

## TL-1 MICROWAVE RADIO

### GENERAL

### DESCRIPTION

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**1.01** The TL-1 radio system provides short-haul line-of-sight microwave facilities for frequency-modulated (FM) transmission of multiplex telephony or other broadband communication signals. The system operates in the common carrier band between 10.7 and 11.7 GHz. Two types of equipment installations are used: an outdoor cabinet and an indoor bay. With outdoor cabinet installations, one or two microwave channels can be provided in each direction of transmission. With the indoor or building installation, as many as six 2-way channels can be provided. Repeater spacings will vary between 7.5 and 35 miles depending upon geographical location, rainfall, and other parameters of the radio path.

**1.02** This section is reissued to add information for TL-1 systems that have been modified to permit an increase in loading from 240 to 600 circuits. The receivers or modified systems may now be equipped with either of the following:

- (a) The J99296AA-1, List 3 modulator-preamplifier unit with the J99296G-2 receiver IF and baseband unit
- (b) The J99296AA-1, List 3 modulator-preamplifier unit with the J99351E-1 IF amplifier unit and the J99351J-1 FM receiver unit.

Since this is a general revision, change arrows ordinarily used have been omitted.

**1.03** TL-1 radio stations are normally operated on an unattended basis. Provisions for automatic alarm reporting to an alarm center, by means of a simple order-wire and alarm system, is an integral part of the TL-1 system. The order-wire and alarm signals are carried by the radio in the voice-frequency spectrum below the multiplex signals. The FM radio-frequency signal

is reduced to baseband at each repeater and terminal.

**1.04** The TL-1 system can be operated as a nondiversity system. The  $1 \times 1$  frequency diversity is available to improve reliability where required. In the diversity system, two radio channels are modulated in parallel. A diversity switch, activated by appropriate logic circuitry, selects the better of the two channels at the receiver.

**1.05** The TL-1 system has been operated with the 6-GHz TM-1 system as a crossband diversity system. The latest FCC rules concerning crossband diversity systems should be consulted. When the crossband system is used, both the 6- and 11-GHz transmitters are modulated by the same input signals. The diversity switch selects the better of the two signals for use at the receiving location. The frequencies and combinations are included in Section 409-300-101.

**1.06** The basic unit of the TL-1 system is the transmitter-receiver panel which is housed in either an outdoor steel cabinet or on a floor-mounted 7- or 9-foot indoor rack. The TL-1 can also be operated in diversity with TL-2 and TJ radio equipment. The transmitter-receiver bay contains a microwave transmitter and receiver, order-wire and alarm equipment, a power supply, a diversity switch unit when needed, and batteries. Batteries power the bay and are continuously charged from commercial ac power. A single antenna with dual polarization is used for simultaneous transmission and reception. Two types of antenna systems are used: the direct radiator arrangement and the periscope arrangement.

**1.07** Fig. 1 is a simplified block diagram showing the basic relationship between terminals and a repeater in a nondiversity system. The diagram shows a 2-hop system with one 2-way channel and

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multiplex dropping and adding at the repeater. Fig. 2 is a block diagram showing a similar type of system with diversity. Fig. 3 is a block diagram illustrating a system with 11- and 6-GHz crossband diversity using TM-1/TL-1.

