

**MJ AND MK MOBILE RADIO TELEPHONE SYSTEM**  
**LARGE SYSTEM EQUIPMENT UNITS**  
**EQUIPMENT DESIGN REQUIREMENTS**  
**RADIO SYSTEMS**

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**1. GENERAL**

**Scope**

**1.01** This section and the references listed in Part 4 describe the general equipment design requirements to be used in the engineering and installation of the large MJ and MK Mobile Radio Telephone Systems. The description covers the most recent configuration of the systems.

**1.02** This specification is reissued to incorporate previous appendix changes.

**Capacity**

**1.03** The large MJ and MK Mobile Radio Telephone Systems will each serve a maximum of 480 customers per system.

**Description**

**1.04** The MJ (150-MHz) and MK (450-MHz) Mobile Radio Telephone Systems are fully automatic, 2-way dial telephone systems using narrowband FM transmission on a maximum of eight 2-way channels between the mobile subscriber and the central office. The systems operate from a step-by-step or crossbar central office (modified with ground start on the central office lines that tie to the control terminal) and use one mobile subscriber line assignment per mobile station. Replacing the existing manual push-to-talk mobile telephone system, the MJ and MK systems furnish multichannel access and automatic full-duplex operation of both mobile and base station radio equipment to allow the subscriber to talk and listen simultaneously. The MJ and MK systems are fully compatible with existing manual toll systems.

**1.05** The MJ and MK Mobile Radio Telephone Systems can be operated over wire-line or carrier-type facilities between the base station control terminal and base station radio equipment. When carrier-type facilities are employed, remote signaling circuits must be provided. These circuits convert dc commands and responses between the control terminal and base station radio equipment to carrier operation.

**1.06** The large MJ and MK Mobile Radio Telephone Systems furnish service that is comparable to present land subscriber service. Both mobile-to-land and land-to-mobile calls may be dialed directly without operator assistance when the mobile station is operating in its home area. Equipment options allow from one to eight channels for use in any one area, depending upon the number of channels necessary to provide good quality service.

**1.07** Small MJ and MK Mobile Radio Telephone Systems, which serve one channel with a maximum of 30 subscriber lines or two channels with a maximum of 90 subscriber lines, are available. The small systems are identical to the large systems except for the switching unit in the base station control terminal. The large system switching unit accommodates a maximum of eight channels and 480 subscriber lines.

**A. Equipment Arrangement**

**1.08** The large MJ and MK systems consist of base station control terminal equipment, base station radio equipment, and mobile station equipment. The base station control terminal consists of a maximum of seven 11-foot 6-inch bays or eleven 9-foot bays of equipment (Fig. 1). Base station radio equipment consists of base station transmitters (Fig. 2 and 3) and remote receivers located in a receiver package (Fig. 4). The mobile station consists of a radio unit (Fig. 5), a supervisory unit (Fig. 6), and a control unit (Fig. 7).

**1.09** The base station control terminal consists of a switching unit and transmission circuits. Individual bays which make up the large system switching unit are the switch control bay and one or more line circuit bays. The transmission equipment consists of one or more transmission signaling and test access (TSTA) bays. The switch control and line circuit bays interconnect selected mobile channels with the land-line appearance (central office connection) assigned to each mobile

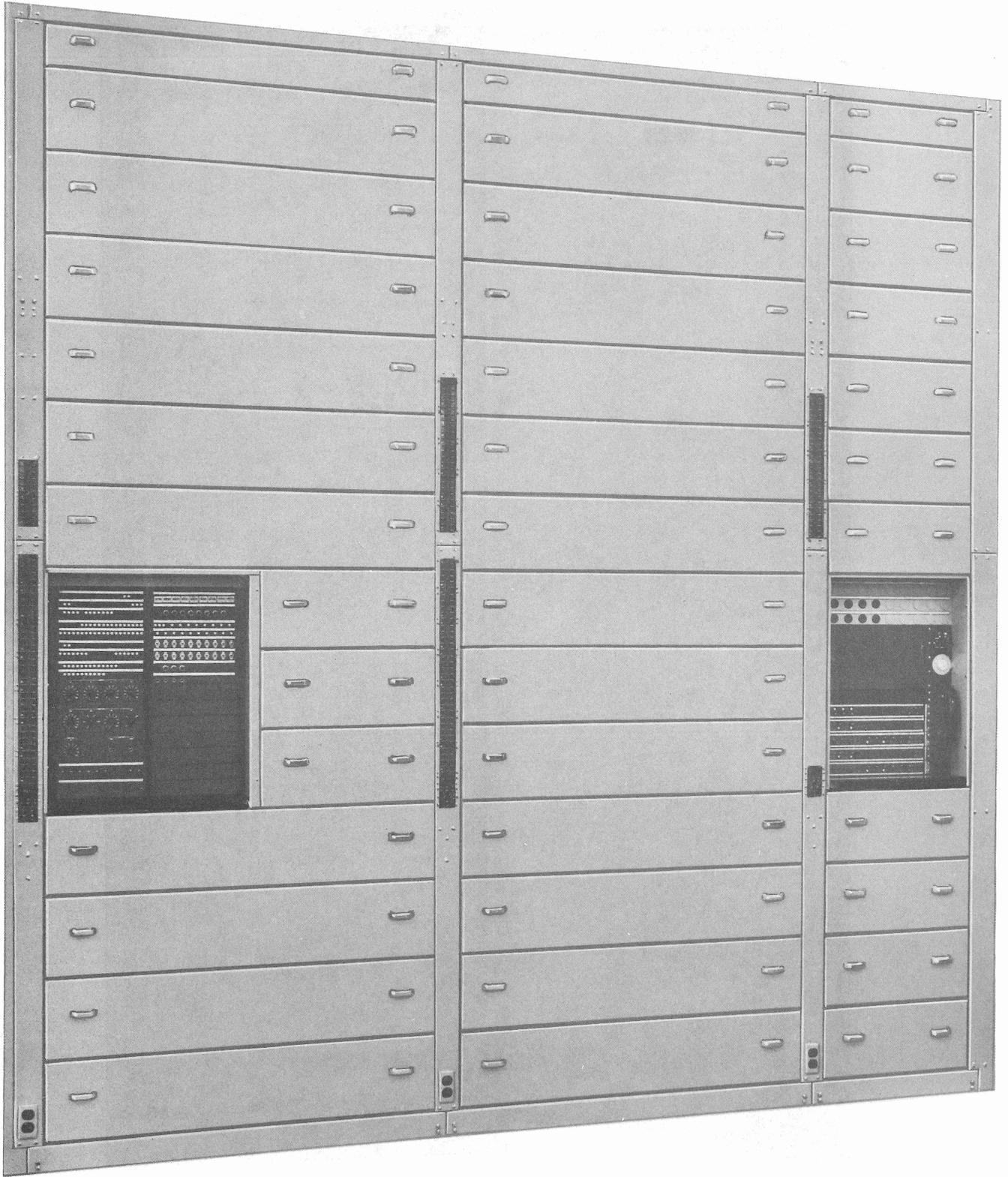
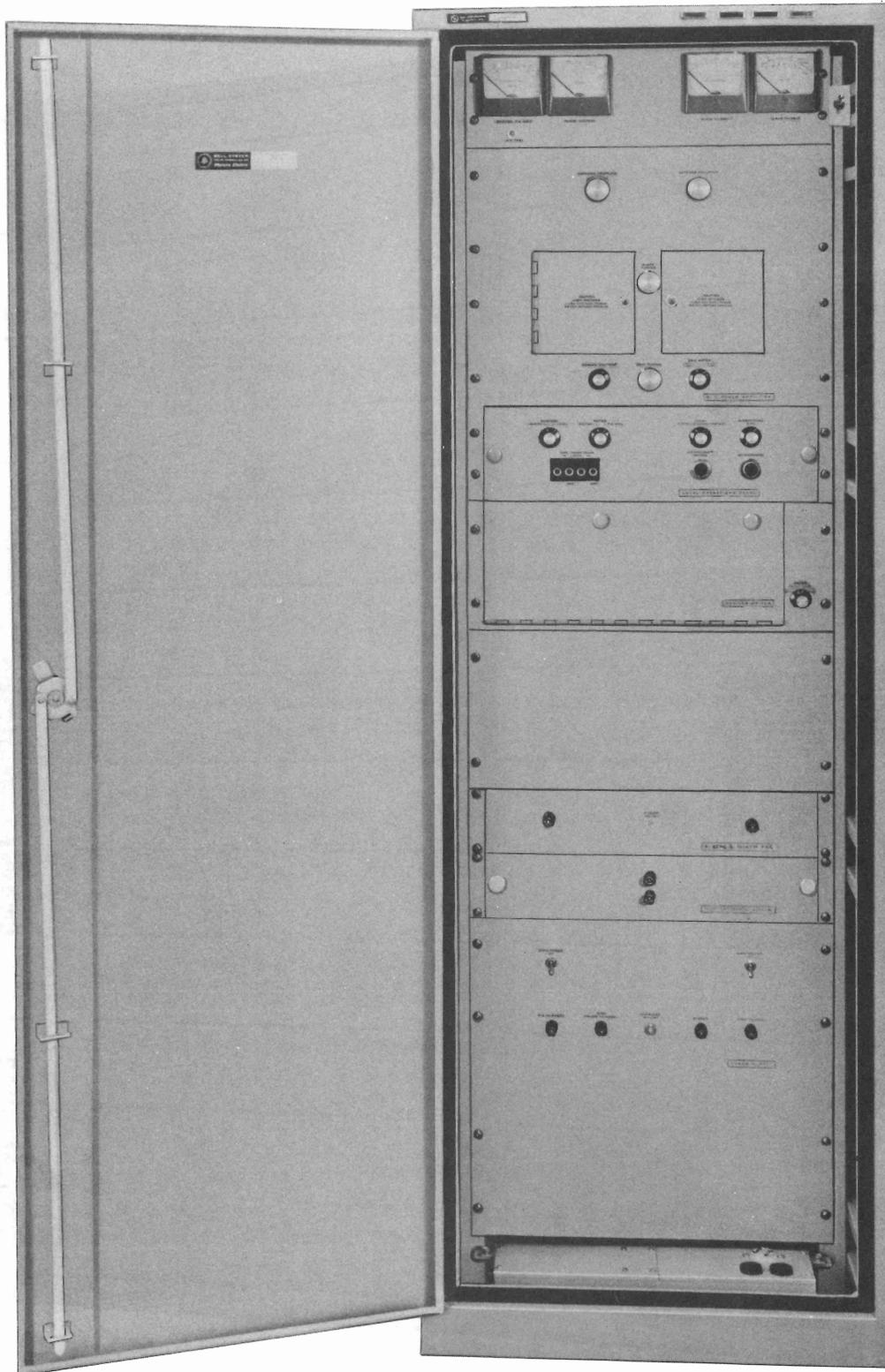


Fig. 1—Typical Base Station Control Terminal



**Fig. 2—Typical Base Station Transmitter—MJ 250-Watt Transmitter Unit KS-19618, L21 Shown**

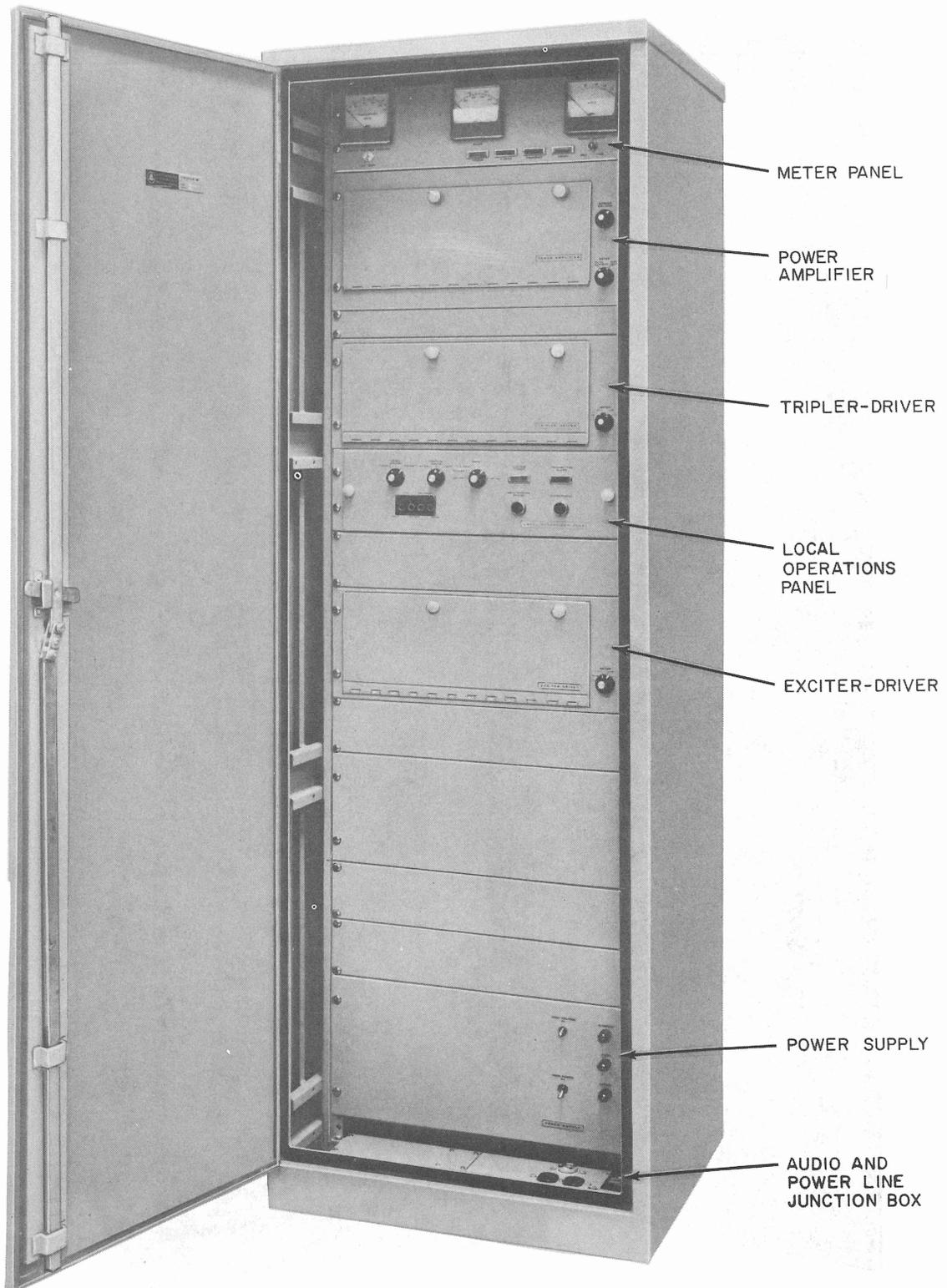


Fig. 3—Typical Base Station Transmitter—MK 5- to 120-Watt Transmitter Unit KS-20285, L1 Shown

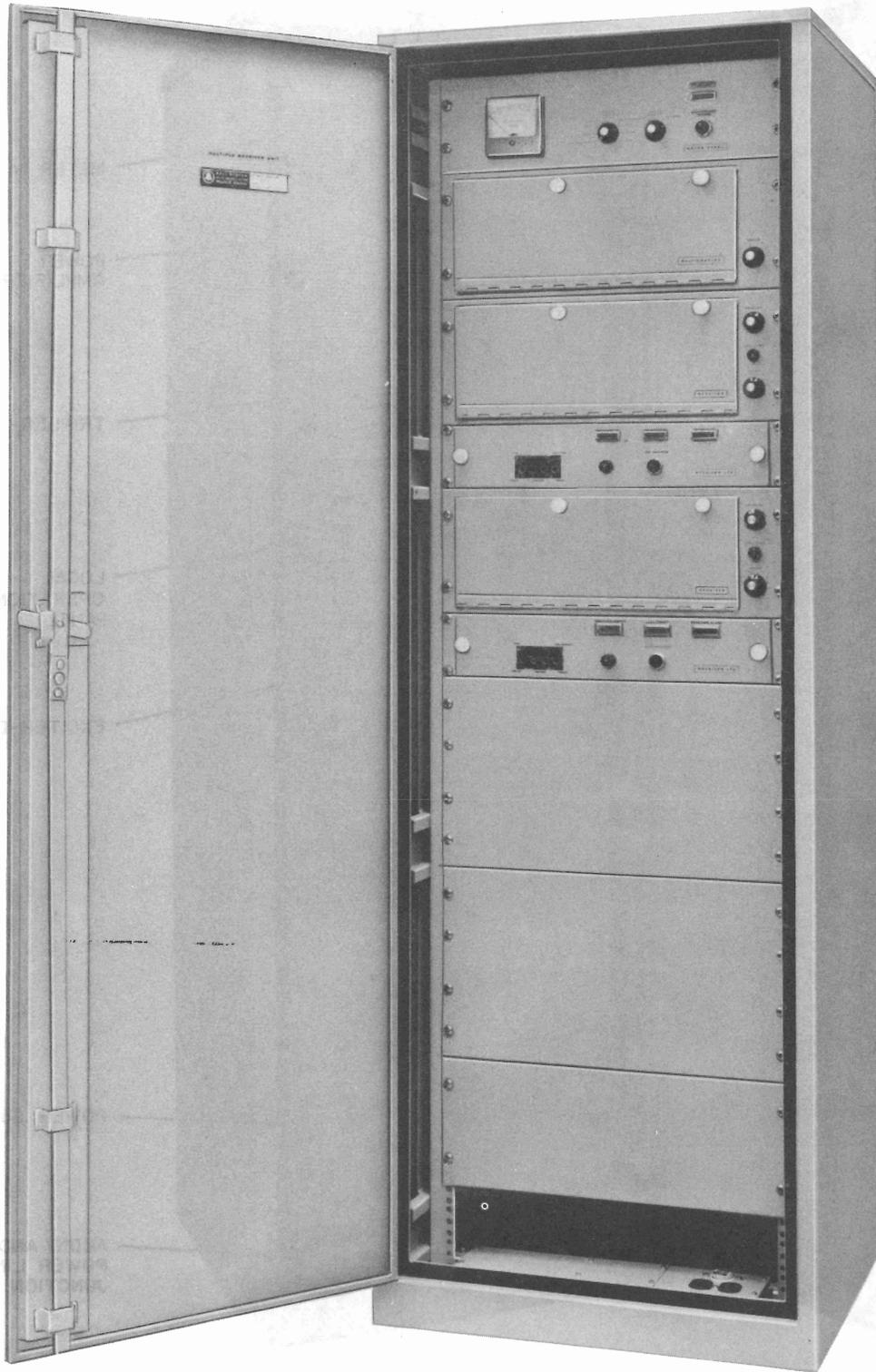
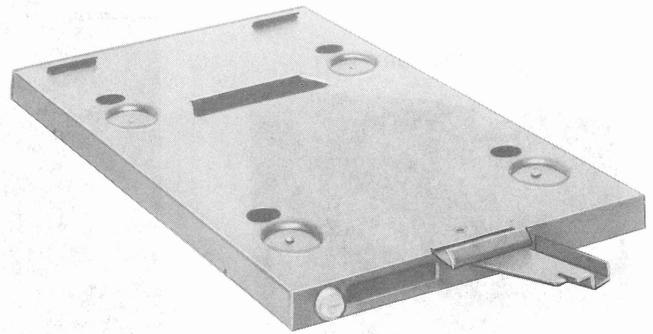


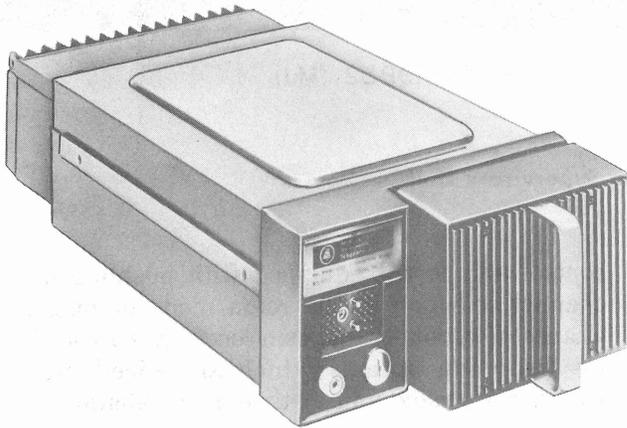
Fig. 4—Typical Base Station Receiver—MK Receiver Package KS-20285, L52 Shown



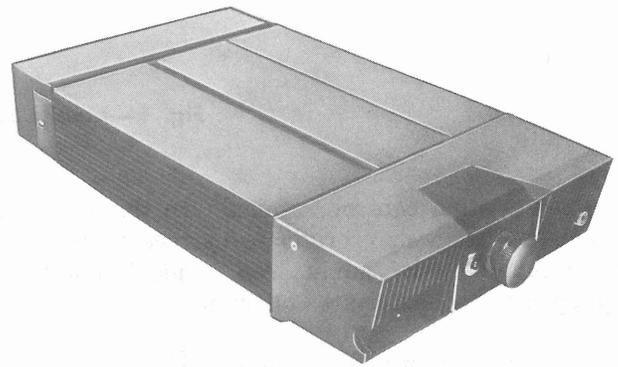
C. KS-20282 (MK)



D. MOUNTING PLATE FOR KS-20282 (MK)



A. KS-19609 (MJ)



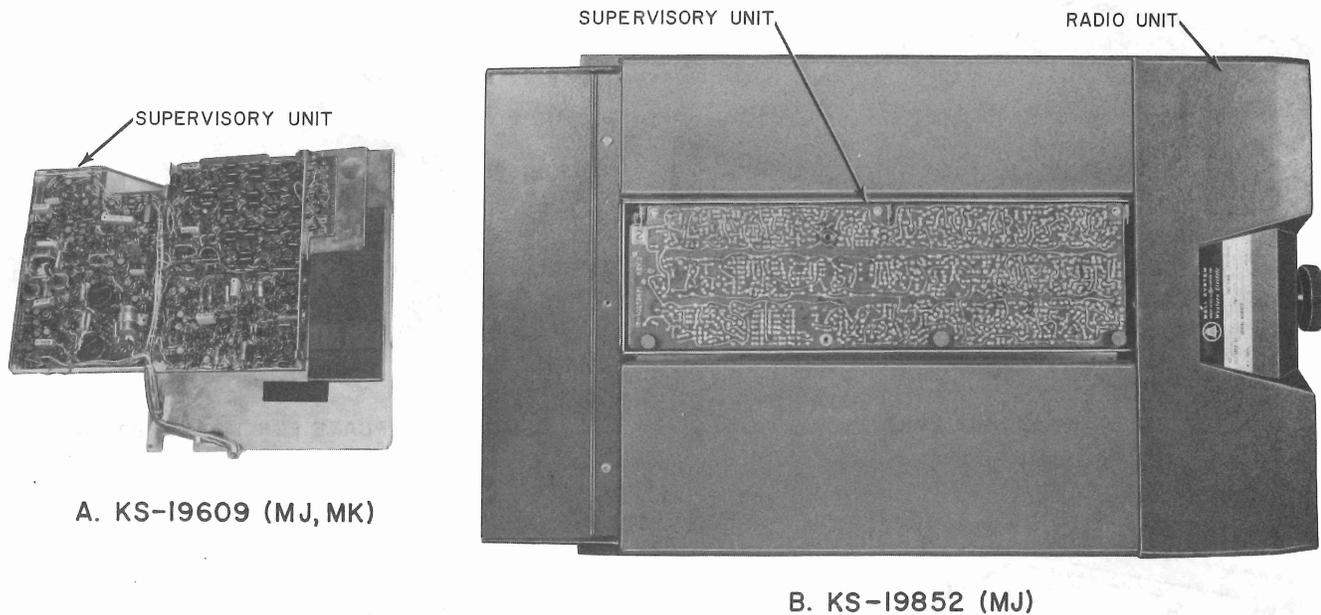
B. KS-19852 (MJ)

**Fig. 5—Mobile Station Radio Unit**

station. Transmission control, transmitter control, channel selection, signaling tone control, and testing facilities are provided by the TSTA bays. Transmission facilities from the TSTA bays connect the individual channels to the base station radio equipment. This equipment, which may or may not be remotely located, consists of high- or low-power FM transmitters and fixed-tuned receivers for each channel. In order to ensure adequate coverage of the assigned area, a number of receivers per channel (maximum of eight) may be placed in remote parts of the coverage area. Receiver selection circuits in the TSTA bay will automatically switch to the receiver providing the best signal-to-noise ratio. The mobile station supervisory unit performs the necessary logic and control functions for the mobile

station, allowing the subscriber simply to dial the desired number. The supervisory unit is mounted within the mobile radio unit.

**1.10** A multichannel access feature, an integral part of the system, permits the mobile station to automatically seek out and lock on an idle channel during on-hook conditions. This is accomplished by the mobile station supervisory and radio units, which search for the channel that is marked by a single-frequency tone. The next call in either direction will then be completed over this channel with system logic functioning to drive all other mobile stations from the channel. All mobile stations not involved in the call will then search for and lock on the next idle channel marked by



**Fig. 6—Mobile Station Supervisory Unit**

the base station control terminal. In this manner, a mobile station may originate or receive calls on any channel in its home area, since it must be equipped for all home-area channels.

**1.11** Three conditions, or modes, of operation are available to the MJ mobile station: the home mode, the roam mode, and the manual mode. The home mode engages the mobile station to search for the marked-idle channel in the group of channels assigned to the mobile station's home area as preset by strapping options in the control unit. The supervisory unit is programmed for automatic operation and contains strapping appropriate to the subscriber number assigned to the mobile station. Should the mobile station roam into a foreign area furnished with control terminal equipment, the roam mode may be selected. This permits the subscriber to select, by means of pushbuttons on the control unit, the individual channels for the radio unit to scan in search of idle-channel markings and ensures that the set will scan only the selected channels. The third mode, manual, enables the MJ mobile station to be compatible with existing manual areas.

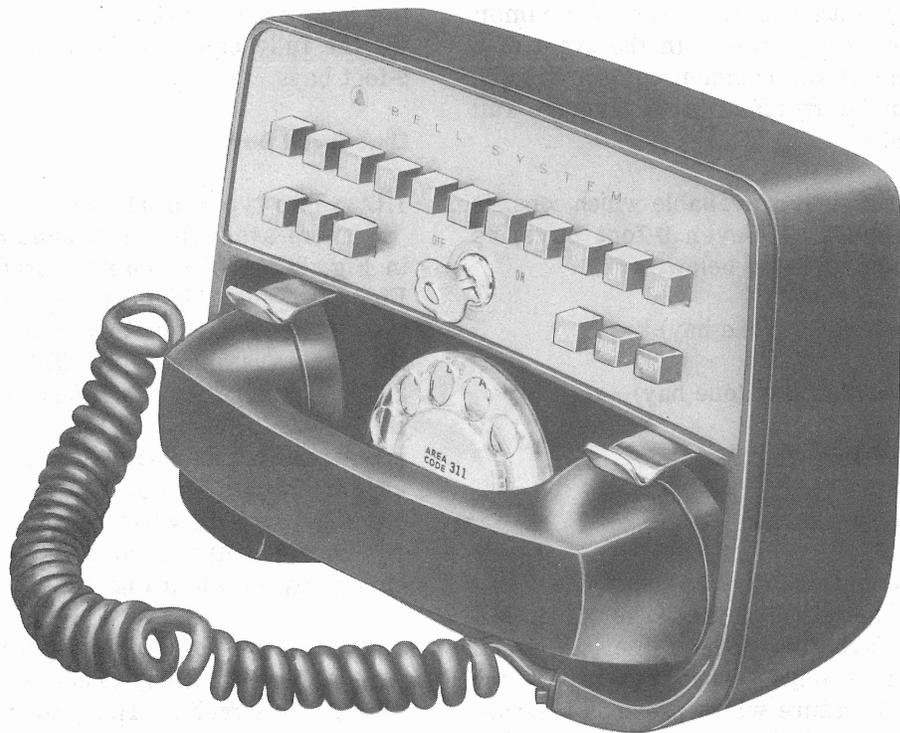
**1.12** The MK system has two modes of operation, home and roam, which are functionally identical to the MJ system except that the MK

control unit is not equipped with pushbuttons for channel selection in the roam mode of operation. Channel selection for the roam condition is accomplished by strapping options which are wired into the subscriber's radio unit at time of installation.

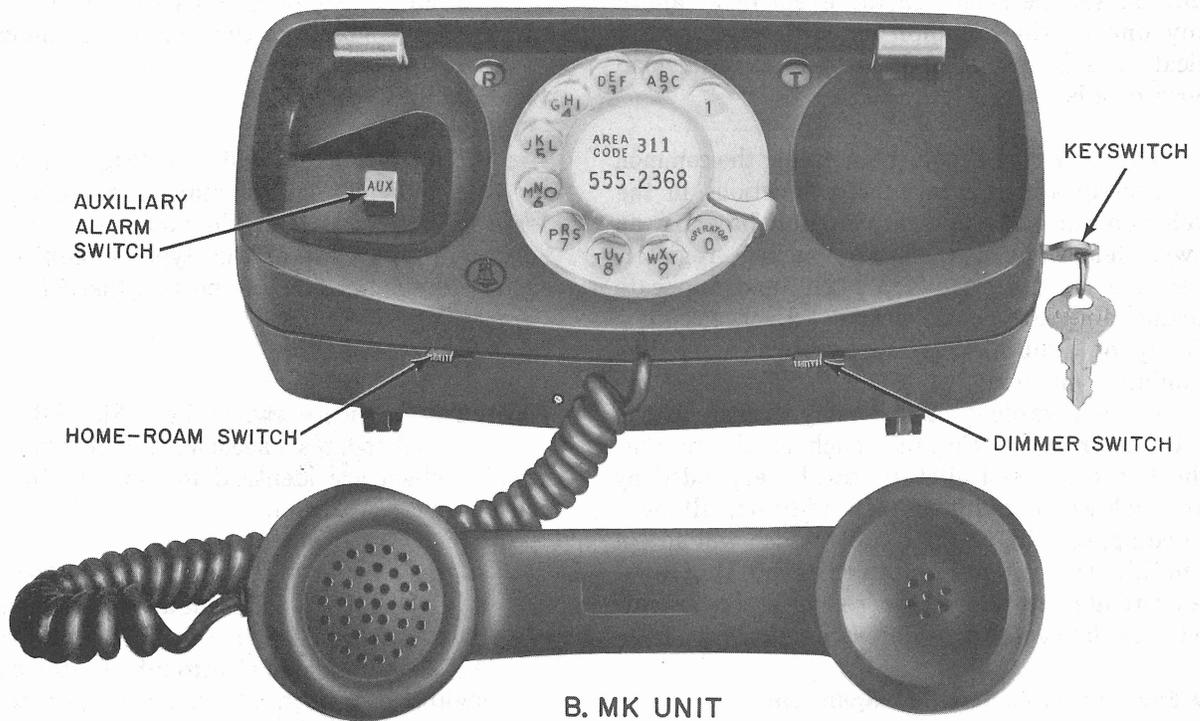
**1.13** Provisions are incorporated in the switching unit whereby it is possible to initially provide an office with 5 lines and 1 channel and to increase the office to a maximum of 480 lines and 8 channels. The control terminal can consist of a maximum of seven 11-foot 6-inch bays, as shown in Fig. 8 and as listed below:

- (a) Switch Control Bay (one bay)
- (b) Duplicate Switch Bay (one bay)
- (c) Line Circuit Bay (two bays)
- (d) TSTA Bay (three bays).

The minimum amount of 11-foot 6-inch bay equipment that can be used for operation of the large MJ or MK system is one switch control bay, one line circuit bay, and one TSTA bay (Fig. 1). A duplicate switch bay is an optional feature which provides a second set of common control circuits (marker, sender, register, and line chain and allotter) to be



A. MJ UNIT



B. MK UNIT

Fig. 7—Mobile Station Control Units

used alternately with the first set of common control circuits on service calls. In the event of a failure in any one of the common control circuits, the duplicate can be switched in to take the full load of service calls.

**1.14** A control terminal is available which consists of a maximum of eleven 9-foot bays, as shown in Fig. 9 and as listed below:

- (a) Switch Control Bay (one bay)
- (b) Duplicate Switch Bay (one bay)
- (c) Line Circuit Bay (four bays)
- (d) TSTA Bay (five bays).

The minimum amount of 9-foot bay equipment that can be used for operation of the large MJ or MK system is one switch control bay, one line circuit bay, and two TSTA bays. The duplicate switch bay is an optional feature which provides a second set of common control circuits (marker, sender, register, and line chain and allotter) to be used alternately with the first set of common control circuits on service calls. In the event of a failure in any one of the common control circuits, the duplicate can be switched in to take the full load of service calls.

**1.15** The individual circuits performing the common control and line switching functions in the switch control and duplicate switch bay are as follows: line chain and allotter, marker, register, sender, link allotter, common pulse, and duplicate switching and test access circuit. Each circuit is made up of a number of relays with each bar containing a maximum of 25 relays (Fig. 10). The bars are removable to allow easy access to the rear of the relays. Circuits, such as the marker or the line chain and allotter, can be expanded by adding relays as required. In addition, all bays come equipped with a frame cable which will accept the maximum number of circuits on that bay. When circuits are added, the relays are connected directly to the cable by soldered connections.

#### **Base Station Control Terminal Equipment**

**1.16** The base station control terminal equipment contained on the 9-foot bays is identical to the equipment contained on the 11-foot 6-inch bays, but the equipment arrangement and location on

the bays vary. Table A lists sizes and weights for the fully equipped 11-foot 6-inch bays and the 9-foot bays.

#### **Line Circuit Bay**

**1.17** Two types of 11-foot 6-inch line circuit bays are available: a 200-line circuit bay, shown in Fig. 8C, and a 100-line circuit bay, shown in Fig. 8F. The 200-line circuit bay accommodates the first 200 lines or any portion thereof. When the large system exceeds 200 lines, an additional 200-line circuit bay (Fig. 8C) may be ordered for a total of 400 lines. When lines 401 through 480 are required, a duplicate switch bay (Fig. 8B) which accommodates the additional 80 lines must be ordered. Systems which are not expected to exceed 100 lines with five channels may order the 100-line circuit bay shown in Fig. 8F.

**1.18** One type of 9-foot line circuit bay is available (Fig. 9C). This bay accommodates a maximum of 120 line circuits. Thus, four bays are required for a full-size system.

**1.19** Line circuits are added to both sizes of line circuit bays in groups of five (one relay bar) and are soldered to the existing frame cable.

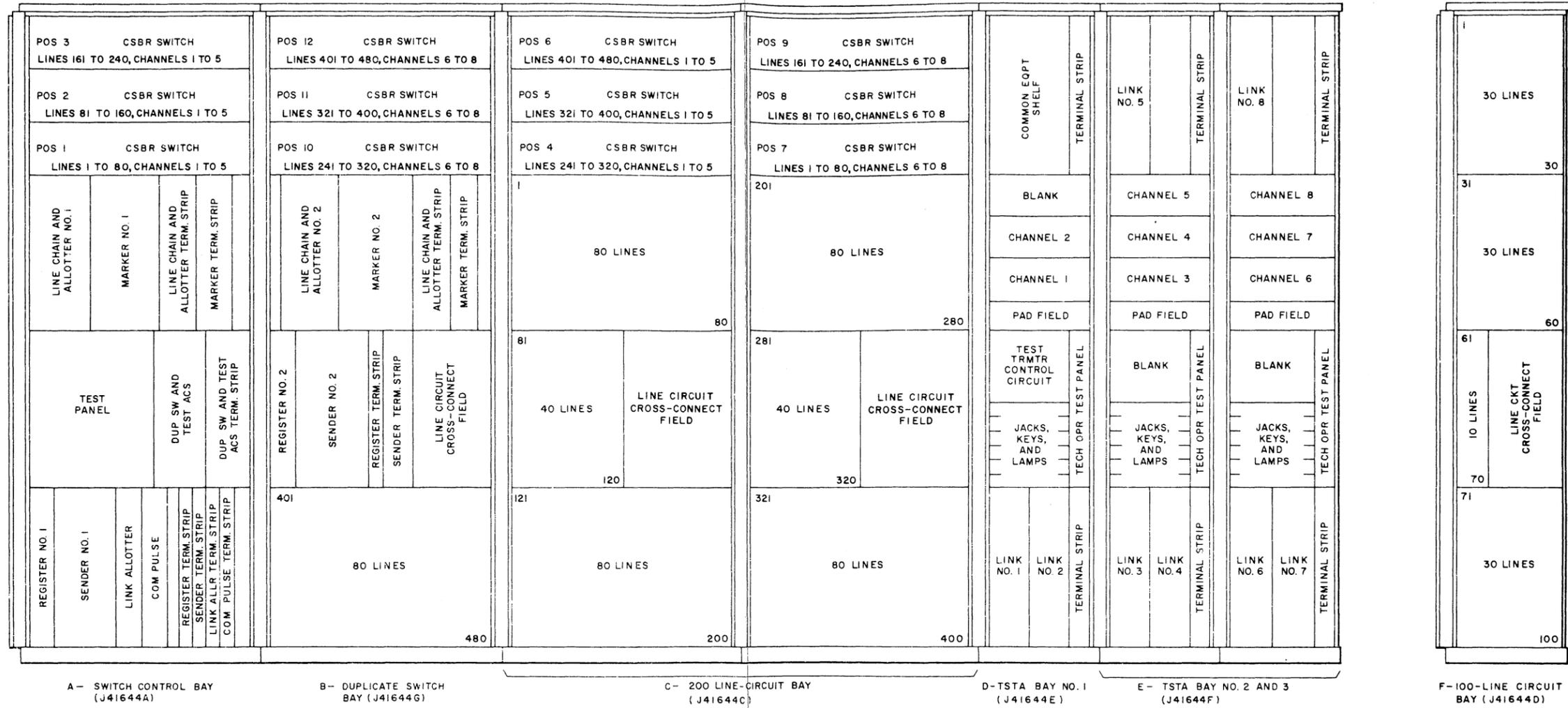
#### **Switch Control Bay**

**1.20** The switch control bay (Fig. 8A and 9A) contains all the common control circuits that serve to interconnect mobile channels with selected lines. Only one bay of this type is required for a system of 480 lines or any portion thereof.

#### **Duplicate Switch Bay**

**1.21** The duplicate switch bay (Fig. 8B and 9B) accommodates a second set of common control circuits which are identical to those in the switch control bay.

**Note:** When a system using 11-foot 6-inch bays is built to maximum size and requires line circuits 401 through 480 or crossbar switches for lines 241 through 480, the duplicate switch bay (Fig. 8B) must be ordered even though the duplicate common control equipment is not required in the system. This condition does not exist in a system using 9-foot bays, since all line circuits and crossbar switches are assembled in the line circuit bays.



