

## J68386G AND J68386H TRANSMITTER RECEIVER BAYS

### GENERAL TEST INFORMATION

#### TD-3 MICROWAVE RADIO

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#### 1. SCOPE

**1.01** This section contains a brief description of the overall approach to be used when performing maintenance on the J68386G and J68386H transmitter-receiver (TR) bays of the TD-3 Microwave Radio Relay System. Also included is an index to the sections which provide descriptive, operating, and maintenance information on the TR bays.

**1.02** This section is reissued to include references to the 660( ) integrated circuit RF amplifier in paragraph 4.07 and Fig. 2. Revision arrows are used to emphasize the more significant changes.

This reissue does not affect the Equipment Test List.

#### 2. GENERAL MAINTENANCE PROCEDURE

**2.01** Maintenance personnel should become familiar with the sections listed in Table A under GENERAL INFORMATION before attempting to perform maintenance on the TR bay.

**2.02** Operating, descriptive, and maintenance information for the TR bay is contained in the

sections listed in Table A. Section 411-500-501 contains the in-service checks to be made at regular intervals as specified in the Equipment Test List (ETL), Section 411-001-011. These in-service checks utilize the meter on the TR bay meter panel to measure selected voltages and currents in various circuits of the transmitter and receiver. If a malfunctioning circuit is discovered during performance of the in-service checks, Section 411-504-501, which contains overall receiver checks, or Section 411-506-501, which contains overall transmitter checks, should be used to isolate the trouble. The procedures specified in each of these sections are performed after first taking the particular TR bay out of service. In these overall check procedures, reference is made to other maintenance sections where required. These sections provide additional information for further isolating any trouble to the unit that may have failed and, if possible, for correcting the malfunction. Once the faulty unit has been located, an attempt is made to bring its operation back to within the required limits by making tuning adjustments or minor repairs. If the unit cannot be made to function properly by this method, it is recommended that it be removed from the TR bay and replaced with a good spare. Normally, the faulty unit is sent to the maintenance center for repair and realignment at the TD-3 test bench.

**2.03** Sections 411-504-501 and 411-506-501 are also used for the normal out-of-service routine maintenance checks required at regular intervals on each TR bay. The recommended routine maintenance interval is specified in the ETL, Section 411-001-011.

**2.04** All TR bay tests specified in the sections listed in Table A are performed using principally a J68392A transmitter-receiver test set. This test set is furnished with almost all of the equipment required for making any test stipulated for the TR bay. The few additional pieces of test equipment required for certain specific tests on some of the units of the bay are specified on drawing ED-50514-12, Test Equipment, Special Tools, and Maintenance Spares.

#### NOTICE

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**TABLE A**  
**TEST INFORMATION**

SECTION	CONTENT
<b>GENERAL INFORMATION</b>	
411-500-100	Description
411-500-301	Turnon and Turnoff Procedures
411-500-500	Tests—General
411-500-501	In-Service Checks
411-500-502	Level Diagrams
<b>COMMON EQUIPMENT TESTS</b>	
411-502-500	Preliminary Checks
411-502-502	-19 Volt Regulator
411-502-503	J68387W 40-MHz Oscillator-Shift Modulator
411-502-504	J68387R Microwave Generator
411-502-505	27A and 28A Integrated Circuit Replacement
<b>RECEIVER TESTS</b>	
411-504-501	Transmission
411-504-502	IF Return Loss
411-504-503	J68387P Receiver Modulator-IF Preamplifier
411-504-505	Noise Figure
<b>TRANSMITTER TESTS</b>	
411-506-501	Transmission
411-506-502	IF Return Loss
411-506-503	J68387U IF Driver Amplifier-Transmission Modulator
411-506-504	J86890A Traveling-Wave Tube Power Supply Tests and TWT Amplifier Replacement
411-506-505	29A and 30A Integrated Circuit Replacement
<b>HOT STANDBY/SPACE DIVERSITY</b>	
411-504-506	Testing and Replacing the 295A IF Switch
411-506-506	Testing and Replacing the RF Switch and Relay
411-600-500	Tests—General Hot Standby/Space Diversity
411-600-501	Tests—Overall Switching
411-600-502	Testing and Replacement of the J68434B Pilot Detector

**2.05** The overall performance of a high-capacity radio system such as the TD-3 system is dependent to a large extent upon the individual performance of each TR bay. Many of the requirements stipulated in the maintenance sections are very tight compared to the requirements of some of the earlier radio systems. However, it is necessary that each TR bay meet these stringent requirements if the TD-3 system is to meet its overall noise and baseband response objectives. Maintenance personnel should adhere strictly to the procedures and requirements given in these sections to ensure satisfactory performance of the system.

