

**TJ MICROWAVE RADIO
TEST SETS
AND TEST EQUIPMENT
TESTING AND MAINTENANCE
EQUIPMENT DESIGN REQUIREMENTS
TOLL SYSTEMS**

1. GENERAL

Scope

1.01 This specification, together with the supplementary information listed herein, covers the equipment design requirements for the framework, equipment, and circuits to be used in the engineering and manufacture of test sets for the TJ radio system. It also describes other maintenance and test equipment that may be used in the testing and maintenance of the TJ radio system.

1.02 This specification is reissued to remove the references to a regional repair center and to update equipment lists.

Description

1.03 J68376A Transmitter-Disconnect Unit:

The transmitter-disconnect unit is an adjustable, balanced, H-type attenuator with a characteristic impedance of 124 ohms which is mounted in a portable case and arranged to hang on the front of the J68374A or J68374C diversity switch and transmission unit. It is used in disconnecting one transmitter in a diversity system without causing a transmission hit or interruption in the working channel. The attenuator can be varied from 0 to 16.4 db in 9 discrete steps so chosen that the return loss of the attenuator is never less than 26 db, even during the transition between steps when adjacent contacts are bridged.

1.04 J68376B IF Test Set: The IF test set is a collection of individual circuits mounted in a common portable case. It includes:

- (a) An IF frequency meter covering the range from 52 to 89 mc
- (b) An IF detector for converting IF energy to direct current
- (c) A metering circuit for measuring the output of the detector
- (d) A 6-db 75-ohm splitting pad for connecting 3 circuits together without introducing an impedance mismatch
- (e) A 15-db 75-ohm unbalanced attenuator with 1-db steps for general use at IF frequencies
- (f) A 15-db and a 30-db 75-ohm unbalanced 19A pad
- (g) A manual gain control circuit which will disable the automatic gain control and supply an adjustable bias from 0 to -4.5 volts for manually adjusting the gain of the IF main amplifier. This circuit is necessary when making received-signal strength and noise-quieting measurements.

1.05 J68376C Impedance Matching Test Set:

This test set, which is mounted in a portable case, is used to transform the impedance of various items of equipment so as to provide correct impedance and levels into and out of the radio. It provides a 75:124-ohm transformer covering the frequency range from 10 kc to 10 mc and a 600:600-ohm transformer which is also arranged for 124:600-ohm use and covers the frequency range from 20 cycles to 60 kc. It also

includes resistance circuits so arranged that a series resistor equal to the characteristic impedance of the circuit may be inserted between the oscillator and the circuit being measured. This permits the use of a vacuum tube voltmeter for transmission measurements on a constant voltage basis. Multiple jacks for 75-ohm unbalance circuits and 124-ohm balance circuits are provided.

1.06 J68376D RF Frequency Meter: This is a portable test set which includes the following circuits:

- (a) A KS-16438 precision-tuned cavity, absorption-type frequency meter, covering the range from 10.650 to 11.750 kmc
- (b) An RF detector for converting the RF energy to direct current
- (c) A metering circuit for measuring the output of the detector

The test set is arranged to connect to the output of the radio transmitter or to the beating oscillator by means of flexible waveguide and is used to measure their respective frequencies. It is also calibrated to make approximate power measurements from -11 to +7 dbm. This test set is not an essential piece of TJ radio test equipment but may be used where a more precise frequency meter is desired than is provided in the KS-16647 RF test set.

Associated Maintenance and Test Equipment

1.07 In addition to the test sets covered in this specification, certain other items are required for the test and maintenance of a TJ radio system. A brief description of the individual items is covered in the following paragraphs. Table A covers the items and quantities recommended.

1.08 The KS-14510, List 1, volt-ohm-milliammeter is the standard Bell System multimeter for general purpose voltage, current, and resistance measurements. The KS-14510, List 1, volt-ohm-milliammeter is recommended for each TJ radio station.

1.09 The Weston model 433-ac voltmeter (0 to 7.5 to 15 volt range) is intended for measuring filament voltages. It is a 3/4 per cent accuracy voltmeter which reads rms voltage as opposed to the KS multimeter which reads average values.

1.10 The Hewlett-Packard 400D vacuum tube voltmeter is used in the TJ radio system for aligning the order wire and alarm circuits as well as for checking amplifier and system frequency characteristics. The frequency range is from 10 cps to 4 mcs, and the voltage range is from 1 millivolt to 300 volts.

1.11 The Hewlett-Packard 410B vacuum tube voltmeter is used in TV applications of TJ radio only for checking the frequency characteristic of the transmitting baseband amplifier. The frequency range is from 20 cycles to 700 mc. The 410B voltmeter will also measure ac and dc voltages in the range from 0.1 to 300 volts.