**Fig. 8—Large MJ or MK System Base Station Control Terminal Equipment on 11-Foot 6-Inch Bays for a System of 480 Subscriber Lines and 8 Channels**

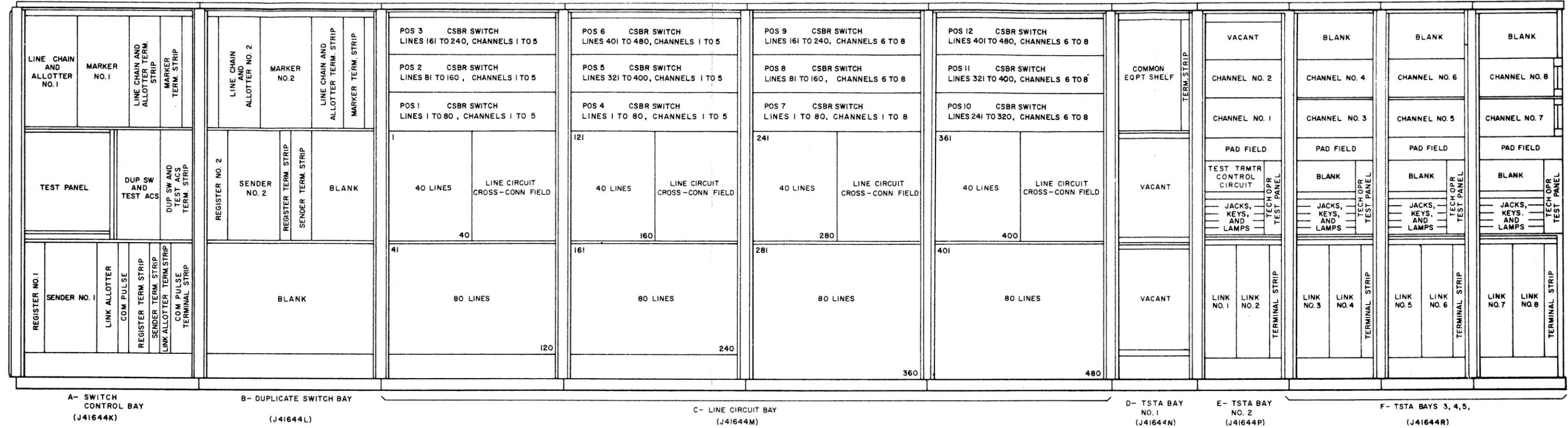


Fig. 9—Large MJ or MK System Base Station Control Terminal Equipment on 9-Foot Bays for a System of 480 Subscriber Lines and 8 Channels



**Fig. 10—Typical Relay Bar for Control Terminal**

#### **Transmission Signaling and Test Access Bay**

**1.22** Two types of 11-foot 6-inch TSTA bays are available. The TSTA bay shown in Fig. 8D contains the test transmitter control circuit, channel equipment for the first two channels, link circuits for the first two channels, and common control equipment used for all channels which may be provided in the system. The channel equipment consists of a hybrid circuit and other circuits for tone detection, line termination, tone generation, transmission gain control, filtering, noise reduction, and receiver selection. The common control equipment consists of the channel selector, the base station identifier, the alarm circuits, and the transmitter switching circuit. Only one bay of this type is required for any one system of 480 lines or any portion thereof. The TSTA bay shown

in Fig. 8E contains channel equipment and link circuits for channels 3, 4, and 5. Channel equipment and link circuits for channels 6, 7, and 8 are provided on a second bay of this type, giving a total of three TSTA bays for a complete complement. A technical operator test panel is provided on each TSTA bay for use with all channel equipment on the bay.

**1.23** Three types of 9-foot TSTA bays are available.

The TSTA bay shown in Fig. 9D is provided with the common equipment for all the channels. The TSTA bay shown in Fig. 9E is provided with the test transmitter control circuit and the channel equipment and link circuits for the first two channels. The TSTA bay shown in Fig. 9F is provided with channel equipment and link circuits for two channels; therefore, three bays of this type are required for channels 3 through 8. A total of five 9-foot TSTA bays is required for a full complement. A technical operator test panel is provided on each bay that contains channel equipment.

#### **Base Station Radio Equipment (MJ)**

**1.24** The base station radio equipment normally consists of one base station transmitter and from one to eight base station receivers for each channel. The receivers (Fig. 4) are spotted throughout the area to ensure the best reception from the mobile station. The number of transmitters and receivers used is determined by the characteristics of the area covered. In large areas, a 250-watt transmitter, supplemented by one 50-watt transmitter, is employed on each channel when necessary (Fig. 2). In small areas, a 50-watt transmitter is used. A 50-watt transmitter-receiver unit (Fig. 11) is available with both transmitter and receiver in the same cabinet. Generally, there should be no need for more than one receiver per channel when a 50-watt transmitter-receiver is used. When two transmitters are used on the channel, frequency synchronization or phase correction between transmitters is not provided other than that provided by high-stability oscillators installed in the transmitters on an optional basis. A multifrequency test transmitter unit (Fig. 12) is optional equipment used to permit line-up and routine testing of receivers. The test transmitter may, in emergencies, replace one of the main transmitters during "down" times. Table B lists sizes and weights of the equipment.

**1.25** The transmission facilities connecting the control and audio circuits from the base

TABLE A

FULLY EQUIPPED BAY	FRAME DIMENSIONS			FLOOR LOADING WEIGHT (LBS)	SHIPPING WEIGHT (LBS)
	HEIGHT	WIDTH	DEPTH		
Switch Control Bay J41644A	11 ft 6 in.	4 ft 2-1/2 in.	1 ft	1200	1400
Duplicate Switch Bay J41644G	11 ft 6 in.	4 ft 2-1/2 in.	1 ft	1200	1400
Line Circuit Bay J41644C	11 ft 6 in.	4 ft 2-1/2 in.	1 ft	1200	1400
Line Circuit Bay J41644D	11 ft 6 in.	2 ft 1-1/8 in.	1 ft	750	1000
Transmission Signaling and Test Access J41644E	11 ft 6 in.	2 ft 1-1/8 in.	1 ft	750	1000
Transmission Signaling and Test Access J41644F	11 ft 6 in.	2 ft 1-1/8 in.	1 ft	750	1100
Switch Control J41644K	9 ft	4 ft 2-1/2 in.	1 ft	1000	1200
Duplicate Switch J41644L	9 ft	4 ft 2-1/2 in.	1 ft	1000	1200
Line Circuit Bay J41644M	9 ft	4 ft 2-1/2 in.	1 ft	1000	1200
Transmission Signaling and Test Access Bay J41644N	9 ft	2 ft 1-1/8 in.	1 ft	300	550
Transmission Signaling and Test Access Bay J41644P	9 ft	2 ft 1-1/8 in.	1 ft	650	900
Transmission Signaling and Test Access Bay J41644R	9 ft	2 ft 1-1/8 in.	1 ft	650	900

TABLE B

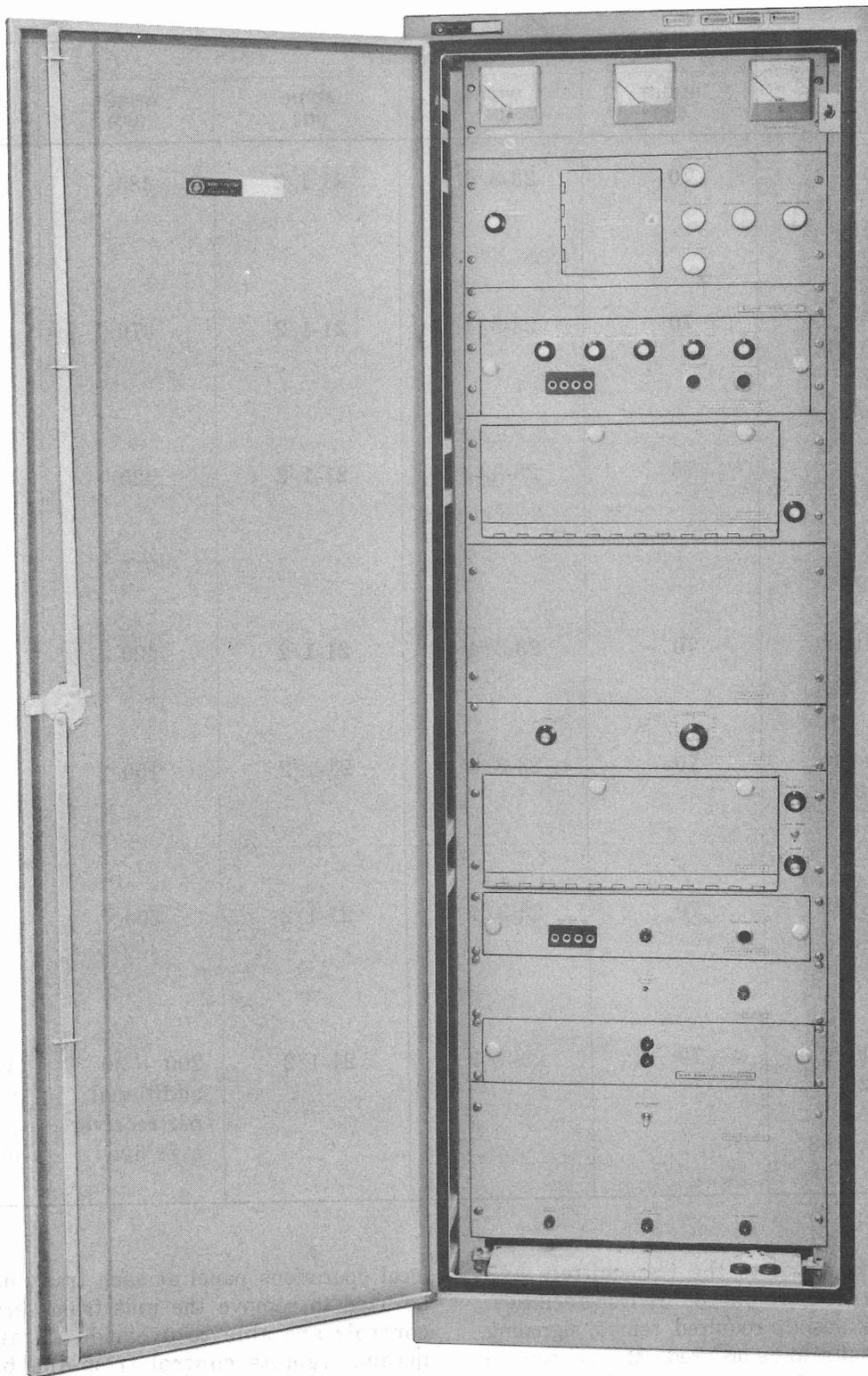
UNIT	CABINET				SHIPPING WEIGHT (LBS)
	HEIGHT (IN.)	WIDTH (IN.)	DEPTH (IN.)	WEIGHT (LBS)	
250-Watt Transmitter Unit KS-19618, L1 or L21	70	23-3/4	21-1/2	485	650
50-Watt Transmitter Unit KS-19618, L2, L3, L22, or L23	70	23-3/4	21-1/2	370	520
50-Watt Transmitter-Receiver Unit KS-19618, L8, L9, L24, or L25	70	23-3/4	21-1/2	420	570
Test Transmitter Unit KS-19618, L16	70	23-3/4	21-1/2	420	570
Receiver Package KS-19618, L124 or L134 (four receivers)	70	23-3/4	21-1/2	150	300
Receiver Package KS-19618, L125 or L135 (five receivers)	70	23-3/4	21-1/2	200	350
Receiver Package KS-19618, L126 through L128 or L136 through L138	70	23-3/4	21-1/2	200 + 30 additional per receiver over five	350 + 30 additional per receiver over five

station control terminal to the transmitters and receivers consist of wire-line or carrier facilities. When carrier facilities are required, remote signaling circuit J41646 must also be ordered. Manual control of the transmitters can be exercised from the channel jack and key field located on the TSTA bays or locally at each transmitter site. Keys on the TSTA bays can be used to remove the transmitter from service and to operate the transmitter at full or low power (F-zero operation). Controls on a

local operations panel at each transmitter site can be used to remove the unit from service. These controls are able to override all automatic or manual remote control from the base station transmission equipment.

#### 250-Watt Transmitter Unit

**1.26** Four 250-watt transmitters are available, all of which are enclosed in indoor cabinets



**Fig. 11—Typical Base Station Transmitter-Receiver—MJ 50-Watt Transmitter-Receiver Unit KS-19618, L24 Shown**

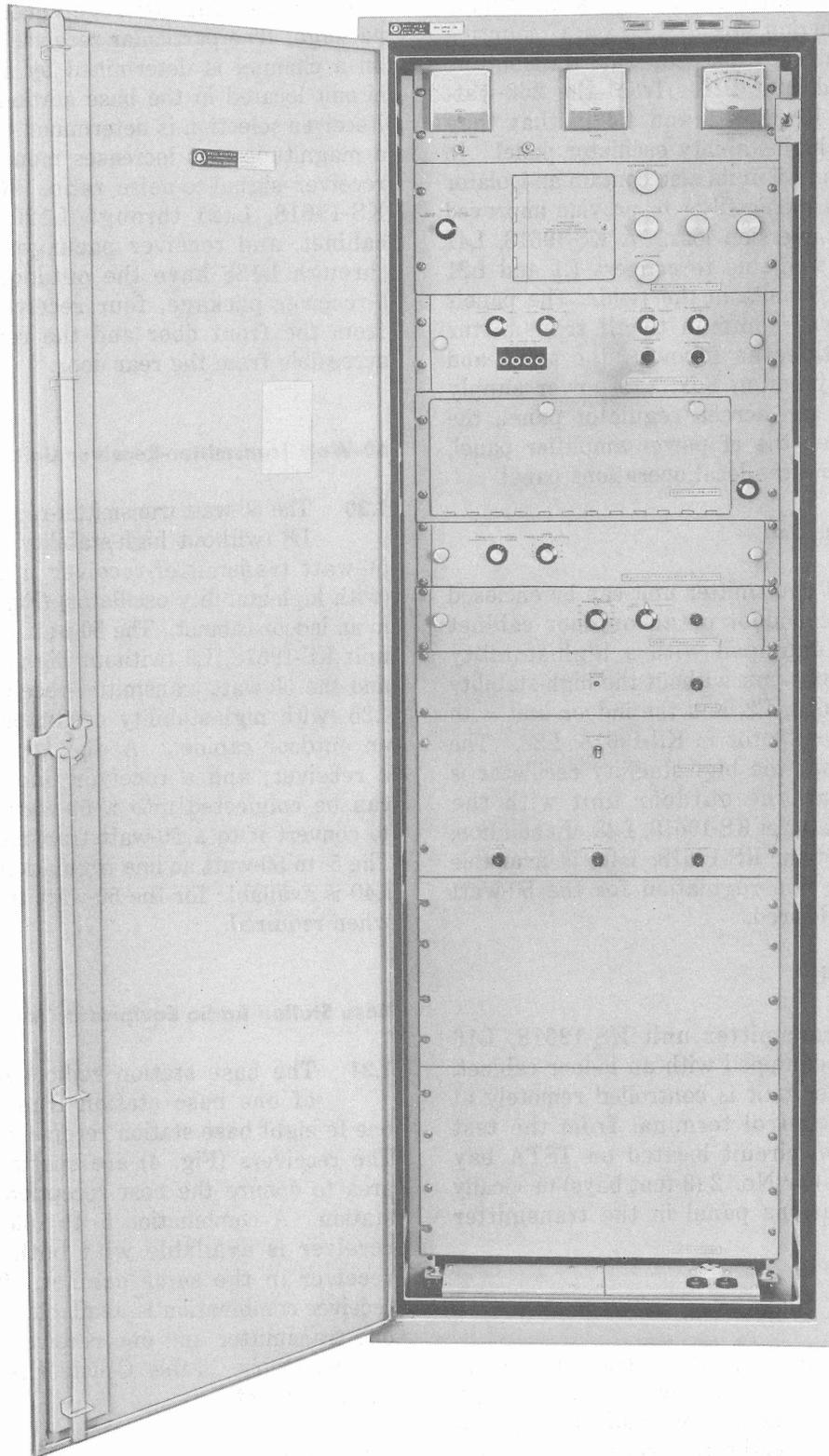


Fig. 12—MJ Test Transmitter Unit KS-19618, L16

and consist of six individual panels, a directional coupler, and a junction box located on a mounting rack inside the cabinet. The 250-watt transmitters KS-19618, L5 and L21 differ from the 250-watt transmitters KS-19618, L1 and L4 in that they contain a List 10 high-stability oscillator panel. In addition, the L4 and L5 units also contain an isolator and a different harmonic filter to provide improved intermodulation conversion loss. A KS-19618, L41 conversion kit is available to convert L1 and L21 units to L4 and L5 units in the field. The panels and junction boxes common to all transmitter cabinets are identified as follows: the audio and power-line filter junction box, the power supply panel, the F-zero and screen regulator panel, the exciter-driver panel, the rf power amplifier panel, the meter panel, and the local operations panel.

#### 50-Watt Transmitter Unit

**1.27** The 50-watt transmitter unit can be enclosed in either an indoor or an outdoor cabinet and can also be equipped with a high-stability oscillator. The indoor unit without the high-stability oscillator is KS-19618, L2, and the indoor unit with the high-stability oscillator is KS-19618, L22. The outdoor unit without the high-stability oscillator is KS-19618, L3, and the outdoor unit with the high-stability oscillator is KS-19618, L23. In addition, a 5- to 50-watt option, KS-19618, L40, is available which provides ac line regulation for the 50-watt transmitter when desired.

#### Test Transmitter Unit

**1.28** The test transmitter unit KS-19618, L16 (Fig. 12) is equipped with an indoor cabinet. The test transmitter unit is controlled remotely at the base station control terminal from the test transmitter control circuit located on TSTA bay No. 1 (11-foot bays) or No. 2 (9-foot bays) or locally at the local operations panel in the transmitter unit.

#### Receiver Package

**1.29** The receiver package consists of a maximum of eight receivers, one receiver per channel, housed in an indoor or an outdoor cabinet. Cabinets housing from one to eight receivers per channel, depending on the number required for adequate reception, can be located at various places in the coverage area to ensure best reception from the mobile station. Each cabinet operates from a single

antenna serving all receivers equipped in the package. The particular receiver used for reception on a channel is determined by a receiver selector circuit located in the base station control terminal. Receiver selection is determined by a dc signal with a magnitude that increases monotonically with the receiver signal-to-noise ratio. Receiver packages KS-19618, L121 through L128 have the indoor cabinet, and receiver packages KS-19618, L131 through L138 have the outdoor cabinet. In an 8-receiver package, four receivers are accessible from the front door and the remaining four are accessible from the rear door.

#### 50-Watt Transmitter-Receiver Unit

**1.30** The 50-watt transmitter-receiver unit KS-19618, L8 (without high-stability oscillator) and the 50-watt transmitter-receiver unit KS-19618, L24 (with high-stability oscillator) (Fig. 11) are mounted in an indoor cabinet. The 50-watt transmitter-receiver unit KS-19618, L9 (without high-stability oscillator) and the 50-watt transmitter-receiver unit KS-19618, L25 (with high-stability oscillator) are mounted in an outdoor cabinet. A diplexer, a test converter, a receiver, and a receiver line terminating unit can be connected into a 50-watt transmitter unit to convert it to a 50-watt transmitter-receiver unit. The 5- to 50-watt ac line regulation option KS-19618, L40 is available for the 50-watt transmitter-receiver when required.

#### Base Station Radio Equipment (MK)

**1.31** The base station radio equipment consists of one base station transmitter and from one to eight base station receivers for each channel. The receivers (Fig. 4) are spotted throughout the area to ensure the best reception from the mobile station. A combination 5- to 100-watt transmitter-receiver is available with both transmitter and receiver in the same cabinet. The transmitter-receiver combination is available for systems where one transmitter and one receiver for each channel are necessary. Table C lists sizes and weights of the equipment.

**1.32** The transmission facilities connecting the control and audio circuits from the base station control terminal to the transmitters and receivers consist of the same wire-line or carrier facilities as in the MJ system (see 1.25).

TABLE C

UNIT	CABINET				SHIPPING WEIGHT (LBS)
	HEIGHT (IN.)	WIDTH (IN.)	DEPTH (IN.)	WEIGHT (LBS)	
5- to 120-Watt Transmitter Unit KS-20285, L1	70	23-3/4	21-1/2	420	570
5- to 100-Watt Transmitter-Receiver Unit KS-20285, L2 or L3	70	23-3/4	21-1/2	420	570
Receiver Package KS-20285, L51 (One Receiver)	70	23-3/4	21-1/2	180	280
Receiver Package KS-20285, L52 (Two Receivers)	70	23-3/4	21-1/2	210	310
Receiver Package KS-20285, L53 (Three Receivers)	70	23-3/4	21-1/2	240	340
Receiver Package KS-20285, L54 (Four Receivers)	70	23-3/4	21-1/2	270	370
Receiver Package KS-20285, L55 (Five Receivers)	70	23-3/4	21-1/2	300	400
Receiver Package KS-20285, L56 (Six Receivers)	70	23-3/4	21-1/2	330	430
Receiver Package KS-20285, L57 (Seven Receivers)	70	23-3/4	21-1/2	360	460
Receiver Package KS-20285, L58 (Eight Receivers)	70	23-3/4	21-1/2	390	490

**5- to 120-Watt Transmitter Unit**

**1.33** The 5- to 120-watt transmitter unit KS-20285, L1 (Fig. 3) is enclosed in a cabinet designed for indoor use; however, a rain shield is available to convert the cabinet for outdoor use. The 5- to 120-watt transmitter cabinet consists of a meter panel, power amplifier, tripler-driver, local operations panel, harmonic filter panel, main power supply, audio line filter and junction panel, and exciter-driver. A diplexer unit (List 102) is available for installations where a common antenna is desired for use with a base transmitter and a base receiver package. This unit mounts in the transmitter cabinet. In addition, two isolator-unit add-to kits are available for use where additional loss is required between adjacent transmitter cabinets. The first isolator add-to kit (List 103) is used in transmitter cabinets where the minimum space loss between the respective antennas is less than 65 dB. The second isolator add-to kit (List 104) is used in conjunction with the List 103 isolator add-to kit where the space loss between the respective antennas is between 15 and 40 dB.

**Receiver Package**

**1.34** The receiver package consists of a maximum of eight receivers, one receiver per channel, housed in a cabinet which is designed for indoor or outdoor use. Cabinets containing from one to eight receivers per channel, depending on the number required for adequate reception, are located at various places in the coverage area to ensure the best reception from the mobile station. Each cabinet operates from a single antenna serving all receivers equipped in the package. The particular receiver used for reception on a channel is determined by a receiver selector circuit, located in the base station control terminal, which automatically selects the receiver with the best signal-to-noise ratio.

**1.35** Eight basic receiver packages are available, which consist of from one to eight receivers as indicated in Table C. Figure 4 shows a typical 2-receiver package installation.

**5- to 100-Watt Transmitter-Receiver**

**1.36** Transmitter-receiver unit KS-20285, L2 is enclosed in a cabinet designed for indoor use; however, a rain shield is available to convert the cabinet for outdoor use. The transmitter-receiver cabinet consists of a meter panel, power amplifier,

tripler-driver, local operations panel, harmonic filter panel, test converter, main power supply, audio line filter and junction panel, receive line terminating unit, receiver, diplexer, and exciter-driver. A transmitter-receiver unit KS-20285, L3 is available, which does not include a diplexer for common antenna use but is otherwise the same as the List 2.

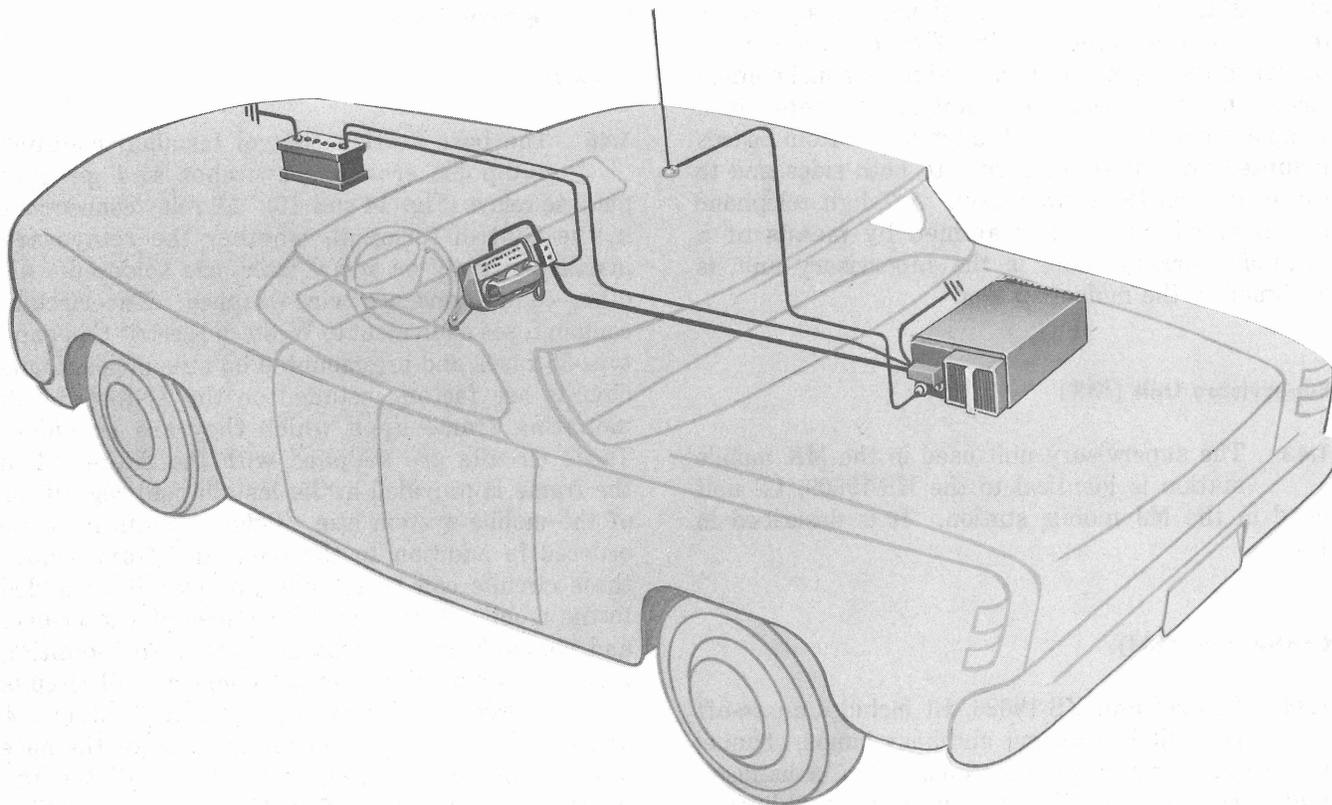
**Mobile Station Equipment (MJ and MK)**

**1.37** The mobile station equipment for both the MJ and MK systems consists of the following three main units: the radio unit, the supervisory unit, and the control unit (Fig. 13). The radio unit, containing the supervisory unit, is usually mounted in the trunk of the mobile vehicle. The control unit is situated in a location accessible to the subscriber.

**Radio Units (MJ)**

**1.38** Two radio units are available. Radio unit KS-19609, L3 is a multifrequency unit capable of operating on any of 11 crystal-controlled frequencies. The transmitter has a nominal rf power output of 20 watts. Provisions are included for varying the channel complement of both the transmitter and receiver with plug-in oscillators to include only the number of channels desired. Dummy channel elements KS-19609, L10 are used for unequipped channels. The supervisory unit described in 1.41 and the transmitter and receiver in the radio unit are housed in a heavy-gauge steel case measuring 11 inches wide, 22-1/2 inches long, and 5 inches high (Fig. 5). The power supply, except for the filtering components, is contained in a separate housing which is mounted on the front panel of the radio unit. The total combined weight is approximately 42 pounds.

**1.39** Radio unit KS-19852, L4 is a multifrequency unit capable of operating on any of 11 crystal-controlled frequencies. The transmitter has a nominal rf power output of 20 watts. Provisions are included for varying the channel complement of both the transmitter and receiver with plug-in oscillators which are mounted on the channel-hunting circuit board. The radio unit consists of a system frame on which is mounted a transmitter, a receiver, a power supply, and a front casting which contains miscellaneous circuit components. The radio unit also includes a diplexer circuit which allows the transmitter and receiver to be operated simultaneously, using the same antenna. The supervisory unit



**Fig. 13—Typical Mobile Station Installation—MJ Shown**

described in 1.42 and the channel-hunting circuit board of the radio unit are mounted in the center portion of the unit. The fully assembled radio unit measures 14 inches wide, 23 inches long, and 4 inches high (Fig. 5). The weight is approximately 45 pounds.

#### **Radio Unit (MK)**

**1.40** Radio Unit KS-20282, L1 is a multifrequency unit capable of operating on any of 12 crystal-controlled frequencies. The transmitter has a nominal rf power output of 16 watts. Provisions are made for varying the channel complement of both transmitter and receiver with a plug-in oscillator and channel elements to include only the number of channels desired. Dummy channel elements KS-20282, L8 are used for unequipped channels. The transmitter and receiver operate directly from the vehicular 12-volt supply, thus eliminating the need for a separate power supply. The transmitter and receiver are housed in a heavy-gauge steel case measuring 12 inches wide, 23 inches long, and 6 inches high (Fig. 5). The unit weighs

approximately 45 pounds. A mounting base KS-20282, L4 is available on which the radio unit can be locked in place. This unit allows easy removal of radio units from subscriber vehicles for replacement or repair purposes.

#### **Supervisory Units (MJ)**

**1.41** Supervisory unit KS-19609, L2 (Fig. 6), for radio unit KS-19609, L3, is a completely transistorized plug-in unit which contains three interconnected printed-circuit boards. The radio unit completely encloses the supervisory unit, eliminating the need for additional storage space in the vehicle. A 7-digit telephone number, which is programmed by means of a strapping arrangement in the supervisory unit, is assigned to the mobile station.

**1.42** Supervisory unit KS-19852, L2 (Fig. 6), for radio unit KS-19852, L4, is a completely transistorized plug-in unit which contains five interconnected printed-circuit boards. The radio unit completely encloses the supervisory unit,

eliminating the need for additional storage space in the mobile vehicle. The five printed-circuit boards of the supervisory unit and the channel-hunting circuit board of the radio unit are mounted in a wrap-around chassis with the top and bottom boards mounted on hinges for access to both sides and to the boards on the center level. A 7-digit telephone number, which is programmed by means of a strapping arrangement in the supervisory unit, is assigned to the mobile station.

#### Supervisory Unit (MK)

**1.43** The supervisory unit used in the MK mobile station is identical to the KS-19609, L2 unit used in the MJ mobile station. It is described in 1.41.

#### Control Unit (MJ)

**1.44** Control unit KS-19626, L1 includes an on-off keyswitch, transmit and busy lamps, channel and mode selection pushbuttons, a dial, a handset, and a ringer (Fig. 7). An auxiliary pushbutton switch is provided, which can be used for enabling an external alarm (horn or lights) in addition to the ringer on the control unit. The control unit can be mounted on the transmission tunnel or dashboard of the vehicle by means of the mounting bracket and hardware furnished and weighs approximately 5-3/4 pounds. A KS-19626, L2 auxiliary bracket is available for installation where additional mounting rigidity is required.

#### Control Unit (MK)

**1.45** Control unit KS-20283, L1 includes an on-off keyswitch, a receive level volume control, transmit and roam lamps, a mode selection slide switch (home and roam), a 2-position lamp-intensity switch (bright or dim), a dial, a handset, and a ringer (Fig. 7). An auxiliary pushbutton switch is provided, which can be used for enabling an external alarm (horn or lights). The control unit can be mounted on the transmission tunnel or dashboard of the vehicle by means of the mounting bracket and hardware furnished and weighs approximately 5 pounds. A KS-19626, L2 auxiliary bracket is available for installation where additional mounting rigidity is required.

## B. Equipment Features

### General

**1.46** The base station control terminal contains 400-point crossbar switches and general purpose relays (Fig. 14 and 15). All relay connections in the control terminal, whether the relays are installed initially or added later, are soldered. All other connections are wire-wrapped. The circuits contain fuses equivalent to Western Electric Company type-35 fuses and are mounted on stile strips. Some circuits are factory-installed on the 11-foot 6-inch mounting frame upon which they are provided. These circuits are supplied with the frame when the frame is provided in the installation, regardless of the mobile system size. Other circuits must be ordered in addition to the mounting frame, since these circuits can be initially provided in or added to the mobile system as the number of subscribers and channels in the system grows. All mounting frames contain cabling to accommodate all circuits whether ordered with the frame or separately. A test panel in the switching unit portion of the base station control terminal is used to indicate the presence and location of malfunctions when they occur (Fig. 16). Circuits which store and transfer digital information, such as the marker, sender, and register circuits, perform two-out-of-five checks to ensure proper operation of the storage and transfer circuits. Alarms are indicated in case of failures.

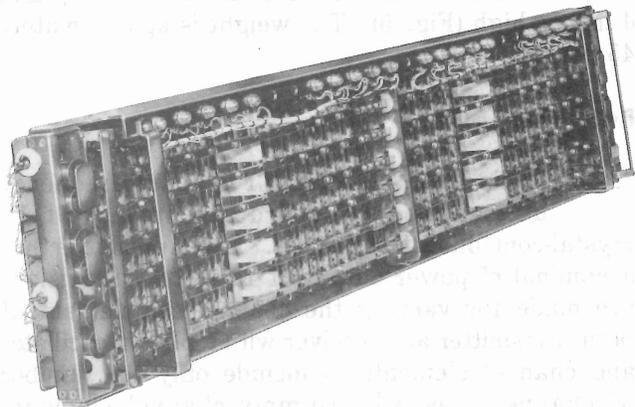
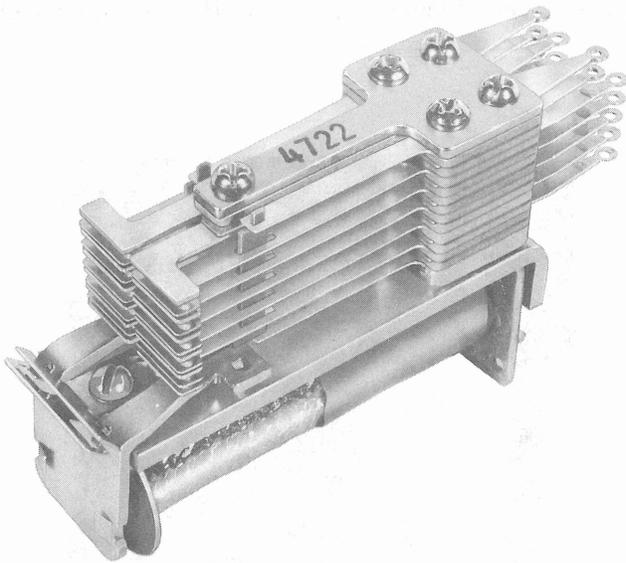


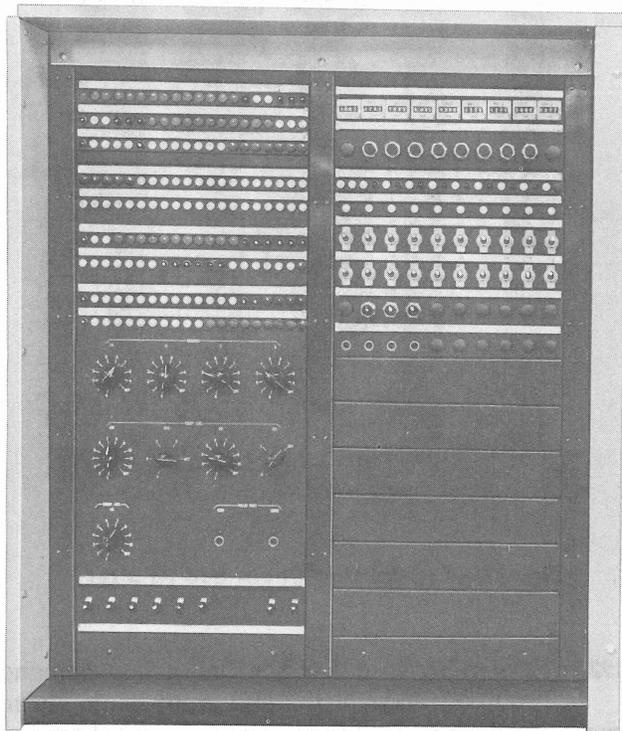
Fig. 14—Crossbar Switch

**Base Station Control Terminal Units  
Line Circuit**

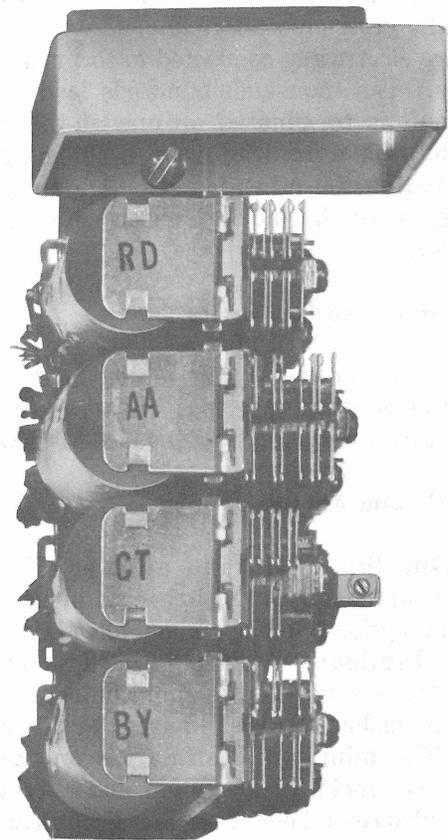


**Fig. 15—General Purpose Relay**

1.47 The line circuits (Fig. 17) are attached to standard mounting bars to be mounted on the line circuit bays. Five subscriber line circuits are provided on each bar, making it possible to equip the mobile telephone system with subscriber lines in increments of 5, up to a maximum of 480 subscriber lines. One line circuit is assigned exclusively to each subscriber line.



**Fig. 16—Switching Unit Test Panel**



**Fig. 17—Line Circuit**

1.48 The line circuit consists of four relays used to seize access to the line chain and allotter and to control all-trunks-busy tones to the calling subscriber. The line circuit facilitates supervision of the call by receiving indications that the land or mobile subscriber's handset has been replaced. Two leads from each line circuit are used to assign numerical values to the last four digits of the mobile subscriber's code number. Any number

assignment can be given to the mobile subscriber by strapping these leads to the marker and the sender circuits at the cross-connect field on the line circuit bays. One lead represents the thousands-hundreds digits, while the other lead represents the tens-units digits.

