DBRN rotary switch to 60.

(7) Reset counter to 0000 by use of RESET switch.

(8) Set MINUTES switch to 15. If any counts are registered in a 15-minute period, grounding arrangements must be improved.

POWER SUPPLY VOLTAGE MEASUREMENT

STEP	ACTION	RESULTS
1	Plug TTY and data set power cords into proper receptacles.	
2	With TTS-28 FUNCTION switch on OHMS, X1 position, test for continuity between GND test point on rectifier and data set frame.	Should read 0, short.
3	Position TTS-28 FUNCTION switch to VDC, 30.	
4	Measure between +20 and GND test points on rectifier.	Should read +20 ±3 volts.
5	Measure between -20 and GND test points on rectifier.	Should read -20 ±3 volts.
6	Compare voltages obtained in Step 4 and 5.	Positive and negative voltages should be nearly equal, the difference not to exceed 2 volts.

DATA SET LEVEL ADJUSTMENTS

3.02 Terminals + and - of TTS-28 should be connected to TP4 and TP5 of MODULATOR unit. Position TTS-28 FUNCTION switch to DBM 900 TERM, 0. Power switch ON.

STEP	ACTION	RESULTS
1	Open screw switch A3.	
2	Depress ANS key. Allow 1 second for MR relay to operate. Open screw switch A1.	TTY starts and runs closed. Lamp on ANS key lights. Meter reads f_{2m} tone (2225 cps).
3	Adjust potentiometer R22 (on MODULATOR card) for specified output level of f_{2m} tone. -8 dbm	Meter reads -8 dbm.
4	Open screw switch A5.	Meter reads f_{2s} tone (2025 cps).

Note: Difference in level between f_{2m} and f_{2s} tones shall not exceed 1.5 db.

5	Close screw switches A1 and A5.	
6	Depress OFF key.	Machine clears out.
7	Depress DATA key.	TTY turns on, DATA and WAIT lamps light.
8	Open screw switch A13.	Meter reads f_{1m} tone (1270 cps) WAIT lamp lights.
9	Adjust potentiometer R23 (on MODULATOR card) for specified output level of f_{1m} tone. -13 dbm	Meter reads -13 dbm.
10	Open screw switch A5.	Meter reads f_{1s} tone (1070 cps).

Note: Difference in level between f_{1m} and f_{1s} tones shall not exceed 1.5 db.

11	Close screw switches A5 and A13.	No reading on TTS-28 meter.

Note: If station is equipped with a TOUCH-TONE dialer, perform Step 12 otherwise, proceed to Step 14.

12	Depress 5 of TOUCH-TONE dialer. (Tone will be heard in loudspeaker.)	Level read on TTS-28 should be -5.25 dbm.
13	If requirements in Step 12 cannot be met, adjust R2 potentiometer.	
14	Close screw switch A3.	
15	Depress OFF key.	Lamp on DATA key extinguishes and station goes to on-hook condition.
16	Remove connections between TTS-28 and MODULATOR unit.	

4. TESTS WITH LOCAL TEST CENTER

4.01 Over-all station tests with the local test center should be made at the time of installation and when clearing routine troubles.

TESTS WITH LOCAL TEST CENTER

4.02 Data Send and Receive

- Levels
- Distortion
- Test Sentence Generator - Fox
- Distortion Tests to Check Regenerator Unit
- Restraint Signals

4.03 Data Answering

- Manual
- Automatic

4.04 Data Connecting

- Data Mode
- Voice Mode

4.05 Data Transmission Interrupt

4.06 Data Transmission Restore

4.07 Wait

- Keyboard
- Transmitter Distributor

4.08 Data Disconnect

- OFF key
- EOT key

4.09 Data - Carrier Fail

4.10 PRE-EMPT

- Data Mode
- Voice Mode

4.11 Alternate Mode

4.12 Out of Service

4.13 Loop Back

4.14 Precedence

4.15 Voice

- Transmission-quality
- Transmission-level

4.16 Voice Answering

4.17 Voice Connecting

4.18 Voice Transfer

- Data to Voice
- Voice to Data

5. TEST TABLES

5.01 Test tables in this section describe in detail various tests that can be used to check the individual cards and sections of the data set. If at any time a measured voltage or result deviates from the one indicated in the test, the trouble is likely to be in that part of the circuit being checked.

