DATA SET 103C

TRANSMITTER-RECEIVER

FOR PRIVATE LINE SERVICE

TEST PROCEDURES

1. INTRODUCTION

1.01 This section describes test procedures for data set 103C. These tests are to be made at time of installation and as a means of clearing routine trouble conditions.

1.02 This section is reissued to:

- Provide a test for sets modified to provide a negative unipolar CONNECT ON signal (Section 591-016-200, 2.07).
- Modify end-to-end test requirements.

2. GENERAL

2.01 Two types of tests are described: a local test of the data set alone, and an end-to-end test involving two data sets separated by the line facility.

2.02 A local dynamic test may also be made using two data sets located adjacent to each other and connected by a short length of station wire. This test eliminates any errors or distortion caused by the line facility.

2.03 Each data set must be tested both as a transmitter and as a receiver.

2.04 The following test equipment is required.

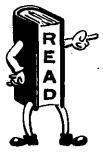
- KS-14510, List 1 volt-ohmmeter or equivalent.
- 1011-type hand set.
- 6- to 10- volt dc external battery supply (KS-7105 battery).
- 902-type data test set (distortion measuring and error checking set).
- 903-type data test set (63-bit word generator).

2.05 Equipment specified for the end-to-end test is required at each end of the system.

3. LOCAL TEST

3.01 This tests the ability of the data set to change dc voltage signals from the business machine into voice frequency signals and send them over the line and to receive voice frequency signals from the line and convert them into dc voltage signals for business machine use. Make originating station test (3.04) when OR wiring option is provided. Make terminating station test (3.05) when AN option is provided.

3.02 If on one of the steps a test fails, refer to the printed boards affecting that step shown at the right. Where more than one board is shown, any of them may be at fault. Replace one and test. If necessary replace another and again check until the test requirement is met.



When replacing any board except the timer board, repeat all previous steps in TRANSMIT, RECEIVE, and CONTROL sections. When replacing timer board, repeat all steps of CONTROL test.

3.03 When testing control circuit, use (a) settings and results for sets modified as in Section 591-016-200, 2.07. Use (b) settings and results for sets not modified.

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3.04 Originating Station Test

STEP	ACTION	PRINTED BOARD
TRANSMIT		
1.	Connect a 1011-type hand set to terminals 2 and 1. Operate hand set switch to MON.	
2.	Remove timer wiring board.	
3.	Strap terminals 21 and 22. OR relay should operate and steady tone (1270 cps) should be heard in 1011 hand set.	Modulator, Hybrid.
4.	Using W1T cords, connect positive post of the external battery to terminal 24 (ground) and negative post to terminal 6. Frequency should change to 1070 cps.	Modulator, Interface.
5.	Connect spade tip of a third W1T cord to negative post of external battery. Touch test clip of cord to terminal 3. DO NOT disconnect battery from terminal 6. Frequency should not change.	Interface
6.	Remove test clip from terminal 3. Frequency should change to 1270 cps for approximately 1 second, then return to 1070 cps.	Interface, Modulator
7.	Rapidly touch test clip to terminal 3 several times. Frequency should alternate between 1270 and 1070 cps.	Interface, Modulator
8.	Connect test clip to terminal 3. Steady frequency of 1070 cps should be heard.	
9.	Disconnect negative battery lead from terminal 6. Strap terminal 6 to terminal 24 (ground). Frequency should change to 1270 cps.	Interface, Modulator
10.	Remove test clip from terminal 3 and rapidly touch it to terminal 3 several times. Frequency should not change.	Interface
11.	Remove external battery and ground connections. Remove strap from terminals 21 and 22. Remove 1011 hand set. OR relay should release.	
RECEIVE		
12.	Reconnect strap to terminals 21 and 22 (timer board is left out). OR relay should operate.	