#### Line Circuit Cross-Connect Field

**1.49** The line circuit cross-connect field is located on the line circuit bays and is used to interconnect the marker and the sender with the line circuits. Line circuit number assignment is made by strapping two leads on the cross-connect field. The cross-connect field consists of terminals which are electrically connected to form two 10-by-10 matrices. The thousands-hundreds lead from each line circuit is terminated on one of the matrices, while the tens-units lead from each line circuit is terminated on the other matrix. Any number may be assigned to the mobile subscriber by providing two straps.

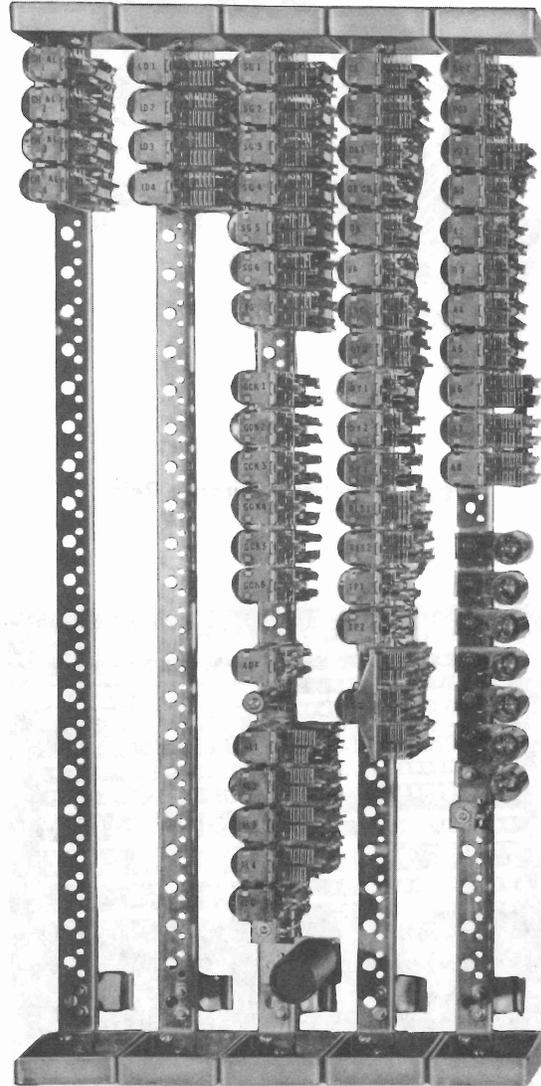
#### Telephone Answering Service

**1.50** Telephone answering service is available for the control terminal on a per-line basis. This feature is covered by SD-99385-01 (J99236G).

#### Line Chain and Allotter

**1.51** One line chain and allotter (Fig. 18) is mounted on the switch control bay, and an additional optional line chain and allotter is mounted on the duplicate switch bay. The minimum equipment for which the line chain and allotter can be furnished is that required for 80 subscriber lines. The minimum installation on the switch control bay includes six chain alarm relays used for all subscriber lines, four line group chain alarm relays used for an 80-line group, four line group demand relays used for an 80-line group, and additional relays required in the circuit. This minimum installation is mounted on four mounting bars. The chain alarm relays and the line group chain alarm relays are not required in the duplicate circuit. The minimum line chain and allotter equipment required on the duplicate switch bay is mounted on four mounting bars. For each additional 80 subscriber lines, an additional set of four line group demand relays is mounted on the existing mounting bars on the switch control bay and the duplicate switch bay, and an additional set of four line group chain alarm relays is mounted on the

existing set of mounting bars on the switch control bay.



**Fig. 18—Typical Line Chain and Allotter**

**1.52** Each relay in either the line group demand group of relays or the line group chain alarm group of relays is used for a group of 20 subscriber lines. When all 20-line groups in an 80-line group are not provided, the extra relays in the 4-relay set will be retained as spares for future additions.

**1.53** The line chain and allotter accepts demands from the line circuits and processes them one at a time, in conjunction with the marker, to

establish a talking path from the line circuit through the crossbar switch to the link circuit. It contains a line demand circuit for each 20-line group equipped and a switch group circuit for each 80 subscriber lines equipped. The 80 subscriber lines (or the number of crossbar switches required to service 80 subscriber lines) are known as a switch group. A switch group consists of one switch when the system has five channels or less and two switches when the system has more than five channels. The line demand circuits are chained to prevent seizure of more than one line demand circuit at a time when more than one of the line circuits are placing demands on the line chain and allotter. The voltage for operation of the line demand relays is rotated to assign priority continuously from one line demand circuit to another. In a like manner, the voltage for operation of the switch group relays is rotated to assign priority continuously from one switch group to another.

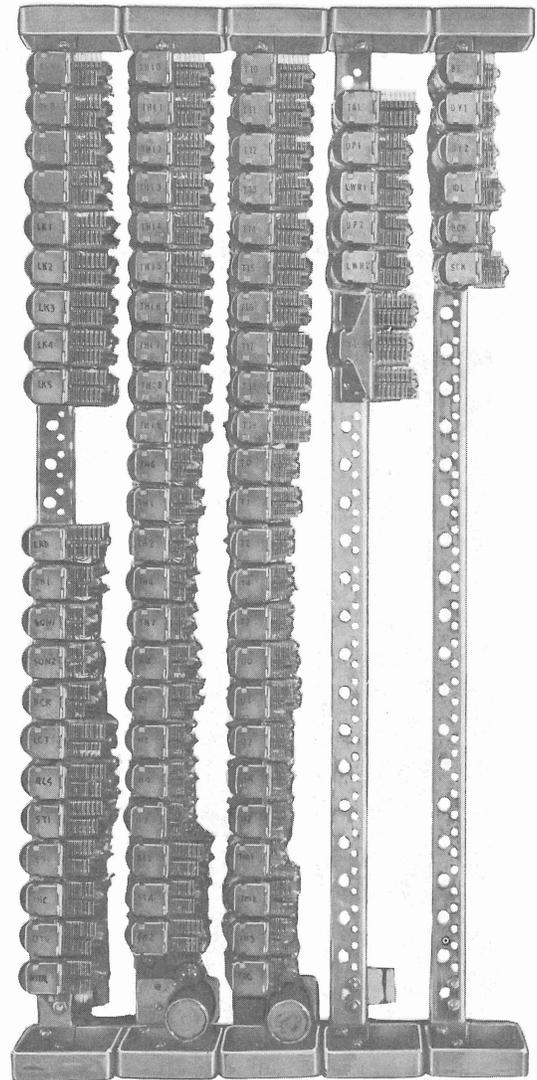
**1.54** When a particular line demand and switch group relay operates, the line chain and allotter will determine the crossbar switch group and switch section in which the line appearance of the mobile subscriber is located and will pass this information to the marker.

#### Crossbar Switches

**1.55** One crossbar switch (Fig. 14) is required for every 80 subscriber lines provided in the system when the system is provided with five channels or less. Two crossbar switches are required for every 80 subscriber lines when the system is provided with more than five channels. Twelve crossbar switches are required for the maximum 8-channel, 480-line system.

#### Marker

**1.56** The minimum marker circuit (Fig. 19) accommodates five channels and one crossbar switch. The minimum installation of the marker consists of equipment mounted on five mounting bars provided on the switch control bay. An identical circuit mounted on the same number of mounting bars is optional and is mounted on the duplicate switch bay. Three additional link relays are required if more than five channels are provided, and one additional switch relay is required for each additional crossbar switch. These relays are mounted on the existing mounting bars of the minimum marker installation.



**Fig. 19—Typical Marker**

**1.57** The marker is used in conjunction with the line chain and allotter to establish a talking path between the line circuit and the link circuit. For incoming calls, the marker receives a 4-digit number from the register, seizes the mobile subscriber line circuit, and closes the crossbar switch crosspoints. On outgoing calls, the marker converts the directory number to equipment location and prepares to close the proper crosspoint after the sender has completed the outpulsing.

#### Sender

**1.58** The sender (Fig. 20) consists of five mounting bars of equipment. The sender is provided

on the switch control bay and the initial installation of the sender services a full complement of lines and link circuits in the system. When duplicate switching is provided in a system, a second sender is supplied with the duplicate switch bay.

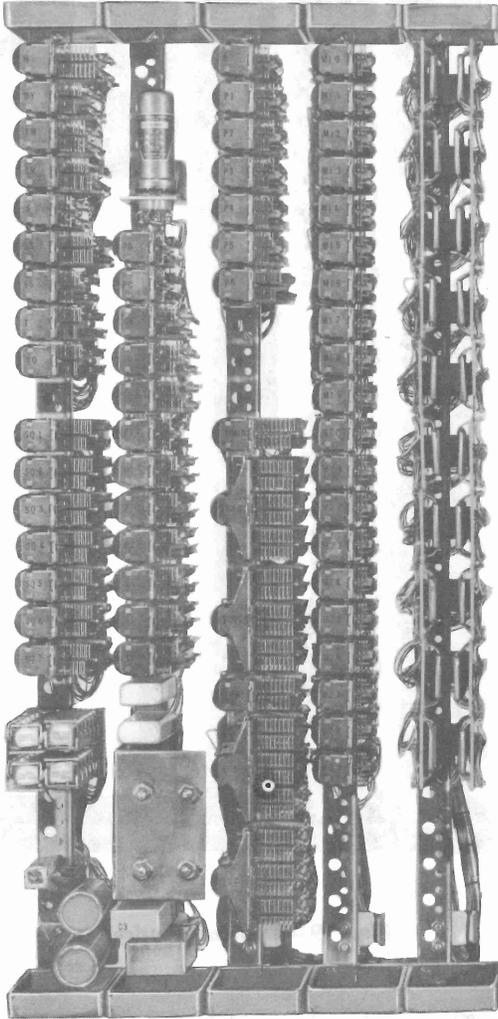


Fig. 20—Sender

**1.59** The sender is not used for incoming calls. For outgoing calls, the sender identifies the last four digits of the called mobile subscriber's code number, using the information received from the line circuit cross-connect field. The sender prefixes the 3-digit number plan area (NPA) code to the four identifying digits, giving the mobile a new 7-digit number to be outputted. The sender then outputted the 7-digit number to the link circuit

at 10 pulses per second and a 50-percent break rate. When the sender is originally installed, strapping is used to permanently identify the NPA code.

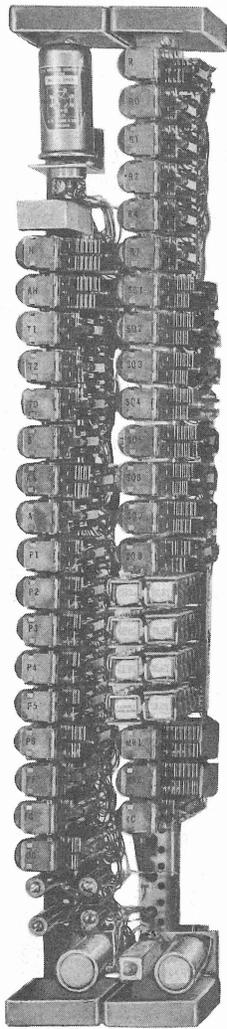
### Register

**1.60** One register (Fig. 21), located on the switch control bay and consisting of relay circuits mounted on two mounting bars, is required in the system. An additional register is mounted on the duplicate switch bay when the duplicate switching facility is required. In addition to these register circuits, two additional relays and provisions for strapping diodes between terminals are required for each register if the mobile system is to be provided with optional roaming line circuit access as discussed in the following paragraph.

**1.61** When the register is initially installed in the system, one of three circuit arrangements is chosen for use in the local area on an optional basis. The three optional circuit arrangements in the register are as follows.

- (a) One circuit arrangement permits the register to gain access to the marker for the purpose of locating the calling mobile subscriber's line circuit if the mobile station is registered in the local NPA. Mobile stations not registered in the local office are routed through the mobile service operator.
- (b) Another circuit arrangement permits mobile stations registered in certain other NPAs, up to a maximum of 12 areas, to gain access to central office restricted line circuits. Strapping arrangements in the register permit mobile station access. Roaming mobile stations in all other areas are routed through the mobile service operator. Mobile stations registered in the local area are given access to the marker for line circuit location.
- (c) The third circuit arrangement permits all roaming mobile stations to gain access to the restricted line circuits regardless of the NPA in which they are registered. The mobile station registered in the local area is given access to the marker.

**1.62** Automatic number identification (ANI) pulses from the mobile station are applied in the form of ground pulses from the link circuit via



**Fig. 21—Typical Register**

the link allotter to the register. A parity check is made after receipt of each digit in the following manner. The mobile station sends a tone during the interdigit time if the cumulative number of pulses sent previously was even in number; no tone is sent if the number of pulses sent was odd. The register compares the parity information with the information it has stored. If the two sources of information do not match, the call is routed to the mobile service operator. The register uses the pulses to identify the mobile station as a mobile station registered in the home area or roaming in the area but registered in a foreign area. The register also uses the pulses as a source of information to be supplied to the marker, making it possible to locate the line circuit of a home mobile station.

**1.63** If the register does not identify the mobile station as a local NPA mobile, a signal is sent to the link circuit, causing the call to be routed to the mobile service operator or causing a restricted line circuit to be seized. The path assigned to the call depends on the circuit option placed in the register. If the mobile is identified as a local NPA mobile station, the register stores the last four digits of the mobile subscriber's code. The information is then sent to the marker, which determines if the mobile station has a line circuit furnished in the office. If the mobile does not have a line circuit furnished, it is a roaming mobile from another NPA and is routed either to the mobile service operator or to a restricted line circuit, depending on the circuit options equipped in the register.

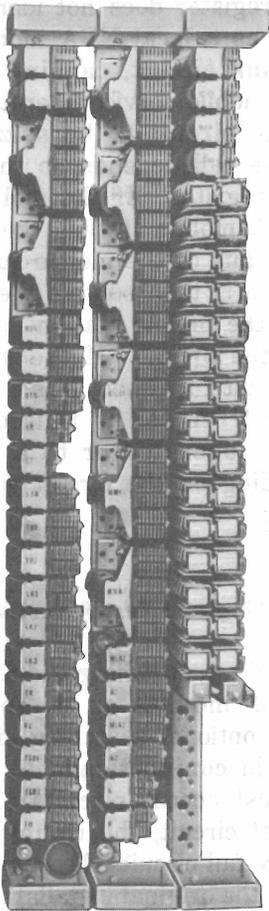
#### **Duplicate Switching and Test Access Circuit**

**1.64** The duplicate switching and test access circuit (Fig. 22) mounts on mounting bars and consists of an optional switching circuit and relay circuits used in conjunction with the test panel (1.75). The test access circuits are the monitor circuit, the test circuit, the trouble record circuit, and the battery fail circuit. The test access circuits are installed in the original installation of the control terminal.

**1.65** The function of the switching circuit is to switch the common control equipment consisting of the line chain and allotter, the marker, the sender, and the register, so that the set of common control equipment located on the switch control bay will be alternately used with the set of common control equipment located on the duplicate switch bay. To complete one call, the common control equipment on the switch control bay is used, after which the switching circuit causes the common control equipment located on the duplicate switch bay to be used in the completion of the next call.

**1.66** The monitor circuit connects to and monitors the line chain and allotter, the marker, the sender, and the register circuits, and permits a call-progress lamp display on the test panel of the monitored circuit. The selection of circuits for monitoring is made at the test panel.

**1.67** The test circuit is used in conjunction with the controls and indicators on the test panel. A description of the test circuit capabilities is given in 1.76.



**Fig. 22—Duplicate Switching and Test Access Circuit—Only Test Access Portion Shown**

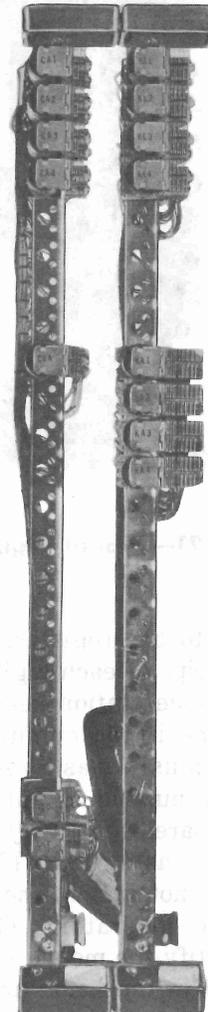
**1.68** The trouble record circuit permits a register, a sender, a line chain and allotter, or a marker circuit which has encountered trouble to operate its trouble meter. The circuit also locks in the display of the trouble call-progress lamp associated with the circuit in which the trouble is contained. If a circuit encounters trouble on a test call, the trouble record circuit performs the same as for a service call except that the circuit's trouble meter does not operate.

**1.69** When duplicate line chain and allotter, marker, sender, and register circuits are provided, the battery fail circuit diverts all calls to the duplicate circuit when a circuit fuse is blown and causes a minor alarm to be indicated. The battery fail circuit indicates a major alarm when duplicate common control circuits are not provided and a fuse is blown, or when duplicate common

control circuits are provided and a fuse is blown in two identical circuits.

#### Link Allotter

**1.70** The link allotter (Fig. 23) is furnished for a minimum of two link circuits. This circuit is mounted on two mounting bars and provided on the switch control bay. If the control terminal contains a duplicate switch bay, additional link allotter equipment must be provided with the first link allotter installation. Additional link allotter equipment is added to accommodate link circuits in multiples of two. Link allotter circuits added for unfurnished link circuits are maintained in the office as spare circuits for future growth.



**Fig. 23—Typical Link Allotter**

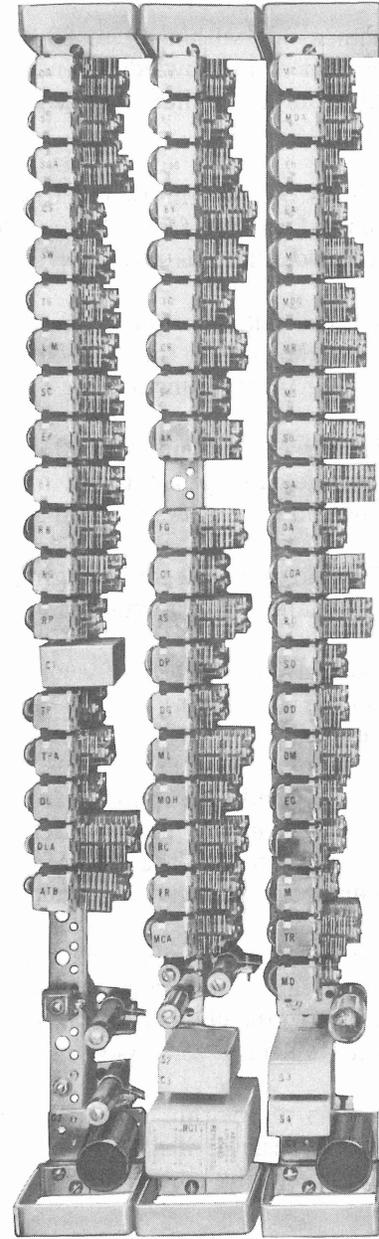
**1.71** The link allotter circuit is basically a connector circuit connecting the line switch unit with a given link circuit. When a call is incoming, the link allotter applies input information to the register and the line chain and allotter circuits. If the link allotter is provided to service duplicate switching, as previously described, input information for an incoming call is applied to the opposite register when one register is processing a call. When a call is outgoing, the link allotter channels information from the line chain and allotter and the sender to the seized link circuit.

### Link Circuit

**1.72** One link circuit (Fig. 24) consisting of three mounting bars is provided in the control terminal for each channel and is mounted on transmission signaling and test access (TSTA) bays. The link circuit for channel 1 differs from the rest in that it contains an all-trunks-busy relay used for returning an all-trunks-busy tone to the calling subscriber when all channels in the system are in use.

**1.73** The link circuit supervises the process of completing a call on the assigned channel. The link circuit controls the tones generated and transmitted to the mobile stations. It receives ground pulses resulting from tones received from the mobile station and uses them to initiate supervisory procedures for completing the call. After the line chain and allotter and the marker have established a talking path for a given call, the link circuit maintains the talking path or releases it, as required, and sends repetitive ringing to the mobile station in the case of an outgoing call. Talking path from the crossbar switch to the transmission equipment is routed through the link circuit. After a call is complete, the link circuit removes the talking path, restoring the channel to normal. To eliminate the manual mode of operation, the link circuits used in control terminals for MK systems must be wired differently from link circuits used in control terminals for MJ systems. An MK modification kit KS-19457, L80 is available to convert in the field each link circuit from MJ system operation to MK system operation.

**1.74** When a call is from a manual station (MJ only), the link circuit routes the call to the mobile service operator. In addition, the link circuit



**Fig. 24—Link Circuit**

performs certain timing functions common to both MJ and MK systems, as follows:

- (a) When a call is outgoing to a roaming MJ or MK mobile station or to a mobile station registered in the home area, the link circuit performs the following timing functions:
  - (1) Times out within 3 seconds if the acknowledgement tone from the called mobile station is not received.

- (2) Times out within 40 to 80 seconds after receipt of acknowledgement if the answer signal from the called mobile station is not received.
- (3) Times out within 15 to 30 seconds after loss of carrier from the mobile station if a disconnect signal is not received.
- (b) When the call is outgoing to a manual mobile station (MJ only), the link circuit performs the following timing functions:
- (1) Measures a 660-millisecond period between the clearing pulse to all manual mobile stations and the start-dial signal to the operator.
  - (2) Measures a 4-second ringing interval to the manual mobile station.
  - (3) Measures a 250-millisecond interval in which a clearing signal is sent to the mobile station.
- (c) When the call is incoming from a roaming MJ or MK mobile station or from a mobile station registered in the home area, the link circuit performs the following timing functions:
- (1) Measures a 300-millisecond interval between removal of idle tone and application of seize tone to the channel, allowing other mobile stations to search for a new channel.
  - (2) Times out within 15 to 30 seconds after loss of carrier if a disconnect pulse is not received from the mobile station.
  - (3) Routes a call to the mobile service operator within 10 to 20 seconds if the land party disconnects but the mobile subscriber does not.

#### Switching Unit Test Panel

**1.75** The test panel (Fig. 16) is used in conjunction with the duplicate switching and test access circuit (1.64). The test panel is provided with busy keys, test keys, a sender pulse ratio test jack, a register input jack, test switches, battery-fail and off-normal lamps, circuit-progress and alarm lamps, and trouble-recording meters.

**1.76** Tests performed by the test panel in conjunction with the test circuit portion of

the duplicate switching and test access circuit (1.67) consist of three different tests: a cross-connection verification test, which simulates an incoming call to verify a line circuit equipment location; an incoming test, which simulates an incoming call to check operational functions of a marker and a line chain; and an outgoing loop-around test, which simulates a call to check the sender's line identification and transmission circuits, the register's ability to receive, store properly, and seize a marker, and the marker's ability to receive the digital information and seize the proper line circuit.

#### Common Pulse Circuit

**1.77** The system is originally provided with one common pulse circuit mounted on one relay bar, which is provided on the switch control bay. The common pulse circuit services the maximum number of lines and channels with which the system is furnished. The circuit provides ground pulses of 1-second duration at 10-, 15-, 30-, and 40-second and 1- and 6-minute intervals. These ground pulses are supplied to circuits in the system to maintain proper supervision.

#### Base Station Control Terminal Transmission Equipment

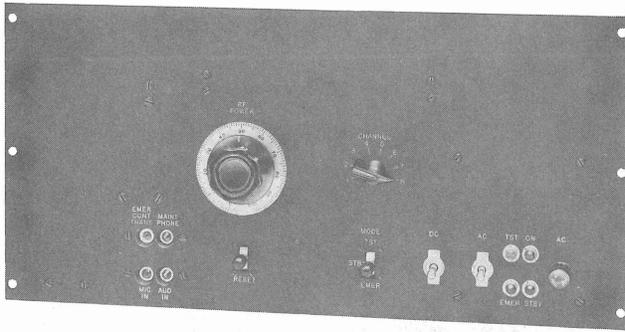
##### Test Transmitter Control Circuit (MJ only)

**1.78** The test transmitter control circuit (Fig. 25) is mounted on TSTA bay No. 1 for 11-foot 6-inch bays and on TSTA bay No. 2 for 9-foot bays. The function of the circuit is to furnish remote control of the test transmitter for test purposes or to allow the test transmitter to be substituted for a regular base station transmitter in an emergency. Emergency operation is used when a base station transmitter fails in operation. Patch cords are used to make the necessary circuit changes. When test operation is used, it is possible to vary the transmitter output power over approximately a 90-dB range (0.1 microwatt to 50 watts), to key the transmitter on, and to set the output frequency of the transmitter to any one of eight preset channels.

##### Mobile Simulator (MK Only)

**1.79** A mobile simulator for use in the MK system may be constructed, which provides the following:

- (a) Routine performance checks on the MK control terminal and associated central office equipment



**Fig. 25—Test Transmitter Control Circuit**

- (b) Qualitative checks on base station transmitter output power
- (c) Qualitative checks on base station receiver sensitivity
- (d) Simulation of customer's mobile station equipment as an aid to analyzing a mobile trouble complaint
- (e) Test fixture to facilitate overall performance checks.

The simulator consists of a control panel (Fig. 26) used in conjunction with MK mobile radio unit KS-20282, L1. The radio unit is used as a combined test transmitter and mobile simulator. The control panel is constructed locally by the operating companies and should be located as close to the control terminal equipment as possible. A standard MJ control head is mounted on the control panel and both MK and MJ systems can be tested from this panel. Equipment and schematic drawing numbers for the MK simulator are listed in Part 2 (Supplementary Information) of this section.

#### **Transmission Signaling and Test Access Common Equipment (MJ and MK)**

**1.80** The TSTA common equipment consists of an alarm circuit, a transmitter switching circuit, a channel selector circuit, and a base station identifier control circuit. The equipment is ordered as a group and is ordered to accommodate a minimum of two channels. Common equipment which accommodates a maximum of eight channels is mounted on six mounting bars.

**1.81 *Transmitter Switching Circuit:*** The transmitter switching circuit (Fig. 27) is controlled by the link circuit and performs the functions of turning the transmitter on full power or low power and accepting a transmitter-on indication from the transmitter. The transmitters can also be controlled manually by keys on the channel jack and key field.

**1.82 *Channel Selector Circuit:*** The channel selector circuit (Fig. 28) consists of two duplicate circuits, chain allotter A and chain allotter B. Each allotter consists of a train of relays which operate independently to select the marked-idle channel. Allotters A and B function in such a manner as to minimize the chance of a given channel's being marked idle for more than 6 minutes at any one time.

**1.83 *Alarm Circuit:*** The alarm circuit (Fig. 29) consists of six relays used for all channels and two additional relays for each channel equipped. The six relays common to all channels are used to apply battery or ground potential to aisle pilot lamps, office alarms, or a manual board as required. Major and minor fuse and equipment alarms and a battery fail alarm are given. An alarm cutoff relay is used when a local audible alarm, controlled by the fuse and equipment alarm relays, is equipped. The two relays provided for each channel are used to cause an alarm when failures of the tone generator and the receiver selector circuit for the channel occur.

**1.84 *Base Station Identifier Control Circuit:*** This circuit (Fig. 30) is used to send identification required by the Federal Communications Commission over each channel provided in the system. Identification is outpulsed in each channel once every 30 minutes, provided the channels are not seized for a call between subscribers. In the event that a channel is seized prior to identification, the identification takes place after the call is complete. In an 8-channel system, identification on channels is attempted sequentially at intervals of approximately 3-3/4 minutes.

**1.85** Identification of the base station on each channel is accomplished by the use of a single-frequency 1800-Hz tone generated by the tone generator. A motor-driven cam, which is rotated at an approximate rate of 1 revolution every 7 to 8 seconds and notched to a prescribed code, sends coded ground pulses to the link circuit in

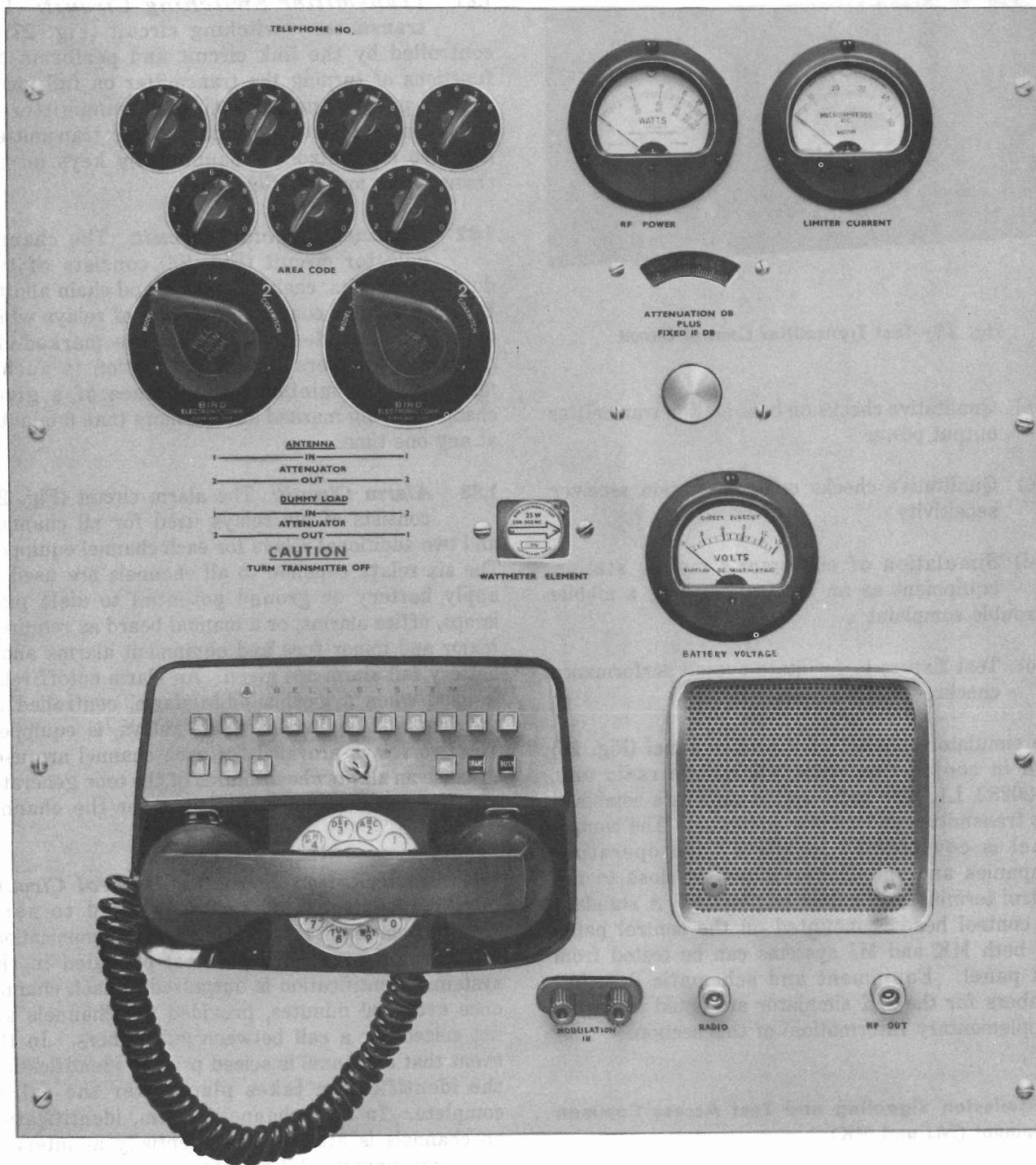
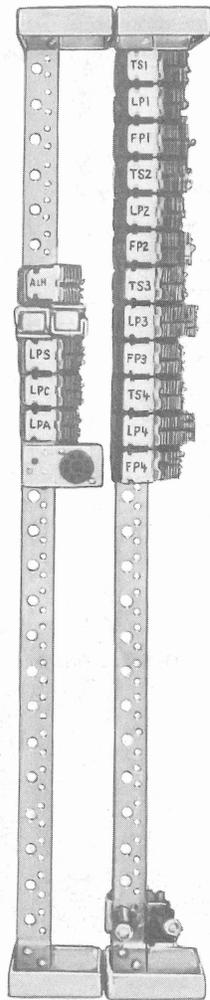


Fig. 26—MK Mobile Simulator

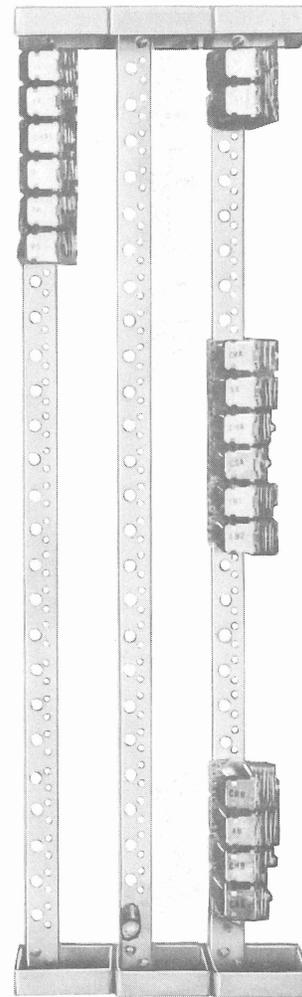


**Fig. 27—Typical Transmitter Switching Circuit**

international Morse code. The link circuit gates the tone generator on and off, according to the code. A second motor-driven shaft, containing one cam for each channel provided, rotates once every 30 minutes and determines when identification will be attempted on each particular channel. The base station identifier control contains alarm circuits which indicate power and identification failures.

**Transmission Signaling and Test Access Channel Shelf Equipment (MJ and MK)**

**1.86** The TSTA channel shelf equipment (Fig. 31) consists of a hybrid circuit, a tone generator circuit, a voice operated gain-adjusting device (VOGAD) circuit, receive and transmit line terminating units, a receiver selector circuit, a bandpass filter,



**Fig. 28—Typical Channel Selector**

a sound operated noise attenuating device (SONAD), and a tone detector circuit. The equipment, which is mounted on a shelf, is ordered as a group with the exception of a transmit line terminating unit and additional receive line terminating units. The line terminating units are ordered as required.

**1.87 Tone Generator:** The tone generator consists of four oscillator circuits mounted on one printed-circuit card. An 1800-Hz seize tone and a 2000-Hz idle tone are used for the automatic mode of outward signaling; 600-Hz and 1500-Hz tones are used in the manual mode of outward signaling. Potentiometers are furnished for controlling output levels. In the event of an oscillator failure, an alarm is generated.

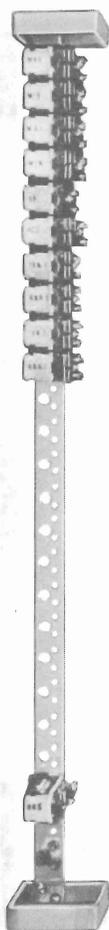


Fig. 29—Alarm Circuit

**1.88 VOGAD:** The VOGAD circuit is contained on two printed-circuit cards. The VOGAD is a gain-adjusting device that provides a constant output for wide variations of input speech signal level. Provisions are included for minimizing the compression of speech signals and effectively preventing noise from affecting the gain increase circuit of the VOGAD. The five circuits comprising the VOGAD are on a main amplifier card and a control circuit card. A plug-in pad is used at the output of the VOGAD for adjustment of the transmit circuit level. All controls and test points are accessible at the front of the main amplifier and control circuit cards.

**1.89 Transmit Line Terminating Unit:** The transmit line terminating unit is mounted on one printed-circuit card. One transmit line terminating unit is required for each transmitter

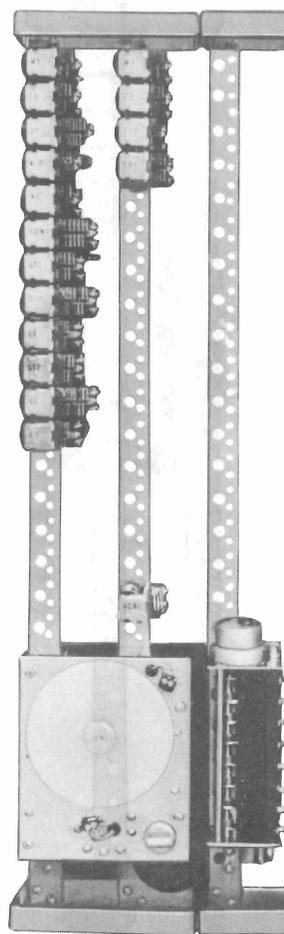


Fig. 30—Typical Base Station Identifier Control Circuit

used in the base station. The transmit line terminating unit matches the 600-ohm transmit leg to the cable pair and connects the dc transmitter control signals to the line. Provision for receiving an rf on-the-air signal from the transmitter is included. The transmit line terminating unit includes provision for line-building-out resistors for a 3500-ohm line loop and protection against lightning or power surges on the line. On an optional basis, a different transmit line terminating unit (two printed-circuit cards) can be provided for controlling two MJ transmitters on a single channel. This option is not available for the MK transmitters.

**1.90 Receive Line Terminating Unit:** The receive line terminating unit is mounted on one printed-circuit card. One receive line terminating unit is required for each receiver used in the base station. The receive line terminating unit matches

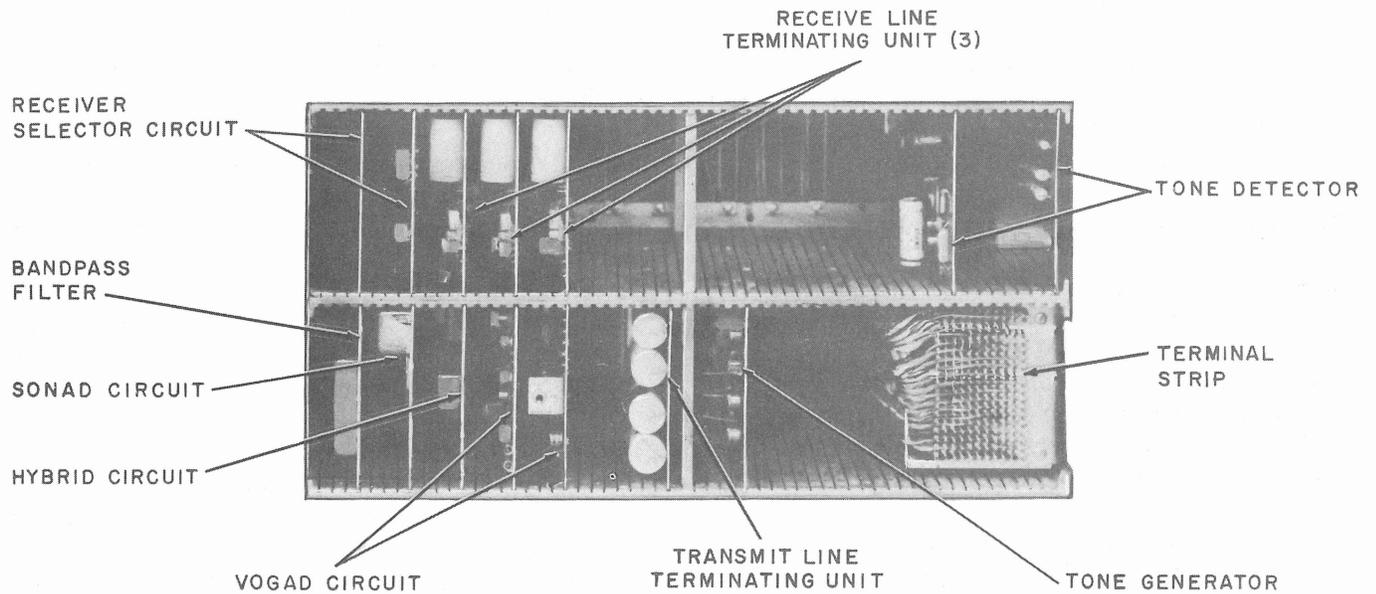


Fig. 31—Channel Shelf

one remote receiver cable pair to the 600-ohm channel shelf unit, provides amplification, indicates if the receiver is in use, and gives an alarm when the receiver fails. It also includes line protection and a dc current-to-voltage converter for the receiver selector unit. A dc current which is proportional to the signal-to-noise ratio of the receiver is received by the receive line terminating unit over the receiver connecting facilities. A means of manually rejecting a receiver is also included.