**2.06** In most cases, troubles causing sudden circuit outages are due primarily to component failure in some unit of the radio bay that can be detected by reading voltages and currents on the meter panel. If trouble has developed and/or a check is being made due to an alarm condition, the in-service checks section should be consulted as a guide to the source of trouble. In many cases, continuity can be quickly restored by substitution of station spares for defective units.

### **3. SAFETY PRECAUTIONS**

#### **A. Dangers**

**3.01** General dangers are as follows:

**Danger 1: DO NOT leave energized waveguides unterminated. The RF power density that may be encountered at and around the traveling-wave tube or output waveguide is potentially hazardous to the eyes and body tissue.**

**Danger 2: Voltages inside the TWT power supply are much higher than those usually found in telephone power plants. Under no circumstances should the built-in interlock feature be defeated.**

#### **B. Cautions**

**3.02** General cautions are as follows:

**Caution 1: Any maintenance on the RF switch or failure of the RF switch will result in loss of service. Loss of dc bias to the IF switch will also result in loss of service.**

**Caution 2: When repeater bays are equipped for hot standby/space diversity**

**operation, both the transmitter and receiver must be switched to the working or standby position before performing maintenance on the microwave generator or -19 volt regulator in the standby or working bays, respectively, since these units are common.**

**Caution 3: When tests are to be performed on an out-of-service basis, obtain a release from the designated control office and remove the channel (or transmitter or receiver) from service as directed by local practice.**

**Caution 4: When removing and replacing waveguide units, care should be exercised to prevent foreign matter from entering the waveguide. Handle all types of waveguide carefully in order to prevent damage to flange mating surfaces and/or flexible waveguide segments. When connecting waveguide units, flanged mating surfaces must be carefully aligned and all screws tightened to prevent RF leakage.**

**Caution 5: All locknuts should be tight to prevent RF leakage but DO NOT overtighten the locknuts on the integrated circuit controls.**

**Caution 6: At the conclusion of all tests, restore the TR bay (or transmitter or receiver) to the service condition and notify the proper control office.**

**Caution 7: The OSM connectors on the RF switch should not be removed except to replace a defective component.**

**Caution 8: On hot standby/space diversity equipped bays, refer to Section 411-600-500 for forced switching procedures to remove service from both the transmitter and receiver. Exercise extra caution during tests since service will be present in some waveguide and IF cabling within this bay.**

#### **C. Warnings**

**3.03** General warning is as follows:

**Warning: DO NOT allow the MG3 panel meter indication to exceed the indication**

*stamped on the front of the 500-MHz generator or the MG4 indication to exceed 55.*

#### 4. GENERAL TEST CONSIDERATIONS

##### A. Interference

**4.01** Certain units of the transmitter-receiver bay function at very low RF power levels and have a considerable amount of gain following them. Other units function at high RF power levels. Extraneous frequencies radiating from any opening in waveguide or coaxial connections may leak into units at low-level points and cause irregularities in the test results or interference with the normal signal being transmitted on the channel. An exposed end of a coaxial cable or an open waveguide makes a good antenna at the radio frequencies used and can radiate a considerable amount of energy. During testing, all sources of microwave energy, including open ends of waveguides and coaxial lines in the test set or repeater bay, should be terminated or otherwise shielded whenever possible so that no unnecessary radiation occurs.

**4.02** Some conditions under which extraneous frequencies may enter a channel at low-level points, or which at high-level points may cause radiation difficulties, are as follows:

- (a) Loose or improperly seated transducers or coaxial connectors and diode holders in modulators
- (b) Improper alignment of waveguide flanges
- (c) Loose or missing screws in waveguide connections
- (d) Loose or worn tuning screws or threads in waveguide components or integrated circuits
- (e) Damaged or missing gaskets under covers of IF units.