STEP	ACTION	PRINTED BOARD
RECEIVE		
13.	Prepare volt-ohmmeter to read dc volts on the 15-volt scale. Connect positive voltmeter lead to terminal 24 and negative lead to 4.	
14.	Place a telephone call to the data test center and request frequency of 2025 cps on data line. Meter should read 6 to 10 volts. Note: If necessary, frequencies may be obtained from a local oscillator connected to terminals 2 and 1.	
15.	Move negative voltmeter lead to terminal 5. Meter should read 6 to 10 volts.	
16.	Request frequency of 2225 cps. Connect positive voltmeter lead to terminal 4, negative lead to 24. Meter should read 0 volts.	Hybrid, Limiter, Discriminator, Interface
17.	Move positive voltmeter lead to terminal 5. Meter should read 6 to 10 volts.	
18.	Remove strap from terminals 21 and 22. OR relay should release. Disconnect all test apparatus and restore data set to normal (insert timer board).	
CONTROL (Refer to 3.03.)		
19.	Connect strap between terminals 21 and 22.	
20.	Request frequency of 2025 cps. (a) Set meter to 60-volt dc scale. Connect + to 24, - to 8. Meter should read 20 ±2 volts. (b) Set meter to X1 scale. Connect to terminals 24 and 8. Meter should read 0 ohm.	Discriminator, Timer
21.	Request frequency of 2225 cps. After approximately 1 second, S relay operates. (a) Meter should read 0 volt. (b) Meter should read ∞ (infinity).	

STEP	ACTION	PRINTED BOARD
22.	Request frequency of 2025 cps. S relay releases.	Discriminator, Timer
	(a) Meter should read 20 ±2 volts.	
	(b) Meter should read 0 ohm.	
23.	Request test center to remove frequency from line.	
	(a) Meter should read 0 volt.	
	(b) Meter should read ∞.	
24.	Remove strap from terminals 21 and 22. Disconnect all test apparatus.	

3.05 Terminating Station Test

STEP	ACTION	PRINTED BOARD
TRANSMIT		
1.	Connect a 1011-type hand set to terminals 2 and 1. Operate hand set switch to MON.	
2.	Remove timer wiring board.	
3.	Strap terminals 21 and 20. AN relay should operate and steady tone of 2225 cps should be heard in 1011 hand set.	Modulator, Hybrid
4.	Using W1T cords, connect positive post of external battery to terminal 24 (ground) and negative post to terminal 6. Frequency should change to 2025 cps.	Modulator, Interface
5.	Connect spade tip end of a third W1T cord to negative post of external battery. Touch test clip of cord to terminal 3. DO NOT disconnect battery from terminal 6. Frequency should not change.	Interface
6.	Remove test clip from terminal 3. Frequency should change to 2225 cps for approximately 1 second, then return to 2025 cps.	Interface, Modulator
7.	Rapidly touch test clip to terminal 3 several times. Frequency should alternate between 2225 and 2025 cps.	Interface, Modulator

STEP	ACTION	PRINTED BOARD
8.	Connect test clip to terminal 3. Steady frequency of 2025 cps should be heard.	
9.	Disconnect negative battery lead from terminal 6. Strap terminal 6 to terminal 24 (ground). Frequency should change to 2225 cps.	Interface, Modulator
10.	Remove test clip from terminal 3 and rapidly touch it to terminal 3 several times. Frequency should not change.	Interface
11.	Remove external battery and ground connections. Remove strap from terminals 21 and 20. Remove 1011 hand set. AN relay should release.	
RECEIVE		
12.	Reconnect strap to terminals 21 and 20 (timer board is left out). AN relay should operate.	
13.	Prepare volt-ohmmeter to read dc volts on the 15-volt scale. Connect positive voltmeter lead to terminal 24 and negative lead to 4.	
14.	Place a telephone call to the data test center and request frequency of 1070 cps on data line. Meter should read 6 to 10 volts.	
	Note: If necessary, frequencies may be obtained from a local oscillator connected to terminals 2 and 1.	Hybrid, Limiter, Discriminator, Interface
15.	Move negative voltmeter lead to terminal 5. Meter should read 6 to 10 volts.	
16.	Request frequency of 1270 cps. Connect positive voltmeter lead to terminal 4, negative lead to 24. Meter should read 0 volt.	
17.	Move positive voltmeter lead to terminal 5. Meter should read 6 to 10 volts.	
18.	Remove strap from terminals 21 and 20. AN relay should release. Disconnect all test apparatus and restore data set to normal (insert timer board).	