**1.91 Receiver Selector Circuit:** The receiver selector circuit consists of a threshold control and a zener-regulated power supply mounted on two printed-circuit cards. The threshold control, as determined by potentiometer adjustments, establishes the signal level (signal-to-noise ratio based upon a dc signal from the receive line terminating unit) at which receiver selection is accomplished and the signal level below which no receiver will remain selected. The receiver selector circuit continuously scans and selects the best receiver at any given moment. This selection also takes place during conversation. The zener-regulated power supply card also contains a relay to freeze the selection process during mobile identification and dialing.

**Note:** When one receiver per channel is employed, the receiver selector functions to establish the accept and reject thresholds only.

**1.92 SONAD:** The SONAD circuit is contained on one printed-circuit card. The SONAD circuit suppresses noise during silent intervals of transmission from the mobile station to the central office subscriber by inserting 20 dB of loss. It has a variable threshold which is operated from the selected receiver dc signal.

**1.93 Tone Detector:** The tone detector consists of two printed-circuit cards. Four circuits in the tone detector are tuned to detect four incoming signals from the mobile station via the receiver selector circuit. The four circuits function to detect a 1633-Hz connect tone, a disconnect tone composed of alternate pulses of 1336 Hz and 2150 Hz at approximately a 20-pulse-per-second rate, a 2150-Hz guard tone (also used as acknowledgement), and dial pulsing consisting of 1633-Hz pulses with a guard tone of 2150 Hz. The tone detector changes the incoming tone pulses to ground pulses and applies them to the link circuit to be used for acknowledgement, connect, disconnect, ANI, and dialing.

**Base Station Radio Equipment (MJ)**

**1.94** The MJ transmitters and receivers are linked to the base station control terminal and controlled as described in 1.25. Receiver selection for each channel is described in 1.29.

**250-Watt Transmitter Unit (MJ)**

**1.95** One base station 250-watt transmitter unit operating in the 150-MHz band is normally used for each channel provided in the system (Fig. 2). Power output of the transmitter, measured at the transmission line leading to the antenna, is 250 watts on high-power operation and less than 0.5 watt on low-power (F-zero) operation.

**1.96** The exciter-driver operating into the 250-watt rf power amplifier supplies the required channel frequency. An audio and power-line filter and a power supply are used in the cabinet in support of transmitter operation. Also in the cabinet are the meter panel and the local operations panel which contain the meters, controls, and circuits required to control and monitor transmitter operation. Low-power operation of the transmitter and regulation of the power amplifier screen voltage is accomplished by the F-zero and screen regulator panel. In remote standby operation, only the POWER lamp is lighted. In local standby operation, both the LOCAL and POWER lamps are lighted. A directional coupler circuit is furnished to permit direct reading of both power output and voltage standing-wave ratio.

**1.97** When a high-stability oscillator panel is not used in the transmitter, the exciter-driver contains a temperature-compensating, crystal-controlled oscillator (in the form of a channel element) and the necessary amplifier and multiplier stages required to drive the rf power amplifier. A modulator circuit contained in the exciter-driver modulates the channel carrier with audio signals received from the local operations panel. An optional high-stability oscillator panel can be used to provide the transmitter with an output frequency signal of excellent long-term stability. The high degree of accuracy and stability is achieved by the use of a precision quartz crystal which is maintained with a temperature stability of a few hundredths of a degree centigrade by a precision oven. The output of the high-stability oscillator replaces the output of the temperature-compensating, crystal-controlled oscillator in the exciter-driver.

The output is amplified and multiplied by the exciter-driver, resulting in the transmitter carrier frequency, and is then applied to the rf power amplifier.

**1.98** Low-power operation of the power amplifier is accomplished by the F-zero and screen regulator panel, which lowers the plate voltage and screen grid voltage in order to decrease the power output of the amplifier to 0.5 watt. The panel also furnishes 24 volts dc for operation of all relays in the cabinet and regulates the voltage applied to the power amplifier screen grid.

**1.99** Three meters on the meter panel are used to monitor power amplifier output power, plate current, and plate voltage. A fourth meter is used to measure the power amplifier control grid voltage and five different circuit values of the exciter-driver. The indication on this meter is determined by the METER switch on the local operations panel in conjunction with switches located on the chassis containing the circuits monitored with the meter.

**1.100** In addition to the METER switch, the local operations panel contains a CONTROL switch, which is used to place the transmitter in the local or the remote mode of operation (1.174). The LOCAL switch on the local operations panel is used when the CONTROL switch is set to LOCAL. The STANDBY position of the CONTROL switch leaves the transmitter in an unkeyed, standby condition; the TRANSMIT position keys the transmitter for full-power operation and lights the TRANSMIT lamp; and the F-ZERO position keys the transmitter for low-power operation and lights the F-ZERO and TRANSMIT lamps. The lamps are located on the transmitter cabinet. A MICROPHONE jack and a MICROPHONE LEVEL control for local modulation of the carrier, a MAINTENANCE PHONE jack for communications between base station radio sites, and jacks for local monitoring of the audio circuit are furnished on the local operations panel. In addition, the local operations panel chassis contains the transmit line terminating circuit and an rf on-the-air circuit. The transmit line terminating circuit is used for interface between the incoming wire-line or carrier facilities and the base station 250-watt transmitter. The rf on-the-air circuit is used to return an indication to the control terminal transmission equipment that radio transmissions are in progress.

**50-Watt Transmitter Unit (MJ)**

**1.101** The 50-watt transmitter unit operates in the 150-MHz band and consists of a local operations panel, an exciter-driver panel, an F-zero panel, a power supply panel, an rf power amplifier panel, a meter panel, a screen regulator panel, an optional high-stability oscillator panel, and an audio and power-line filter junction box.

**1.102** The transmitter panels perform the same function as the 250-watt transmitter described in 1.95 through 1.98. Like the 250-watt transmitter, the 50-watt transmitter has a directional coupler circuit. A 5- to 50-watt option is available which allows for regulation of the output power. The option allows the transmitter output power to be varied by controlling the regulated screen grid voltage applied to the power amplifier.

**1.103** The F-zero panel decreases the transmitter from high-power to low-power operation by lowering only the power amplifier screen grid voltage. The METER switch on the local operations panel has an additional position to monitor receiver circuits when a receiver is equipped in the cabinet to form the 50-watt transmitter-receiver unit (refer to 1.115).

**1.104** Two meters on the meter panel are used to monitor power amplifier output power and plate current or plate voltage. A third meter may be switched to metering points in the power amplifier, exciter-driver, or receiver. The indication on this meter is determined by the METER switch on the local operations panel in conjunction with switches located on the chassis containing the circuits monitored with the meter. The R.F. TEST jack, furnished on the meter panel, is used for measuring frequency and deviation. The level at the test jack is fixed. An adjustable attenuator (Dumont type 21-1CBA) can be connected to provide lower levels as required. (Refer to Section 104-201-000.)

**1.105** The meter panel installed in the outdoor cabinet contains, in addition to the jack and three meters, four indicating lamps. The POWER lamp indicates that voltage is applied to all parts of the cabinet. Local operation of the transmitter is indicated by the LOCAL lamp. Transmitter keying is indicated by the TRANSMIT lamp and transmitter low-power operation is indicated

by the F-ZERO lamp. The lamp locations for the indoor transmitter are on the cabinet.

**Test Transmitter Unit (MJ)**

**1.106** Like the 50-watt transmitter cabinet (1.101), the test transmitter cabinet contains an exciter-driver panel, an rf power amplifier panel, a power supply panel, an audio and power-line filter junction box, a meter panel, a local operations panel, a directional coupler, and an F-zero panel. The directional coupler circuit is furnished to permit direct reading of both power output and voltage standing-wave ratio. In addition, an ac regulator panel, a test transmitter line terminating unit panel, and a multiple oscillator selector panel are used. The 50-watt test transmitter unit (Fig. 12) used for test and line-up of the remote receivers can be pretuned to operate on any one of eight different frequencies. Power output can be varied from 0.1 microwatt to 50 watts. Both frequency selection and power adjustment can be accomplished locally at the test transmitter cabinet or remotely at the base station transmission equipment.

**1.107** The multiple oscillator selector panel is used for selecting, either locally or remotely, the channel element corresponding to the frequency of the channel on which the test transmitter is to be operated. Local, remote, and emergency modes of operation for the test transmitter are described in 1.177 through 1.184. The LOCAL FREQUENCY SELECTION switch is supplied on the multiple oscillator selector panel for use in the local mode of operation to select the desired channel frequency. A FREQUENCY CONTROL switch is supplied to select normal operation of the test transmitter by local or remote control or to select emergency operation of the test transmitter. Emergency operation of the test transmitter can be used when a channel base station transmitter fails, providing the test transmitter is retuned. High-power or low-power (F-zero) operation can be used in the emergency mode of operation. The low-power output is 0.5 watt.

**1.108** The test transmitter line terminating unit is used to terminate wire-line or carrier facilities from the base station transmission equipment to make remote control possible. The LOCAL POWER ADJUST switch on the line terminating unit is used for local control of the transmitter output power. A TEST TRANS/EMERGENCY switch is furnished on the line terminating unit to

allow normal operation (remote or local) or emergency operation of the test transmitter. Realignment is required to switch from test transmitter to emergency operation.

**1.109** In addition to the wire-line or carrier facilities terminated at the test transmitter line terminating unit for remote control, the test transmitter unit also has the wire-line or carrier facilities terminated at the transmitter line terminating circuit. The transmitter line terminating circuit is contained on the local operations panel chassis, as in the 250-watt and 50-watt transmitter units. The local operations panel is the same as that described for the 250-watt transmitter (1.100). The ac regulator panel contained in the test transmitter unit furnishes a regulated input line voltage to all circuits in the cabinet. The meter panel contains three meters for measurement of power amplifier plate current and voltage, power amplifier control grid voltage, exciter-driver circuit values, and power output of the power amplifier. Four lamps to indicate power on, low-power operation, transmitter keying, and local operation are located on the cabinet.

#### **Receiver Package (MJ)**

**1.110** Depending upon the number of receivers installed in the receiver package, each base station receiver package can receive up to eight frequencies simultaneously in the 150-MHz band. One receiver is used for each channel. A multicoupler permits from two to four receivers to be connected to one antenna. When five to eight receivers are required, one antenna can be used if two multicouplers and an rf power splitter are employed. In addition to the receivers, the multicouplers, and the rf power splitter, the cabinet contains a receiver meter panel and an audio and power-line junction box. One receiver line terminating unit is also equipped for each receiver.

**1.111** The meter panel consists of a meter, a meter polarity switch, a 5-position receiver selector switch, and a handset jack. Measurements required for alignment and maintenance of the selected receiver can be made using this meter panel. The RECEIVER SELECTOR switch is used to select the receiver to be tested. The METER switch on the receiver is then used to select the desired test point to be monitored. A METER POLARITY switch is furnished to measure the discriminator output. The MAINTENANCE PHONE

jack is furnished for intercommunications between the base station radio sites. One meter panel is required for four receivers or less. For more than four receivers, two meter panels are required.

**1.112** The multicoupler consists of an impedance-matching device and crystal filters corresponding to the number of receivers in the system. Each filter is tuned to the frequency of its associated receiver.

**1.113** The receiver contains, in addition to the METER switch, an audio LINE LEVEL control and a SQUELCH control located on the front panel. The channel frequency on which the receiver will operate is determined by the frequency of the channel element contained in each receiver. This frequency is multiplied and mixed with the incoming frequency to produce the constant first intermediate frequency of 8 MHz.

**1.114** The receiver line terminating unit matches impedance between wire-line or carrier facilities and the receiver output circuit. It also furnishes a dc voltage proportional to the signal-to-noise ratio of the receiver. This dc voltage and audio signals are sent over the wire-line or carrier facilities to the base station transmission equipment by the line terminating unit. Each line terminating unit consists of a power supply, a signal-to-noise ratio voltage circuit, and a line matching transformer. Taps on the transformer permit matching of the line impedance. The RCVR LISTEN jack on the front panel enables the audio signals received at the receiver to be monitored. Break jacks, RCVR OUT and LINE OUT, are also provided to permit isolation of line and receiver.

#### **50-Watt Transmitter-Receiver Unit (MJ)**

**1.115** The 50-watt transmitter-receiver cabinet (Fig. 11) houses a receiver tuned to 5.26 MHz above the operating frequency of the 50-watt transmitter, which operates in the 150-MHz band. Duplex operation is employed in the unit, making simultaneous operation of the transmitter and receiver possible with the use of a single antenna. The transmitter portion of the unit is the same as the 50-watt transmitter (including available options) described in 1.101 through 1.105. The 50-watt transmitter-receiver unit is formed by physically connecting a diplexer, a test converter, a receiver, and a receiver line terminating unit to connectors reserved in the 50-watt transmitter cabinet for

this purpose. The receiver and the receiver line terminating unit are identical to those housed in the receiver package cabinet described in 1.110 through 1.114. The audio and power-line filter jack box and the meter panel contained in the 50-watt transmitter cabinet are used with the receiver when the unit is converted to a 50-watt transmitter-receiver unit as previously described.

**1.116** The test converter is used to test the receiver housed in the 50-watt transmitter-receiver unit when a test transmitter is not provided in the mobile system. It contains an oscillator and mixer circuit used to convert the transmitter output frequency to the receiver frequency. This frequency is channeled to the receiver input for test purposes. The test converter may be turned on remotely by the base station transmission equipment (1.210) or locally by use of a switch on the test converter panel.

**1.117** The diplexer enables a common antenna to be used simultaneously by both the transmitter and receiver, provided the transmitter frequency is 5.26 MHz below the receiver frequency. Each diplexer is tuned at the factory according to the frequencies specified by the customer. A diplexer factory-tuned on a common-carrier transmitting frequency within the 152.51- to 152.81-MHz range may be operated on any transmitting frequency in this range without retuning.

#### **Base Station Radio Equipment (MK)**

**1.118** The MK transmitters and receivers are linked to the base station control terminal and controlled as described in 1.32. Receiver selection for each channel is described in 1.34.

#### **5- to 120-Watt Transmitter Unit (MK)**

**1.119** One base station 5- to 120-watt transmitter unit operating in the 450-MHz band is normally used for each channel provided in the system (Fig. 3). Power output of the transmitter, measured at the transmission line leading to the antenna, is 100 watts on high-power operation and 0.5 watt on low-power (F-zero) operation.

**1.120** The 5- to 120-watt transmitter employs an exciter-driver, a tripler-driver, and a power amplifier stage to process a carrier signal. A temperature-compensating, crystal-controlled oscillator (channel element) in the exciter-driver stage furnishes

the fundamental transmitter frequency. The output signal (150 to 170 MHz) from the exciter-driver is coupled to the tripler-driver, where it is tripled in frequency, and its output operating into the 100-watt rf power amplifier supplies the required channel frequency. A power and audio line filter, an exciter-driver power supply, and a main power supply are used in the cabinet in support of transmitter operation. The cabinet also contains a meter panel and a local operations panel on which are mounted the meters, controls, and circuits required to control and monitor transmitter operation. Low-power operation of the transmitter is accomplished by the F-zero circuit, which regulates the screen voltages to the tripler-driver and power amplifier. In remote standby operation, only the POWER lamp is lighted. In local operation, both the POWER and LOCAL lamps are lighted. A directional coupler is furnished to permit direct reading of both power output and voltage standing-wave ratio.

**1.121** A meter panel equipped with three meters is provided for checking and aligning the base station transmitter. The POWER OUTPUT meter indicates the rf output (measured in watts) of the station. The EXCITER-TRIPLER-DRIVER-PA-GRID meter indicates exciter-driver or tripler-driver voltages and currents, and voltage on the control grid of the power amplifier, as selected by the METER switch on the local operations panel. Switches on the exciter-driver and tripler-driver chassis, used in conjunction with the METER switch, determine circuit points to be monitored by the meter. The PLATE meter and an associated switch on the power amplifier chassis are used to measure the plate voltage or current of the power amplifier tube.

**1.122** The local operations panel contains a CONTROL switch and a LOCAL switch in addition to the METER switch. The transmitter is placed in the local or remote mode of operation (refer to 1.185) by the use of the CONTROL switch. The LOCAL switch is used when the CONTROL switch is set to the LOCAL position. The LOCAL switch has three positions: STANDBY, TRANSMIT, and F-ZERO. The STANDBY position of the switch places the transmitter in an unkeyed, ready condition. Placing the LOCAL switch in the TRANSMIT position lights the TRANSMIT lamp, and the transmitter can then be operated at its full-rated rf output power. The F-ZERO position of the switch keys the transmitter for low-power operation and lights the F-ZERO and TRANSMIT lamps.

**1.123** A MICROPHONE jack and a MIC LEVEL control for local modulation of the carrier, a MAINTENANCE PHONE jack for communications between base station radio sites, and jacks for local monitoring of the audio circuit are also furnished on the local operations panel. The panel contains, in addition, a line-matching circuit and an rf on-the-air circuit. The line-matching circuit is used for interface between the incoming wire-line or carrier facilities and the base station 5- to 120-watt transmitter. The rf on-the-air circuit is used to return an indication to the control terminal transmission equipment that radio transmissions are in progress.

#### Receiver Package (MK)

**1.124** A base station receiver package of maximum capacity is capable of receiving eight frequencies simultaneously in the 450-MHz band. One receiver and associated receiver line terminating unit are used for each channel. Depending upon system requirements, the base station can be set up as a one-receiver station or any complement thereof up to a maximum of eight receivers. (Fig. 4 shows a 2-receiver package.) A multicoupler permits from two to four receivers to be connected to a single antenna. When receivers five through eight are required in a cabinet, all eight receivers can be connected to the same antenna, provided two multicouplers and an rf power splitter are used. In addition to the receivers, the multicouplers, and the rf power splitter, the cabinet contains a meter panel and an audio and power line junction box.

**1.125** The meter panel consists of a meter, a meter polarity switch, a multicoupler power-indicating light, and a handset jack. Measurements required for alignment and maintenance of the selected receiver or line terminating unit can be made by using this meter panel. The METER FUNCTION switch is used to select the receiver, line terminating unit, or multicoupler to be tested. The METER switch on the receiver or multicoupler is then used to select the desired test point to be monitored. The METER POLARITY switch is provided for measurement of the discriminator output. The multicoupler power light is provided as a positive indication of multicoupler power and fuse condition. The handset jack (MAINTENANCE PHONE) is provided for intercommunications between the various base station radio sites. One meter panel is required for four

receivers or less. For more than four receivers, two meter panels are required.

**1.126** The multicoupler consists of an impedance-matching device and four crystal filters. Each of the four crystal filters is tuned to the frequency of its associated receiver. One multicoupler accommodates from two to four receivers. For more than four receivers, two multicouplers are required.

**1.127** The receiver contains, in addition to the meter switch, an audio LINE LEVEL control and a SQUELCH control located on the front panel. The channel frequency on which the receiver will operate is determined by the channel element contained in each receiver. This frequency is multiplied and mixed with the incoming frequency to produce the constant first intermediate frequency of 11 MHz.

**1.128** The receiver line terminating unit matches the impedance between the wire-line or carrier facilities and the receiver output circuit. It also furnishes a dc voltage proportional to the signal-to-noise ratio of the receiver. The dc voltage and audio signal are sent over the wire-line or carrier facilities to the base station transmission equipment by the line terminating unit. Each line terminating unit consists of a power supply, a signal-to-noise ratio voltage circuit, and a line matching transformer. Taps on the transformer permit matching of the line impedance. A handset connector (LINE MONITOR), located on the front panel, enables the received audio signal to be monitored. A set of multiple jacks (EQUIPMENT BREAK, EQUIPMENT BRIDGE; and LINE BREAK, LINE BRIDGE) are also located on the front panel of the line terminating unit. These jacks permit monitoring of the audio signal on the line facility and isolation of the line facility from the receiver.

#### 5- to 100-Watt Transmitter-Receiver Unit (MK)

**1.129** The 5- to 100-watt transmitter-receiver cabinet, similar to the one shown in Fig. 11, houses a receiver tuned 5.00 MHz above the operating frequency of the 5- to 120-watt transmitter, which operates in the 450-MHz band. Full-duplex operation is employed in this unit, making simultaneous operation of the transmitter and receiver possible with the use of a single antenna. The transmitter used in the cabinet is the same as the 5- to 120-watt transmitter described in 1.119 through 1.123. The

5- to 100-watt transmitter-receiver unit is formed by physically connecting a diplexer, a test converter, a receiver, and a receiver line terminating unit to connectors provided in the 5- to 120-watt transmitter cabinet for this purpose. The receiver and receiver line terminating unit are identical to those in the receiver package described in 1.124 through 1.128. The audio and power-line filter jack box and the meter panel in the 5- to 120-watt cabinet are used with the receiver when the unit is converted to a 5- to 100-watt transmitter-receiver unit.

**1.130** The test converter, in conjunction with the power sampler, is used to check overall performance of the base station. It consists of an oscillator, a mixer (part of the power sampler), a relay module, and a control for adjusting the output level. This unit converts the transmitter output frequency to the receiver frequency and then connects the signal to the receiver input for test purposes. The unit can be turned on remotely by the base station transmission equipment or locally by a switch on the test converter panel.

**1.131** The diplexer enables a common antenna to be used simultaneously by both the transmitter and receiver, provided the transmitter frequency is 5.00 MHz below the receiver frequency. Each diplexer is tuned at the factory according to the frequencies specified by the customer. A diplexer factory-tuned on a common-carrier frequency within the 454.40- to 454.650-MHz range can be operated on any frequency in this range without retuning.

#### **Mobile Station Equipment (MJ)**

##### **Radio Units (MJ)**

**1.132** The transmitter of radio units KS-19609 and KS-19852 is a nominal 20-watt, crystal-controlled unit capable of operating on any of 11 common-carrier mobile frequency assignments in the 150-MHz band. The receiver is completely transistorized and is of the crystal-controlled, superheterodyne type. It accepts frequency-modulated signals on any of the 11 common-carrier base station frequency assignments in the assigned band.

**1.133** *Radio Unit KS-19609:* This radio unit (Fig. 5) is completely housed in a heavy-gauge steel case with a removable top for access to the components mounted on the radio chassis. The transmitter, receiver, power supply, diplexer, and channel-hunting logic together form a drawer unit which slides into the case. The power supply with

some of the filtering components is contained in a separate housing which mounts on the front panel. Metering connections are made through receptacles on the front panel. Two metering receptacles are located under a protective name plate cover and are used to connect a portable test set necessary to align and check the transmitter and receiver. The antenna is connected to a UHF-type coaxial connector on the radio unit front panel. To prevent dust and dirt from entering the radio unit, the case is not vented.

**1.134** The radio unit contains supervisory unit KS-19609, L2 and transistorized oscillator plug-in modules, one module for each channel upon which the radio unit will operate. The oscillator module generates the radio frequency required for the transmitter and receiver to operate on a given channel. The oscillator module corresponding to the desired channel of operation is selected by a switching circuit in the radio unit. The radio unit is interconnected with the control unit by the use of a multiple-conductor cable.

**1.135** *Radio Unit KS-19852:* This radio unit (Fig. 5) consists of a transmitter, a receiver, a power supply, a channel-hunting circuit board (located in the supervisory unit housing), and a diplexer. Supervisory unit KS-19852, L2, described below, fits into the center housing. Individual covers for each subassembly can be lifted off to service the radio unit, or any individual subassembly can be completely removed. A front casting is designed to fit on the end of the assembly and provides mounting for the power and control cable jack and for the antenna jack. When this casting is removed from the assembly and disconnected from the radio unit, the 10-volt regulator and the keying relay are exposed. The transmitter contains a safety interlock switch which is opened when the cover is removed, and a centralized metering jack which is provided for use with a test set. The test set meters the transmitter multiplier, amplifier, and power amplifier stages as well as filament and regulated supply voltages. The metering jack also provides access to receiver audio, microphone, and push-to-talk leads. The receiver also contains a centralized metering jack (for use with the test set) which facilitates alignment and servicing. The test set meters the receiver multiplier and limiter stages, as well as the discriminator, audio, regulated 10 volts, and filtered 12 volts.

**1.136** The channel-hunting circuit board contains oscillator plug-in modules, one module for each channel. The oscillator module generates the radio frequency required for the transmitter and receiver to operate on a given channel. The oscillator module corresponding to the desired channel of operation is selected by a switching circuit on the circuit board. The diplexer allows the simultaneous operation of the transmitter and receiver, using a single antenna. A multiple-conductor cable is used to interconnect the radio unit (containing the supervisory unit) and the control unit.

### **Supervisory Units (MJ)**

**1.137** Supervisory units KS-19609, L2 and KS-19852, L2 contain the tone detectors, oscillators, timers, and logic circuits required for operation of the radio unit and the control unit on an automatic or a manual basis. The supervisory unit causes the mobile set to hunt over each equipped channel for the marked-idle channel and, when the marked-idle channel is detected, locks the mobile station to that channel. When a call is incoming from the base station to the mobile station, the supervisory unit evaluates the incoming mobile station code number information. If the code number is not the one assigned to the mobile station, the supervisory unit initiates a search for the new marked-idle channel. If the code number is the one assigned to the mobile station, the supervisory unit keys the transmitter in the radio unit and injects an acknowledgement tone generated by the unit into the transmitter input circuit. The supervisory unit turns on the ringer in the control unit to alert the subscriber to an incoming call when ringing signals are received from the radio unit. An answer signal is generated and sent to the transmitter when the mobile subscriber goes off-hook to answer the call. A disconnect signal is sent to the transmitter upon termination of the call. When a call is outgoing to the base station, the supervisory unit sends the mobile station code number information for ANI to the mobile transmitter when the base station commands it to do so. After dial tone is received by the mobile subscriber, the supervisory unit converts the dial pulses from the control unit into tone signals and feeds them to the transmitter. It also controls handset muting to maintain privacy and provide talk-off protection during signaling. The unit also maintains supervision over calls placed in the manual mode of operation.

**1.138 *Supervisory Unit KS-19609, L2:*** This supervisory unit (Fig. 6) is a completely transistorized, logic, tone-generating, and pulse-decoding unit. The supervisory unit consists mainly of two tone generators with their associated timer circuits, two tone detectors, a pulse and digit counter, and logic circuits required to control the mobile station. The tone generators and the timer circuitry, under control of logic circuits, and the pulse and digit counter produce all of the mobile station-to-base station signaling tones (1.137). The tone detectors respond to base station-to-mobile station signaling and produce outputs which cause the mobile station to search for and lock onto a marked-idle channel, to indicate when ANI is to commence, and to drive the pulse counter during base station outpulsing. The digit counter contains a 7-digit code corresponding to the area code and the last four digits of that particular mobile station. Coding is accomplished by the strapping of digit counter terminals on the printed-circuit board. It is possible to program the digit counter with any one of ten million 7-digit code numbers. Thus, any 7-digit can be programmed in the mobile station. The pulse and digit counter determines when a particular mobile station has been signaled and furnishes the information required to generate ANI.

**1.139 *Supervisory Unit KS-19852, L2:*** This supervisory unit (Fig. 6) is a completely transistorized, logic, tone-generating, and pulse-decoding unit. The supervisory unit consists of two tone receiver boards, a decoder board, a tone oscillator board, and a logic board. Each of the two tone receiver boards functions as a tone detector to convert incoming tones to positive and negative shifts in voltage for the decoder board. One tone receiver is for 600- and 1500-Hz tones used in manual operation. The other is for 1800- and 2000-Hz tones used for automatic operation. The decoder contains a 7-digit code corresponding to the area code and the last four digits of that particular mobile station. Coding is accomplished by strapping on the printed-circuit board; and by using the strapping, any 7-digit code can be programmed in the mobile station. The decoder accepts incoming voltage shifts which represent the mobile station code, counts the transitions, stores them until the bit train is complete, and stores the digits when correct. When the code number is correct, it triggers the logic board. If the call is not for the mobile station, or if the number is otherwise incorrect, the call will be dropped. The logic board provides supervision

and switching of the circuits as required during the processing of a call. In the processing of a call, either inward or outward, the mobile station must respond to the operating conditions selected by the operator and to the signals transmitted from the control terminal. For each condition of operation, the requirements differ in some degree and the logic board provides the necessary controls. The tone oscillator board provides the three tone frequencies needed in the operation of the mobile station for signaling.

#### Control Unit (MJ)

**1.140** Control unit KS-19626 (Fig. 7) mounts on the transmission tunnel or on the dashboard. A multiconductor cable is used for interconnections with the radio unit. The control unit contains a rotary dial, a mode selector switch consisting of 3 mode pushbuttons, a channel selector switch consisting of 11 channel pushbuttons, an AUX pushbutton, a TRANS lamp, a BUSY lamp, and an on-off keyswitch. The dial is illuminated by a lamp contained within the unit.

**1.141** The H (home), R (roam), and M (manual) mode pushbuttons on the mode selector switch are interlocked with positive blockout so that when one pushbutton is pushed, the previously pressed pushbutton will release. When the H pushbutton is pressed, the channel selector switch is changed to nonlocking, spring-return operation so that each channel pushbutton on the channel selector switch will immediately release after being pressed. When the R pushbutton is pressed, the channel selector switch is changed to all-pushbutton-latch operation. Each channel pushbutton pressed will latch until the H or M pushbutton is pressed. When the M pushbutton is pressed, the channel selector switch changes to single-pushbutton-latch operation. One channel pushbutton will latch at a time. The pushbutton is released by pressing another channel pushbutton or one of the mode pushbuttons.

**1.142** The AUX pushbutton is used to supplement the control unit ringer with an external alarm for signaling the subscriber. The TRANS lamp indicates when the transmitter in the radio unit is keyed. The BUSY lamp indicates that the system is busy.

#### Mobile Station Equipment (MK)

##### Radio (MK)

**1.143** The transmitter of the KS-20282 radio is a nominal 16-watt, crystal-controlled, transistorized unit, capable of operating on any of 12 common-carrier mobile frequency assignments in the 450-MHz band. The receiver is also completely transistorized and is of the crystal-controlled, double conversion, superheterodyne type. It accepts frequency-modulated signals on any of 12 common-carrier base station frequency assignments in the assigned band.

**1.144** *Radio Unit KS-20282, L1:* This radio unit (Fig. 5) is completely housed in a heavy-gauge steel case with a removable top for access to the components mounted on the radio chassis. The case can be mounted directly on the trunk floor of the vehicle, or a mounting base with a key-operated lock is available on which the radio unit can be mounted. This base provides for easy removal of the radio from the subscriber's vehicle for repair or replacement. The radio unit operates directly from the vehicular 12-volt (positive or negative ground) power supply, eliminating the need for a separate power supply. The transmitter, receiver, diplexer, and channel-hunting logic together form a drawer unit which slides into the case. Metering connections are made through receptacles on the front panel. Two metering receptacles are located under a protective nameplate cover and are used to connect a portable test set necessary to align and check the transmitter and receiver. The antenna is connected to a UHF-type connector on the radio unit front panel. To prevent dust and dirt from entering the radio unit, the case is not vented.

##### Supervisory Unit (MK)

**1.145** The supervisory unit used in the MK mobile radio is the same supervisory unit KS-19609, L2 that is also used in the MJ mobile radio. The unit is described in 1.137 and 1.138.

##### Control Unit (MK)

**1.146** Control unit KS-20283 (Fig. 7) mounts on the transmission tunnel or dashboard of the vehicle and provides the subscriber with the necessary controls, indicators, and audio facilities required to operate the mobile station. The control unit includes an on-off keyswitch, a receive level

volume control, transmit (T) and roam (R) lamps, a mode selection slide switch (home and roam), a lamp-intensity switch (bright or dim), an illuminated dial, a handset, a ringer, and an AUX alarm pushbutton.

**1.147** The home/roam selection switch and the dimmer slide switch are located on the underside of the control unit as indicated in Fig. 7. To select the home mode of operation, the mode selection switch is operated to the right; and to select the roam mode, the switch is operated to the left. The dimmer switch provides for two light intensities (bright or dim) of the roam (R) and transmit (T) lamps. The AUX pushbutton is used to supplement the control unit ringer with an external alarm for signaling the subscriber. Illumination of the T lamp indicates when the transmitter in the radio unit is keyed. Illumination of the R lamp indicates that the roam mode of operation has been selected.

### C. Functional Characteristics

#### Base Station Control Terminal (MJ and MK)

**1.148** The control terminal contains a nonblocking network employing 400-point crossbar switches. Each horizontal level on the crossbar switches is assigned to a mobile subscriber and connects through the mobile subscriber's line circuit connection to his assigned terminals on the main distributing frame. The vertical connection to be used will be determined by the link circuit associated with the marked-idle channel, since each link circuit is connected to one particular switch vertical for a given channel.

#### Outgoing Call Control Function (MJ and MK)

**1.149** When a call is outgoing to a mobile subscriber, the land subscriber dials the mobile subscriber's directory number and reaches a set of terminals on the main distributing frame in the central office, the same as in a normal call between land subscribers (Fig. 32). A ground start (tip side) condition from the central office seizes the line circuit on the line circuit bay which is assigned specifically to the called mobile subscriber.

**1.150** A demand is then sent to the line chain and allotter, which determines the line appearance of the mobile subscriber on the set of crossbar switches. This consists of determining

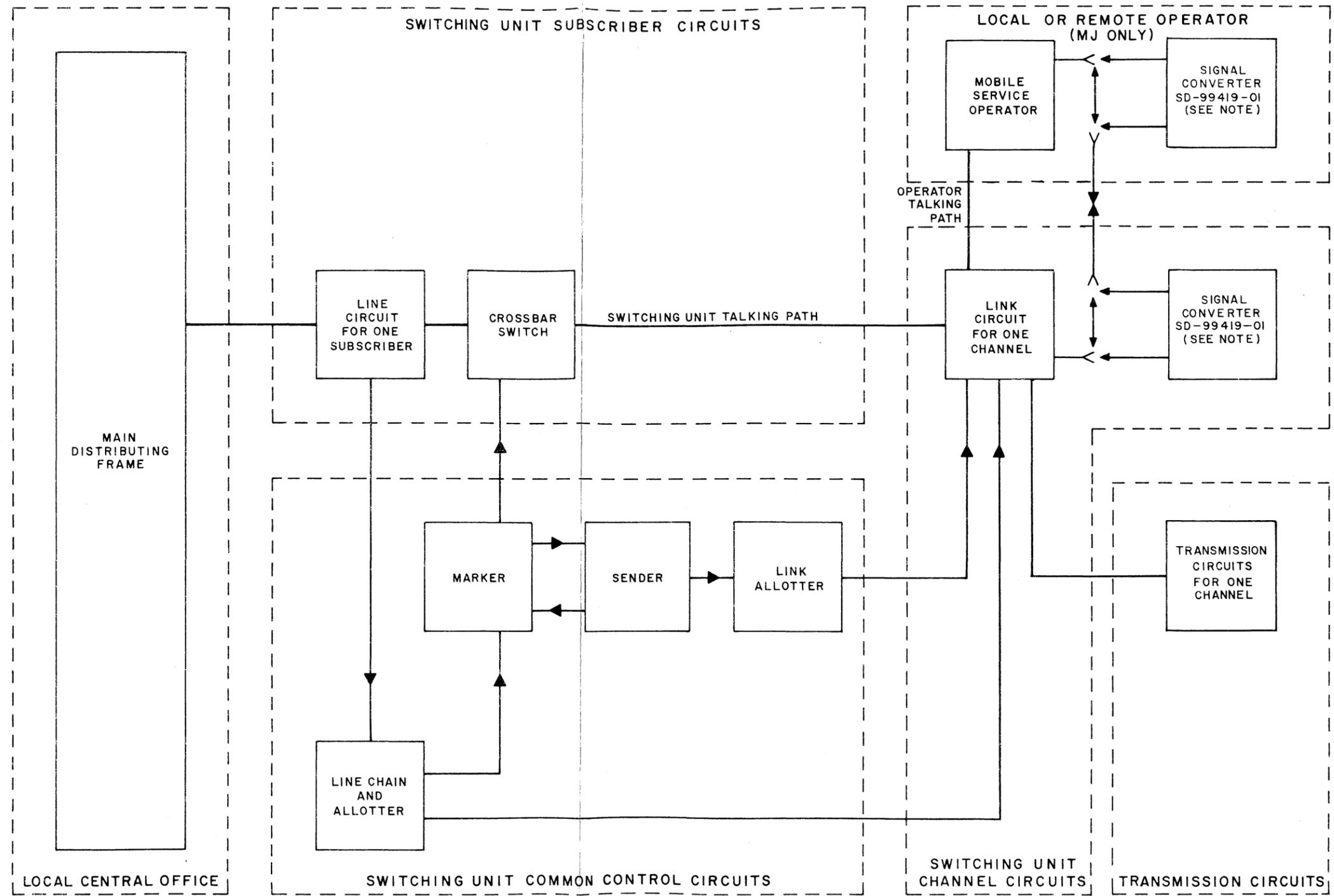
the particular 80-line group and section in the group to which the mobile subscriber's line circuit is connected.

**1.151** The line chain and allotter circuit, upon seizure, makes a demand on the marked-idle link circuit. If a link circuit is idle, the link circuit causes the idle tone to be removed from the channel and seize tone to be applied. When this happens, the line chain and allotter seizes the marker.