5.02 Tests using the 907A data test set are in table form. Tables A through G give specific step-by-step testing instructions and are titled as follows:

TABLE	TITLE
A	Connect test
B	Disconnect test
C	Bias test
D	Sensitivity test
E	Restrainer test
F	Distortion tests (164C4)
G	Timing tests

5.03 Table G contains tests of timing functions of the data set. These tests are not a series of tests, but rather, are individual timing tests and are not numbered. However the first test described in this table, the send break test, is a basic

timing test and will test common timing elements on the TIMER unit (card). This test should be performed first whenever there is a timing trouble to establish immediately whether the common circuitry on the TIMER unit (card) or an individual timing circuit is at fault. In the latter case the circuit elements associated with the timing function in trouble may not be on the TIMER card. A test of the particular timing function involved may now isolate the trouble to the defective card or portion of the data set wiring. These tests are intended to be performed on a data set that is in good working condition and where only incorrect timing intervals are suspected; any other data set trouble should be cleared before these tests are used.

5.04 When the 907A data test set is required the following procedures must be followed when using Tables A, B, C, D, and E.

(1) Remove modulator unit.

(2) Plug 37 pin connector cord assembly from jack provided on test card to jack on data test set.

(3) Plug modulator unit into test card.

(4) Remove demodulator unit and open screw switch D-6 and Close D-1, reinsert in Demodulator slot.

(5) Remove 4-WIRE LOGIC unit and open screw switches E1 and E3 and close E2, reinsert in 4-Wire Logic slot.

(6) Set TTS-28 meter to -10 DBM BRDG.

(7) Connect test set probes to M-1 and M-2 of 907A data test set.

(8) Set 907A data test set

SELECTOR 105A

A TEST 5

B TEST 5

ADJ 500

ORIG } ORIG DATA MODE
ANS } ANS ANS MODE

(9) Set 907A test set to ORIG.

(10) Depress DATA key on attendants set. Note reading on TTS-28 and record. Adjust potentiometer R22 (on Modulator unit)for a reading of 17.5 volts.

(11) Depress OFF key.

(12) Set 907A test set to ANS. Depress ANS key on attendant set. Note reading on TTS-28 and record. Adjust potentiometer R-23 (on Modulator unit) for a reading of 17.5 volts.

(13) Data set and test set are now ready for completing tests in Tables A, B, C. D, and E.

Upon completion of tests in Tables A, B, C, D, and E restore modulator potentiometers R22 and R23 to the original settings as recorded. Set screw switch settings on the demodulator unit and 4-Wire Logic to original settings.

CIRCUIT TESTING ARRANGEMENTS

5.05 Screw switches A1, A3, A5, A7, A9, A11, A13, E1, E2, and E3 are provided to facilitate circuit testing procedures. For normal data set operation, the screw switches mentioned above should be closed with the exception of E2 which is normally open. The screw switch functions are as follows:

Screw Switch	Position	Function
A1	open	Disable Timer Output
A3	open	Disable Automatic Transfer to Voice Timer
		Output in Answer Mode

Screw Switch	Position	Function
A5	open	Send Space
A7	open	Disconnect Tip
A9	open	Disconnect Ring
A11	open	Disable Carrier Fail Output
A13	open	Send F_1

Screw Switch	Position	Function
E1	open	Disconnect Voice and TTD Amplifier from Line.
E2	closed	Connect Send Signals into Receiver
E3	open	Disconnect Receiver Amplifier from line

TABLE A

CONNECT TEST

Step	Action	907A Data Test Set				TTS-28			Atnd Set	Normal Indication and Procedure	Next Step	Abnormal Indication and Procedure	Next Step
		SW-A Position	SW-B Position	ANS-ORIG Switch Position	ADJ	Function Switch Position	Probe Position +	Probe Position -					
1		5	5	DATA See Note	500				ANS	Set will connect.	End of Test	Set will not connect.	2
2		5	5	ANS	500	-10-DBM BRDG	TP 1 DEMOD card	GRD	ANS	Reading of -16db ±3db.	3	Out of limits	10
3	Disconnect test probes	5	5	ANS	500	15 VAC	TP 3 DEMOD card	GRD	ANS	Reading of 4 volts ac ±1 volt ac.	4	Replace DEMODULATOR card.	1
4	Disconnect test probes	5	5	ANS	500	30 VDC	GRD	TP 4 DEMOD card	ANS	Reading of less than 1,0 volt dc.	5	Replace DEMODULA-TOR card and check local wiring.	1
5		5	5	ANS	500	30 VDC	GRD	TP 2 DEMOD card	ANS	Reading between 0 and 15 volts dc.	6	Replace DEMODULATOR card.	1
6		5	5	ANS	500	30 VDC	GRD	TP 1 TIMER card	ANS	Reading of less than 3.0 volts dc.	7	Replace TIMER card and/or DEMODULATOR card.	1
7		5	5	ANS	500	30 VDC	J6-21	GRD	ANS	Reading of -5 volts dc ±2 volts dc, replace TIMER card.	8	Replace DEMODULATOR card.	1
8		5	5	ANS	500	30 VDC	T 2 TIMER card	-20 on rec-tifier	ANS	Reading of 18 volts dc ±2 volts dc.	9	Replace TIMER card.	1
9		5	5	ANS	500	30 VDC	GRD	TP 3 TIMER card	ANS	Reading of 20 volts dc ±2 volts dc.	10	(a)Replace TIMER card. (b)Check timing cir-cuit wiring. (c)Replace LOGIC card.	1
10	Disconnect test probes and disconnect power					X1 OHMS	J6-21 DEMOD card	GRD	ANS	Reading of less than 300 ohms. Replace DEMODULATOR card.	1	Check wiring from J6-21 through TOUCH-TONE dialer and loudspeaker. When trouble is clear-ed, recheck Step 1.	1