**4.03** The maintenance sections specify that the output of the transmitter be disconnected from the antenna system before making any swept tests on the TR bay. This procedure must be followed to prevent interfering with the adjacent channels.

##### B. Sequence of Tests

**4.04** The tests of this series of sections are arranged in a logical sequence for completely

routing a transmitter-receiver bay. When departing from this sequence, such as when troubleshooting or making special tests, note that certain unit changes or circuit adjustments affected previously adjusted elements that must then be checked to ensure proper operation of the bay.

##### C. Failure to Meet Requirements

**4.05** When performing swept amplitude response (flatness) tests, ac ripple that may appear on the oscilloscope trace should not be included in the determination of transmission flatness. If the test equipment has been adjusted properly, the sweep frequency will not be locked to the 60-Hz line and, therefore, any ac ripple on the test trace will appear as a nonstationary pattern. This aids in subtracting out the effect of the ac ripple from the oscilloscope presentation when performing flatness measurements.

**4.06** When requirements are not met, check all of the test equipment for proper functioning, calibration, level, frequency, etc., and verify any mathematical computations before changing any units. This can often save considerable time. Check also for loose waveguide connections and for loose or improperly seated transducers, coaxial cords, and probes in both the repeater bay and test equipment. Patch and connecting cords and plugs should be tested for cut-out, open, etc., by substitution or by gentle manipulation. Check for loose diode-holding devices in both test and repeater bays; finger tightness is sufficient. Cords used for RF and IF test connections should be as short as practical; the test equipment should be arranged to permit this.

##### D. Warm-Up Time

**4.07** Continuity of power is a big factor in stabilizing transmission characteristics. This applies especially to the microwave generator, the TWT, and the 660( ) integrated circuit RF amplifier. When the power is removed from these units long enough to allow substantial cooling or when a cold replacement unit is substituted, a warm-up period is required to stabilize the transmission characteristics. The warm-up period depends upon the particular unit and how cold it is when power is applied. Minimum warm-up times are specified in the tests.

##### E. Replacing Components

**4.08** Components (other than modulator and multiplier diodes) in the individual units normally

are not replaced in the field. Charts direct the replacement of entire units and repetition of tests as a result of failure in service or failure to meet requirements. Thus, spare units must be available to use as replacements for units in trouble. Defective units should be promptly returned to the appropriate maintenance center or factory for repairs.

## 5. MAINTENANCE RECORDS

**5.01** Certain meter indications, noted under known conditions, must be recorded for later reference. Some indications will be recorded on the units, where directed, and some will be recorded in spaces on the meter panel pushbuttons. Other indications may require posting in the permanent station maintenance records.

## 6. EMERGENCY RESTORATION

### A. General

**6.01** A defective TD-3 radio channel may ordinarily be restored to service by switching, either manually or automatically, the failed channel to a spare channel in frequency diversity systems or to the standby receiver or transmitter in hot standby/space diversity systems.

**6.02** At times, due to circumstances such as a multiplicity of troubles, no patching facility will be available. Circuit restoration under such circumstances will depend entirely upon repairs to the affected channel. While travel time (especially to outlying stations) will account for most of the delay in restoration in such cases, repair time at the radio station should be held to a minimum.

**6.03** When service is restored by switching to a spare channel or standby transmitter or re-

ceiver, the loss of this spare facility jeopardizes all other working channels in that switching section until the failed channel is cleared. Depending upon the time of day and traffic load, it will be advisable to effect repairs as rapidly as possible.

**6.04** With hot standby/space diversity, a defective receiver or transmitter can be replaced by making use of hot standby/space diversity switching. Refer to Section 411-600-500 for forced switching procedures. Failure of an IF or RF switch could result in loss of service.

### B. Procedures

**6.05** In most cases, troubles causing sudden circuit outages are due primarily to component failures in some unit of the radio bay which can be detected by reading voltages and currents on the meter panel. Similarly, the section causing the trouble can be readily isolated by noting the receiver or transmitter output indication. In many cases, continuity can be quickly restored by substitution of station spares for defective units.