**1.152** When the marker is seized, it places link, switch, and switch section information into operation. The marker sends a start signal to the sender to begin the outpulsing procedure. The last four digits of the 7-digit number are identified by the sender, which prefixes the 3-digit number plan area (NPA) code, forming a new 7-digit number which the sender outpulses to the link circuit. The link circuit applies the outpulsing from the sender to the tone generator, which modulates the base station transmitter carrier. Pulses representing the 7-digit number are used to selectively signal the called mobile station. At the end of the outpulsing procedure, the sender delivers an end-of-send signal to the link and marker circuits. The marker, after operating the proper select and hold magnets on the crossbar switch to establish a talking path, releases the common control circuits. If the normal release procedure has not been performed by the marker in 5 seconds, the marker alarms the condition.

**1.153** The link circuit is connected to the line circuit through the crossbar switch when the select and hold magnets are operated. This results in the tip, ring, and sleeve connections being extended from the link circuit to the line circuit through the crossbar switch. Connection of the talking path through the crossbar switch is maintained by the hold magnet in the switch under control of the link circuit.

**1.154** If the outgoing call is to a roaming mobile station instead of to a mobile station operating in the home area, the signaling to the mobile station and the establishment of a talking path is accomplished through the mobile service operator. In this case, the calling land subscriber contacts the mobile service operator and gives the 10-digit code number of the roaming mobile station. The operator seizes the marked-idle link circuit in the local mobile system and completes a talking



NOTE:  
USE WHEN MOBILE SERVICE OPERATOR IS REMOTE.

Fig. 32—Control of Outgoing Call for Large Control Terminal, Block Diagram

path from the operator switchboard through the link circuit to the transmission equipment.

**1.155** After the talking path between the land subscriber and the transmission equipment has been established and selective signaling has been sent to the mobile station (whether accomplished automatically by the common control circuits or manually by the mobile service operator), the mobile station returns an acknowledgement tone through the transmission equipment to the link circuit. If, in the automatic handling, acknowledgement is not received by the link circuit, the link circuit releases the channel and switch crosspoints. If the talking path is established by the mobile service operator, the link circuit signals the operator with a 600-Hz tone in the event that the acknowledgement signal is not received from the mobile station. This indicates that the connection should be removed, restoring the link circuit to normal.

**1.156** If the acknowledgement signal is verified by the link circuit, repetitive ringing (2 seconds on and 4 seconds off) is sent to the mobile station by the link circuit. When the mobile subscriber goes off-hook, the mobile station sends a connect tone to the link circuit, which then trips the repetitive ringing and maintains the talking path until the land or mobile subscriber replaces the handset. If the call was under supervision of the operator, the lamp signal is initiated when the conversation is complete to indicate that the connection should be removed to release the talking path and restore the link circuit.

**1.157** If the call is outgoing to a manual mobile station (MJ only), the operator must be contacted by the calling land subscriber, who designates the channel to which the manual mobile station is assigned. The operator seizes the link circuit associated with the channel to which the mobile is assigned and establishes a talking path to the mobile by dialing the appropriate 5-digit number. The operator supervises the call.

#### **Incoming Call Control Function (MJ and MK)**

**1.158** Establishment of talking path between the main distributing frame and the transmission equipment for an incoming call to a land subscriber is accomplished basically the same as for an outgoing call (Fig. 33). The line circuit assigned to the mobile subscriber must first be seized, after which the line chain and allotter and the marker can

establish a talking path. The calling mobile station must first be identified as a local or a roaming mobile station. If the mobile station is local, the last four digits of its code number must be identified before the line circuit assigned to it can be seized. If the mobile station is roaming, the call is completed by seizure of a restricted line circuit or by being routed through the mobile service operator, depending on the circuit option installed in the register.

**1.159** This identification procedure is known as automatic number identification (ANI) and is accomplished by the register circuit. The link circuit receives a connect tone from the mobile station when the mobile subscriber goes off-hook to initiate a call. Upon receipt of the connect tone, the link circuit removes the idle tone and seizes a register through the link allotter. The register circuit receives and stores the ANI digits.

**1.160** If the mobile station is not local, it is routed to the mobile service operator or a restricted line circuit as described in 1.61. If the mobile station is local, the subscriber's last four digits are sent to the marker on a two-out-of-five basis. The four digits from the register are used by the marker to locate the mobile station's line circuit on the line circuit bays. A translating circuit in the marker is used to apply ground and voltage potential through two matrices of terminals to two leads which are unique to the mobile station's line circuit. This seizes the circuit. Approximately 3 seconds are allowed for the translator relays in the marker to operate. After the relays have operated, the marker is allowed approximately 5 additional seconds to establish a talking path. If the marker is timed out in either event, an alarm is sounded and a signal is sent from the marker through the register to the link circuit, causing the call to be routed to the mobile service operator. When the line circuit is seized, the talking path is established in the same manner as for an outgoing call except that the sender is not required and no signals are sent to or received from the sender by the marker.

**1.161** When the talking path is established, dial tone is passed from the central office through the link circuit and the transmission equipment to the mobile station. At this time, the mobile subscriber can dial the number of the party to be called. When the mobile subscriber dials the number, the mobile station transmits its dialing frequencies, which are received by the

transmission equipment in the base station, converted to dc pulses, and repeated by the link circuit to the central office. After the talking interval, disconnection is the same as in an outgoing call.

**1.162** When a call is incoming from a manual mobile station (MJ only), the link circuit is signaled by a burst of carrier from the mobile station. This burst of carrier is caused by the subscriber's pressing the push-to-talk button. The carrier operates a relay in the link circuit, causing seizure of the link circuit and routing of the call to the mobile service operator. The operator answers the call by connecting to the appropriate jack and completes the talking path through the switchboard. Supervision must be maintained by the operator to disconnect the talking path after completion of the talking interval to restore the link circuit to normal.

#### **Base Station Control Terminal Transmission Equipment (MJ and MK)**

**1.163** Each channel contains a complete set of transistorized transmission equipment which is located on its channel equipment shelf and reserved for its exclusive use (Fig. 34). The transmission equipment enables the base station transmitter to be modulated with speech and supervisory signals and applies incoming speech and supervisory signals to the link circuit or the switching unit talking path as required. The hybrid network which is part of the transmission equipment divides the remainder of the transmission equipment into two groups. One group forms the transmit speech path between the link circuit and the base station transmitter, and the other group forms the receive speech path from a base station receiver to the link circuit. Equipment forming the transmit speech path consists of a VOGAD circuit and pad and a transmit line terminating unit (one for each transmitter) in addition to the hybrid network. Equipment composing the receive speech path, in addition to the hybrid network, consists of a receive line terminating unit (one for each receiver), a receiver selector, a bandpass filter, and a SONAD circuit. A tone generator is used to apply tones for signaling to the transmit speech path, and a tone detector is used to detect tones received on the receive speech path. A transmitter switching circuit is part of the transmission equipment which is mounted on the common equipment shelf on transmission signaling and test access (TSTA) bay No. 1.

#### **Transmit Speech Path (MJ and MK)**

**1.164** The talking path in the base station control terminal switching unit is extended to the base station transmitter over the transmit speech path in the base station control terminal transmission equipment (Fig. 34). The transmit speech path is used to modulate the base station transmitter not only with speech from the land subscriber but also with supervisory tones from the tone generator.

**1.165** The tip and ring leads from the switching unit talking path are extended to the hybrid network which applies the speech signals to the VOGAD circuit in the transmit speech path. The VOGAD is a circuit which adjusts itself automatically to furnish a constant level of speech output over a wide range of input levels. The constant output of the VOGAD circuit is adjusted to the level required for modulation of the base station transmitter. A resistance pad is contained in the transmit speech path to permit the output from the VOGAD circuit to be adjusted. The transmit line terminating unit contains circuits which match the impedance between the transmission equipment and the wire-line or carrier facilities which connect to the base station transmitter. The base station transmitter may be located remotely (a number of miles) from the base station control terminal. The transmit line terminating unit also contains circuits used in conjunction with other circuits in the MJ or MK mobile system for the performance of transmitter switching functions.

#### **Receive Speech Path (MJ and MK)**

**1.166** The receive speech path applies speech signals incoming from a base station receiver to the tip and ring leads in the control terminal switching unit talking path (Fig. 34). Like the transmit speech path, the receive speech path accommodates supervisory tones as well as speech signals. The tone detector detects and converts the incoming tones to dc pulses and applies them to the link circuit for supervising switching functions.

**1.167** An incoming signal (speech or supervisory tone) is received by a group of radio receivers assigned to the channel and transmitted to the base station transmission circuits. The signal is applied through a pad network and an impedance-matching receive line terminating unit to the receiver selector. The receiver selector selects the receiver having the largest signal-to-noise

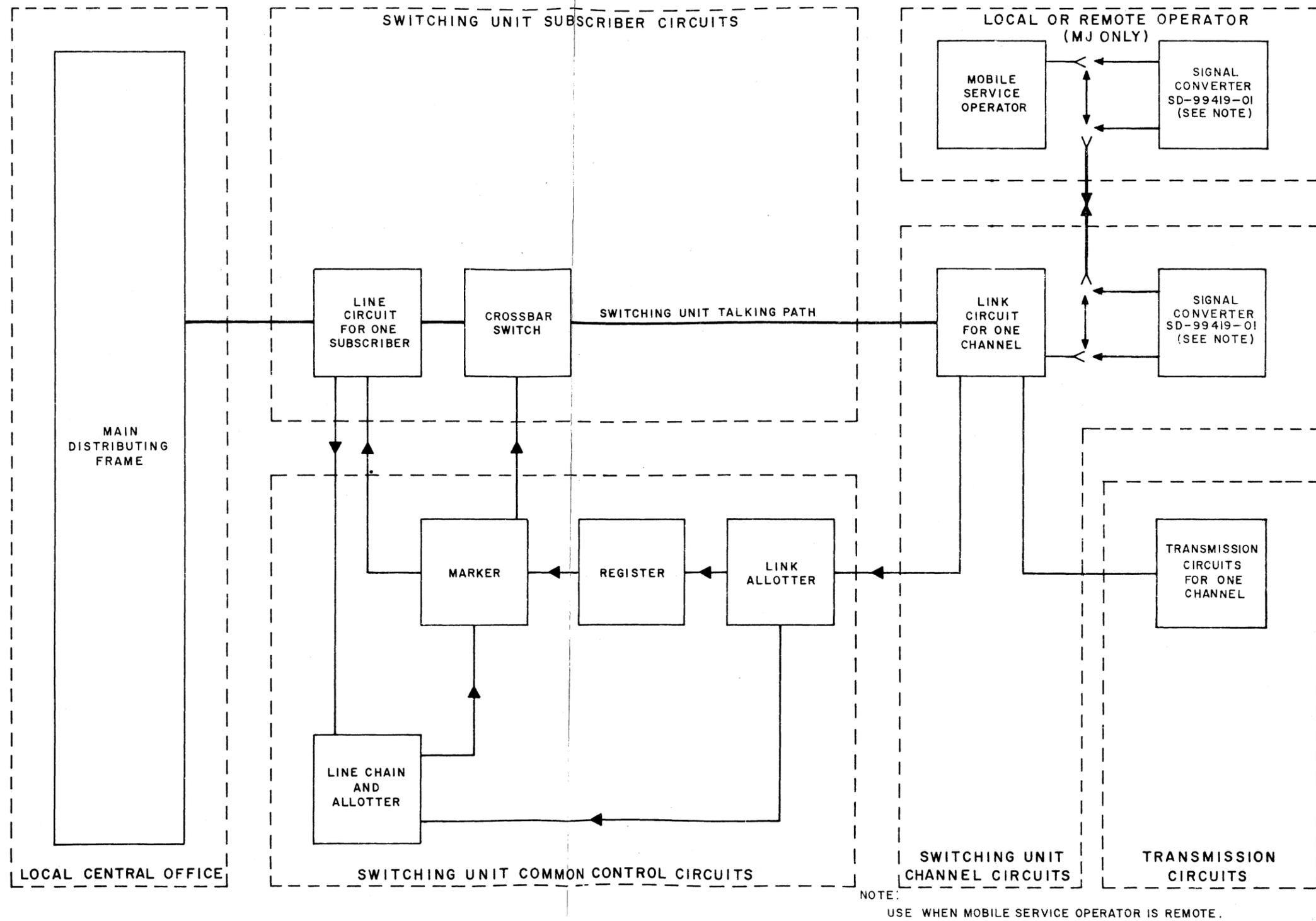
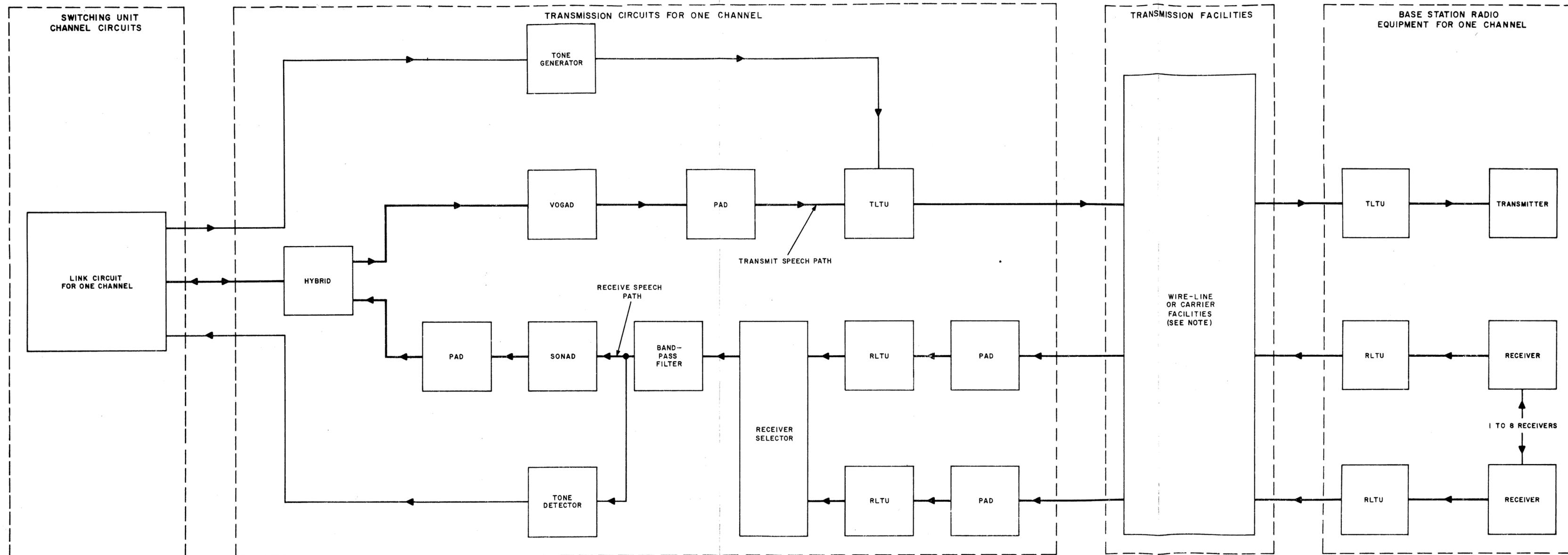


Fig. 33—Control of Incoming Call for Large Control Terminal, Block Diagram



NOTE:  
REMOTE SIGNALING UNIT SD-2R059-01.

Fig. 34—Base Station Control Terminal Transmission Circuits, Block Diagram

ratio and applies the signal from the receiver through a bandpass filter. From the bandpass filter, the signal is applied through the tone detector if the signal is a supervisory tone. A supervisory tone is applied to the link circuit after being converted to ground pulses by the tone detector. If the signal is a speech signal, the speech signal is applied through the SONAD circuit to the hybrid network, which couples the speech signal to the control terminal switching unit talking path. A resistance pad is provided at the SONAD output to facilitate changing the level at that point.

#### **Tone Signaling (MJ and MK)**

**1.168** The tone generator applies one of four supervisory tones through the transmit line terminating unit to the transmit speech path. Two of the tones, 600 and 1500 Hz, are used for selective signaling in the manual mode of operation (MJ only). The 1800- and 2000-Hz tones are used for the seize tone and the idle tone, respectively, in the home and roam modes of operation. Under the direct control of the link circuit, the tone generator modulates the transmitter with idle tone to cause all mobile stations not involved in a call to lock on the idle channel, or modulates the transmitter with an alternation of two tones to perform functions of selective signaling and repetitive ringing.

#### **Tone Detection (MJ and MK)**

**1.169** Supervisory tones are transmitted by the mobile station to the base station for establishing an incoming or outgoing call. The tones are received by a tone detector circuit via the bandpass filter and receiver selector circuits. These tones are used by the mobile station for acknowledgement, ANI, disconnect, connect, and dialing. The tone detector operates a relay associated with the incoming tone and applies a ground pulse representing the incoming tone to the link circuit, which receives it as input information used for establishing the call.

#### **Transmitter Switching (MJ and MK)**

**1.170** The base station transmitter is normally controlled by the link circuit through the transmitter switching circuit and the transmit line terminating unit, but the control may be transferred to the channel jack and key field by operation of the CHAN O/SVC key. The power at which the

transmitter can be operated is determined by operation of either the full-power or the low-power relay in the transmitter switching circuit. A third relay in the transmitter switching circuit provides an indication that the transmitter is turned on.

#### **Receiver Selection (MJ and MK)**

**1.171** The current generator associated with each channel receiver uses a dc input from the receiver to apply a generated current over the transmission facilities to the receiver line terminating unit. This generated current, which is based on the signal-to-noise ratio of the associated receiver, is converted to a voltage by the receiver line terminating unit and applied to the receiver selector. The receiver, one of a maximum of eight, with the highest signal-to-noise ratio is chosen by the receiver selector and its output audio applied to the receive speech path.

**1.172** Two threshold adjustments on the receiver selector determine the minimum signal-to-noise ratio at which a receiver will be connected to the speech path and the signal-to-noise ratio at which a receiver will be disconnected after it is once connected. A signal from the link circuit to the receiver selector freezes receiver selection during the ANI procedure and during mobile dialing.

**1.173** An output from the SONAD circuit is used to indicate to the link circuit that speech is being received from the mobile station. This signal is used by the link circuit to route a call to the mobile service operator when speech from the mobile station is absent for longer than 1 minute.

#### **Base Station Radio Equipment (MJ and MK)**

##### **Transmitter Control (MJ)**

**1.174** The CONTROL switch on the local operations panel is used to assign transmitter control to a local operator at the transmitter site or to a remote operator at the base station transmission equipment (Fig. 35). A negative 24 volts operates the F-zero relay when the LOCAL switch is set to F-ZERO and the CONTROL switch is set to LOCAL. The F-zero relay applies a lower-than-normal plate and screen grid voltage to the output stage of the 250-watt transmitter to achieve a power output of 0.5 watt. To the output stage of the 50-watt transmitter, it applies a lower-than-normal screen grid voltage to achieve a power output of 0.5 watt.

**1.175** The negative 24 volts is applied through the CONTROL switch and the LOCAL switch to operate the keying relay in the power supply when the CONTROL switch is set to LOCAL and the LOCAL switch is set to TRANSMIT. The keying relay keys the transmitter by applying line voltage to the primary of the power supply high-voltage transformer and to the exciter-driver chassis in the case of the 250-watt transmitter. In the case of the 50-watt transmitter, the line voltage is applied to the power supply only. When the LOCAL switch is set to STANDBY, neither the F-zero relay nor the keying relay is operated and the transmitter remains in a standby condition.

**1.176** When the CONTROL switch is set to REMOTE, the negative 24 volts is applied through the polar-type remote relay to operate the F-zero relay or the keying relay. The particular relay operated depends upon the polarity of a remote control signal incoming on the wire-line or carrier facilities from the base station transmission equipment. The remote control signal operates the remote relay in one direction or the other. The F-zero relay and the keying relay cause the transmitter to operate on low power or high power as described previously. In addition, the F-zero relay and the keying relay cause the rf on-the-air circuit to return an rf on-the-air signal over the wire-line or carrier facilities to the base station transmission equipment to give a visual indication that the transmitter is keyed. When no remote control signal is received from the base station transmission equipment, the polar-type remote relay in the local operations panel is not operated and the transmitter remains in a standby condition.

#### Test Transmitter Control (MJ Only)

**1.177** The frequency and rf power output of the test transmitter, in test operation, can be controlled locally by controls and switches in the test transmitter cabinet or remotely from the base station transmission equipment (1.78). DC signals transmitted over the transmission facilities between the base station control terminal transmission equipment and the test transmitter cabinet are used for remote control. The test transmitter can also be used as an emergency substitute for a regular transmitter.

**1.178** To use the test transmitter as an emergency substitute, the TEST TRANS/EMERGENCY switch on the line terminating unit and the

FREQUENCY CONTROL switch on the multiple oscillator selector panel are set to EMERGENCY (Fig. 36). This causes the line terminating unit and the multiple oscillator selector chassis to be disconnected from the other circuits in the cabinet. In this condition, the test transmitter is the same as an ordinary transmitter, as described in 1.174. A channel element having the proper frequency must be plugged into the exciter-driver chassis and the transmitter realigned as required to operate on a given channel in the emergency mode of operation.

**1.179** To use the transmitter for test purposes, the TEST TRANS/EMERGENCY switch and the FREQUENCY CONTROL switch are set to TEST TRANS and NORMAL, respectively. The rf power output of the test transmitter is controlled locally by setting the CONTROL switch on the local operations panel to LOCAL. In this position, a power output control voltage from the LOCAL POWER ADJUST switch on the line terminating unit is applied through the TEST TRANS/EMERGENCY switch, where it is applied to the screen grid of the tripler and driver stages on the exciter-driver chassis.

**1.180** To control the rf power output of the test transmitter remotely, the CONTROL switch is set to REMOTE. In the REMOTE position, a power output control voltage from the wire-line or carrier facilities incoming from the base station transmission equipment is applied through the TEST TRANS/EMERGENCY switch, where it is applied to the screen grid of the tripler and driver stages on the exciter-driver chassis.

**1.181** The LOCAL FREQUENCY SELECTION switch on the multiple oscillator selector panel can be used by a local operator to set the test transmitter to a desired channel frequency. When the CONTROL switch is set to LOCAL, the local/remote relay on the multiple oscillator selector chassis is operated, causing ground to be applied through the LOCAL FREQUENCY SELECTION switch on the multiple oscillator selector panel to a channel element. The channel element corresponding to the desired channel frequency is selected by the local operator when setting the LOCAL FREQUENCY SELECTION switch. The channel element output is amplified and applied to the modulator circuit in the exciter-driver. The exciter-driver multiplies and amplifies the channel

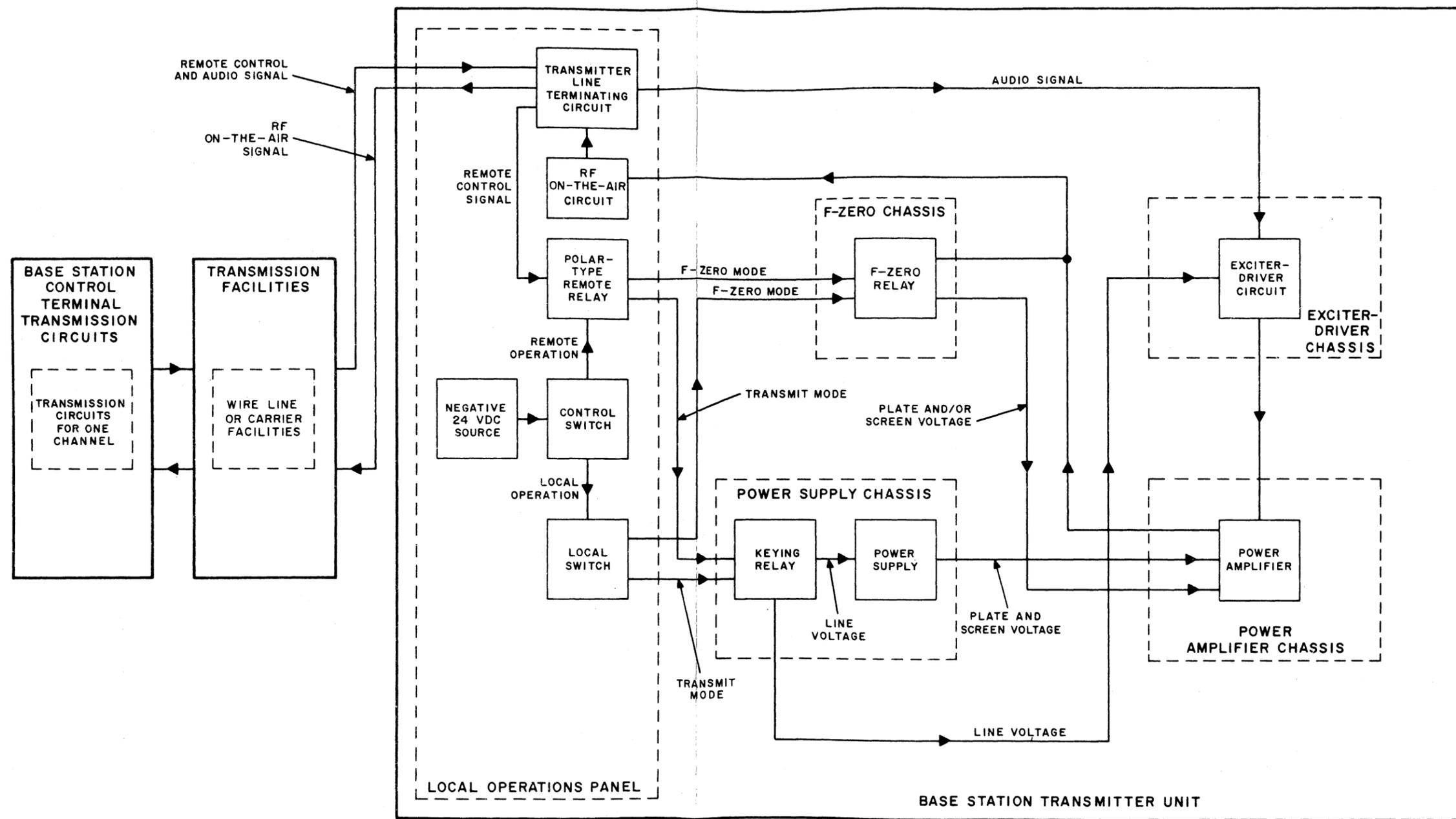


Fig. 35—MJ Transmitter Control, Block Diagram

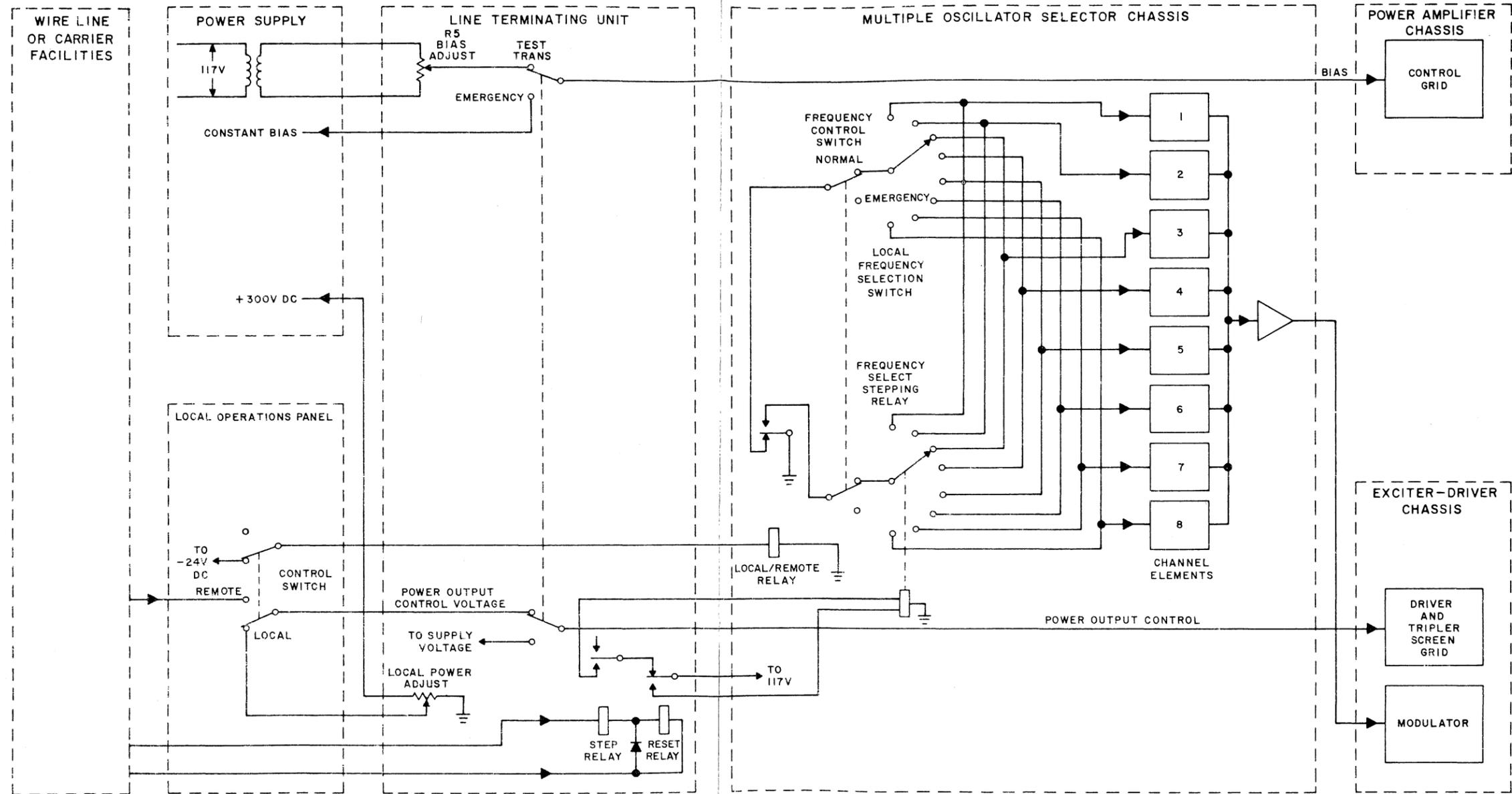


Fig. 36—MJ Test Transmitter Control, Simplified Schematic Diagram

element frequency to obtain the desired channel frequency.

**1.182** The frequency select stepping relay on the multiple oscillator selector chassis can be controlled by a remote operator to set the test transmitter to a desired channel frequency. When the CONTROL switch is set to REMOTE, the local/remote relay is released, causing ground potential to be applied through the stepping relay to a selected channel element.

**1.183** The frequency select stepping relay is controlled by incoming pulses from the base station transmission equipment. The incoming pulses are applied to the step relay in the line terminating unit. The relay operates once for each pulse and causes the frequency select stepping relay to step once for each operation. When the current in the step relay and the reset relay in the line terminating unit is reversed in polarity, the reset relay and the step relay operate. The reset relay resets the frequency select stepping relay. This is used to provide a starting reference in case a pulse is missed.

**1.184** In test operation, the power amplifier control grid bias voltage can be adjusted. An adjustable voltage is applied from the bias adjust potentiometer on the line terminating unit through the TEST TRANS/EMERGENCY switch to the power amplifier control grid. In emergency operation, a constant bias is applied to the power amplifier.

#### Transmitter Control (MK)

**1.185** The CONTROL switch on the local operations panel determines the mode of operation of the base station transmitter. It can be set to control the transmitter locally at the transmitter site or remotely at the base station transmission equipment (Fig. 37).

**1.186** A positive 24 volts dc operates the F-zero relay when the LOCAL switch is set to F-ZERO and the CONTROL switch is set to LOCAL. The F-zero relay applies a lower-than-normal screen voltage to the tripler-driver and power amplifier. This voltage causes the transmitter, when keyed, to produce an rf output of 0.5 watt. With the CONTROL switch set to LOCAL and the LOCAL switch set to TRANSMIT, a positive 24 volts dc is coupled through the CONTROL and LOCAL

switches to the transmitter switching circuit. The transmitter switching circuit is then activated to supply 24 volts dc to the exciter-driver and to turn on the main power supply, which supplies all the voltage required to operate the transmitter at its full-rated rf output power. When the LOCAL switch is set to STANDBY, neither the F-zero relay nor the transmitter switching circuit is energized and the transmitter remains in a standby condition.

**1.187** The transmitter equipment is operated remotely with the CONTROL switch set to REMOTE. A dc control current, received over the wire-line or carrier facilities from the base station transmission equipment, operates the polar-type remote relay. The remote relay operates in one direction or the other, depending on the polarity of the incoming control current. A positive 24 volts dc is then coupled through the CONTROL switch and the closed contacts of the remote relay to operate the transmitter switching circuit or the F-zero relay. The transmitter switching circuit and F-zero relay cause the transmitter to operate on low power or high power as previously described. When the transmitter is keyed, dc inputs to the rf on-the-air circuit from the directional coupler and remote relay cause this circuit to return an indication to the control terminal that the transmitter has been keyed. When no control current is received from the base station transmission equipment, the remote relay is not operated and the transmitter remains in a standby condition.

#### Receiver Supervision and Selection (MJ and MK)

**1.188** All receivers assigned to a particular channel are installed in different receiver cabinets (one to eight receivers per cabinet), and the cabinets are spotted throughout the coverage area to ensure best reception from the mobile station. The receiver with the highest signal-to-noise ratio on a given channel is selected by the base station transmission equipment. Receiver selection is made on the basis of a dc signal which is produced by the line terminating unit in the receiver cabinet. This signal is sent to the base station transmission equipment over the same wire-line or carrier facilities from the line terminating unit in the receiver cabinet.

#### Mobile Station Equipment (MJ)

**1.189** When the MJ control unit is set for home or roam operation, the supervisory unit

performs the necessary logic and control functions for automatic operation of the mobile station. The supervisory unit controls the radio unit, which cycles through a predetermined set of channels. The channels to be scanned are established in home operation by strapping contained in the control unit and in roam operation by the subscriber, who sets the channel selector pushbuttons on the control unit. Upon command from the supervisory unit, the channels selected are scanned at the rate of four channels per second until the supervisory unit detects the idle-channel tone. The supervisory unit then sends a stop-search signal to the radio unit, causing the radio unit to lock on the marked-idle channel. A 120-millisecond recognition delay is incorporated into the supervisory unit to avoid false detection of idle tone. Brief fades of the idle tone will not cause the channel to be abandoned. Search will be initiated if idle tone is absent for more than a nominal 175 milliseconds.

#### **Mobile-to-Land Sequence (Home Operation)**

**1.190** Before a mobile subscriber can initiate a call, the mobile equipment must be homed-in on the marked-idle channel when the subscriber lifts his handset. Upon going off-hook, the supervisory unit initiates the connect sequence causing the mobile transmitter to be turned on (Fig. 38). There are two phases of the connect sequence: first, a 350-millisecond connect delay; and second, the transmittal of connect tone for 50 milliseconds. The tone oscillators in the supervisory unit send a guard tone ( $F_g$ ) of 2150 Hz during the connect delay and connect tone ( $F_c$ ) of 1633 Hz during the connect interval.

**1.191** Upon receipt of the connect tone, the base station control terminal removes the idle tone previously defined from the channel and replaces it 300 milliseconds later with a seize tone of 1800 Hz. Idle tone is placed on the next available channel. Detection of idle-tone dropout causes all on-hook mobiles to be blocked from originating calls and initiates channel hunting for the new marked-idle channel. The mobile attempting to connect must detect the dropout of idle tone during its connect interval (50 milliseconds) for a valid seizure. If idle-tone dropout is detected too soon (during the connect delay interval), the call attempt is blocked and the sequence shorted, after which the busy lamp on the control unit is energized. Thus, two mobiles can make a valid seizure only if there is an overlap of their connect intervals.

Should idle tone still be present after the connect interval, the call attempt is again blocked.

**1.192** Detection of seize tone by the calling mobile primes the supervisory unit for ANI. The removal of seize tone causes the supervisory unit to outpulse the mobile ANI code with 25-millisecond pulses of connect tone at 20 pps. To enable ANI error detection, the supervisory unit transmits odd-even parity information along with ANI code. The odd-even parity information in the form of guard tone is transmitted after every cumulatively totaled even pulse. The base station control terminal verifies the first three digits as the home NPA code and translates the last four digits to the mobile subscriber's line location. After the selected line is connected to the seized channel, dial tone is returned from the central office and passed to the mobile control unit handset over the established radio channel. Upon receipt of dial tone, the mobile subscriber can dial the call. Dial pulsing consists of a dial-off-normal tone interrupted by pulses of connect tone. The base station control terminal converts each pulse into the conventional dc dial pulsing for the central office. On completion of the call and return of the mobile hookswitch to on-hook, the tone oscillators in the supervisory unit transmit a 3/4-second signal composed of alternate 25-millisecond pulses of disconnect tone ( $F_d$ ) of 1336 Hz and guard tone at 20 pps to furnish disconnect supervision to the control terminal. At the end of the disconnect burst, the supervisory unit turns off the transmitter and initiates search for the idle channel.

#### **Mobile-to-Land Sequence (Roam Operation)**

**1.193** The mobile-to-land sequence for a roaming mobile is identical to that for a mobile operating in the home mode, up to the point of receipt of ANI by the local base station control terminal. When the identification of a mobile originating a call is not possible, equipment options make it possible for the call to be handled in a number of different ways. Refer to 1.61.