Note: To perform above tests in DATA mode use DATA key wherever ANS is specified. Depressing DATA key on attendant set will present off-hook signal to 907. The 907 in turn will initiate SF guard interval followed by f_{2m} tone to complete connect sequence. A tone, a pause, and the f_{2m} will be audible on attendant set speaker.

TABLE B

DISCONNECT TEST

Step	Action	907A Data Test Set				TTS-28			Atnd Set	Normal Inidcation and Procedure		Abnormal Indication and Procedure	
		SW-A Position	SW-B Position	ANS-ORIG Switch Position	ADJ	Function Switch Position	Probe Position +	Probe Position -			Next Step		Next Step
1		5	5	ORIG See Note	500				DATA	Set will connect.	2	Refer to connect table A	
2		4	5	ORIG	500					Set will disconnect.	End of Test	Set does not disconnect.	3
3		4	5	ORIG	500	15 VAC	GRD	TP 3 DEMOD card	DATA	Reading of 0 volts.	4	Replace DEMODULATOR card.	Repeat 1 and 2
4	Disconnect test probes	4	5	ORIG	500	15 VDC	GRD	TP 2 DEMOD card	DATA	Reading of 0.5 volts dc.	5	Replace DEMODULATOR card.	Repeat 1 and 2
5	Disconnect test probes	4	5	ORIG	500	30 VDC	GRD	TP 1 TIMER card	DATA	Reading of less than 3.0 volts. dc.	6	Replace TIMER card.	Repeat 1 and 2
6	Disconnect test probes	4	5	ORIG	500	30 VDC	J6-21 DEMOD card	GRD	DATA	Reading of 5 volts dc ±2 volts dc. Change TIMER card.	7	Replace TIMER card.	Repeat 1 and 2
7		4	5	ORIG	500	30 VDC	TP 2 TIMER card	-20 on rectifier	DATA	Reading of 18 volts ±2 volts dc.	8	Check chassis wiring and replace TIMER card.	Repeat 1 and 2
8	Disconnect test probes	4	5	ORIG	500	30 VDC	GRD	TP 3 TIMER card	DATA	Reading of less than 1.0 volt dc.		(a) Replace TIMER card. (b) Check timing circuit wiring. (c) Replace LOGIC card.	Repeat 1 and 2

Note: Depressing DATA key on attendant set will present off-hook signal to 907. The 907 in turn will initiate SF guard interval followed by f_{2m} tone to complete connect sequence. A tone, a pause, and the f_{2m} will be audible on attendant set speaker.

TABLE C

BIAS TEST

Step	Action	907A Data Test Set				TTS-28			Atnd Set	Normal Indication and Procedure		Abnormal Indication and Procedure	
		SW-A Position	SW-B Position	ANS-ORIG Switch Position	ADJ	Function Switch Position	Probe Position +	Probe Position −			Next Step		Next Step
1		5	5	ORIG or ANS	500				DATA or ANS	Set will connect.	2	See Table A for connect test.	
2	Move switch A quickly; otherwise data set will clear out.	9	5	ORIG or ANS	500				DATA or ANS	Printer will print meaningless copy.	3	Make "trouble in local copy". Check wiring in local copy circuitry.	2
3		9	5	ORIG or ANS	500	30 VDC	M-1 907A	TP 4 DEMOD card	DATA or ANS	Meter will read upscale (if not reverse meter probes) approx 1.0 volt dc.	4		
4		9	5	ORIG or ANS	500	1.5 VDC	M-1 907A	TP 4 DEMOD card	DATA or ANS	Reading must be less than 1.0 volt dc.	End of Test	Replace DEMODULATOR card.	1

Note 1: Depressing DATA key on attendant set will present off-hook signal to 907. The 907 in turn will initiate SF guard interval followed by f_{2m} tone to complete connect sequence. A tone, a pause, and the f_{2m} will be audible on attendant set speaker.

