▶F-58654 PORTABLE TEST SET FOR ACOUSTIC AND INDUCTIVE COUPLERS DESCRIPTION AND OPERATION◀

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1. GENERAL

1.01 ▶This section provides descriptive, calibrative and operational information for the F-58654 coupler test set, hereafter referred to as the test set.◀

1.02 This section is reissued to correct the title and a voltage value in the oscillator frequency check. Calibration information has been arranged in step procedure format and includes additional information when using a 600 ohm oscillator.

1.03 The test set is designed to measure the output level of the signal power for customer-provided acoustically or inductively coupled voiceband equipment. Use of the test set will verify customer compliance with the applicable tariff in regard to signal power within the bandwidth of 300-3200 Hz when coupling customer-provided equipment (CPE) to the direct distance dialing (DDD) network. Signal levels from CPE must not exceed -9 dBm at the input to the local loop when averaged over a 3-second interval. The telephone company (telco) may authorize a higher input signal power level on a fixed longer-than-average local loop in order for the power level input at the central office (CO) to be approximately -12 dBm or less (3-second interval average).

1.04 ▶The test set simulates the transmission characteristics of a 500-type telephone set when connected to a 900-ohm loop with a 3-dB loss at 1000 Hz.◀

Acoustically Coupled CPE

1.05 A signal acoustically coupled to the DDD network is influenced by the acoustic interface between the acoustic device and the telephone set. In addition, the electrical and acoustic properties of the telephone set and the characteristics of the transmission facilities affect acoustic coupling. The T-type carbon transmitter (which is used in most 500-type, Princess®, and Trimline® telephone sets) is sensitive to certain factors such as handset position, vibration, and packing of the carbon granules in the transmitter.

Inductively Coupled CPE

1.06 Since a telephone set contains components with magnetic fields associated with them, inductive coupling of data or voice signals is possible. One means of inductively transmitting by magnetic coupling is through a U-type receiver found in most 500-type telephone sets. Trimline and some 500-type telephone sets equipped with LA- or LB-type receivers produce weak magnetic fields, making inductive coupling impractical.

2. DESCRIPTION

A. Physical Description

2.01 The F-58654 test set is a portable test set which weighs approximately 7 pounds. Dimensions of the test set are given in Fig. 1. The test set consists of a G-type handset (with the T-1 carbon transmitter replaced by a magnetic transmitter) and shaping networks for the transmitter and receiver. ⧫A dBm meter is located on the front panel of the test set (center mounted in the handset cradle). The test set circuitry is located on two printed circuit boards contained in the two-tone gray plastic case. Eight standard flashlight D-cells supply 12 Vdc to the amplifier and oscillator circuits.⧫ When access to the battery is required, a probe is inserted and pressed into the lock release hole, permitting the battery compartment cover to be lifted.

B. ⧫Control Keys and Jacks

2.02 The front panel of the test set contains T and R output jacks and five keys to condition the test set for measuring acoustic or inductive inband signal power.⧫

2.03 ***OFF:*** When depressed, this key disconnects the battery from the active electronic circuits. This key is automatically depressed when the test set cover is fully closed.

2.04 ***RCVR:*** This key selects the handset receiver as the mode of coupling to the CPE. When depressed, the RCVR key connects the U-3 receiver to the test set measuring circuit.

2.05 ***XMTR:*** This key selects the handset transmitter as the mode of coupling to the CPE. When depressed, the XMTR key connects the AC-3 transmitter to the test set measuring circuit.

2.06 ***OSC:*** This key activates a 2125-Hz oscillator to provide an answer-back tone for data couplers that require answer-back to operate.

2.07 ***ADD 10 dB:*** This key provides a 10-dB pad for attenuating the measured signal. When this key is depressed, 10 dB must be added to all meter indications.

2.08 ***T and R:*** The tip and ring output jacks located on the test set front panel provide access to the simulated tip and ring termination. The signal appearing at the output jacks represents instantaneous power rather than a 3-second average power level as indicated by the meter. External test equipment utilizing these jacks should have an input impedance greater than 35 kohms.