#### **Land-to-Mobile Sequence (Home Operation)**

**1.194** On a call to a mobile station, the base station control terminal seizes the marked-idle channel by shifting from idle tone ( $F_i$ ) to seize tone ( $F_s$ ). The dropout of idle tone and detection of seize tone by the idle/seize tone detector holds all mobiles on the channel and blocks them from

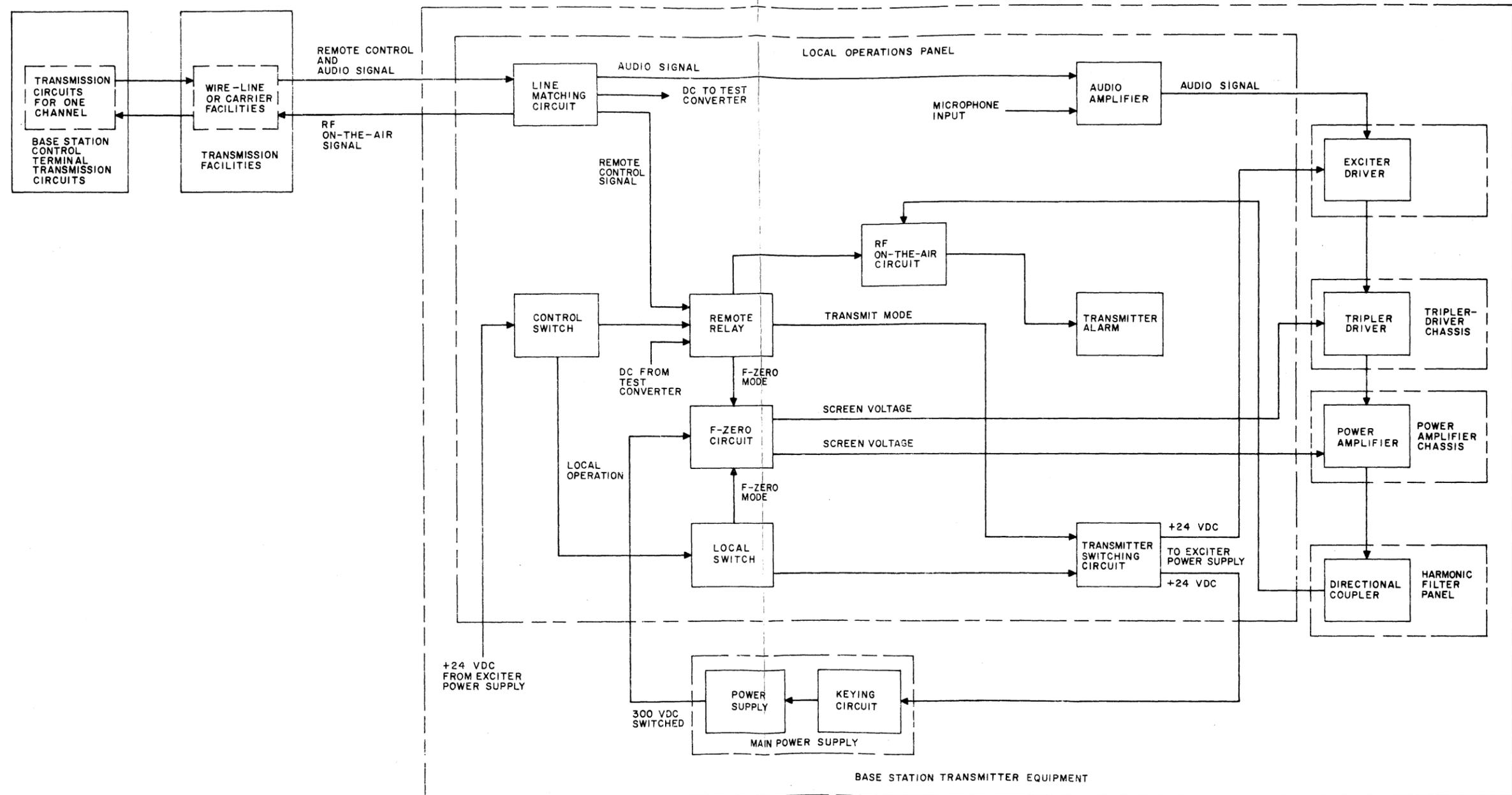


Fig. 37—MK Transmitter Control, Block Diagram

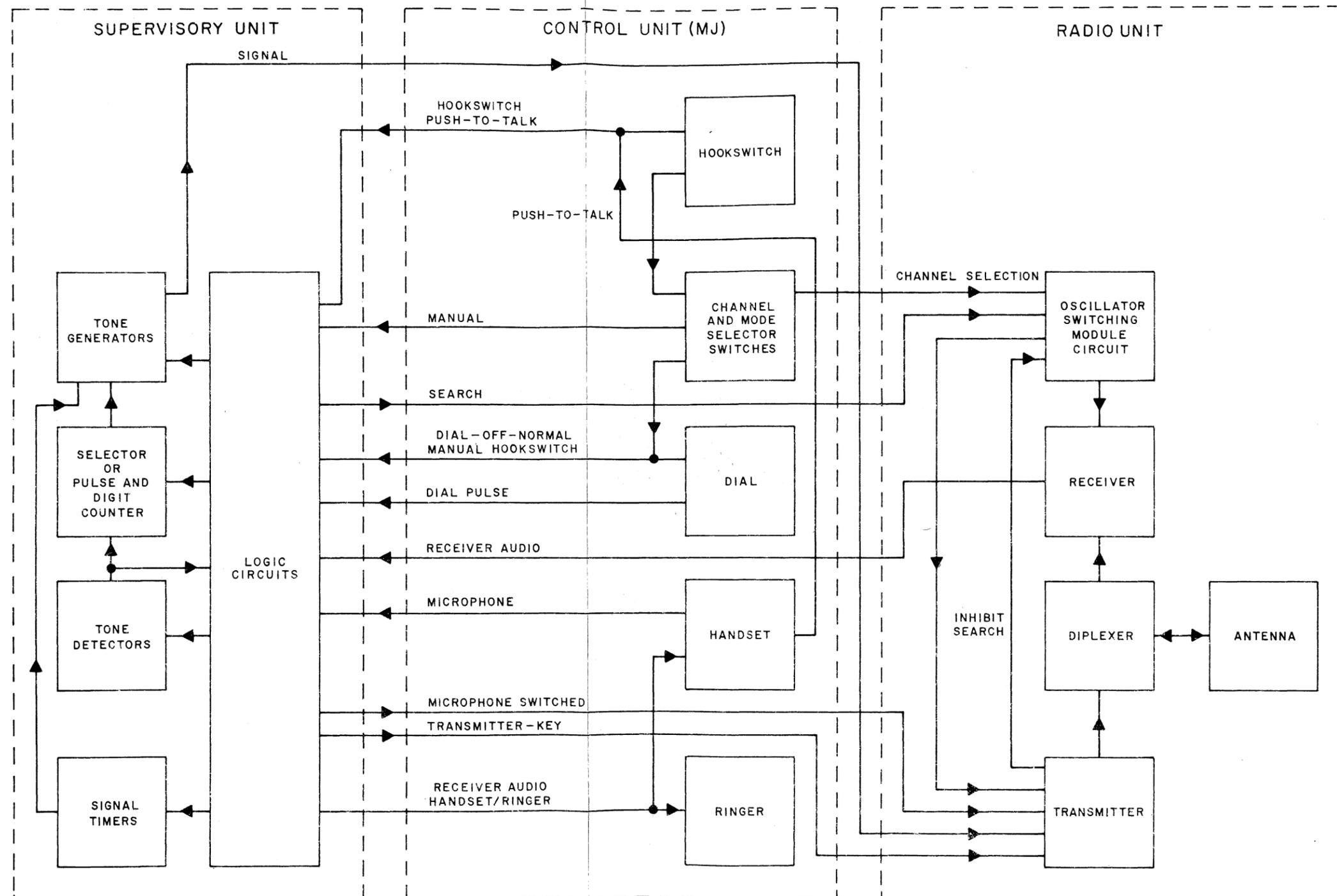


Fig. 38—MJ Mobile Station Equipment, Block Diagram

originating a call in preparation for receiving outward signaling. The signaling consists of mark-space keying between idle and seize tone at the rate of 10 pps. As each mobile detects a digit mismatch, it abandons the channel and initiates search for the marked-idle channel. On completion of selective signaling, all mobiles except the desired one will have abandoned the seized channel to seek the new marked-idle channel.

**1.195** Upon correct selector match after the last digit, the supervisory unit in the called mobile causes the transmitter to be turned on and a 3/4-second acknowledgement signal to be transmitted. The acknowledgement signal consists of guard tone. If the base station control terminal does not receive this signal within 3 seconds after signaling, seize tone is removed and the call abandoned. If coding acknowledgement is received, the base station control terminal sends repetitive ringing at the standard cycle of 2 seconds on and 4 seconds off. If the mobile station does not answer within 40 to 80 seconds, the base station control terminal abandons the call.

**1.196** The mobile, upon going off-hook, causes the supervisory unit to turn on the transmitter and send a 400-millisecond burst of answer signal. The answer signal consists of connect tone. Upon receipt of the answer signal, the control terminal stops the ringing and establishes a talking path between the calling party and the mobile via the radio channel. Upon return of the mobile to on-hook, disconnect supervision is provided, which is a 3/4-second burst of disconnect tone alternating with guard tone at 20 pps.

#### **Land-to-Mobile Sequence (Roam Operation)**

**1.197** To signal a roaming mobile, the mobile operator dials or keys the mobile station's 4-digit code number prefixed by its 3-digit NPA code. Upon acknowledgement, all supervision is the same as for a home mobile station.

#### **Mobile Station Equipment (MK)**

**1.198** When the MK mobile station control unit is set for home or roam operation, the supervisory unit performs the necessary functions for automatic operation of the mobile station. The supervisory unit controls the radio unit, which cycles through a programmed set of channels. The channels to be scanned are programmed in home

and roam modes of operation by straps on the channel strapping board contained in the radio unit. Upon command from the supervisory unit, the programmed complement of channels is scanned at the rate of four channels per second until the supervisory unit detects the idle-channel tone. The supervisory unit then sends a stop-search signal to the radio unit, causing the radio unit to lock on the marked-idle channel. A 120-millisecond recognition delay is incorporated in the supervisory unit to avoid false detection of idle tone. Brief fades of the idle tone will not cause the channel to be abandoned. Search will be initiated if idle tone is absent for more than a nominal 175 milliseconds.

#### **Mobile-to-Land Sequence (Home Operation)**

**1.199** Before a mobile subscriber can initiate a call, the mobile equipment must be homed-in on the marked-idle channel when the subscriber lifts his handset. Upon going off-hook, the supervisory unit initiates the connect sequence causing the mobile transmitter to be turned on (Fig. 39). There are two phases of the connect sequence: first, a 350-millisecond connect delay; and second, the transmittal of connect tone for 50 milliseconds. The tone oscillator in the supervisory unit sends a guard tone ( $F_g$ ) of 2150 Hz during the connect delay and connect tone ( $F_c$ ) of 1633 Hz during the connect interval.

**1.200** Upon receipt of the connect tone, the base station control terminal removes the idle tone, previously defined, from the channel and replaces it 300 milliseconds later with a seize tone of 1800 Hz. Idle tone is placed on the next available channel. Detection of idle-tone dropout causes all on-hook mobiles to be blocked from originating calls and initiates channel hunting for the new marked-idle channel. The mobile attempting connect must detect the dropout of idle tone during its connect interval (50 milliseconds) for a valid seizure. If idle-tone dropout is detected too soon (during the connect delay interval), the call attempt is blocked, the sequence is shorted, and the transmit lamp (T) on the control unit does not light. Thus, two mobiles can make a valid seizure only if there is an overlap of their connect intervals. Should idle tone still be present after the connect interval, the call attempt is again blocked.

**1.201** Detection of seize tone by the calling mobile primes the supervisory unit for ANI. The removal of seize tone causes the supervisory unit

to outpulse the mobile ANI code with 25-millisecond pulses of connect tone at 20 pps. To enable ANI error detection, the supervisory unit transmits odd-even parity information along with the ANI code. The odd-even parity information in the form of guard tone is transmitted after every cumulatively totaled even ANI pulse. Guard tone is not transmitted after every cumulatively totaled odd pulse. The base station control terminal verifies the first three digits as the home NPA code and translates the last four digits to the mobile subscriber's line location. After the selected line is connected to the seized channel, dial tone is returned from the central office and passed to the mobile control unit handset over the established radio channel. Upon receipt of dial tone, the mobile subscriber can dial the call. Dial pulsing consists of a dial-off-normal tone interrupted by pulses of connect tone. The base station control terminal converts each pulse into the conventional dc dial pulsing for the central office. On completion of the call and return of the mobile hookswitch to on-hook, the tone oscillators in the supervisory unit transmit a 3/4-second signal composed of alternating 25-millisecond pulses of disconnect tone (Fd) of 1336 Hz and guard tone at 20 pps to furnish disconnect supervision to the control terminal. At the end of the disconnect burst, the supervisory unit turns off the transmitter and initiates search for the idle channel.

#### **Mobile-to-Land Sequence (Roam Operation)**

**1.202** The mobile-to-land sequence for a roaming mobile is identical to that for a mobile operating in the home mode, up to the point of receipt of ANI by the local base station control terminal. When the identification of a mobile originating a call is not possible, equipment options make it possible for the call to be handled in a number of different ways. Refer to 1.61.

#### **Land-to-Mobile Sequence (Home Operation)**

**1.203** On a call to a mobile station, the base station control terminal seizes the marked-idle channel by shifting from idle tone (Fi) to seize tone (Fs). The dropout of idle tone and detection of seize tone by the idle/seize tone detector holds all mobiles on the channel and blocks them from originating a call in preparation for receiving outward signaling. The signaling consists of mark-space keying between idle tone and seize tone at the rate of 10 pps. As each mobile detects a

digit mismatch, it abandons the channel and initiates search for the marked-idle channel. On completion of selective signaling, all mobiles except the desired one will have abandoned the seized channel to seek the new marked-idle channel.

**1.204** Upon correct selector match after the last digit, the supervisory unit in the called mobile causes the transmitter to be turned on and a 3/4-second acknowledgement signal to be transmitted. The acknowledgement signal consists of guard tone. If the base station control terminal does not receive this signal within 3 seconds after signaling, seize tone is removed and the call abandoned. If coding acknowledgement is received, the base station control terminal sends repetitive ringing at the standard cycle of 2 seconds on and 4 seconds off. If the mobile station does not answer within 40 to 80 seconds, the base station control terminal abandons the call.

**1.205** The mobile, upon going off-hook, causes the supervisory unit to turn on the transmitter and send a 400-millisecond burst of answer signal. The answer signal consists of connect tone. Upon receipt of the answer signal, the control terminal stops the ringing and establishes a talking path between the calling party and the mobile via the radio channel. Upon return of the mobile to on-hook, disconnect supervision is provided, which is a 3/4-second burst of disconnect tone alternating with guard tone at 20 pps.

#### **Land-to-Mobile Sequence (Roam Operation)**

**1.206** To signal a roaming mobile, the mobile operator dials or keys the mobile station's 4-digit code number prefixed by its 3-digit NPA code. Upon acknowledgement, all supervision is the same as for a home mobile station.

### **D. System Test Features**

#### **Switching Unit Test Panel (MJ and MK)**

**1.207** The test panel contained on the switch control bay is used to test the base station control terminal switching unit as described in 1.75.

#### **Technical Operator Test Panel (MJ and MK)**

**1.208** A technical operator test panel is located on transmission signaling and test access (TSTA) bays No. 1, 2, and 3 (11-foot bays) and

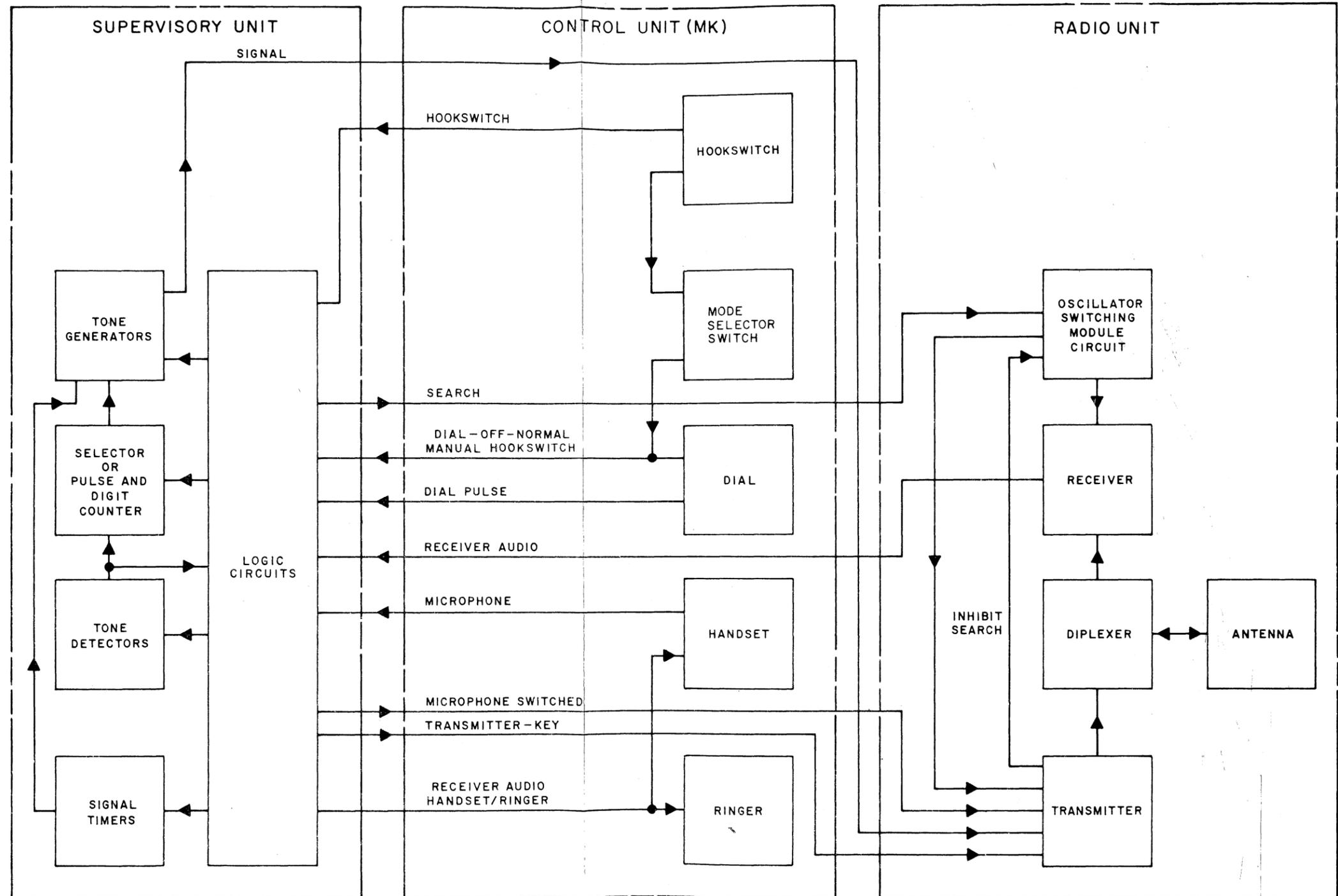


Fig. 39—MK Mobile Station Equipment, Block Diagram

No. 2, 3, 4, and 5 (9-foot bays). The technical operator test panel enables a technician to monitor existing calls or to originate outgoing calls to mobile stations. This facilitates checking the operation and adjustment of the various channel circuits. The technical operator test panel contains a dial, a handset, a channel selector key, a mode key, a talk key, and a set of jacks for use with the headset. Each technical operator test panel services the channels provided on the TSTA bay on which it is mounted.

#### **Transmission Signaling and Test Access Channel Jack and Key Field (MJ and MK)**

**1.209** Each channel provided in the mobile system has a channel jack and key field located on the TSTA bay for the purpose of testing the base station transmission equipment and the base station radio equipment associated with the channel. The channel jack and key field contains a series of jacks, lamps, and keys to monitor the input and output signals of the individual circuits, to indicate equipment failures, and to make-busy a given channel or receiver. The TX FAIL lamp is energized when a transmitter has failed to respond to a command. The channel base station transmitter can be removed from service by operating the CHAN O/SVC key, which prevents the transmitter from being controlled by the switching equipment. With the CHAN O/SVC key operated, the transmitter can be operated on full or low power by means of keys. Appropriate lamp indications displayed on the channel jack and key field indicate the transmitter state of operation. A receiver failure is marked by an RCVR FAIL lamp whenever the dc signal from the receiver falls below a predetermined value. When a receiver fails in operation, it can be rejected from the circuit by use of the RCVR REJ key so that the channel can operate normally without it.

**1.210** *CONV SW Key:* The CONV SW key on the channel jack and key field is used in conjunction with the transmitter full-power key. The CONV SW key makes it possible to test the receiver contained in the low-power transmitter-receiver unit when the mobile system is not equipped with a test transmitter.

#### **Miscellaneous Test Panel (MJ and MK)**

**1.211** The miscellaneous test panel is mounted on TSTA bay No. 1 for use in testing all

channels equipped in the mobile system. It contains an IDLE CHANNEL ADVANCE KEY for each channel furnished in the mobile system. The key is used to advance the marked-idle condition from one channel to the channel next in sequence for the purpose of checking the channel selection function. The panel contains two lamps for each channel to indicate a marked-idle channel or a busy channel, an alarm lamp for the transmitter switching circuit, three alarm lamps for the base station identifier control circuit, an ALB lamp to indicate an all-links-busy condition, and two lamps to indicate the channel selector chain allotter in use. The panel contains three keys to apply test pulses to the channel selector and two keys to reset the circuits after an alarm is indicated in the transmitter switching circuit or the base station identifier control circuit.

#### **Test Transmitter (MJ Only)**

**1.212** The test transmitter is used to test the base station receivers and can be used in the event of an emergency as described in 1.107. The test transmitter control circuit is described in 1.78.

#### **Mobile Simulator (MK Only)**

**1.213** The major components of the MK mobile simulator are shown in Fig. 40. The simulator operates on assigned MK frequencies either to test base receiver and base transmitter operation or to simulate a customer's mobile unit as an aid in analyzing mobile trouble complaints. As indicated in Fig. 41, the transmitter is connected directly to an antenna when the coaxial switches of the rf circuit are in position 2. In this position, the power output to the antenna is approximately 16 watts. When the coaxial switches are in position 1, a fixed (10-dB) attenuator and a variable (6- to 120-dB) attenuator are inserted in the line, enabling the power output of the transmitter to the antenna to be varied. Calls to any desired mobile or land telephone number can be simulated using the control panel. Therefore, all signaling and logic functions of the system can be tested. A standard MJ control head is mounted on the control panel.

#### **Mobile Station Supervisory Unit Test Sets (MJ and MK)**

**1.214** Two supervisory unit test sets are available. They are self-contained, portable instruments

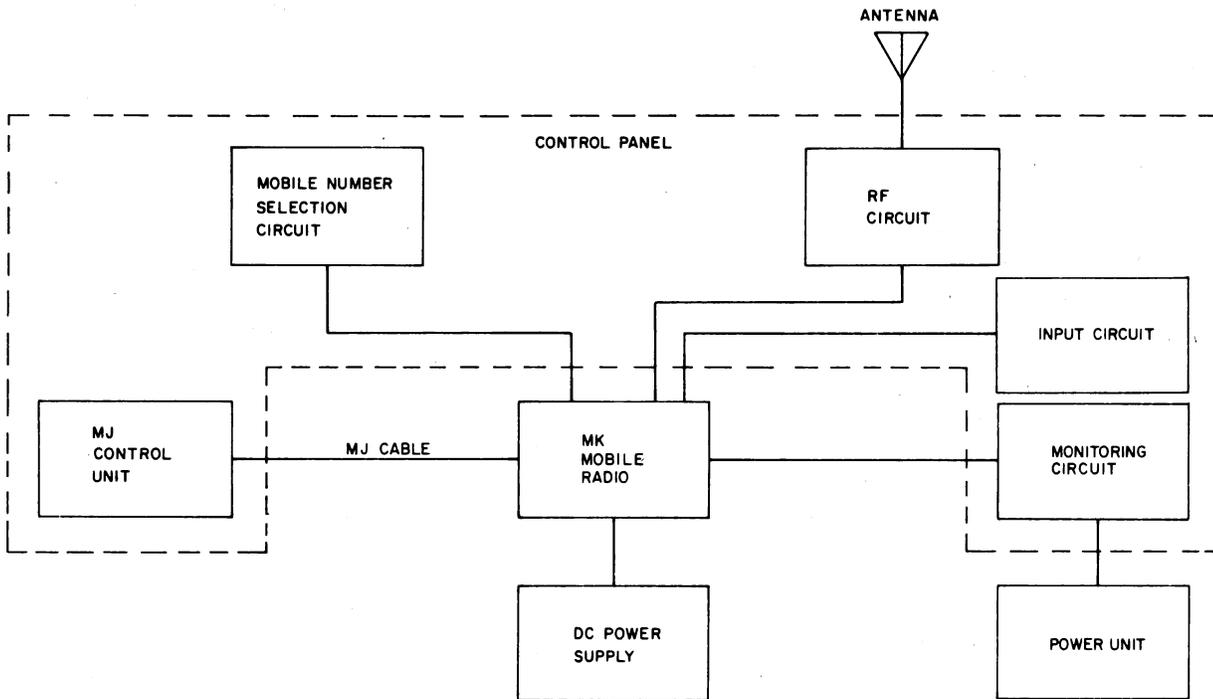


Fig. 40—MK Mobile Simulator, Block Diagram

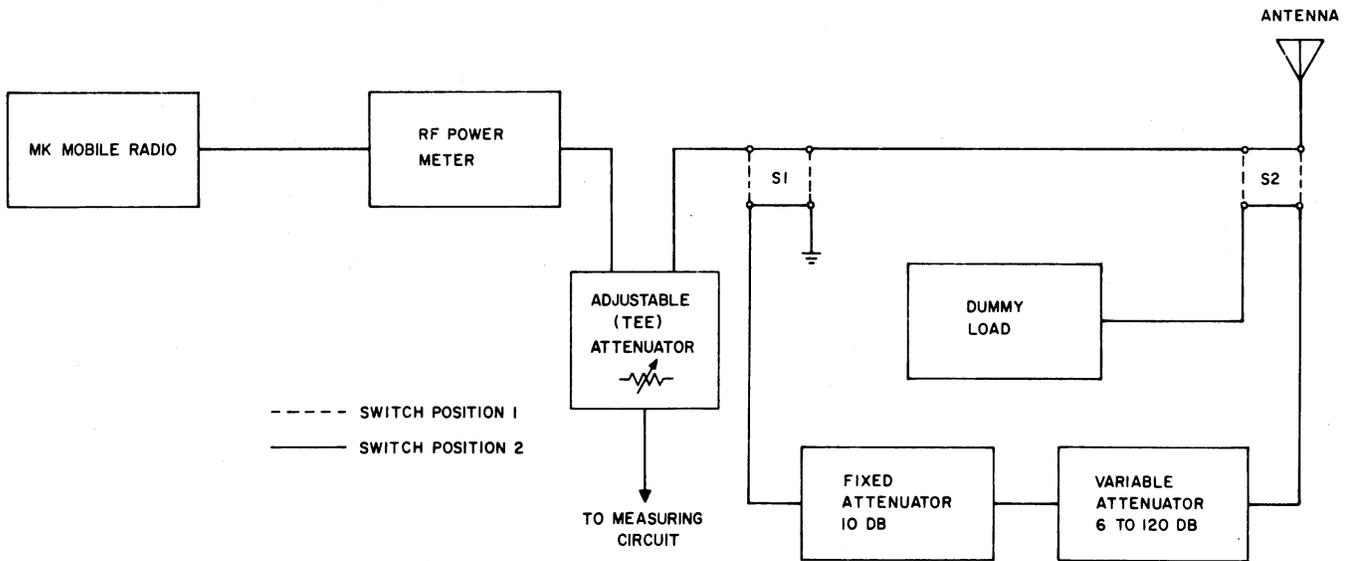


Fig. 41—MK Mobile Simulator RF Circuit, Block Diagram

designed to permit off-the-air functional testing of the supervisory unit. Motorola model T1257A test set measures 11 inches high, 6-1/2 inches deep, and 11 inches wide and is used to test supervisory unit KS-19609, L2. General Electric model 4EX5A10 test set measures 9 inches high, 6 inches deep and 13-1/4 inches wide and is used to test supervisory unit KS-19852, L2. Optional cables and connectors are available with the 4EX5A10 test set for use with supervisory unit KS-19609, L2. Each test set supplies power to the supervisory unit and generates the base station signaling sequences required to simulate both an incoming and an outgoing call. Visual indicators on the T1257A test set show the state of the logic outputs of the supervisory unit and provide a visual readout of the automatic number identification (ANI) code outputted from the supervisory unit. A speaker in the 4EX5A10 test set furnishes audible monitoring of signals used for testing. Available with this test set as an option is an 11-channel, crystal-controlled signal generator so that tests may be easily made using the rf path to the receiver without need for an external signal generator. Crystals must be ordered separately for each channel required.

#### Mobile Station Radio Unit Test Sets (MJ)

**1.215** The Motorola model S1056A portable test set, together with adapter TEN6055A, furnishes the metering necessary to align and check radio unit KS-19609. It also provides intermediate frequencies for alignment of receiver IF stages. Crystals must be ordered separately. Crystal frequencies used are 5.26 MHz for the first IF and 455 kHz for the second IF. The test set measures 12-1/2 inches high, 6-1/2 inches deep, and 12 inches wide and weighs 11 pounds. An internal 6-volt dc source consisting of four 1-1/2 volt D batteries connected in series supplies operating voltage for the test set. The test set furnishes a means of metering circuits in transmitters and receivers, and it contains a direct-indicating multiscale meter, a transistorized ac voltmeter, a transistorized oscillator, and a zero-center scale. Test set model S1057A is also available to check radio unit KS-19609. It is the same as test set model S1056A except that it contains a peaking generator which is a crystal-controlled signal source. The generator is used for tuning the rf stages in the receivers.

**1.216** The General Electric model 4EX3A10 portable test set is used for aligning and troubleshooting radio unit KS-19852. A test cable connects the test set to the transmitter or receiver being serviced to furnish centralized metering of various circuits. The transmitter can be keyed with a switch on the test set. Dimensions of the set are 3-1/2 inches high, 5 inches deep, and 13 inches wide. It includes a 3-1/2 inch panel meter, a 20,000-ohm-per-volt voltmeter, jacks for connecting an audio oscillator for modulating the transmitter, and jacks for measuring the audio output from the receiver.

#### Mobile Station Radio Unit Test Sets (MK)

**1.217** The Motorola model S1056A portable test set, together with adapter TEN6055A, furnishes the metering necessary to align and check radio unit KS-20282, L1. It also provides intermediate frequencies for alignment of receiver IF stages. Crystals must be ordered separately. Crystal frequencies used are 5.26 MHz for the first IF and 455 kHz for the second IF. The test set measures 12-1/2 inches high, 6-1/2 inches deep, and 12 inches wide and weighs 11 pounds. An internal 6-volt dc source consisting of four 1-1/2 volt D batteries connected in series supplies operating voltage for the test set. The test set furnishes a means of metering circuits in transmitters and receivers, and it contains a direct-indicating multiscale meter, a transistorized ac voltmeter, a transistorized oscillator, and a zero-center scale. Test set model S1057A can also be used to check radio unit KS-20282, L1. It is the same as test set model S1056A except that it contains a peaking generator which is a crystal-controlled signal source. The generator is used for tuning the rf stages in the receivers.

#### E. Power Requirements

**1.218** Power requirements for the MJ and MK base station radio equipment are listed in Tables D and E, respectively. Power requirements for the MJ and MK mobile station equipment are listed in the installation requirements for each type of mobile station. Power requirements for the base station control terminal equipment are contained in SD-2R023-02.

TABLE D (MJ)

BASE STATION RADIO EQUIPMENT	MAXIMUM dc POWER REQUIREMENTS (48 Vdc)	MAXIMUM ac POWER REQUIREMENTS (117 Vac)
250-Watt Transmitter Unit KS-19618, L1 or L21	None	10 amperes
50-Watt Transmitter Unit KS-19618, L2, L3, L22, or L23	None	3 amperes
Test Transmitter Unit KS-19618, L16	None	3 amperes
Receiver Package KS-19618, L121 through L128 or L131 through L138	None	0.25 ampere per receiver
50-Watt Transmitter-Receiver Unit KS-19618, L8, L9, L24, or L25	None	3.25 amperes

TABLE E (MK)

BASE STATION RADIO EQUIPMENT	MAXIMUM dc POWER REQUIREMENTS (48 Vdc)	MAXIMUM ac POWER REQUIREMENTS (117 Vac)
5- to 120-Watt Transmitter Unit KS-20285, L1	None	7.8 amperes
5- to 100-Watt Transmitter- Receiver Unit KS-20285, L2	None	7.8 amperes
5- to 100-Watt Transmitter- Receiver Unit KS-20285, L3	None	7.8 amperes
Receiver Package KS-20285, L51 through L58	None	0.25 ampere per receiver

## SUBDIVISIONS OF EQUIPMENT

1.219 Equipment in the MJ and MK Mobile Radio Telephone Systems is listed by J or KS code numbers as follows:

## MJ and MK Control Terminal Equipment

<u>Equipment Code</u>	<u>Rating of Unit</u>	<u>Title</u>	<u>ITT Drawing</u>	<u>Circuit Drawing</u>
J41644A	AT&TCo Std	Switch Control Bay	317011 ( ) 113	SD-2R001-01
			317007 ( ) 113	SD-2R003-01
			317001 ( ) 113	SD-2R005-01
			317004 ( ) 113	SR-2R006-01
			317003 ( ) 113	SD-2R007-01
			317005 ( ) 113	SD-2R009-01
			317036 ( ) 113	SD-2R013-02
J41644C	AT&TCo Std	200-Line Circuit Bay	329679 ( ) 113	SD-2R002-01
			317001 ( ) 113	SD-2R005-01
J41644D	AT&TCo Std	100-Line Circuit Bay	329685 ( ) 113	SD-2R002-01
J41644E	AT&TCo Std	Transmission Signaling and Test Access Bay No. 1	317006 ( ) 113	SD-2R000-01
			321155 ( ) 113	SD-2R008-01
			317029 ( ) 113	SD-2R010-01
				SD-2R011-01
				SD-2R012-01
				SD-2R014-01
				SD-2R015-01
	SD-2R016-01			
	SD-2R019-01			
J41644F	AT&TCo Std	Transmission Signaling and Test Access Bay No. 2 or No. 3	317006 ( ) 113	SD-2R000-01
				SD-2R008-01
				SD-2R019-01
J41644G	AT&TCo Std	Duplicate Switch Bay	329679 ( ) 113	SD-2R002-01
			317007 ( ) 113	SD-2R003-01
			317002 ( ) 113	SD-2R004-01
			317001 ( ) 113	SD-2R005-01
			317004 ( ) 113	SD-2R006-01
			317003 ( ) 113	SD-2R007-01
J41644K	AT&TCo Std	Switch Control Bay	317011 ( ) 113	SD-2R001-01
			317007 ( ) 113	SD-2R003-01
			317002 ( ) 113	SD-2R004-01
			317004 ( ) 113	SD-2R006-01
			317003 ( ) 113	SD-2R007-01
			317005 ( ) 113	SD-2R009-01
			317036 ( ) 113	SD-2R013-02

<u>Equipment Code</u>	<u>Rating of Unit</u>	<u>Title</u>	<u>ITT Drawing</u>	<u>Circuit Drawing</u>
J41644L	AT&TCo Std	Duplicate Switch Bay	317007 ( ) 113 317002 ( ) 113 317004 ( ) 113 317003 ( ) 113	SD-2R003-01 SD-2R004-01 SD-2R006-01 SD-2R007-01
J41644M	AT&TCo Std	Line Circuit Bay No. 1, 2, 3, or 4	329683 ( ) 113 317001 ( ) 113	SD-2R002-01 SD-2R005-01
J41644N	AT&TCo Std	Transmission Signaling and Test Access Bay No. 1	321155 ( ) 113 321155 ( ) 113 321155 ( ) 113	SD-2R010-01 SD-2R011-01 SD-2R012-01 SD-2R014-01
J41644P	AT&TCo Std	Transmission Signaling and Test Access Bay No. 2	317006 ( ) 113 317029 ( ) 113	SD-2R000-01 SD-2R008-01 SD-2R015-01 SD-2R016-01 SD-2R019-01
J41644R	AT&TCo Std	Transmission Signaling and Test Access Bay No. 3, 4, or 5	317006 ( ) 113 317029 ( ) 113	SD-2R000-01 SD-2R008-01 SD-2R019-01
KS-19457, L50		Spare Parts Package (For Bay Circuits)		
KS-19663, L5		End Cover (11-Foot Bay)		
KS-19456, L13		End Cover (9-Foot Bay)		

**MJ Base Station and Mobile Station Radio Equipment**

**Note:** The following listings are for basic cabinets or units only. Refer to the listings under Part 4 (Equipment) for ordering information.

<u>Equipment Code</u>	<u>Rating of Unit</u>	<u>Title</u>	<u>Circuit Drawing</u>
KS-19618, L1	AT&TCo Std	250-Watt Transmitter Cabinet (Indoor)	SD-2R024-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R032-01 SD-2R034-01 SD-2R036-01 SD-2R058-01 SD-2R065-01

<u>Equipment Code</u>	<u>Rating of Unit</u>	<u>Title</u>	<u>Circuit Drawing</u>
KS-19618, L2	AT&TCo Std	50-Watt Transmitter Cabinet (Indoor)	SD-2R027-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R035-01 SD-2R044-01 SD-2R045-01 SD-2R046-01 SD-2R047-01 SD-2R056-01 SD-2R064-01
KS-19618, L3	AT&TCo Std	50-Watt Transmitter Cabinet (Outdoor)	SD-2R027-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R035-01 SD-2R044-01 SD-2R045-01 SD-2R046-01 SD-2R047-01 SD-2R056-01 SD-2R064-01
KS-19618, L4	AT&TCo Std	250-Watt Transmitter Cabinet (Indoor)	SD-2R024-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R032-01 SD-2R034-01 SD-2R036-01 SD-2R058-01 SD-2R065-01
KS-19618, L5	AT&TCo Std	250-Watt Transmitter Cabinet (Indoor)	SD-2R024-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R032-01 SD-2R033-01 SD-2R034-01 SD-2R036-01 SD-2R058-01 SD-2R061-01 SD-2R065-01

<u>Equipment Code</u>	<u>Rating of Unit</u>	<u>Title</u>	<u>Circuit Drawing</u>
KS-19618, L8	AT&TCo Std	50-Watt Transmitter-Receiver Cabinet (Indoor)	SD-2R027-01
			SD-2R029-01
			SD-2R030-01
			SD-2R031-01
			SD-2R035-01
			SD-2R037-01
			SD-2R038-01
			SD-2R039-01
			SD-2R040-01
			SD-2R044-01
			SD-2R045-01
			SD-2R046-01
			SD-2R047-01
SD-2R056-01			
SD-2R064-01			
KS-19618, L9	AT&TCo Std	50-Watt Transmitter-Receiver Cabinet (Outdoor)	SD-2R027-01
			SD-2R029-01
			SD-2R030-01
			SD-2R031-01
			SD-2R035-01
			SD-2R037-01
			SD-2R038-01
			SD-2R039-01
			SD-2R040-01
			SD-2R044-01
			SD-2R045-01
			SD-2R046-01
			SD-2R047-01
SD-2R056-01			
SD-2R064-01			
KS-19618, L16	AT&TCo Std	Test Transmitter Cabinet (Indoor)	SD-2R025-01
			SD-2R030-01
			SD-2R031-01
			SD-2R034-01
			SD-2R035-01
			SD-2R041-01
			SD-2R042-01
			SD-2R044-01
			SD-2R045-01
			SD-2R047-01
SD-2R048-01			
SD-2R064-01			

<u>Equipment Code</u>	<u>Rating of Unit</u>	<u>Title</u>	<u>Circuit Drawing</u>
KS-19618, L21	AT&TCo Std	250-Watt Transmitter Cabinet (Indoor)	SD-2R024-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R032-01 SD-2R033-01 SD-2R034-01 SD-2R036-01 SD-2R058-01 SD-2R061-01 SD-2R065-01
KS-19618, L22	AT&TCo Std	50-Watt Transmitter Cabinet (Indoor)	SD-2R027-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R035-01 SD-2R044-01 SD-2R045-01 SD-2R046-01 SD-2R047-01 SD-2R056-01 SD-2R061-01 SD-2R064-01
KS-19618, L23	AT&TCo Std	50-Watt Transmitter Cabinet (Outdoor)	SD-2R027-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R035-01 SD-2R044-01 SD-2R045-01 SD-2R046-01 SD-2R047-01 SD-2R056-01 SD-2R061-01 SD-2R064-01
KS-19618, L24	AT&TCo Std	50-Watt Transmitter-Receiver Cabinet (Indoor)	SD-2R027-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R035-01 SD-2R037-01 SD-2R038-01

<u>Equipment Code</u>	<u>Rating of Unit</u>	<u>Title</u>	<u>Circuit Drawing</u>
			SD-2R039-01 SD-2R040-01 SD-2R044-01 SD-2R045-01 SD-2R046-01 SD-2R047-01 SD-2R056-01 SD-2R061-01 SD-2R064-01
KS-19618, L25	AT&TCo Std	50-Watt Transmitter-Receiver Cabinet (Outdoor)	SD-2R027-01 SD-2R029-01 SD-2R030-01 SD-2R031-01 SD-2R035-01 SD-2R037-01 SD-2R038-01 SD-2R039-01 SD-2R040-01 SD-2R044-01 SD-2R045-01 SD-2R046-01 SD-2R047-01 SD-2R056-01 SD-2R061-01 SD-2R064-01
KS-19618, L41		Kit for converting KS-19618, L1 and L21 to KS-19618, L4 and L5	
KS-19618, L121 through L128*	AT&TCo Std	Receiver Cabinet (Indoor)	SD-2R026-01 SD-2R038-01 SD-2R039-01 SD-2R040-01
KS-19618, L131 through L138*	AT&TCo Std	Receiver Cabinet (Outdoor)	SD-2R026-01 SD-2R038-01 SD-2R039-01 SD-2R040-01
KS-19609	AT&TCo Std	Mobile Radio	SD-2R018-01 SD-2R028-01
KS-19852	AT&TCo Std	Mobile Radio	SD-2R057-01 SD-2R062-01
KS-19626, L1	AT&TCo Std	Mobile Control Unit	SD-2R020-01

\* Third digit of list number indicates quantity of receiver circuits in cabinet.