Note 2: If the power to the data set was removed before the test, it should be continuously applied for 15 minutes before the test is performed.

TABLE D

SENSITIVITY TEST

Step	Action	907A Data Test Set				Atnd Set	Normal Indication and Procedure		Abnormal Indication and Procedure	
		SW-A Position	SW-B Position	ANS-ORIG Switch Position	ADJ			Next Step		Next Step
1		7	5	ORIG or ANS	500	DATA or ANS	Set will connect if sufficiently sensitive.	3	Set does not connect.	2
2		6	Same as above	ORIG or ANS	Same as above	DATA or ANS	Set will connect.	3	Replace DEMODULATOR card. If no improvement perform connect test per Table A.	1
3		4	Same as above	ORIG or ANS	Same as above	DATA or ANS	TTY-may print some meaningless copy and then data set will clear out and go to on-hook condition.	End of Test	Go to disconnect test, per Table B.	

Note: Depressing DATA key on attendant set will present off-hook signal to 907. The 907 in turn will initiate SF guard interval followed by f_{2m} tone to complete connect sequence. A tone, a pause, and the f_{2m} will be audible on attendant set speaker.

TABLE E

RESTRAINER TEST

Step	Action	907A Data Test Set				TTS-28				Normal Indication and Procedure		Abnormal Indication and Procedure	
		SW-A Position	SW-B Position	ANS-ORIG Switch Position	ADJ	Function Switch Position	Probe Position +	Probe Position -	Atnd Set		Next Step		Next Step
1		5	5	ORIG or ANS	500				DATA or ANS	Set connect.	2	See Table A for connect test.	
2		10	Same as above	ORIG or ANS	Same as above	30 VDC	TP 2 RESTR card	GRD		WAIT lamp will light. Reading will be 0.45 volt dc to 0.85 volt dc.	3	Open screw switches A-1 and A-11, then readjust R-7 of RESTRAINER card for 0.65 volt dc. Check opposite mode and if necessary balance adjustment so that both DATA and ANS modes are within 0.45 volt dc to 0.85 volt dc with A-1 and A-11 closed.	
3	Remove test probes. Depress BREAK key. Rotate SW-A step by step to position 5.	5	Same as above	ORIG or ANS	Same as above					TRANSMISSION INTERRUPT lamp will light and RESTORE lamp will remain lit until TRANSMISSION RESTORE button is depressed.		Check lamps and wiring of RESTRAINT circuit.	
4	Disconnect meter probes.	11	Same as above	ANS only	Same as above				ANS	WAIT lamp will continue to light.	End of Test	(a) Check TRANSMISSION RESTORE lamp and wiring. (b) Replace RESTRAINER card. (c) Replace DEMODULATOR card.	

Note: Depressing DATA key on attendant set will present off-hook signal to 907. The 907 in turn will initiate SF guard interval followed by f_{2m} tone to complete connect sequence. A tone, a pause, and the f_{2m} will be audible on attendant set speaker.

TABLE F

DISTORTION TESTS USING 164C TMS

Receive Bias Test Procedure Using 164C TMS*	907A Data Test Set			Test Results
	SW-A Position	SW-B Position	Test Lead Connection	
1. Establish a connection to a source of unbiased telegraph signals via local test center. 2. Remove RESTRAINER card for this test. 3. Connect test extender card to 907A using connector cable and insert test extender card in RESTRAINER card slot. 4. Open screw switch B-5 (machine will run open).	19	OFF	M-1 to TP 4 of DEMOD card	Distortion shall not exceed 7.5%. When distortion is greater than 7.5% check DEMOD card using Table C. If trouble proves into TTY or local wiring refer to appropriate section covering the TTY.
5. Insert plug of 164C TMS into SIG jack of 907A. 6. Arrange 164C TMS for 20MA and 8/100 operation.	19	OFF	M-1 to TP 12 TP 2 of REGENERATOR unit	
Send Bias Test Procedure Using 164C TMS	18	OFF	NONE	Sending distortion shall not exceed 5% marking or spacing. When distortion is exceeded, trouble is in TTY or local wiring. Refer to appropriate section covering TTY.
1. Remove MODULATOR card for this test. 2. Close screw switch B-11. 3. Connect test card to 907A using connector cable and insert test card in MODULATOR card slot. 4. Insert plug of 164C TMS into SIG jack of 907A. 5. Arrange 164C TMS for 20MA and 8/100 operation. 6. Depress LOCAL key on attendant set and transmit from TTY.				