C. Functional Description

2.09 The following text gives a brief functional description of the test set as shown in the block diagram of Fig. 2.

Transmitter Network

2.10 The AC-3 is a stable 300-ohm electromagnetic transmitter. The transmitter network has an input impedance of 300 ohms and an output impedance of 900 ohms while simulating the transmission characteristics of a typical 500-type telephone set on an average loop.

Receiver Network

2.11 The U-3 receiver unit permits transmission of data through the telephone handset (receiver) by either acoustic or inductive coupling, although inductive coupling is the more efficient of the two methods (except for LA- or LB-type receivers). The receiver network shapes the received signal while providing a 900-ohm termination for the U-3 receiver unit.

Amplifier

2.12 The 4-stage audio frequency amplifier is designed to provide a maximum of 60-dB gain where the input and output impedance is 900 ohms. Since the amplifier gains required for the transmit and receive modes are different, a shunt resistor is used to produce the proper signal level. Power required by the amplifier is 12 Vdc which is supplied from an interval battery via the OFF key.

Oscillator

2.13 Some data couplers that originate calls require an answer-back tone to energize the coupler. The test set contains an audio frequency oscillator which generates a 2125-Hz tone with an output level of 0.01 volt. This results in the U-3 receiver

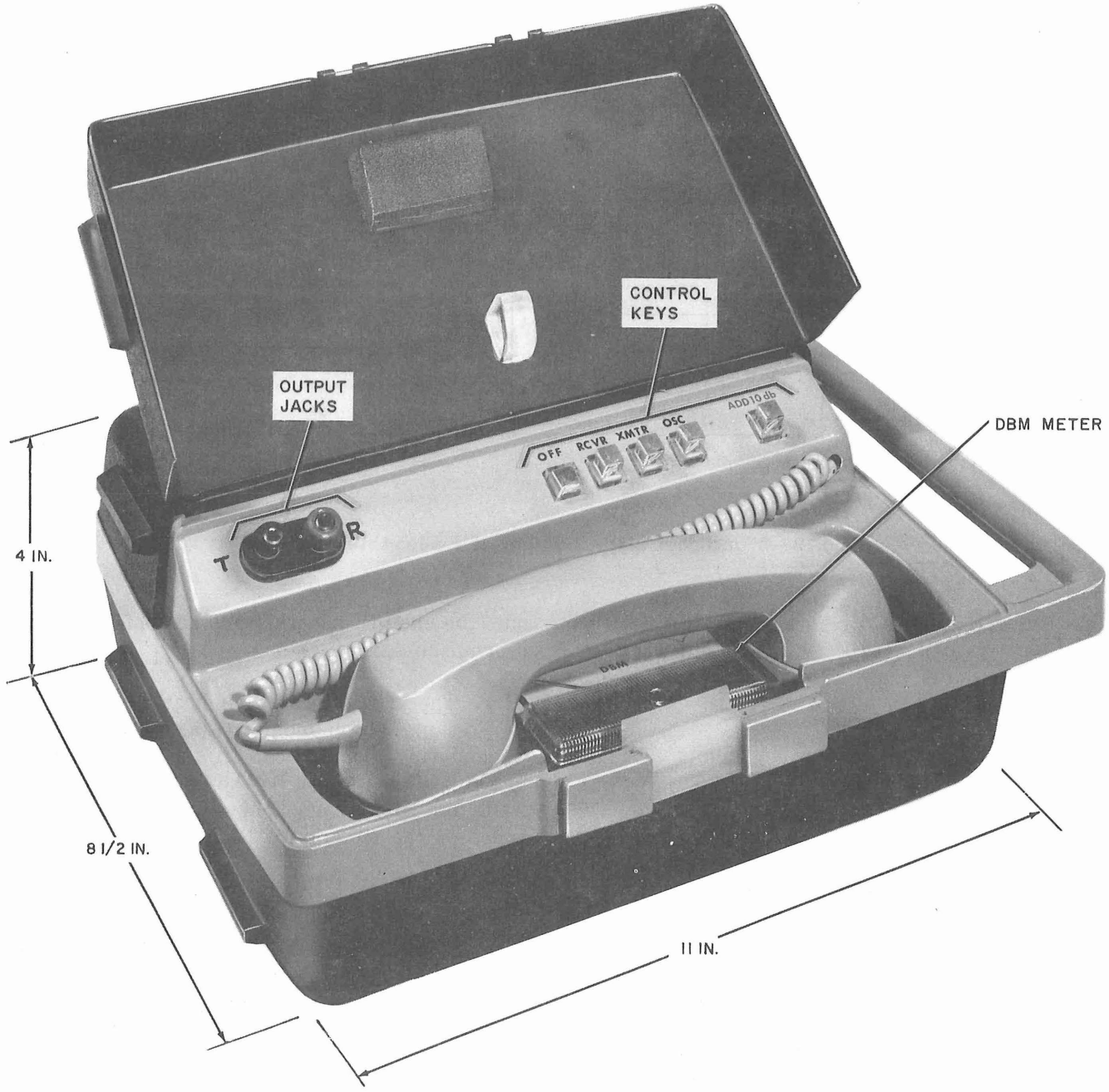

Fig. 1—▶F-58654 Portable Test Set—Cover Open◀

producing a tone of approximately 84-dB sound pressure level (SPL) when the OSC key is depressed.

Pads

2.14 The two attenuator pads within the test set provide signal loss to enable associated circuitry to function correctly. In order to obtain 3/4-scale deflection on the meter, an additional 5-dB gain is required from the amplifier. The 5-dB pad in the T and R jack circuit compensates for the additional gain so that correct levels can be measured by separate meters. The 10-dB pad functions as a range extender for the meter circuit. Where

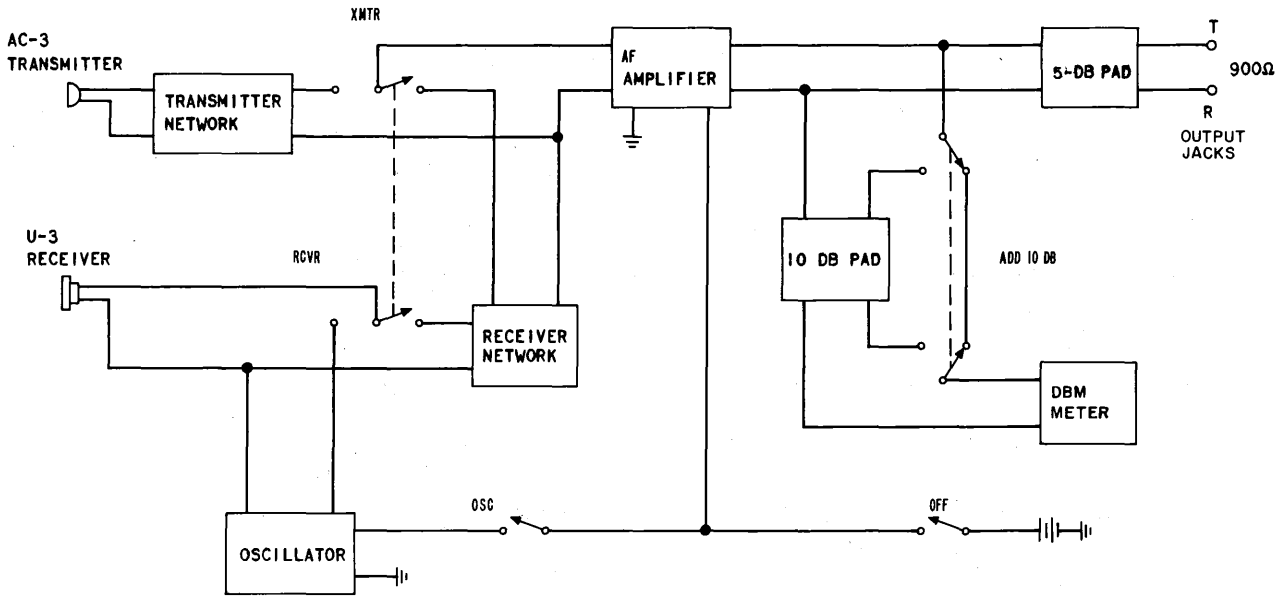

Fig. 2—Functional Block Diagram of F-58654 Test Set

measurement of a signal drives the meter to full-scale deflection, this pad can be switched into the test circuit and 10 dB must be added to the meter indication.