**MK Base Station and Mobile Station Radio Equipment**

**Note:** The following listings are for basic cabinets or units only. Refer to the listings under Part 4 (Equipment) for ordering information.

<u>Code Equipment</u>	<u>Rating of Unit</u>	<u>Title</u>	<u>Circuit Drawing</u>
KS-20285, L1	AT&TCo Std	5- to 120-Watt Transmitter Cabinet (Indoor)	SD-2R083-01
KS-20285, L2	AT&TCo Std	5- to 100-Watt Transmitter-Receiver (With Diplexer) Cabinet (Indoor)	SD-2R082-01
KS-20285, L3	AT&TCo Std	5- to 100-Watt Transmitter-Receiver (Without Diplexer) Cabinet (Indoor)	SD-2R082-01
KS-20285, L51 through L58*	AT&TCo Std	Receiver Cabinet (Indoor or Outdoor)	SD-2R081-01
KS-20282, L1	AT&TCo Std	Mobile Radio	SD-2R080-01 SD-2R079-01
KS-20283, L1	AT&TCo Std	Control Unit	SD-2R078-01

**Note:** A KS-20285, L105 rain shield is available to adapt the transmitter and transmitter-receiver cabinets for outdoor installations.

\* Second digit of list number indicates quantity of receiver circuits in cabinet.

**2. SUPPLEMENTARY INFORMATION**

**2.01** Supplementary information for the large MJ and MK Mobile Radio Telephone Systems is given in the following list:

- 405-000-000—Numerical Index—Division 405
- 806-000-000—Equipment Design and General Equipment Requirements and Engineering Information—Radio Systems and Television Systems
- 806-158-151—Remote Signaling Units (MJ Only)
- 806-157-181—MJ and MK Mobile Radio Telephone Systems—Performance Requirements—Large System Control Terminal

**3. DRAWINGS**

**3.01** This part contains a complete list of drawings for the large MJ and MK Mobile Radio Telephone Systems.

**A. Circuits**

**3.02** Schematic drawings for the large MJ and MK control terminal are listed as follows:

- SD-2R000-01—Transmission Signaling and Test Access Circuit
- SD-2R001-01—Duplicate Switching and Test Access Circuit
- SD-2R002-01—Line Circuit
- SD-2R003-01—Sender Circuit
- SD-2R004-01—Marker Circuit
- SD-2R005-01—Crossbar Switch Circuit
- SD-2R006-01—Register Circuit
- SD-2R007-01—Line Chain and Allotter Circuit
- SD-2R008-01—Link Circuit
- SD-2R009-01—Link Allotter Circuit
- SD-2R010-01—Base Station Identifier Control Circuit
- SD-2R011-01—Channel Selector Circuit
- SD-2R012-01—Transmitter Switching Circuit
- SD-2R013-02—Common Pulse Circuit

SD-2R014-01—Alarm Circuit  
 SD-2R015-01—Test Transmitter Control Circuit  
 SD-2R016-01—TSTA Miscellaneous Test Circuit  
 SD-2R017-01—Stile Circuit  
 SD-2R019-01—Technical Operator Test Panel Circuit  
 SD-2R023-01—Key Sheet  
 SD-2R023-02—Current Drain Data  
 ES-2R102-01—MK Mobile Simulator Circuit  
 SD-99385-01—Auxiliary Line Circuit

**3.03** Schematic drawings for the MJ base station and mobile station radio equipment are listed as follows:

SD-2R018-01—KS-19609 Mobile Radio Circuit  
 SD-2R020-01—Control Unit Circuit  
 SD-2R022-01—Mobile Interconnection Cable Circuit  
 SD-2R023-01—Key Sheet  
 SD-2R024-01—Base Station 250-Watt Transmitter—Application Schematic  
 SD-2R025-01—Base Station Test Transmitter—Application Schematic  
 SD-2R026-01—Base Station Receiver—Application Schematic  
 SD-2R027-01—Base Station 50-Watt Transmitter—Receiver—Application Schematic  
 SD-2R028-01—KS-19609 Supervisory Unit Circuit  
 SD-2R029-01—Exciter-Driver Circuit (250W) (50W)  
 SD-2R030-01—Exciter Power Supply Circuit (250W) (50W) (Test Transmitter)  
 SD-2R031-01—Lead Filter Circuit (250W) (50W) (Test Transmitter)  
 SD-2R032-01—Harmonic Filter Circuit (250W)  
 SD-2R033-01—RF Power Amplifier Circuit (250W)  
 SD-2R034-01—Local Operations Panel Circuit (250W) (Test Transmitter)  
 SD-2R035-01—F-Zero Panel Circuit (50W) (Test Transmitter)  
 SD-2R036-01—High-Voltage Power Supply Circuit (250W)  
 SD-2R037-01—Test Converter Circuit (50W Transmitter-Receiver)  
 SD-2R038-01—Receiver Circuit (Receiver)  
 SD-2R039-01—Receiver Power Supply Circuit (Receiver)  
 SD-2R040-01—Receiver Line Terminating Unit Circuit (Receiver)  
 SD-2R041-01—Multiple Oscillator Selector Circuit (Test Transmitter)  
 SD-2R042-01—Test Transmitter Line Terminating Unit Circuit (Test Transmitter)  
 SD-2R044-01—RF Power Amplifier Circuit (50W) (Test Transmitter)  
 SD-2R045-01—High-Voltage Power Supply Circuit

(50W) (Test Transmitter)

SD-2R046-01—Local Operations Panel Circuit (50W)  
 SD-2R047-01—Harmonic Filter Circuit (50W) (Test Transmitter)  
 SD-2R048-01—Exciter-Driver Circuit (Test Transmitter)  
 SD-2R056-01—Screen Regulator Circuit (50W) (50W Transmitter-Receiver)  
 SD-2R057-01—KS-19852 Mobile Radio Circuit  
 SD-2R058-01—F-Zero and Screen Regulator Panel Circuit (250W)  
 SD-2R059-01—Remote Signaling Circuit (MJ Only)  
 SD-2R061-01—High-Stability Oscillator Circuit (50W) (250W)  
 SD-2R062-01—KS-19852 Supervisory Unit Circuit  
 SD-2R063-01—Low-Noise Exciter-Driver Circuit (50W) (250W)  
 SD-2R064-01—Directional Coupler Circuit (50W) (Test Transmitter)  
 SD-2R065-01—Directional Coupler Circuit (250W)

**3.04** Schematic drawings for the MK base station and mobile station radio equipment are listed as follows:

SD-2R023-01—Key Sheet  
 SD-2R078-01—Control Unit Circuit  
 SD-2R079-01—Mobile Interconnection Cable Circuit  
 SD-2R080-01—Mobile Radio  
 SD-2R081-01—Multiple Receiver Circuit  
 SD-2R082-01—Transmitter Receiver Circuit  
 SD-2R083-01—Transmitter Circuit

#### **B. Control Terminal Floor Plan Data**

**3.05** Floor plan data for the control terminal is listed as follows:

SECT. 7.1—Switch Control Bay (sheet 98)  
 SECT. 7.1—Duplicate Switch Bay (sheet 99)  
 SECT. 7.1—Line Circuit Bay, 120 or 200 lines (sheet 100)  
 SECT. 7.1—Line Circuit Bay, 100 lines (sheet 101)  
 SECT. 7.1—TSTA Bay (sheet 102)  
 SECT. 7.1—Channel Bay (sheet 103)

#### **C. Equipment**

**3.06** Equipment drawings are listed as follows:

ED-2R024-01—MK Mobile Simulator Equipment  
 J41644A-( )—Switch Control Bay  
 J41644C-( )—Line Circuit Bay No. 1 or No. 2  
 J41644D-( )—Line Circuit Bay  
 J41644E-( )—Transmission Signaling and Test Access

Bay No. 1  
 J41644F-( )—Transmission Signaling and Test Access  
 Bay No. 2 or No. 3  
 J41644G-( )—Duplicate Switch Bay  
 J41644K-( )—Switch Control Bay  
 J41644L-( )—Duplicate Switch Bay  
 J41644M-( )—Line Circuit Bay  
 J41644N-( )—Transmission Signaling and Test Access  
 Bay No. 1  
 J41644P-( )—Transmission Signaling and Test Access  
 Bay No. 2  
 J41644R-( )—Transmission Signaling and Test Access  
 Bay No. 3, 4, or 5  
 J99236G-( )—Auxiliary Line Circuit—Relay  
 Rack-Mounted Equipment.

#### 4. EQUIPMENT

**4.01** The following information contains a complete list of all equipment contained in the MJ and MK Mobile Radio Telephone Systems. The equipment is listed according to J or KS number so that an equipment engineer may use the list to order any size MJ or MK Mobile Radio Telephone System. The system is ordered by specifying J numbers to Western Electric Co. or KS numbers to the supplier. The double coding of the terminal units is made necessary by Western Electric Co. record practices. The "Max" quantities specified at the end of each listing refer to the maximum number of the particular list that can be equipped on a bay.

**4.02** Two sets of ITT drawings are furnished with each basic bay ordered. The drawings contain all the wiring information needed to install a fully equipped bay. These drawings should be retained for the purpose of adding new equipment and for troubleshooting purposes.

#### A. Control Terminal, 11-Foot 6-Inch Bays (See Fig. 8)

**J41644A—AT&T Co Std—Switch Control Bay**  
 (KS-19455, L1)

**Equipment—J41644A-( )**

**List 1**—Framework, assembly, relay and crossbar adjusting tools, fuses, touch-up paint, wiring, and common equipment per KS-19455, L1 for one switch control bay equipped with common circuits for first 80 lines. One required per system. Included are two

List 22 wiring drawings and one each of the following circuits:

KS-19457, L5 Marker (SD-2R004-01, Fig. 1, 2, 3, 4, 5, 6, and 7 and "N" and "J" options). Handles lines 1 to 80 and up to 5 link circuits. KS-19457, L8 Line Chain and Allotter (SD-2R007-01, Fig. 1, 2, 3, and 4 and "Z" option). Handles lines 1 to 80.

KS-19457, L12\* Register (SD-2R006-01, Fig. 1 and "Z" option).

KS-19457, L16 Link Allotter (SD-2R009-01, Fig. 1 and "Z" and "V" options). Handles two link circuits.

KS-19457, L22 Sender (SD-2R003-01, Fig. 1 and "Z" option).

KS-19457, L24 Duplicate Switching and Test Access (SD-2R001-01, Fig. 1 and 3 and "Z" option).

KS-19457, L27 Common Pulse (SD-2R013-02, Fig. 1).

\*When ordering a List 1 bay, specify that the register be equipped with either List 7 or List 8.

**List 2**—Crossbar Switch per KS-19457, L4 (SD-2R005-01, Fig. 1) required in addition to List 1 or for field addition use. One required for each 80 lines or any portion thereof if system is equipped with five channels or less. If system is equipped with more than five channels, two of List 2 are required for each 80 lines or portion thereof. Equip switches on switch control bay J41644A, line circuit bay J41644C, and duplicate switch bay J41644G in order of positions 1 through 12 given in Fig. 8. A maximum of 3 switches can be equipped on each bay. (Max 12, min 1 for system.)

**List 3**—Marker equipment per KS-19457, L6 (SD-2R004-01, "P" through "Z" options as required per Note 102). One required in addition to List 1 for each crossbar switch 2 to 12 that is equipped. (Max 11.) Refer to Note 1.

**List 4**—Marker equipment per KS-19457, L7 (SD-2R004-01, "M" option as required per Note 102). One required in addition to List 1 when channels 6 through 8 or a portion thereof are equipped. (Max 1.)

Refer to Note 1.

- List 5**—Line Chain and Allotter equipment per KS-19457, L10 (SD-2R007-01, Fig. 2). One required in addition to List 1 for each additional 80 lines (lines 81 to 480) or portion thereof equipped. (Max 5.) Refer to Note 1.
- List 6**—Line Chain and Allotter equipment per KS-19457, L11 (SD-2R007-01, Fig. 3). One required in addition to List 1 for each additional 80 lines (lines 81 to 480) or portion thereof equipped. (Max 5.) Refer to Note 1.
- List 7**—Register Roamer equipment per KS-19457, L14 (SD-2R006-01, Fig. 2). One required in addition to List 1 when 1 to 12 specific roaming NPA codes are allowed to access a roamer line circuit. (Max 1.) Refer to Note 1.
- List 8**—Register Roamer equipment per KS-19457, L15 (SD-2R006-01, Fig. 3 and "X" or no option). One required in addition to List 1 when all roaming NPA codes are routed to a roamer line circuit or when all roaming NPA codes are routed to the mobile service operator. (Max 1.) Refer to Note 1.
- List 9**—Link Allotter equipment per KS-19457, L17 (SD-2R009-01, Fig. 2, 3, or 4 and "Y," "X," or "W" option). One required in addition to List 1 for each additional two channels, or part, equipped (channels 3 and 4, 5 and 6, or 7 and 8). (Max 3.) Refer to Note 1.
- List 10**—Link Allotter equipment per KS-19457, L18 (SD-2R009-01, Fig. 5 and "Z" option). One required in addition to List 1 when duplicate switching is provided. This equipment is associated with channels 1 and 2. (Max 1.) Refer to Note 1.
- List 11**—Link Allotter equipment per KS-19457, L19 (SD-2R009-01, Fig. 6, 7, or 8 and "Y," "X," or "W" option). One required in addition to Lists 1 and 10 (when duplicate switching is provided) for each two channels, or part, equipped (channels 3 and 4, 5 and 6, or 7 and 8). (Max 3.) Refer to Note 1.
- List 12**—Duplicate Switching and Test Access equipment per KS-19457, L25 (SD-2R001-01, Fig. 2 and "Y" option). One required in addition to List 1 when duplicate switching is provided. (Max 1.) Refer to Note 1.
- List 13**—Unassigned
- List 14**—Marker equipment per KS-19457, L54 (SD-2R004-01, "P" through "Z" options as required per Note 102). One required for each crossbar switch 2 to 12 that is added to an existing system. (Max 11.) Refer to Note 2.
- List 15**—Marker equipment per KS-19457, L55 (SD-2R004-01, "M" option as required per Note 102). One required when channels 6 through 8 or a portion thereof are added to an existing system. (Max 1.) Refer to Note 2.
- List 16**—Line Chain and Allotter equipment per KS-19457, L56 (SD-2R007-01, Fig. 2) and per KS-19457, L57 (SD-2R007-01, Fig. 3). One required for each additional 80 lines (lines 81 to 480) or portion thereof added to an existing system. (Max 5.) Refer to Note 2.
- List 17**—Register Roamer equipment per KS-19457, L58 (SD-2R006-01, Fig. 2). One required when a change is made in an existing system from List 8 roamer condition to List 7 roamer condition. Refer to Note 2.
- List 18**—Register Roamer equipment per KS-19457, L59 (SD-2R006-01, Fig. 3 and "X" or no option). One required when a change is made in an existing system from List 7 roamer condition to List 8 roamer condition. Refer to Note 2.
- List 19**—Link Allotter equipment per KS-19457, L60 (SD-2R009-01, Fig. 2, 3, or 4 and "Y," "X," or "W" option). One required for each additional two channels or part (channels 3 and 4, 5 and 6, or 7 and 8) added to an existing system. (Max 3.) Refer to Note 2.
- List 20**—Link Allotter equipment per KS-19457, L61 (SD-2R009-01, Fig. 5 and "Z" option) and Duplicate Switching and Test Access equipment per KS-19457, L64 (SD-2R001-01, Fig. 2 and "Y" option). One required when duplicate switching is added to an existing system. (Max 1.) Refer to Note 2.
- List 21**—Link Allotter equipment per KS-19457, L62 (SD-2R009-01, Fig. 6, 7, or 8 and "Y," "X," or "W" option). One required in addition to List 20 for each two channels or part (channels 3 and 4, 5 and 6, or 7 and 8) when duplicate switching is added to an existing system. (Max 3.) Refer to Note 2.
- List 22**—Wiring Drawings per KS-19455, L7. As required if a need for additional copies

of wiring information for bay J41644A arises.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

**J41644C—AT&TCo Std—Line Circuit Bay No. 1 or No. 2—200 Lines (KS-19455, L3)**

Equipment—J41644C( )

**List 1**—Framework, assembly, fuses, and wiring per KS-19455, L3 for one line circuit bay equipped to accept a maximum of 200 line circuits and 3 crossbar switches. Included are two sets of List 9 wiring drawings. Bay No. 1 provides for lines 1 through 200 and Bay No. 2 provides for lines 201 through 400.

**List 2**—Crossbar Switch per KS-19457, L4 (SD-2R005-01, Fig. 1) required in addition to each List 1 or for field addition use. For number required, see J41644A, List 2.

**List 3**—Line equipment per KS-19457, L1 (SD-2R002-01, Fig. 1 and 2) required in addition to List 1 for line circuits. This list provides the first 5 lines in each group of 20 lines (1 to 5, 21 to 25, 41 to 45, 61 to 65, etc.). (Max 10 for each bay.) Refer to Note 1.

**List 4**—Line equipment per KS-19457, L2 (SD-2R002-01, Fig. 1) required in addition to List 1 for line circuits. This list provides 5 lines for use as the second, third, or fourth group in each group of 20 lines (6 to 10, 11 to 15, 16 to 20, etc.). (Max 30 for each bay.) Refer to Note 1.

**List 5**—Line equipment per KS-19457, L3 (SD-2R002-01), Fig. 3) required in addition to Lists 1 and 3. One required for each group of 20 lines or portion thereof. (Max 10 for each bay.) Refer to Note 1.

**List 6**—Line equipment per KS-19457, L51 (SD-2R002-01, Fig. 1 and 2), and KS-19457, L3 (SD-2R002-01, Fig. 3). This list provides the first 5 lines in each group of 20 lines added to an existing system (1 to 5, 21 to 25, 41 to 45, etc.). (Max 9 for each bay.) Refer to Note 2.

**List 7**—Line equipment per KS-19457, L52

(SD-2R002-01, Fig. 1). This list provides 5 lines for use as the second, third, or fourth group in each group of 20 lines added to an existing system (6 to 10, 11 to 15, 16 to 20, 26 to 30, etc.). (Max 30 for each bay.) Refer to Note 2.

**List 8**—Unassigned.

**List 9**—Wiring Drawings per KS-19455, L9. As required if a need for additional copies of wiring information for bay J41644C arises.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

**J41644D—AT&TCo Std—Line Circuit Bay—100 Lines (KS-19455, L4)**

Equipment—J41644D( )

**List 1**—Framework, assembly, wiring and fuses per KS-19455, L4 for one line circuit bay equipped to accept a maximum of 100 lines. Included are two sets of List 7 wiring drawings. One required when system is not expected to grow to more than 100 lines and 5 channels.

**List 2**—Same as J41644C, List 3. (Max. 5.) Refer to Note 1.

**List 3**—Same as J41644C, List 4. (Max 15.) Refer to Note 1.

**List 4**—Same as J41644C, List 5. (Max 5.) Refer to Note 1.

**List 5**—Same as J41644C, List 6. (Max 4.) Refer to Note 2.

**List 6**—Same as J41644C, List 7. (Max 15.) Refer to Note 2.

**List 7**—Wiring Drawings per KS-19457, L10. As required if a need for additional copies of wiring information for bay J41644D arises.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

**J41644E—AT&T Co Std—Transmission Signaling  
and Test Access Bay No. 1 (KS-19455,  
L5)**

Equipment—J41644E-( )

**List 1**—Framework, assembly, fuses, wiring, and common equipment per KS-19455, L5 for one transmission signaling and test access bay No. 1. Contains equipment to accommodate first channel and provision for housing a maximum of two channels. One required per system. List 1 includes two sets of List 24 wiring drawings and one each of the following:

Technical Operator Test Panel (SD-2R019-01)

KS-19457, L20 Link Circuit (SD-2R008-01, Fig. 1 and 2)

KS-19457, L28 TSTA Miscellaneous Test Circuit (SD-2R016-01, Fig. 1)

KS-19457, L43 (J41644E, L11) Channel Test Jack Field Assembly (SD-2R000-01, Fig. 2)

KS-19457, L44 (J41644E, L12) Channel Test Jack Field Assembly (SD-2R000-01, Fig. 4)

KS-19457, L33\* (J41644E, L7) Channel Shelf (SD-2R000-01, Fig. 1)

The component plug-in units of this channel shelf are as follows (one of each):

KS-19457, L34 Hybrid (SD-2R000-01, CPS1)

KS-19457, L35 Ckt A VOGAD (SD-2R000-01, CPS2A)

KS-19457, L35 Ckt B VOGAD (SD-2R000-01, CPS2B)

KS-19457, L37 Tone Generator (SD-2R000-01, CPS3)

KS-19457, L38 (J41644E, L10) Receive Line Terminating Unit (SD-2R000-01, CPS5)

KS-19457, L39 Ckt A Receiver Selector (SD-2R000-01, CPS6A)

KS-19457, L39 Ckt B Receiver Selector (SD-2R000-01, CPS6B)

KS-19457, L40 SONAD (SD-2R000-01, CPS9)

KS-19457, L41 Ckt A Tone Detector (SD-2R000-01, CPS8A)

KS-19457, L41 Ckt B Tone Detector (SD-2R000-01, CPS8B)

KS-19457, L42 Bandpass Filter (SD-2R000-01, CPS7)

\* The channel shelf does not include a transmit line terminating unit. Two types of transmit line terminating units, Lists 8 and 9, are available and one must be ordered for an initial system. Additional receive line terminating units per List 10 may also be required.

**List 2**—Link Circuit per KS-19457, L21 (SD-2R008-01, Fig. 1). One required in addition to List 1 for link circuit No. 2 when channel 2 is equipped. (Max 1.) Refer to Note 1.

**List 3**—TSTA Test equipment per KS-19457, L29 (SD-2R016-01, Fig. 2). One required in addition to List 1 for miscellaneous test equipment required for each link 2 to 8 equipped. (Max 7.) Refer to Note 1.

**List 4**—TSTA Common equipment per KS-19457, L30 (SD-2R010-01, Fig. 1 and 5 and "Z" option; SD-2R011-01, Fig. 1 and "Z" option; SD-2R012-01, Fig. 1; SD-2R014-01, Fig. 1). One required in addition to List 1 for common equipment to handle channels 1 and 2 or part. (Max 1.) Specify station call letters for code wheel furnished with this equipment. If call letters are not known at time of order, the code wheel may be ordered later as Code Wheel (part of KS-19457, L30) Station Call Letters\_\_\_\_\_. Refer to Note 1.

**List 5**—TSTA Common equipment per KS-19457, L31 (SD-2R010-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option; SD-2R011-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option; SD-2R012-01, Fig. 2, 3, or 4 and "Z", "Y", or "X" option; SD-2R014-01, Fig. 2). One required in addition to Lists 1 and 4 for TSTA common equipment to handle each additional two channels, or part, equipped (channels 3 and 4, 5 and 6, or 7 and 8). (Max 3.) Refer to Note 1.

**List 6**—TSTA Common equipment per KS-19457,

- L32 (SD-2R012-01, Fig. 5). One required for TSTA common equipment in addition to the first List 5 equipped. (Max 1.) Refer to Note 1.
- List 7**—Channel Shelf per KS-19457, L33 (SD-2R000-01, Fig. 1). One required in addition to List 1 when channel 2 is equipped. For description of components, see List 1. (Max 1.) Refer to Note 1.
- List 8**—Transmit Line Terminating Unit (plug-in board) per KS-19457, L36 (SD-2R000-01, CPS4, Fig. 8 and "T" option). Required for single-transmitter-per-channel use. One required (for each channel 1 and 2) in addition to each List 1, List 7, or List 17, or for system revision use. (Mounts in KS-19457, L33.) (Max 2.)
- List 9**—Transmit Line Terminating Unit—MJ only (two plug-in boards) per KS-19457, L48 Ckt A and Ckt B (SD-2R000-01, CPS4A and CPS4B, Fig. 9). Required for 2-transmitter-per-channel use. One required (for each channel 1 and 2) in addition to each List 1, List 7, or List 17, or for system revision use. (Mounts in KS-19457, L33.) (Max 2.)
- List 10**—Receive Line Terminating Unit (plug-in board) per KS-19457, L38 (SD-2R000-01, CPS5, Fig. 5). One required for each additional receiver (2 to 8) per each channel 1 and 2. (Mounts in KS-19457, L33.) (Max 7 per channel = 14 total.)
- List 11**—Channel Test Jack Field Assembly per KS-19457, L43 (SD-2R000-01, Fig. 2). One required in addition to List 1 when channel 2 is equipped. (Max 1.) Refer to Note 1.
- List 12**—Channel Test Jack Field Assembly per KS-19457, L44 (SD-2R000-01, Fig. 4). One required in addition to List 1 when channel 2 is equipped. (Max 1.) Refer to Note 1.
- List 13**—Test Jack equipment per KS-19457, L45 (SD-2R000-01, Fig. 7). One required in addition to List 1 for each receive line terminating unit (2 to 8) equipped on each channel 1 and 2. (Max 14.) Refer to Note 1.
- List 14**—Pad Socket Assembly per KS-19457, L46 (SD-2R000-01, Fig. 3 and 6). Required in addition to List 1 or for system expansion use. One required for each receive line terminating unit (1 to 8) equipped on each channel 1 and 2 and two required for each channel 1 and 2 equipped. (Max 20.)
- List 15**—Test Transmitter Control Circuit per KS-19457, L47 (SD-2R015-01). One required in addition to List 1 if test transmitter is equipped. (Max 1.) Refer to Note 1.
- List 16**—Jack and Key equipment per KS-19457, L49 (SD-2R000-01, Fig. 10). One required in addition to List 1 for each channel 1 and 2 when system uses two transmitters per channel. (Max 2.) Refer to Note 1.
- List 17**—Link Circuit per KS-19457, L63 (SD-2R008-01, Fig. 1), Channel Shelf per KS-19457, L68 (SD-2R000-01), Channel Test Jack Field Assemblies per KS-19457, L69 (SD-2R000-01, Fig. 2), and KS-19457, L70 (SD-2R000-01, Fig. 4). One required when channel 2 is added to an existing system. For description of components in shelf, see J41644E, List 1. (Max 1.) Refer to Note 2.
- List 18**—TSTA Test equipment per KS-19457, L65 (SD-2R016-01, Fig. 2). One required for each link (2 to 8) added to an existing system. (Max 7.) Refer to Note 2.
- List 19**—TSTA Common equipment per KS-19457, L66 (SD-2R010-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option; SD-2R011-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option; SD-2R012-01, Fig. 2, 3, or 4 and "Z", "Y", or "X" option; SD-2R014-01, Fig. 2). One required for TSTA common equipment to handle each two channels or part (channels 3 and 4, 5 and 6, or 7 and 8) added to an existing system. (Max 3.) Refer to Note 2.
- List 20**—TSTA Common equipment per KS-19457, L67 (SD-2R012-01, Fig. 5). One required in addition to the first List 19 added to an existing system. (Max 1.) Refer to Note 2.
- List 21**—Test Jack equipment per KS-19457, L71 (SD-2R000-01, Fig. 7). One required for each receive line terminating unit (2 to 8) added to an existing system on each channel 1 and 2. (Max 14.) Refer to Note 2.
- List 22**—Test Transmitter Control Circuit per KS-19457, L72 (SD-2R015-01). One required when test transmitter is added to an existing system. (Max 1.) Refer to Note 2.
- List 23**—Jack and Key equipment per KS-19457, L73 (SD-2R000-01, Fig. 10). One required for each channel 1 and 2 when a second transmitter per channel is added to an

existing system. (Max 2.) Refer to Note 2.

**List 24**—Wiring Drawings per KS-19455, L11. As required if a need for additional copies of wiring information for bay J41644E arises.

**List 25**—MK Modification Kit per KS-19457, L80 (SD-2R008-01). One required for each channel 1 and 2 when bay is for an MK system. (Max 2.) Refer to Note 1.

**List 26**—MK Modification Kit per KS-19457, L80 (SD-2R008-01). One required for each channel 1 and 2 when an MJ control terminal is being converted for use in an MK system. (Max 2.) Refer to Note 2.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

**J41644F—AT&T Co Std—Transmitter Signaling and Test Access Bay No. 2 or No. 3 (KS-19455, L6)**

Equipment—J41644F(-)

**List 1**—Framework, assembly, fuses, wiring, and common equipment per KS-19455, L6 for one transmission signaling and test access bay. A maximum of two such bays are required in any one system and are designated as TSTA bay No. 2 and TSTA bay No. 3. The former houses channels 3, 4, and 5 while the latter houses channels 6, 7, and 8. List 1 includes two sets of List 15 wiring drawings and one each of the following:

KS-19457, L21 (J41644F, L2) Link Circuit (SD-2R008-01, Fig. 1)

KS-19457, L43 (J41644F, L7) Channel Test Jack Field Assembly (SD-2R000-01, Fig. 2)

KS-19457, L44 (J41644F, L8) Channel Test Jack Field Assembly (SD-2R000-01, Fig. 4)

KS-19457, L33 (J41644F, L3) Channel Shelf (SD-2R000-01, Fig. 1. See J41644E, List 1 for component parts.)

Technical Operator Test Panel (SD-2R019-01).

**List 2**—Link Circuit per KS-19457, L21 (SD-2R008-01, Fig. 1). One required in addition to List 1 for each link circuit No. 4, 5, 7, or 8 when channel 4, 5, 7, or 8 is equipped. (Max 2 for each bay.) Refer to Note 1.

**List 3**—Channel Shelf per KS-19457, L33 (SD-2R000-01). One required in addition to List 1 for each channel 4, 5, 7, or 8 equipped. For component descriptions, see J41644E, List 1 and Lists 4, 5, and 6 below. (Max 2 for each bay.) Refer to Note 1.

**List 4**—Transmit Line Terminating Unit (plug-in board) per KS-19457, L36 (SD-2R000-01, CPS4, Fig. 8 and "T" option). Required for single-transmitter-per-channel use. One required (for each channel 3 through 8 equipped) in addition to each List 1, List 3, or List 12, or for system revision use. (Mounts in KS-19457, L33.) (Max 3 for each bay.)

**List 5**—Transmit Line Terminating Unit—MJ only (two plug-in boards) per KS-19457, L48 Ckt A and Ckt B (SD-2R000-01, CPS4A and CPS4B, Fig. 9). Required for 2-transmitter-per-channel use. One required (for each channel 3 through 8 equipped) in addition to each List 1, List 3, or List 12, or for system revision use. (Mounts in KS-19457, L33.) (Max 3 for each bay.)

**List 6**—Receive Line Terminating Unit (plug-in board) per KS-19457, L38 (SD-2R000-01, CPS5). One required for each additional receiver (2 to 8) per each channel 3 through 8 equipped. (Mounts in KS-19457, L33.) (Max 7 per channel = 21 total for each bay.)

**List 7**—Channel Test Jack Field Assembly per KS-19457, L43 (SD-2R000-01, Fig. 2). One required in addition to List 1 for each channel 4, 5, 7, or 8 equipped. (Max 2 for each bay.) Refer to Note 1.

**List 8**—Channel Test Jack Field Assembly per KS-19457, L44 (SD-2R000-01, Fig. 4). One required in addition to List 1 for each channel 4, 5, 7, or 8 equipped. (Max 2 for each bay.) Refer to Note 1.

**List 9**—Test Jack equipment per KS-19457, L45 (SD-2R000-01, Fig. 7). One required in addition to List 1 for each receive line terminating unit (2 to 8) equipped on each channel 3 through 8. (Max 21 for each bay.) Refer to Note 1.

- List 10**—Pad Socket Assembly per KS-19457, L46 (SD-2R000-01, Fig. 3 and 6). Required in addition to List 1 or for system expansion use. One required for each receive line terminating unit (1 to 8) equipped on each channel 3 through 8 and two required for each channel 3 through 8 equipped. (Max 30 for each bay.)
- List 11**—Jack and Key equipment per KS-19457, L49 (SD-2R000-01, Fig. 10). One required in addition to List 1 for each channel 3 through 8 when system uses two transmitters per channel. (Max 3 for each bay.) Refer to Note 1.
- List 12**—Link Circuit per KS-19457, L63 (SD-2R008-01, Fig. 1), Channel Shelf KS-19457, L68 (SD-2R000-01), and Channel Test Jack Field Assemblies KS-19457, L69 (SD-2R000-01, Fig. 2) and KS-19457, L70 (SD-2R000-01, Fig. 4). One required when channel 4, 5, 7, or 8 is added to an existing system. For description of components in shelf, see J41644E, L1. (Max 2 for each bay.) Refer to Note 2.
- List 13**—Test Jack Equipment per KS-19457, L71 (SD-2R000-01, Fig. 7). One required for each receive line terminating unit (2 to 8) added to an existing system on each channel 3 through 8. (Max 21 for each bay.) Refer to Note 2.
- List 14**—Jack and Key equipment per KS-19457, L73 (SD-2R000-01, Fig. 10). One required for each channel 3 through 8 when a second transmitter per channel is added to an existing system. (Max 3 for each bay.) Refer to Note 2.
- List 15**—Wiring Drawings per KS-19455, L12. As required if a need for additional copies of wiring information for bay J41644F arises.
- List 16**—MK Modification Kit per KS-19457, L80 (SD-2R008-01). One required for each channel 3 through 8 when bays are for an MK system. (Max 3 for each bay.) Refer to Note 1.
- List 17**—MK Modification Kit per KS-19457, L80 (SD-2R008-01). One required for each channel 3 through 8 when MJ bays are to be converted for an MK system. (Max 3 for each bay.) Refer to Note 2.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

**J41644G—AT&TCo Std—Duplicate Switch Bay (KS-19455, L13)**

Equipment—J41644G( )

- List 1**—Framework, assembly, fuses, and wiring per KS-19455, L13 for one duplicate switch bay. One required per system when duplicate switching feature, line circuits 401 to 480, or crossbar switches No. 10, 11, or 12 are required in a system. (See Fig. 8.) Included are two sets of List 17 wiring drawings.
- List 2**—Crossbar Switch per KS-19457, L4 (SD-2R005-01, Fig. 1) required in addition to List 1 or for field additions. For number required, see J41644A, List 2.
- List 3**—Line equipment per KS-19457, L1 (SD-2R002-01, Fig. 1 and 2) and KS-19457, L3 (SD-2R002-01, Fig. 3) required in addition to List 1 for line circuits. This list provides the first 5 lines in each group of 20 lines (401 to 405, 421 to 425, 441 to 445, or 461 to 465). (Max 4.) Refer to Note 1.
- List 4**—Line equipment per KS-19457, L2 (SD-2R002-01, Fig. 1) required in addition to List 1 for line circuits. This list provides 5 lines for use as the second, third, or fourth group in each group of 20 lines (406 to 410, 411 to 415, 416 to 420, etc.). (Max 12.) Refer to Note 1.
- List 5**—Marker equipment per KS-19457, L6 (SD-2R004-01, "P" through "Z" options, as required per Note 102). Required only for duplicate switching condition. One required in addition to Lists 1 and 18 for each crossbar switch 2 to 12 that is equipped. (Max 11.) Refer to Note 1.
- List 6**—Marker equipment per KS-19457, L7 (SD-2R004-01, "M" option as required per Note 102). Required only for duplicate switching condition. One required in addition to Lists 1 and 18 when channels 6 through 8 or a portion thereof are equipped. (Max 1.) Refer to Note 1.
- List 7**—Line Chain and Allotter equipment per KS-19457, L11 (SD-2R007-01, Fig. 3). Required only for duplicate switching condition. One required in addition to Lists 1 and 18 for each additional 80 lines (lines

81 to 480) or portion thereof equipped. (Max 5.) Refer to Note 1.