* Use 164C4 or 164C3 modified for 8/100 operation.

TABLE G

TIMING TESTS

Test Description	907A Data Test Set					Action	Normal Indication and Procedure	Abnormal Indication and Procedure
	SW-A Position	SW-B Position	ANS-ORIG Switch Position	ADJ	Test Lead Connections			
SEND BREAK	14	7	ORIG	099	T1 to TP 2 of TIMER card. T2 to TP 3 of TIMER card.	Depress DATA key. Allow data set to connect. Depress and hold RESET button of 907A. Momentarily depress BREAK key. Release RESET button.	GOOD lamps on 907A and TRANSMISSION INTERRUPT lamp of attendant set will light.	Replace TIMER card.
SEND SPACE Can be performed in either ORIG or ANS mode.	14	7	ORIG or ANS	286	T1 to TP 2 of TIMER card. T2 to TP 3 of TIMER card.	Depress DATA (or ANS) key on attendant set. When set connects, open screw switch A-1, depress OFF key and momentarily operate RESET button on 907A.	GOOD lamps on 907A will light. Close screw switch A-1.	If either HIGH or LOW lamps do not light, replace LOGIC card.
MONITOR MARK ORIG mode	14	7	ANS	175	T1 to TP 2 of TIMER card. T2 to TP 3 of TIMER card.	Open screw switch A-3. Depress and hold RESET button on 907A. Depress ANS key on attendant set. Release RESET button.	GOOD lamps will light on 907A. Close screw switch A-3.	If either HIGH or LOW lamps do not light, replace RESTRAINT card.
SF GUARD INTERVAL	14	7	ORIG	500	T1 to TP 2 of TIMER card. T2 to TP 3 of TIMER card.	Open screw switch A-5. Depress and hold RESET button on 907A. Depress ANS key on attendant set. Release RESET button.	GOOD lamps will light on 907A. Close screw switch A-5.	If either HIGH or LOW lamps do not light, replace MODULATOR card.
MONITOR MARK ANS mode	12	7	ORIG	090	T1 to TP 1 of TIMER card. T2 to TP 3 of TIMER card.	Open screw switch A-5, depress DATA key on attendant set. Open screw switch A-3. Depress RESET of 907A test set. Ground TP 1 of TIMER card. Note: This connection must be made quickly and firmly so there is no bounce or false pulse when contact is made.	GOOD lamps will light on 907A. Close screw switch A-3 and A-5.	If either HIGH or LOW lamps do not light, replace MODULATOR card.
MONITOR SPACE	12	7	ORIG	135	T1 to TP 1 of TIMER card. T2 to TP 3 of TIMER card.	Depress DATA key on attendant set. Allow set to connect. Operate BREAK key. Momentarily depress RESET button on 907A test set. Rapidly open screw switch A-5.	GOOD lamps will light on 907A. Close screw switch A-5.	If either HIGH or LOW lamps do not light, replace LOGIC card.
SEND MARK Can be performed in either ORIG or ANS mode.	14	9	ORIG or ANS	030	T1 to TP 2 of TIMER card. T2 to TP 3 of TIMER card.	With screw switch B-5 out and B-6 in, depress DATA key, allow set to connect; depress and hold RESET button on 907A. Send EOT and CTRL from TTY keyboard, then release RESET button. Machine will not clear out until RESET button is released.	GOOD lamps on 907A will light. Restore switches to normal.	If either HIGH or LOW lamps do not light, replace LOGIC card.

PREPARATION

1. Remove MODULATOR unit.
2. Plug 37 pin connector cord assembly from jack provided on test card to jack on data test set.
3. Plug MODULATOR unit into test card.

TABLE G (CONT)

Test Description	907A Data Test Set					Action	Normal Indication and Procedure	Abnormal Indication and Procedure
	SW-A Position	SW-B Position	ANS-ORIG Switch Position	ADJ	Test Lead Connections			
MONITOR BREAK	12	7	ANS	055	T1 to TP 1 of TIMER card. T2 to TP 3 of TIMER card.	Depress ANS key on attendant set. When set connects, momentarily depress RESET on 907A. Open screw switch A-5 until TTY runs open.	(a)When GOOD lamps on 907A light, close switch A-5. (b)TTY will continue to run open. ANS lamp remains lit. Depress ANS key. TTY will run closed.	If either NORMAL INDICATION fails, replace LOGIC card.

Table G (cont'd)