3. OPERATION

3.01 In operation, the test set measures the total inband energy input to a telephone loop by simulating the transmission characteristics of a 500-type telephone set and averaging the signal level during a 3-second interval.

3.02 To perform an output signal level measurement of a data coupler by using the test set, place the test set handset into the appropriate chamber of the data coupler and request the customer to condition the coupler to transmit data. If the data coupler mode of operation is acoustic coupling into the handset transmitter, the XMTR key must be depressed. If the data coupler mode of operation is either inductive or acoustic coupling to the handset receiver, the RCVR key on the test set must be depressed.

3.03 Depressing the XMTR and OSC keys simultaneously will apply a 2125-Hz tone to the data coupler under test via the U-3 receiver. Data couplers which require an answer-back tone must be energized in this manner before data can be transmitted.

3.04 The test set meter indicates (in dB) data signal power monitored at the telephone set tip and ring termination. If the meter is driven to full-scale deflection by the measured signal, the ADD 10 dB key must be depressed and 10 dB added to the meter indication.

3.05 For more comprehensive tests, auxiliary test equipment such as an ac voltmeter, oscilloscope, or frequency counter, may be connected to the T and R output jacks. This equipment must have an input impedance of 35 kohms or higher.

3.06 The test set is turned off by depressing the OFF key or by simply returning the handset to the cradle and closing the test set cover.

3.07 A detailed test procedure to measure the output signal power level of acoustically or inductively coupled customer-provided equipment is given in Section 107-305-500 (Testing Acoustically and Inductively Coupled Devices Using the F-58654 Test Set—Test Procedure).

4. CALIBRATION

4.01 The test set should be calibrated periodically or at any time evidence of an erroneous meter indication occurs. Before attempting any calibration of the test set, verify that sufficient battery voltage is present (see Part 5).

4.02 Test equipment required to calibrate the test set is listed as follows:

- ▶One audio frequency oscillator capable of generating a 1000-Hz signal which will provide an output of at least +10 dBm at 50 ohms or +20 dBm at 600 ohms output impedance
- One frequency counter
- One ac meter◀
- Two 1/2-watt, 5% resistors (value depends on output impedance of the test oscillator).

4.03 ▶The signal-to-noise ratio can be degraded by as much as 18 dB when using the 600 ohm output impedance oscillator. Use of a 900 ohm output impedance oscillator will result in even greater degradation of the signal-to-noise ratio.

4.04 ***Oscillator Frequency Check***

STEP	PROCEDURE
1	Remove the receiver cap from the handset.
2	Connect the frequency counter across the handset receiver terminals.
3	Depress the OSC key on the test set. ***Requirement:*** Read frequency of 2125 Hz ±130 Hz.
4	No oscillator adjustment is possible, therefore, package and send the test set to the appropriate Western Electric Service Center for repair.

4.05 ***Transmitter Calibration***

Note: The values in brackets pertain to the 600 ohm output impedance oscillator. Do not interchange the values between the 50 and 600 ohm oscillators during calibration.

STEP	PROCEDURE
1	Determine the oscillator output impedance (Zout) to be used, for example, Zout = 50 ohms.
2	Shunt the oscillator output with a 5 ohm resistor in series with another resistor whose value is determined by substracting 5 ohms from the oscillator Zout. Therfore, two resistors are required with values of 45 [595] and 5 ohms.
3	Remove the transmitter cap from the handset and connect the ac meter across the 5 ohm resistor as shown in Fig. 3A.
4	Adjust the AF oscillator output to 1000 Hz.