**Note:** Check the FCC regulations concerning crossband diversity systems of the TM-1/TL-1 configuration.



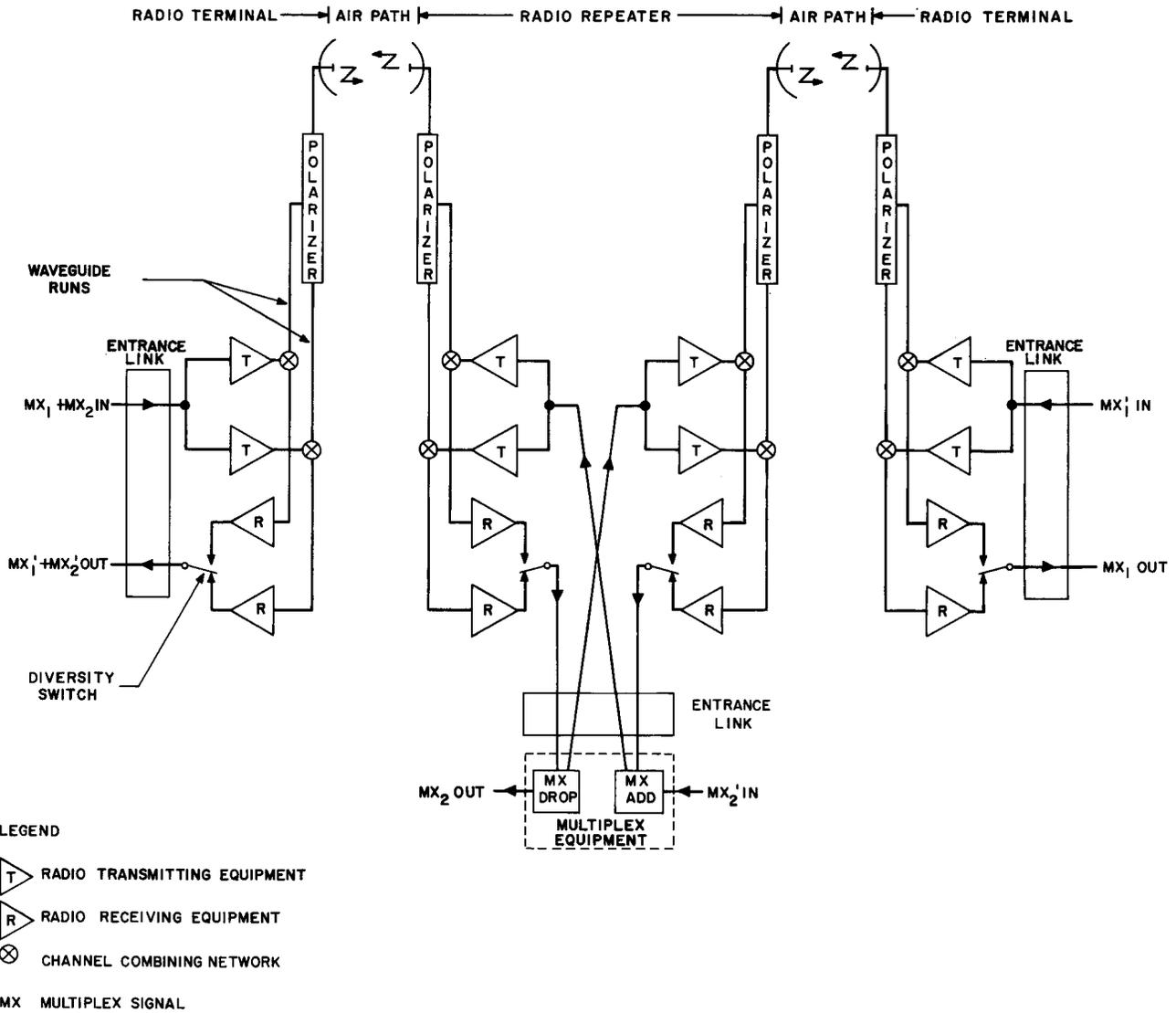


Fig. 2—Two-Hop TL-1 System—One 2-Way Diversity Channel—Block Diagram

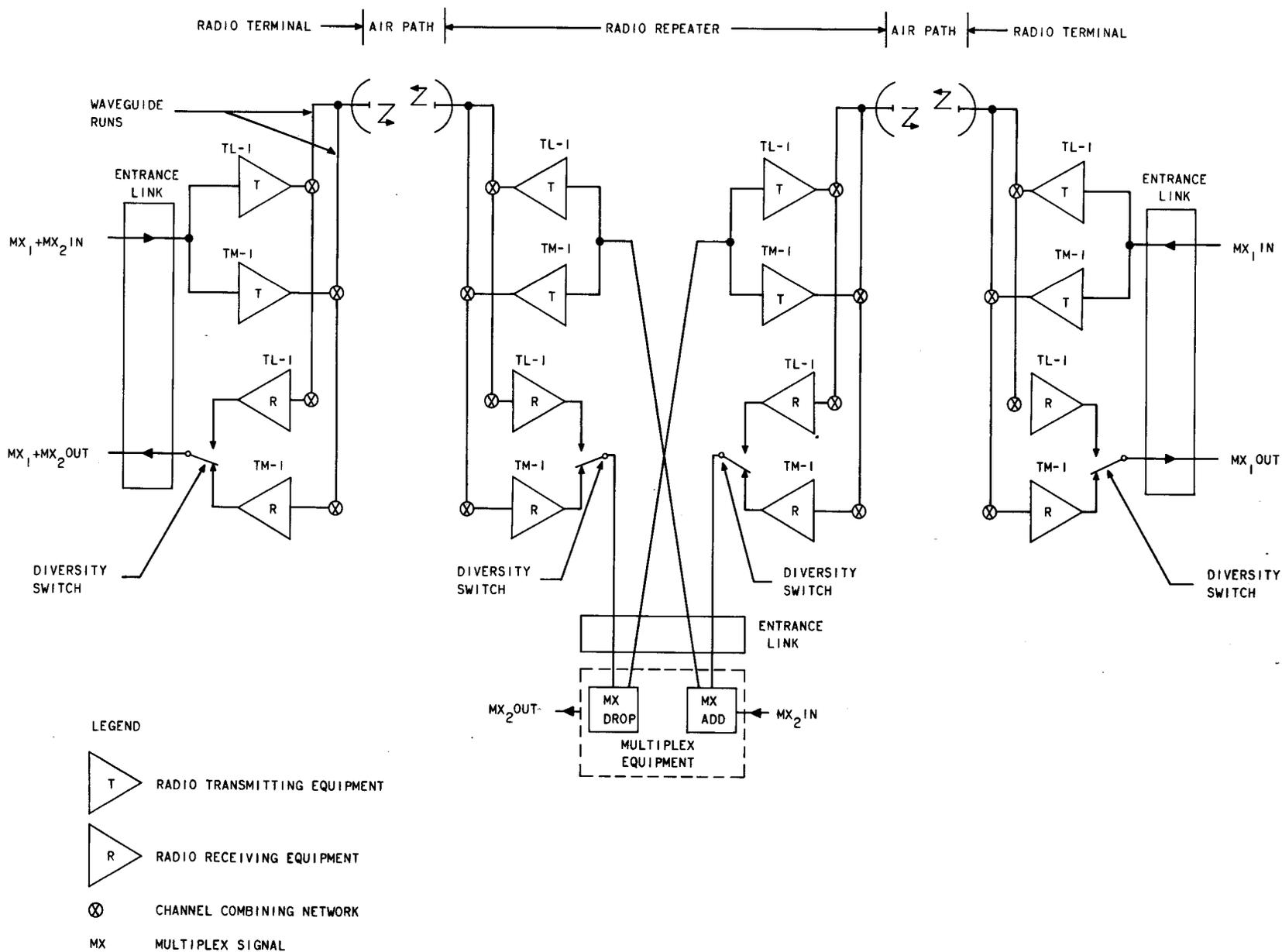


Fig. 3—Two-Hop TL-1/TM-1 System—One 2-Way Crossband Diversity Channel—Block Diagram