STEP	ACTION	PRINTED BOARD
CONTROL (Refer to 3.03)		
19.	Reconnect strap between terminals 21 and 20.	
20.	Request frequency of 1070 cps	
	(a) Set meter to 60-volt dc scale. Connect + to 24, - to 8. Meter should read 20 ±2 volts.	
	(b) Set meter to X1 scale. Connect to terminals 24 and 8. Meter should read 0 ohm.	
21.	Request frequency of 1270 cps. After approximately 1 second, S relay operates.	Discriminator, Timer
	(a) Meter should read 0 volt.	
	(b) Meter should read ∞ (infinity).	
22.	Request frequency of 1070 cps. S relay releases.	
	(a) Meter should read 20 ±2 volts	
	(b) Meter should read 0 ohm.	
23.	Request test center to remove frequency from line	
	(a) Meter should read 0 volt	
	(b) Meter should read ∞.	
24.	Remove strap from terminals 21 and 20. Disconnect all test apparatus.	

4. END-TO-END TEST

4.01 This test measures the distortion and error rate of the data system.

4.02 Each station is to be tested both as a transmitter and as a receiver. Fig. 1 shows a block diagram of test setup.

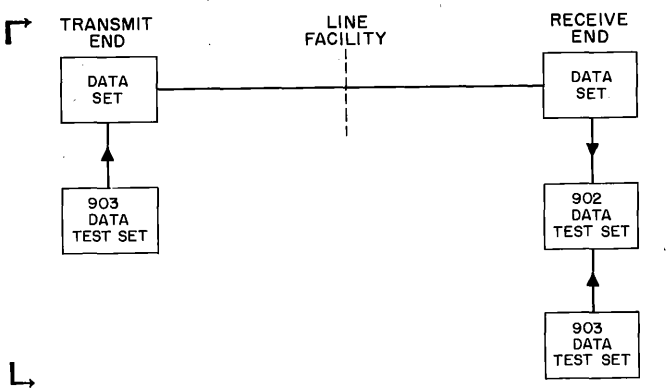

Fig. 1 - Block Diagram, End-to-End Test

4.03 Preparation of Test and Data Sets

Transmit End

1. Remove data set cover and raise rear chassis.

2. Remove plug of D16E-51 cord, disconnecting business machine from data set.

3. Connect strap between terminals 25 and 6 on data set terminal strip D.

4. Prepare 903 data test set as follows: ←

BIT/SEC - 180
RANDOM-DOT - RANDOM
TRIGGER - Either + or -

5. Connect SIGNAL OUT terminals of 903 set to data set terminal - black ← to 24, red to 3.

6. Connect power cords of data set and 903 set to 117-volt ac 3-wire receptacle (two parallel blades and a U-shaped grounding pin). ←

Receive End

1. Remove data set cover and raise rear chassis.

2. Remove plug of D16E-51 cord, disconnecting business machine from data set.

3. Prepare test equipment as follows:

903 data test set - ←

BIT/SEC - EXT CLOCK
RANDOM DOT - RANDOM
TRIGGER - Either + or -

902 data test set - ←

BIT/SEC - 180

4. Connect 903 test set to 902 test set with cord provided.

5. Connect DATA IN terminals of 902 ← set to data set terminal - black to 24, red to 5.

6. Connect power cords of data set and 903 set to 117-volt ac 3-wire receptacle (two parallel blades and a U-shaped grounding pin). ←

4.04 Test Procedure

1. Establish voice communication between stations. To start test, the transmit station depresses START button of 903 test set, sending the 63-bit word ← over the line. Transmit station has no further duties until direction of data transmission is reversed.

2. Attendant at receive station should monitor the line to verify that data signal is being received.

3. When data signal is heard, depress START button of 903 test set, then ← depress WORD SYNC AND RESET button of 902 set. ←

4. Set meter selection switch to DIST ADJ, wait several seconds, then zero meter using DISTORTION knob. Set switch to VOLTS ADJ, wait several seconds, then zero meter using VOLTS knob. Set switch to PHASE ADJ, wait several seconds, then zero meter using PHASE knob.

5. Set meter selection switch to DIST MEAS. Meter now indicates percentage of distortion, which should not exceed 20 per cent. (Occasional peaks may be higher.)

6. Depress START button of 903 set and ← note that TOTAL ERRORS lamps on 902 set light.

7. Depress WORD SYNC AND RESET button of 902 set and note the time. ←

8. Length of test and maximum distortion and error rate will vary between systems. Specific procedures and requirements will be prescribed by serving test center.

- When local dynamic test is made using a short length of station wire in place of a private line facility, distortion rate should not exceed 10 per cent and no errors should be recorded.

4.05 Re-establish voice communication with distant station. Change test setup so that former transmit station becomes receive end. Repeat Steps 1 through 8 in 4.04.