STEP	PROCEDURE
	Requirement: Read 0.0063 [0.0065] volts on ac meter.
5	Depress the test set XMTR key.
	Requirement: Read -9 dB ±1.5 dB [-8.8 dB ±1.5 dB] on DBM meter at test set. See Step 7.
6	Reconnect the ac meter across the test set T and R output jacks.
	Requirement: Read between 0.34 ±.06 [0.35 ±.06] volts. See Step 7.
7	Do not attempt adjustments if ***either*** Step 5 or Step 6 ***Requirements*** are met. (Go to Receiver Check).
8	If adjustments are required, access the test set circuitry by removing the bottom cover which is secured by three Allen screws.
9	Adjust amplifier gain potentiometer (see Fig. 4).
	Requirement: Read 0.355 volts on ac meter.
10	Adjust meter calibration potentiometer (see Fig. 4).
	Requirement: Read -9 dB on DBM meter.

4.06 *Receiver Check*

Note: The values in brackets pertain to the 600 ohm output impedance oscillator. Do not interchange oscillator values during check.

STEP	PROCEDURE
1	Remove the receiver cap from the handset.
2	Establish calibration test connections per Fig. 3B.
3	Adjust the AF oscillator output to 1000 Hz.
	Requirement: Read 0.125 [0.0065] volt on ac meter.
4	Reconnect the ac meter to T and R output jacks of the test set.
5	Depress the RCVR key of the test set.

STEP	PROCEDURE
	Requirement: Read 0.066 ±.034 [0.0082 ±.0042] volt on ac meter.
6	No receiver adjustment is possible, therefore, package and send to the appropriate Western Electric Service Center for repair.◀

5. MAINTENANCE

5.01 No routine maintenance is required for the electronic circuits contained in the test set. Calibration procedures given in Part 4 are to be performed when required.

5.02 The test set battery should be checked for sufficient voltage periodically or prior to calibration checks. Gain access to the battery compartment by moving the hinged protective cover down and inserting an acceptable probe (eg, a pencil) into the battery cover latch release mechanism. Pressing inward on the probe releases the latch mechanism and the battery cover may be opened to the limit provided by the hinges.

5.03 Depress the test set XMTR and OSC keys to place the battery under load. Connect a dc voltmeter across the battery terminals. If the voltmeter indicates 10 volts or less, replace the battery with eight fresh KS-6522 (or equivalent D-size) cells.

6. REFERENCES

6.01 The following Bell System technical references contain additional information concerning use of the F-58654 test set in connection with acoustic and inductive coupling:

SECTION	TITLE
PUB 41803	Acoustic and Inductive Coupling for Data and Voice Transmission