TABLE A				
TEST EQUIPMENT REQUIRED AT A MAINTENANCE CENTER				
ITEM NO.	DESCRIPTION	NO. REQUIRED		
		TEL	TV	D-TYPE ALM
1	KS-16647 RF Test Set (HP 62401)	1	1	
2	Hewlett-Packard 400D, VTVM	2	1	
3	Hewlett-Packard 650A Oscillator (Note 3)	1		
4	Hewlett-Packard 200CD Oscillator (Note 3)	1	1	
5	Hewlett-Packard 130A or 130B Oscilloscope (Note 1)	1	1	
6	Weston ac Voltmeter Type 433 (0 - 7.5 - 15)	1	1	
7	J64061C, L3 and L4, Signal Generator (Note 3)	1	1	
8	J64070B, L2, Power Meter and KS-6522 Dry Cell			1

TABLE A (Contd)				
TEST EQUIPMENT REQUIRED AT A MAINTENANCE CENTER				
ITEM NO.	DESCRIPTION	NO. REQUIRED		
		TEL	TV	D-TYPE ALM
9	J68376B, L1, IF Test Set	1	1	
10	J68376C, L1, Impedance Matching Test Set	2	2	
11	KS-14510, L1, Volt-ohm-milliammeter	1	1	
12	KS-15750, L1, Tube Tester	1	1	
13	KS-16599, L1, Ripple Pipe	1	1	
14	Hewlett-Packard 410B VTVM		1	
15	KS-15538, L2, Carrier Frequency Voltmeter	1		
16	J64047B, L2 and L3, Diff Gain and Phase Transmitter (Note 4)		1	
17	J64047C, L2 and L3, Diff Gain and Phase Receiver (Note 5)		1	
18	J68376A, L1 and L2, Transmitter-Disconnect Unit (Note 2)	1	1	
19	J68337G, L1 and L2, Linearity Test Set	1	1	
20	52B Test Set			1
21	502A Waveguide Termination	1	1	
22	ED-59517-10, G22, Coaxial Shorting Plug	1	1	
23	PRD 196CF2 Attenuator	1	1	
24	Misc Cords and Apparatus (See 5.02.)	1	1	

Note 1: Required Y-axis sensitivity — 25 millivolts per inch, ac and dc. Du Mont 304A may be used also.

Note 2: Required for diversity operation only.

Note 3: Use oscillator suitable for multiplex being transmitted, e.g., HP 200CD for ON2; HP 650A, or 61C and HP 200CD, for L1.

Note 4: Required only at maintenance centers responsible for transmitting terminals.

Note 5: Required only at maintenance centers responsible for receiving terminals.

1.12 The KS-15538 Sierra carrier frequency voltmeter is used with ON and L multiplex. Since it is a selective voltmeter, it can be used for in-service alignment by measuring the ON carrier or the 64-kc pilot on L1 on a bridging basis. The voltmeter is usually specified as a piece of ON maintenance equipment, so it may not always be necessary to order an additional unit for TJ radio maintenance.

1.13 *J64061C, Lists 3 and 4, Signal Generator (61C):* This consists of two independent signal generators in one test set, as follows:

(a) A sine-wave generator continuously variable from 300 kc to 10 mc in 5 bands selected by push buttons. In addition, fixed frequencies of 60 cycles, 5, 10, 25, 50, 75, 100, 150, 200, and 250 kc, and 2 and 3.759 mc are available on pushbutton keys. The output level of the oscillator is controlled by a precision attenuator from +10 volts to -60 dbv in 1-db steps. Output impedances of 75-ohm unbalanced or 124-ohm balanced are available. A vacuum tube voltmeter is provided to permit accurate adjustment and continuous monitoring of the power delivered to the attenuator. This oscillator is used to transmit signals of known levels into the television loop when making transmission measurements over the video-frequency band.

(b) A 15.75-kc video signal generator simulates the synchronizing pulse and picture signal. Controls are provided for varying the amplitudes and widths of the sync and picture signals.

1.14 The Hewlett-Packard 200CD oscillator has a frequency range of 5 cycles to 600 kc. It has a transformer output with an unbalanced

attenuator between the transformer and one output terminal. The output impedance is 600 ohms. It is suitable for testing a message system transmitting ON carrier.

1.15 The Hewlett-Packard 650A oscillator has a frequency range of 10 cycles to 10 mc and an unbalanced impedance of 600 ohms. The wider frequency range of the 650A oscillator makes it suitable for use with TJ radio systems transmitting L carrier.

1.16 *J68337G, Lists 1 and 2, Linearity Test Set:*

This test set is required to linearize the TJ radio transmitter and receiver. It is used in conjunction with a low-frequency oscillator and a Hewlett-Packard 130A or 130B oscilloscope.

1.17 The J64047B, Lists 2 and 3, and J64047C, Lists 2 and 3, differential gain and phase set is used to measure differential gain and phase on a TV system.

1.18 *J64070B, List 2, Power Meter:* This is a thermocouple-type power meter for measuring 75-ohm unbalanced and 124-ohm balanced circuits. This meter is considered precision reference instrument to which all questions on the accuracy of other measuring equipment can be referred.