## 7. TABLE AND CHARTS

**7.01** The sections listed in Table A provide specific information for performing routine maintenance tests and assisting in isolating trouble.

**7.02** Figures 1 and 2 show the order of testing the radio receiver and transmitter, respectively.

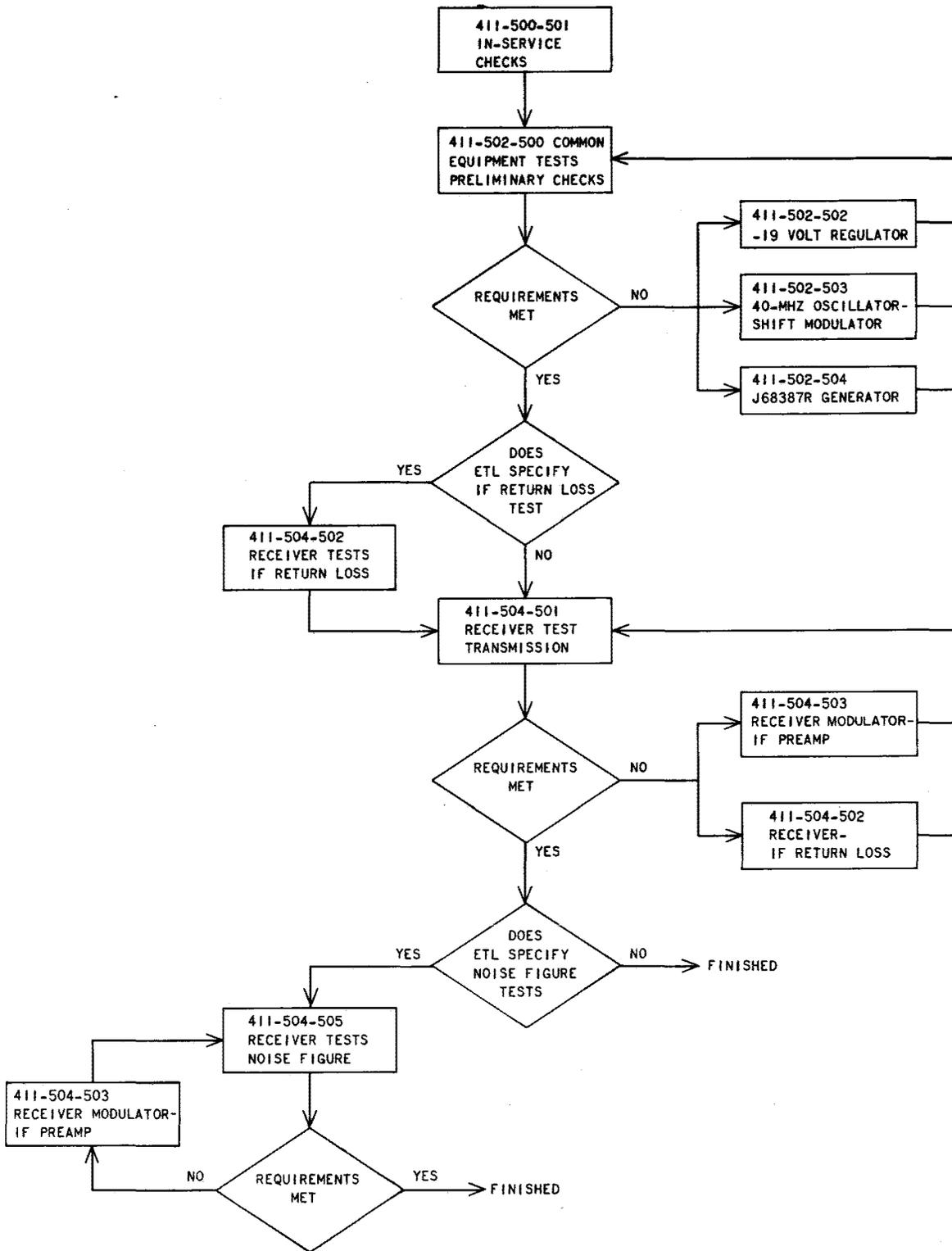


Fig. 1—BSP Usage When Testing a Receiver

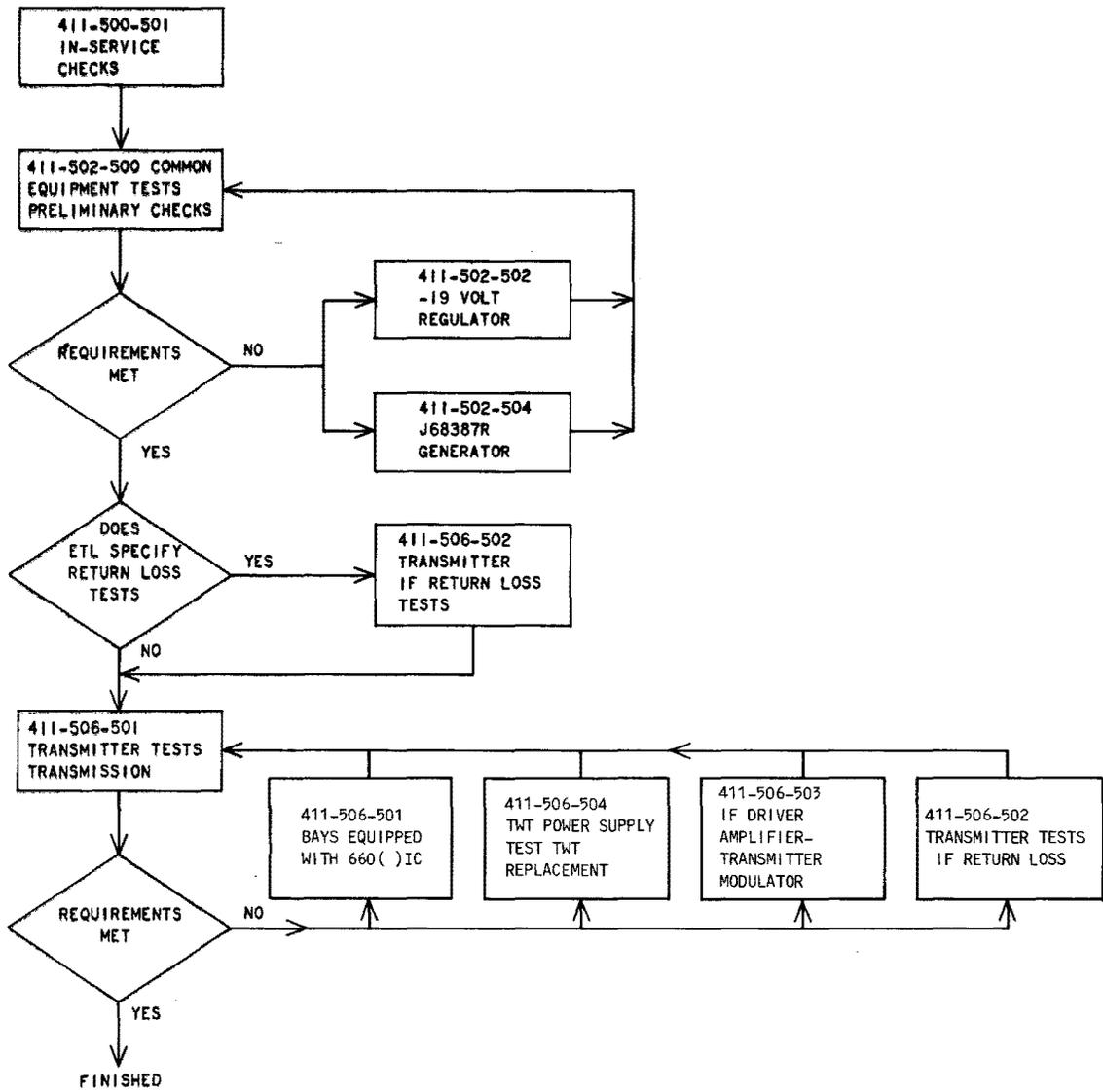


Fig. 2—BSP Usage When Testing a Transmitter