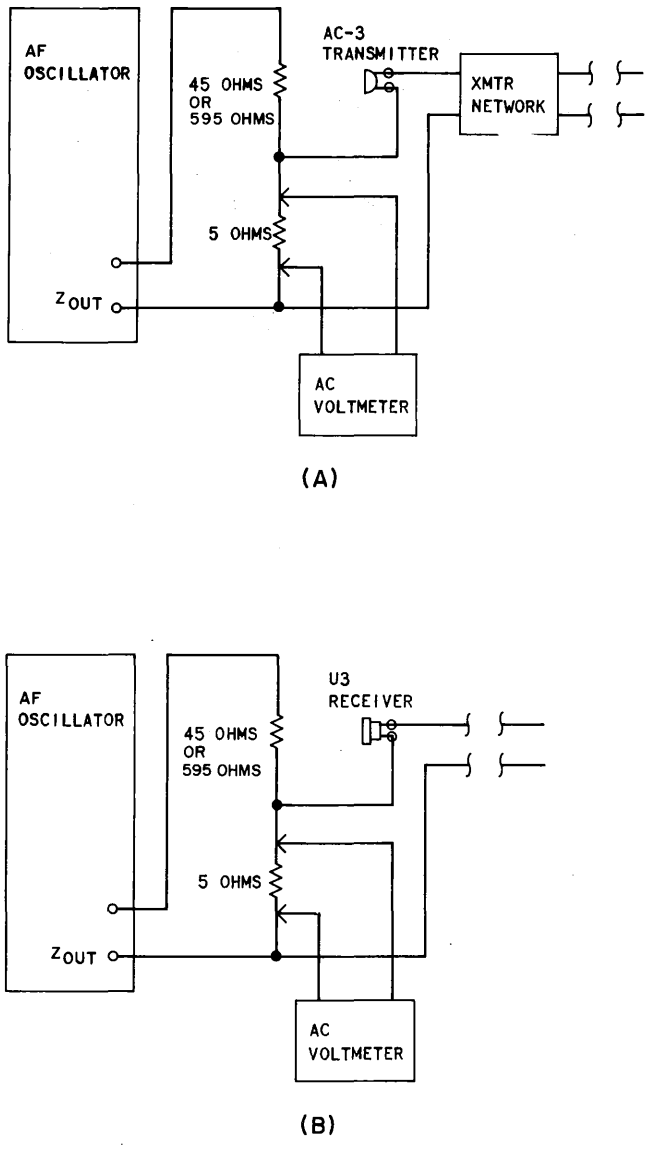

Fig. 3—▶Test Connections◀

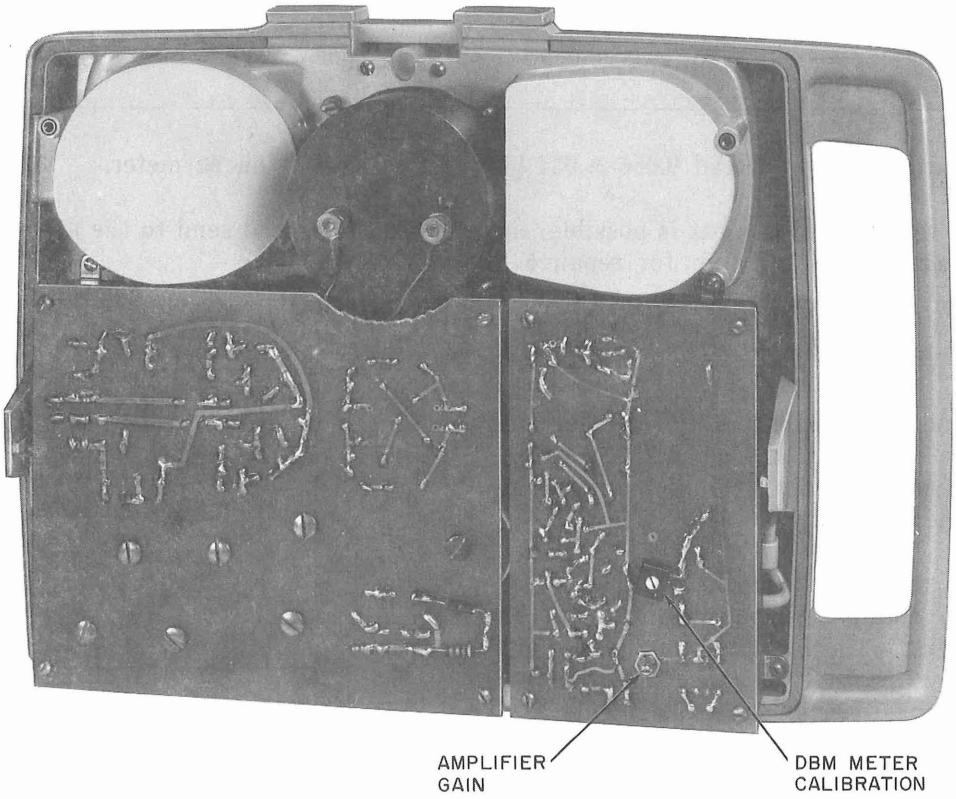

Fig. 4—F-58654 Portable Test Set—Internal View

SECTION	TITLE	SECTION	TITLE
PUB 41005	Data Communications Using the Switched Telecommunication Network	314-205-301	Data Systems—DATAPHONE® Service And Data Access Arrangements on Direct Distance Dialing Network—Methods of Investigating Trouble Reports and/or Tariff Compliance When Using Acoustically or Inductively Coupled Devices
103-305-500	Testing Acoustically and Inductively Coupled Devices Using the F-58654 Test Set, Test Procedures		