1.19 The Hewlett-Packard 130A or 130B oscilloscope is a general purpose piece of test equipment. It covers a frequency range from direct current to 300 kc with a maximum sensitivity of 1 mv/cm. It is used in a number of the tests specified in the BSPs; and, because of the internal calibration feature, it can also be used as a voltmeter.

1.20 The KS-16647 RF test set is a piece of test equipment, which operates in the 10.7- to 11.7-kmc frequency range, consisting of a signal generator and power and frequency measuring sections. A waveguide switch permits: (a) measuring the signal generated within the set; (b) measuring a signal from an external source; or (c) using the set as a source of RF power. Provision is made for 60-cycle sine wave, 20-kc square wave, and external modulation. The set operates on commercial 115/230 volts ac. In-

put and output connections are standard Bell System connectors. Storage space is provided in the lid for a 4-foot length of flexible waveguide, a 10-db directional coupler, and waveguide screws. These items are furnished with the test set.

1.21 The 52B test set is a telephone dial unit arranged with cords for portable use and is recommended for testing the D-type alarm units.

1.22 Size and weight of equipment:

	LENGTH (IN.)	WIDTH (IN.)	HEIGHT (IN.)	WEIGHT (LB)
J68376A	8	5	5	5
J68376B	12	9	9	8
J68376C	10	7	10	12
J68376D	12	9	10	14

Note: The dimensions shown include covers but do not include handles, latches, and feet.

2. SUPPLEMENTARY INFORMATION

800-600-000 — List of General Equipment Requirement Sections

804-000-000 — Equipment Design and General Equipment Requirements and Engineering Information — Toll Systems

800-612-163 — Wiring and Cabling

800-614-159 — Numbering and Lettering

X-67736 — Manufacturing Testing Requirements for J68376A Transmitter-Disconnect Unit

X-67917 — Manufacturing Testing Requirements for J68376B IF Test Set

X-67918 — Manufacturing Testing Requirements for J68376D RF Frequency Meter

3. DRAWINGS

WECO J drawings should be ordered by referring to the prefix and base number and requesting the current dash (—) number.

Circuit

SD-59800-01 — Transmission Testing Circuits

Equipment

- J68376A-() — Transmitter-Disconnect Unit
- J68376B-() — IF Test Set
- J68376C-() — Impedance Matching Test Set
- J68376D-() — RF Frequency Meter

4. EQUIPMENT

J68376A — AT&TCo Standard — Transmitter-Disconnect Unit

Equipment — J68376A-()

List 1 — Framework, assembly, wiring, and equipment for one transmitter-disconnect unit.

	WIRE	EQUIP	NOTES
SD-59800-01:			
Fig. 1	1	1	

List 2 — Equipment required in addition to List 1 for two patching cords for connection to diversify switch and transmission unit.

	WIRE	EQUIP	NOTES
SD-59800-01:			
Fig. 4, ED-59517-10, Group 17	2	2	

J68376B — AT&TCo Standard — IF Test Set

Equipment — J68376B-()

List 1 — Framework, assembly, wiring, and equipment for one IF test set.

	WIRE	EQUIP	NOTES
SD-59800-01:			
Fig. 2	1	1	
Fig. 3	1	1	
Fig. 5	1	1	
Fig. 6	1	1	
Fig. 7		1	
Fig. 14		1	
Fig. 15		1	
Fig. 29		3	
SD-59800-01:			
Fig. 30		1	
Fig. 31, Option X		4	

J68376C — AT&TCo Standard — Impedance Matching Test Set

Equipment — J68376C-()

List 1 — Framework, assembly, wiring, and equipment for one impedance matching test set.

	WIRE	EQUIP	NOTES
SD-59800-01:			
Fig. 8	1	1	
Fig. 9	1	1	
Fig. 10	1	1	
Fig. 11	1	1	
Fig. 16	1	1	
Fig. 17	1	1	
Fig. 18	1	1	
Fig. 19	1	1	
Fig. 20	1	1	
Fig. 31, Option Y		1	
Fig. 32		1	
Fig. 34		1	
Fig. 35		1	

J68376D — AT&TCo Standard — RF Frequency Meter

Equipment — J68376D-()

List 1 — Framework, assembly, wiring, and equipment for one RF frequency meter.

	WIRE	EQUIP	NOTES
SD-59800-01:			
Fig. 12 (See 5.01.)	1	1	
Fig. 13	1	1	
Fig. 32		1	
Fig. 36		1	

5. GENERAL NOTES

5.01 The KS-16412 varistor used in 53A detector of J68376D can be ordered as a spare or replacement.

5.02 The following cords are to be ordered in the quantity shown per maintenance center basis for general use.

	WIRE	EQUIP	NOTES		WIRE	EQUIP	NOTES
SD-59800-01:				Fig. 26	1	1	
Fig. 21		1		Fig. 27		1	
Fig. 22	1	1		Fig. 28		1	
Fig. 23	1	1		Fig. 31, Option Z		1	
Fig. 24	1	1		Fig. 31, Option W		1	
Fig. 25	2	2		Fig. 33		1	

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