- List 8**—Register Roamer equipment per KS-19457, L14 (SD-2R006-01, Fig. 2). Required only for duplicate switching condition. One required in addition to Lists 1 and 18 when 1 to 12 specific roaming NPA codes are allowed to access a roamer line circuit. (Max 1.) Refer to Note 1.
- List 9**—Register Roamer equipment per KS-19457, L15 (SD-2R006-01, Fig. 3 and "X" or no option). Required only for duplicate switching condition. One required in addition to Lists 1 and 18. When all roaming NPA codes are routed to a roamer line circuit or when all roaming NPA codes are routed to the mobile service operator. (Max 1.) Refer to Note 1.
- List 10**—Line equipment per KS-19457, L51 (SD-2R002-01, Fig. 1 and 2) and per KS-19457, L3 (SD-2R002-01, Fig. 3). This list provides the first 5 lines in each group of 20 lines added to an existing system (401 to 405, 421 to 425, 441 to 445, or 461 to 465). (Max 4.) Refer to Note 2.
- List 11**—Line equipment per KS-19457, L52 (SD-2R002-01, Fig. 1). This list provides 5 lines for use as the second, third, or fourth group in each group of 20 lines added to an existing system (406 to 410, 411 to 415, 416 to 420, etc.). (Max 12.) Refer to Note 2.
- List 12**—Marker equipment per KS-19457, L54 (SD-2R004-01, "P" through "Z" options, as required per Note 102). One required for each crossbar switch 2 to 12 that is added to an existing system when List 18 is equipped. One also required for each crossbar switch 2 to 12 existing in and/or added to a system when List 19 is ordered. (Max 11.) Refer to Note 2.
- List 13**—Marker equipment per KS-19457, L55 (SD-2R004-01, "M" option as required per Note 102). One required when channels 6 through 8 or a portion thereof are added to an existing system when List 18 is equipped. One also required when channels 6 through 8 or a portion thereof exist in and/or are added to a system when List 19 is ordered. (Max 1.) Refer to Note 2.
- List 14**—Line Chain and Allotter equipment per KS-19457, L57 (SD-2R007-01, Fig. 3). One

required for each additional 80 lines (lines 81 to 480) or portion thereof added to an existing system when List 18 is equipped. One also required for each additional 80 lines (lines 81 to 480) or portion thereof that exist in and/or are added to a system when List 19 is ordered. (Max 5.) Refer to Note 2.

- List 15**—Register Roamer equipment per KS-19457, L58 (SD-2R006-01, Fig. 2). One required when List 18 is equipped in an existing system and a change is made from List 9 roamer condition to List 8 roamer condition or when List 19 is ordered and 1 to 12 specific roaming NPA codes are allowed to access a roamer line circuit. Refer to Note 2.
- List 16**—Register Roamer equipment per KS-19457, L59 (SD-2R006-01, Fig. 3 and "X" or no option). One required when List 18 is equipped in an existing system and a change is made from List 8 roamer condition to List 9 roamer condition or when List 19 is ordered and all roaming NPA codes are routed to a roamer line circuit or all roaming NPA codes are routed to the mobile service operator. Refer to Note 2.
- List 17**—Wiring Drawings per KS-19457, L8. As required if a need for additional copies of wiring information for bay J41644G arises.
- List 18**—Common circuits for first 80 lines. One required in addition to List 1 for duplicate switching feature. (Max 1.) Refer to Note 1. Included are one each of the following circuits:

KS-19457, L5 Marker (SD-2R004-01, Fig. 1, 2, 3, 4, 5, 6, and 7 and "N" and "K" options). Handles lines 1 to 80 and up to 5 link circuits.

KS-19457, L9 Line Chain and Allotter (SD-2R007-01, Fig. 1 and 3 and "Y" option). Handles Lines 1 to 80.

KS-19457, L13\* Register (SD-2R006-01, Fig. 1 and "Y" option).

KS-19457, L23 Sender (SD-2R003-01, Fig. 1 and "Y" option).

\*When ordering List 18, specify that the register be equipped with either List 8 or List 9.

**List 19**—Common circuits for first 80 lines. One required when duplicate switching feature is added to an existing system. (Max 1.) Refer to Note 2. Included are the following circuits:

KS-19457, L74 Marker (SD-2R004-01, Fig. 1, 2, 3, 4, 5, 6, and 7 and "N" and "K" options). Handles lines 1 to 80 and up to 5 link circuits.

KS-19457, L75 Chain and Allotter (SD-2R007-01, Fig. 1 and 3 and "Y" option). Handles lines 1 to 80.

KS-19457, L76\* Register (SD-2R006-01, Fig. 1 and "Y" option).

KS-19457, L77 Sender (SD-2R003-01, Fig. 1 and "Y" option).

\*When ordering List 19, specify that the register be equipped with either List 15 or List 16.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

**KS-19663 End Covers**

**List 5**—End Covers, required when 11-foot control terminal bays are arranged in more than one row. One required for each additional row.

**KS-19457 Spare Parts Package**

**List 50**—The following spare parts are included in List 50:

(a) One of each of the following ITT-type relay coils:

P2	S32	S53	T9
P3	S34	S64	T14
S3	S36	S78	T15

S6	S38	S80	T19
S10	S46	S81	T21
S11	S50	T3	T41
S12	S52	T6	T52

(b) Two of each of the following ITT-type relay coils:

S8	S17	S75
S9	S45	

(c) One type UA-42359 and one type 95694-1 Clare complete mercury relays.

(d) Two type 80975-1 ITT complete duo quintet relays.

(e) One each of the following ITT-type relay stacks:

4017	4051	4199	4497
4020	4058	4231	4508
4022	4093	4237	6007
4031	4100	4287	
4040	4120	4424	

(f) One 300-microfarad 60V Aeorvox AEP plug-in electrolytic capacitor.

(g) One 180-microfarad 60V Sprague DEA plug-in electrolytic capacitor.

(h) One KS-19457, L26 channel shelf equipped with one TLTU KS-19457, L36 is included. (KS-19457, L26 differs from KS-19457, L33 in that shelf wiring is not included.)

(j) Two type 1N2070 diodes.

- (k) One package of relay armature residual clips containing two each of the following types: AA, AE, AF, AH, AK.
- (l) Two type 1S(X)1-T Micro Switches, each equipped with a JX-20 actuator.
- (m) Two Sylvania B4861 lamps, each equipped with a B8071 lamp cap (red).
- (n) Two Sylvania B4861 lamps, each equipped with a B8073 lamp cap (white).

**B. Control Terminal, 9-Foot Bays (See Fig. 9)**

**J41644K—AT&T Co Std—Switch Control Bay (KS-19456, L1)**

Equipment—J41644K-( )

**List 1**—Framework, assembly, relay and crossbar adjusting tools, fuses, touch-up paint, wiring, and common equipment per KS-19456, L1 for one switch control bay equipped with common circuits for first 80 lines. One required per system. Included are two sets of List 20 wiring drawings and one each of the following circuits:

KS-19457, L5 Marker (SD-2R004-01, Fig. 1, 2, 3, 4, 5, 6, and 7 and "N" and "J" options). Handles lines 1 to 80 and up to 5 link circuits.

KS-19457, L8, Line Chain and Allotter (SD-2R007-01, Fig. 1, 2, 3, and 4 and "Z" option). Handles lines 1 to 80.

KS-19457, L12\* Register (SD-2R006-01, Fig. 1 and "Z" option).

KS-19457, L16 Link Allotter (SD-2R009-01, Fig. 1 and "Z" and "V" options). Handles 2 link circuits.

KS-19457, L22 Sender (SD-2R003-01, Fig. 1 and "Z" option).

KS-19457, L24 Duplicate Switching and Test Access (SD-2R001-01, Fig. 1 and 3 and "Z" option).

KS-19457, L27 Common Pulse (SD-2R013-02, Fig. 1).

\*When ordering List 1, specify that the register be equipped with either List 6 or List 7.

**List 2**—Marker equipment per KS-19457, L6 (SD-2R004-01, "P" through "Z" options as required per Note 102). One required in addition to List 1 for each crossbar switch 2 to 12 that is equipped. (Max 11.) Refer to Note 1.

**List 3**—Marker equipment per KS-19457, L7 (SD-2R004-01, "M" option as required per Note 102). One required in addition to List 1 when channels 6 through 8 or a portion thereof are equipped. (Max 1.) Refer to Note 1.

**List 4**—Line Chain and Allotter equipment per KS-19457, L10 (SD-2R007-01, Fig. 2). One required in addition to List 1 for each additional 80 lines (lines 81 to 480) or portion thereof equipped. (Max 5.) Refer to Note 1.

**List 5**—Line Chain and Allotter equipment per KS-19457, L11 (SD-2R007-01, Fig. 3). One required in addition to List 1 for each additional 80 lines (lines 81 to 480) or portion thereof equipped. (Max 5.) Refer to Note 1.

**List 6**—Register Roamer equipment per KS-19457, L14 (SD-2R006-01, Fig. 2). One required in addition to List 1 when 1 to 12 specific roaming NPA codes are allowed to access a roamer line circuit. (Max 1.) Refer to Note 1.

**List 7**—Register Roamer equipment per KS-19457, L15 (SD-2R006-01, Fig. 3 and "X" or no option). One required in addition to List 1 when all roaming NPA codes are routed to a roamer line circuit or when all roaming NPA codes are routed to the mobile service operator. (Max 1.) Refer to Note 1.

**List 8**—Link Allotter equipment per KS-19457, L17 (SD-2R009-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option). One required in addition to List 1 for each additional two channels or part equipped (channels 3 and 4, 5 and 6, or 7 and 8). (Max 3.) Refer to Note 1.

**List 9**—Link Allotter equipment per KS-19457, L18 (SD-2R009-01, Fig. 5 and "Z" option). One required in addition to List 1 when duplicate switching is provided. This equipment is associated with channels 1 and 2. (Max 1.) Refer to Note 1.

**List 10**—Link Allotter equipment per KS-19457,

L19 (SD-2R009-01, Fig. 6, 7, or 8 and "Y", "X", or "W" option). One required in addition to Lists 1 and 9 (when duplicate switching is provided) for each two channels or part equipped (channels 3 and 4, 5 and 6, or 7 and 8). (Max 3.) Refer to Note 1.

**List 11**—Duplicate Switching and Test Access equipment per KS-19457, L25 (SD-2R001-01, Fig. 2 and "Y" option). One required in addition to List 1 when duplicate switching is provided. (Max 1.) Refer to Note 1.

**List 12**—Marker equipment per KS-19457, L54 (SD-2R004-01, "P" through "Z" options as required per Note 102). One required for each crossbar switch 2 to 12 that is added to an existing system. (Max 11.) Refer to Note 2.

**List 13**—Marker equipment per KS-19457, L55 (SD-2R004-01, "M" option as required per Note 102). One required when channels 6 through 8 or a portion thereof are added to an existing system. (Max 1.) Refer to Note 2.

**List 14**—Line Chain and Allotter equipment per KS-19457, L56 (SD-2R007-01, Fig. 2) and per KS-19457, L57 (SD-2R007-01, Fig. 3). One required for each additional 80 lines (lines 81 to 480) or portion thereof added to an existing system. (Max 5.) Refer to Note 2.

**List 15**—Register Roamer equipment per KS-19457, L58 (SD-2R006-01, Fig. 2). One required when a change is made in an existing system from List 7 roamer condition to List 6 roamer condition. Refer to Note 2.

**List 16**—Register Roamer equipment per KS-19457, L59 (SD-2R006-01, Fig. 3 and "X" or no option). One required when a change is made in an existing system from List 6 roamer condition to List 7 roamer condition. Refer to Note 2.

**List 17**—Link Allotter equipment per KS-19457, L60 (SD-2R009-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option). One required for each additional two channels or part (channels 3 and 4, 5 and 6, or 7 and 8) added to an existing system. (Max 3.) Refer to Note 2.

**List 18**—Link Allotter equipment per KS-19457, L61 (SD-2R009-01, Fig. 5 and "Z" option) and Duplicate Switching and Test Access equipment per KS-19457, L64 (SD-2R001-01, Fig. 2 and "Y" option). One required

when duplicate switching is added to an existing system. (Max 1.) Refer to Note 2.

**List 19**—Link Allotter equipment per KS-19457, L62 (SD-2R009-01, Fig. 6, 7, or 8 and "Y", "X", or "W" option). One required in addition to List 18 (when duplicate switching is added) for each two channels or part (channels 3 and 4, 5 and 6, or 7 and 8) added to an existing system. (Max 3.) Refer to Note 2.

**List 20**—Wiring Drawings per KS-19456, L7. As required if a need for additional copies of wiring information for bay J41644K arises.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

#### **J41644L—AT&T Co Std—Duplicate Switch Bay (KS-19456, L2)**

Equipment—J41644L(-)

**List 1**—Framework, assembly, fuses, wiring, and common equipment per KS-19456, L2 for one duplicate switch bay equipped with common circuits for first 80 lines. One required per system when duplicate switching feature is equipped. Included are two sets of List 12 wiring drawings and one each of the following circuits:

KS-19457, L5 Marker (SD-2R004-01, Fig. 1, 2, 3, 4, 5, 6, and 7 and "N" and "K" options). Handles lines 1 to 80 and up to 5 link circuits.

KS-19457, L9 Line Chain and Allotter (SD-2R007-01, Fig. 1 and 3 and "Y" option). Handles lines 1 to 80.

KS-19457, L13\* Register (SD-2R006-01, Fig. 1 and "Y" option).

KS-19457, L23 Sender (SD-2R003-01, Fig. 1 and "Y" option).

\*When ordering List 1, specify that the register be equipped with either List 5 or List 6.

- List 2**—Marker equipment per KS-19457, L6 (SD-2R004-01, "P" through "Z" options as required per Note 102). One required in addition to List 1 for each crossbar switch 2 to 12 that is equipped. (Max 11.) Refer to Note 1.
- List 3**—Marker equipment per KS-19457, L7 (SD-2R004-01, "M" option as required per Note 102). One required in addition to List 1 when channels 6 through 8 or a portion thereof are equipped. (Max 1.) Refer to Note 1.
- List 4**—Line Chain and Allotter equipment per KS-19457, L11 (SD-2R007-01, Fig. 3). One required in addition to List 1 for each additional 80 lines (lines 81 to 480) or portion thereof equipped. (Max 5.) Refer to Note 1.
- List 5**—Register Roamer equipment per KS-19457, L14 (SD-2R006-01, Fig. 2). One required in addition to List 1 when 1 to 12 specific roaming NPA codes are allowed to access a roamer line circuit. (Max 1.) Refer to Note 1.
- List 6**—Register Roamer equipment per KS-19457, L15 (SD-2R006-01, Fig. 3 and "X" or no option). One required in addition to List 1 when all roaming NPA codes are routed to a roamer line circuit or when all roaming NPA codes are routed to the mobile service operator. (Max 1.) Refer to Note 1.
- List 7**—Marker equipment per KS-19457, L54 (SD-2R004-01, "P" through "Z" options as required by Note 102). One required for each crossbar switch 2 to 12 that is added to an existing duplicate switching system. (Max 11.) Refer to Note 2.
- List 8**—Marker equipment per KS-19457, L55 (SD-2R004-01, "M" option as required per Note 102). One required when channels 6 through 8 or a portion thereof are added to an existing duplicate switching system. (Max 1.) Refer to Note 2.
- List 9**—Line Chain and Allotter equipment per KS-19457, L57 (SD-2R007-01, Fig. 3). One required for each additional 80 lines (lines 81 to 480) or portion thereof added to an existing duplicate switching system. (Max 5.) Refer to Note 2.
- List 10**—Register Roamer equipment per KS-19457, L58 (SD-2R006-01, Fig. 2). One required

when a change is made in an existing duplicate switching system from List 6 roamer condition to List 5 roamer condition. Refer to Note 2.

- List 11**—Register Roamer equipment per KS-19457, L59 (SD-2R006-01, Fig. 3 and "X" or no option). One required when a change is made in an existing duplicate switching system from List 5 roamer condition to List 6 roamer condition. Refer to Note 2.
- List 12**—Wiring Drawings per KS-19456, L8. As required if a need for additional copies of wiring information for bay J41644L arises.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

**J41644M—AT&T Co Std—Line Circuit Bay No. 1, 2, 3, or 4—120 Lines (KS-19456, L3)**

Equipment—J41644M-( )

- List 1**—Framework, assembly, fuses, and wiring per KS-19456, L3 for one line circuit bay equipped to accept a maximum of 120 line circuits and 3 crossbar switches. Included are two sets of List 9 wiring drawings. One bay is required for each 120 lines or less that are equipped. (Max 4 bays.)
- List 2**—Crossbar Switch per KS-19457, L4 (SD-2R005-01, Fig. 1). Required in addition to each List 1 or for field addition use. One required for each 80 lines or any portion thereof if system is equipped with 5 channels or less. If system is equipped with more than 5 channels, two of List 2 are required for each 80 lines or portion thereof. A maximum of three switches can be equipped on each bay, in order of positions given in Fig. 9. (Max 12, min 1 for system.)
- List 3**—Line equipment per KS-19457, L1 (SD-2R002-01, Fig. 1 and 2). Required in addition to List 1 for line circuits. This list provides the first 5 lines in each group of 20 lines (1 to 5, 21 to 25, 41 to 45, 61 to 65, etc.). (Max 6 for each bay.) Refer to Note 1.
- List 4**—Line equipment per KS-19457, L2 (SD-2R002-01,

Fig. 1). Required in addition to List 1 for line circuits. This list provides 5 lines for use as the second, third, or fourth group in each group of 20 lines (6 to 10, 11 to 15, 16 to 20, etc.). (Max 18 for each bay.) Refer to Note 1.

**List 5**—Line equipment per KS-19457, L3 (SD-2R002-01, Fig. 3). Required in addition to Lists 1 and 3. One required for each group of 20 lines or portion thereof. (Max 6 for each bay.) Refer to Note 1.

**List 6**—Line equipment per KS-19457, L51 (SD-2R002-01, Fig. 1 and 2) and per KS-19457, L3 (SD-2R002-01, Fig. 3). This list provides the first 5 lines in each group of 20 lines added to an existing system (1 to 5, 21, to 25, 41, to 45, etc.). (Max 5 for each bay.) Refer to Note 2.

**List 7**—Line equipment per KS-19457, L52 (SD-2R002-01, Fig. 1). This list provides 5 lines for use as the second, third, or fourth group in each group of 20 lines added to an existing system (6 to 10, 11 to 15, 16 to 20, 26 to 30, etc.). (Max 18 for each bay.) Refer to Note 2.

**List 8**—Unassigned.

**List 9**—Wiring Drawings per KS-19456, L9. As required if a need for additional copies of wiring information for bay J41644M arises.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

**J41644N—AT&T Co Std—Transmission Signaling and Test Access Bay No. 1 (KS-19456, L4)**

Equipment—J41644N-( )

**List 1**—Framework, assembly fuses, wiring, and common equipment per KS-19456, L4 for one transmission signaling and test access bay No. 1. Included are two sets of List 7 wiring drawings. One required per system.

**List 2**—TSTA Common equipment per KS-19457, L30 (SD-2R010-01, Fig. 1 and 5 and "Z" option; SD-2R011-01, Fig. 1 and "Z" option; SD-2R012-01, Fig. 1; SD-2R014-01, Fig. 1).

One required in addition to List 1 for common equipment to handle channels 1 and 2 or part. (Max 1.) Specify station call letters for code wheel associated with this equipment. If call letters are not known at time of order, the code wheel may be ordered later as Code Wheel (part of KS-19457, L30) Station Call Letters \_\_\_\_\_ Refer to Note 1.

**List 3**—TSTA Common equipment per KS-19457, L31 (SD-2R010-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option; SD-2R011-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option; SD-2R012-01, Fig. 2, 3, or 4 and "Z", "Y", or "X" option; SD-2R014-01, Fig. 2). One required in addition to List 1 for TSTA common equipment to handle each additional two channels or part equipped (channels 3 and 4, 5 and 6, or 7 and 8). (Max 3.) Refer to Note 1.

**List 4**—TSTA Common equipment per KS-19457, L32 (SD-2R012-01, Fig. 5). One required for TSTA common equipment in addition to the first List 3 equipped. (Max 1.) Refer to Note 1.

**List 5**—TSTA Common equipment per KS-19457, L66 (SD-2R010-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option; SD-2R011-01, Fig. 2, 3, or 4 and "Y", "X", or "W" option; SD-2R012-01, Fig. 2, 3, or 4 and "Z", "Y", or "X" option; SD-2R014-01, Fig. 2). One required for TSTA common equipment to handle each additional two channels (channels 3 and 4, 5 and 6, or 7 and 8) or part added to an existing system. (Max 3.) Refer to Note 2.

**List 6**—TSTA Common equipment per KS-19457, L67 (SD-2R012-01, Fig. 5). One required for TSTA common equipment in addition to the first List 5 equipped when channels 3 and 4 are added to an existing system. (Max 1.) Refer to Note 2.

**List 7**—Wiring Drawings per KS-19456, L10. As required if a need for additional copies of wiring information for bay J41644N arises.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

***J41644P—AT&TCo Std—Transmission Signaling and Test Access Bay No. 2 (KS-19456, L5)***

Equipment—J41644P-( )

**List 1**—Framework, assembly, fuses, wiring, and common equipment per KS-19456, L5 for one transmission signaling and test access bay No. 2. Contains equipment to accommodate first channel and provision for housing a maximum of two channels. One required per system. List 1 includes two sets of List 19 wiring drawings and one each of the following:

Technical Operator Test Panel (SD-2R019-01)

KS-19457, L20 Link Circuit (SD-2R008-01, Fig. 1 and 2)

KS-19457, L28 TSTA Miscellaneous Test Circuit (SD-2R016-01, Fig. 1)

KS-19457, L43 (J41644P, L8) Channel Test Jack Field Assembly (SD-2R000-01, Fig. 2)

KS-19457, L44 (J41644P, L9) Channel Test Jack Field Assembly (SD-2R000-01, Fig. 4)

KS-19457, L33 (J41644P, L4)\* Channel Shelf (SD-2R000-01, Fig. 1)

The component plug-in units of the KS-19457, L33 channel shelf are as follows (one each):

KS-19457, L34 Hybrid (SD-2R000-01, CPS1)

KS-19457, L35 Ckt A VOGAD (SD-2R000-01, CPS2A)

KS-19457, L35 Ckt B VOGAD (SD-2R000-01, CPS2B)

KS-19457, L37 Tone Generator (SD-2R000-01, CPS3)

KS-19457, L38 (J41644P, L7) Receive Line Terminating Unit (SD-2R000-01, CPS5)

KS-19457, L39 Ckt A Receiver Selector (SD-2R000-01, CPS6A)

KS-19457, L39 Ckt B Receiver Selector (SD-2R000-01, CPS6B)

KS-19457, L40 SONAD (SD-2R000-01, CPS9)

KS-19457, L41 Ckt A Tone Detector (SD-2R000-01, CPS8A)

KS-19457, L41 Ckt B Tone Detector (SD-2R000-01, CPS8B)

KS-19457, L42 Bandpass Filter (SD-2R000-01, CPS7).

\*The channel shelf does not include a transmit line terminating unit. Two types of transmit line terminating units, Lists 5 and 6, are available and one must be ordered for an initial system. Additional receiver line terminating units, per List 7, may also be required.

**List 2**—Link Circuit per KS-19457, L21 (SD-2R008-01, Fig. 1). One required in addition to List 1 when channel 2 is equipped. (Max 1.) Refer to Note 1.

**List 3**—TSTA Test equipment per KS-19457, L29 (SD-2R016-01, Fig. 2). One required in addition to List 1 for miscellaneous test equipment required for each link 2 to 8 equipped. (Max 7.) Refer to Note 1.

**List 4**—Channel Shelf per KS-19457, L33 (SD-2R000-01, Fig. 1). One required in addition to List 1 when channel 2 is equipped. For description of components, see List 1. (Max 1.) Refer to Note 1.

**List 5**—Transmit Line Terminating Unit (plug-in board) per KS-19457, L36 (SD-2R000-01, CPS4, Fig. 8 and "T" option). Required for single-transmitter-per-channel use. One required (for each channel 1 and 2) in addition to each List 1, List 4, or List 14, or for system revision use. (Mounts in KS-19457, L33.) (Max 2.)

**List 6**—Transmit Line Terminating Unit—MJ only (two plug-in boards) per KS-19457, L48, Ckt A and Ckt B (SD-2R000-01, CPS4A and CPS4B, Fig. 9). Required for 2-transmitter-per-channel use. One required (for each channel 1 and 2) in addition to each List 1, List 4, or List 14, or for system revision use. (Mounts in KS-19457, L33.) (Max 2.)

**List 7**—Receive Line Terminating Unit (plug-in board) per KS-19457, L38 (SD-2R000-01, CPS5, Fig. 5). One required for each additional receiver (2 to 8) per each channel

- 1 and 2. (Max 7 per channel = 14 total.)
- List 8**—Channel Test Jack Field Assembly per KS-19457, L43 (SD-2R000-01, Fig. 2). One required in addition to List 1 when channel 2 is equipped. (Max 1.) Refer to Note 1.
- List 9**—Channel Test Jack Field Assembly per KS-19457, L44 (SD-2R000-01, Fig. 4). One required in addition to List 1 when channel 2 is equipped. (Max 1.) Refer to Note 1.
- List 10**—Test Jack equipment per KS-19457, L45 (SD-2R000-01, Fig. 7). One required in addition to List 1 for each receive line terminating unit (2 to 8) equipped on each channel 1 and 2. (Max 14.) Refer to Note 1.
- List 11**—Pad Socket Assembly per KS-19457, L46 (SD-2R000-01, Fig. 3 and 6). Required in addition to List 1 or for system expansion use. One required for each receive line terminating unit (1 to 8) equipped on each channel 1 and 2 and two required for each channel 1 and 2 equipped. (Max 20.)
- List 12**—Test Transmitter Control Circuit per KS-19457, L47 (SD-2R015-01). One required in addition to List 1 if test transmitter is equipped. (Max 1.) Refer to Note 1.
- List 13**—Jack and Key equipment per KS-19457, L49—MJ only (SD-2R000-01, Fig. 10). One required in addition to List 1 for each channel 1 and 2 when system uses two transmitters per channel. (Max 2.) Refer to Note 1.
- List 14**—Link Circuit per KS-19457, L63 (SD-2R008-01, Fig. 1), Channel Shelf per KS-19457, L68 (SD-2R000-01), and Channel Test Jack Field Assemblies per KS-19457, L69 (SD-2R000-01, Fig. 2) and KS-19457, L70 (SD-2R000-01, Fig. 4). One required when channel 2 is added to an existing system. For description of components in shelf, see List 1. (Max 1.) Refer to Note 2.
- List 15**—TSTA Test equipment per KS-19457, L65 (SD-2R016-01, Fig. 2). One required for miscellaneous test equipment required for each link (2 to 8) added to an existing system. (Max 7.) Refer to Note 2.
- List 16**—Test Jack equipment per KS-19457, L71 (SD-2R000-01, Fig. 7). One required for each receive line terminating unit (2 to 8) added to an existing system on each channel 1 and 2. (Max 14.) Refer to Note 2.
- List 17**—Test Transmitter Control Circuit per KS-19457, L72 (SD-2R015-01). One required

when test transmitter is added to an existing system. (Max 1.) Refer to Note 2.

- List 18**—Jack and Key equipment per KS-19457, L73 (SD-2R000-01, Fig. 10). One required for each channel 1 and 2 when a second transmitter per channel is added to an existing system. (Max 2.) Refer to Note 2.
- List 19**—Wiring Drawings per KS-19456, L11. As required if a need for additional copies of wiring information for bay J41644P arises.
- List 20**—MK Modification Kit per KS-19457, L80 (SD-2R008-01). One required for each channel 1 and 2 when bay is for an MK system. (Max 2.) Refer to Note 1.
- List 21**—MK Modification kit per KS-19457, L80 (SD-2R008-01). One required for each channel 1 and 2 when MJ bay is to be converted for an MK system. (Max 2.) Refer to Note 2.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

**J41644R—AT&T Co Std—Transmission Signaling and Test Access Bay No. 3, 4, or 5 (KS-19456, L6)**

Equipment—J41644R-( )

- List 1**—Framework, assembly, fuses, wiring, and common equipment per KS-19456, L6 for one TSTA bay. A maximum of three such bays are required in any one system and are designated as TSTA bay No. 3, TSTA bay No. 4, and TSTA bay No. 5. TSTA bay No. 3 houses channels 3 and 4, TSTA bay No. 4 houses channels 5 and 6, and TSTA bay No. 5 houses channels 7 and 8. List 1 includes two sets of List 15 wiring drawings and one each of the following component units:

KS-19457, L21 (J41644R, L2) Link Circuit (SD-2R008-01, Fig. 1)

KS-19457, L43 (J41644R, L7) Channel Test Jack Field Assembly (SD-2R000-01, Fig. 2)

KS-19457, L44 (J41644R, L8) Channel Test Jack Field Assembly (SD-2R000-01, Fig. 4)

KS-19457, L33 (J41644R, L3) Channel Shelf (SD-2R000-01, Fig. 1). See J41644P, List 1 for component parts.

Technical Operator Test Panel (SD-2R019-01).

**List 2**—Link Circuit per KS-19457, L21 (SD-2R008-01, Fig. 1). One required in addition to List 1 when channel 4, 6, or 8 is equipped. (Max 1 for each bay.) Refer to Note 1.

**List 3**—Channel Shelf per KS-19457, L33 (SD-2R000-01). One required in addition to List 1 for each channel 4, 6, or 8 equipped. For component descriptions, see J41644P, List 1 and Lists 4, 5, and 6 below. (Max 1 for each bay.) Refer to Note 1.

**List 4**—Transmit Line Terminating Unit (plug-in board) per KS-19457, L36 (SD-2R000-01, CPS4, Fig. 8 and "T" option). Required for single-transmitter-per-channel use. One required (for each channel 3 through 8 equipped) in addition to each List 1, List 3, or List 12, or for system revision use. (Mounts in KS-19457, L33.) (Max 2 for each bay.)

**List 5**—Transmit Line Terminating Unit—MJ only (two plug-in boards) per KS-19457, L48 Ckt A and Ckt B (SD-2R000-01, CPS4A and CPS4B, Fig. 9). Required for 2-transmitter-per-channel use. One required (for each channel 3 through 8 equipped) in addition to each List 1, List 3, or List 12, or for system revision use. (Mounts in KS-19457, L33.) (Max 2 for each bay.)

**List 6**—Receive Line Terminating Unit (plug-in board) per KS-19457, L38 (SD-2R000-01, CPS5, Fig. 5). One required for each additional receiver (2 to 8) per each channel 3 through 8. (Mounts in KS-19457, L33.) (Max 7 per channel = 14 total for each bay.)

**List 7**—Channel Test Jack Field Assembly per KS-19457, L43 (SD-2R000-01, Fig. 2). One required in addition to List 1 for each channel 4, 6, or 8 equipped. (Max 1 for each bay.) Refer to Note 1.

**List 8**—Channel Test Jack Field Assembly per KS-19457, L44 (SD-2R000-01, Fig. 4). One required in addition to List 1 for each

channel 4, 6, or 8 equipped. (Max 1 for each bay.) Refer to Note 1.

**List 9**—Test Jack equipment per KS-19457, L45 (SD-2R000-01, Fig. 7). One required in addition to List 1 for each receive line terminating unit (2 to 8) equipped on each channel 3 through 8. (Max 14 for each bay.) Refer to Note 1.

**List 10**—Pad Socket Assembly per KS-19457, L46 (SD-2R000-01, Fig. 3 and 6). Required in addition to List 1 or for system expansion use. One required for each receive line terminating unit (1 to 8) equipped on each channel 3 through 8 and two required for each channel 3 through 8 equipped. (Max 20 for each bay.)

**List 11**—Jack and Key equipment per KS-19457, L49 (SD-2R000-01, Fig. 10). One required in addition to List 1 for each channel 3 through 8 when system uses two transmitters per channel. (Max 2 for each bay.) Refer to Note 1.

**List 12**—Link Circuit per KS-19457, L63 (SD-2R008-01, Fig. 1), Channel Shelf per KS-19457, L68 (SD-2R000-01), and Channel Test Jack Field Assemblies per KS-19457, L69 (SD-2R000-01, Fig. 2) and KS-19457, L70 (SD-2R000-01, Fig. 4). One required when channel 4, 6, or 8 is added to an existing system. For description of components in shelf, see J41644P, List 1. (Max 1 for each bay.) Refer to Note 2.

**List 13**—Test Jack equipment per KS-19457, L71 (SD-2R000-01, Fig. 7). One required for each receive line terminating unit (2 to 8) added to an existing system on each channel 3 through 8. (Max 14 for each bay.) Refer to Note 2.

**List 14**—Jack and Key equipment per KS-19457, L73 (SD-2R000-01, Fig. 10). One required for each channel 3 through 8 when a second transmitter per channel is added to an existing system. (Max 2 for each bay.) Refer to Note 2.

**List 15**—Wiring Drawings per KS-19456, L12. As required if a need for additional copies of wiring information for bay J41644R arises.

**List 16**—MK Modification Kit per KS-19457, L80 (SD-2R008-01). One required for each channel 3 through 8 when bays are for an MK system. (Max 2 for each bay.) Refer to Note 1.

**List 17**—MK Modification Kit per KS-19457, L80

(SD-2R008-01). One required for each channel 3 through 8 when MJ bays are to be converted for an MK system. (Max 2 for each bay.) Refer to Note 2.

**Note 1:** These circuits are wired in the bay at the supplier; order only in conjunction with List 1.

**Note 2:** These circuits are prepared for field installation; order only when adding to existing bays.

#### KS-19456 End Covers

**List 13**—End covers. Required when 9-foot control terminal bays are arranged in more than one row. One required for each additional row.

#### KS-19457 Spare Parts Package

**List 50**—For a list of the spare parts contained in List 50, refer to listing under 11-foot 6-inch bay equipment.

### C. Base Station Radio Equipment (MJ)

#### KS-19618 250-Watt Transmitter Unit

**List 1**—250-Watt Transmitter. Indoor cabinet; includes List 14 channel element. Refer to Note 1.

**List 4**—250-Watt Base Station Transmitter. Same as List 1 except with an isolator (improved intermodulation conversion loss).

**List 5**—250-Watt Base Station Transmitter. Same as List 21 except with an isolator (improved intermodulation conversion loss).

**List 21**—250-Watt Transmitter. Indoor cabinet; includes List 10 oscillator. Refer to Note 1.

**List 10**—High-Stability Oscillator. Stability:  $\pm 0.0001$  percent. For 2-transmitter-per-channel use. Includes all necessary equipment for converting from List 1 to List 21. Refer to Note 1.

**List 14**—Single-Frequency Transmitter Channel Element. For single-transmitter-per-channel use. Refer to Note 1.

**List 41**—Field Conversion Kit to convert List 1 to List 4 and List 21 to List 5.

#### KS-19618 50-Watt Transmitter Unit

**List 2**—50-Watt Transmitter. Indoor cabinet; includes List 14 channel element. Refer to Note 1.

**List 3**—50-Watt Transmitter. Same as List 2 except outdoor cabinet. Refer to Note 1.

**List 22**—50-Watt Transmitter. Indoor cabinet; includes List 10 oscillator. Refer to Note 1.

**List 23**—50-Watt Transmitter. Same as List 22 except outdoor cabinet. Refer to Note 1.

**List 10**—See listing under 250-Watt Transmitter Unit.

**List 14**—See listing under 250-Watt Transmitter Unit.

**List 40**—5- to 50-Watt Option. Required in addition to List 2, 3, 22, or 23 when 5- to 50-watt operation is required. (Replaces the screen regulator.)

#### KS-19618 Test Transmitter Unit

**List 16**—Test Transmitter. Indoor cabinet. Variable output from 0.1 microwatt to 50 watts. Order List 14 and/or List 18 channel elements separately. Refer to Note 2.

**List 14**—See listing under 250-Watt Transmitter Unit.

**List 18**—Two-Frequency Transmitter Channel Element. Test transmitter condition only. (Up to 4 can be used for a maximum of 8 channels.) Refer to Note 2.

#### KS-19618 50-Watt Transmitter-Receiver Unit

**List 8**—50-Watt Transmitter-Receiver. Indoor cabinet; includes List 14 channel element for transmitter; also includes List 15 channel element and List 27 crystal filter for receiver. Refer to Note 1.

**List 9**—50-Watt Transmitter-Receiver. Same as List 8 except with outdoor cabinet.

**List 24**—50-Watt Transmitter-Receiver. Indoor cabinet; includes List 10 oscillator for transmitter; also includes List 15 channel element and List 27 crystal filter for receiver. Refer to Note 1.

**List 25**—50-Watt Transmitter-Receiver. Same as List 24 except outdoor cabinet. Refer to Note 1.

**List 10**—See listing under 250-Watt Transmitter Unit.

**List 14**—See listing under 250-Watt Transmitter

Unit.

**List 15**—Single-Frequency Receiver Channel Element. Receiver use only. When changing frequency in an existing receiver, also order List 27 crystal filter for the corresponding frequency. Refer to Note 1.

**List 27**—Receiver Crystal Filter. For receivers of transmitter-receiver packages only. Refer to Note 1.

**List 40**—See listing under 50-Watt Transmitter Unit.

#### KS-19618 Receiver Package

**List 12\***—Receiver Package. Indoor cabinet; includes List 15 channel element and List 26 crystal filter. Refer to Note 3.

**List 13\***—Receiver Package. Same as List 12 except outdoor cabinet. Refer to Note 3.

\*Replace asterisk with number (1 to 8) which indicates the number of receivers and associated units required in the cabinet.

**List 15**—Single-Frequency Receiver Channel Element. Receiver use only. When changing frequency in an existing receiver, also order List 26 crystal filter for the corresponding frequency. Refer to Note 1.

**List 26**—Receiver Crystal Filter. For receivers of receiver packages only. Refer to Note 1.

**List 19**—Add-To Receiver Kit. Required for expanding a receiver package to include an additional receiver. Includes List 28 receiver and power supply and List 29 line terminating unit. When expanding to a fifth receiver, order List 20 in place of List 19. Refer to Note 1.

**List 20**—Add-To Receiver and Cabinet Expansion Kit. Required for expansion to fifth receiver only. Includes List 19 add-to receiver kit and cabinet expansion kit. Receiver package will accommodate up to 8 receivers after addition of this kit.

**List 28**—Receiver and Power Supply. Part of List 19 add-to receiver kit; includes List 26 crystal filter and connecting coaxial cable.

**List 29**—Line Terminating Unit. Part of List 19 add-to receiver kit.

#### Notes for Use With MJ Base Station Radio Equipment

**Note 1:** Specify one of the following channels:

Channel 1 (JL) 157.77 MHz (receive),  
152.51 MHz (transmit)

Channel 2 (YL) 157.80 MHz (receive),  
152.54 MHz (transmit)

Channel 3 (JP) 157.83 MHz (receive),  
152.57 MHz (transmit)

Channel 4 (YP) 157.86 MHz (receive),  
152.60 MHz (transmit)

Channel 5 (YJ) 157.89 MHz (receive),  
152.63 MHz (transmit)

Channel 6 (YK) 157.92 MHz (receive),  
152.66 MHz (transmit)

Channel 7 (JS) 157.95 MHz (receive),  
152.69 MHz (transmit)

Channel 8 (YS) 157.98 MHz (receive),  
152.72 MHz (transmit)

Channel 9 (YR) 158.01 MHz (receive),  
152.75 MHz (transmit)

Channel 10 (JK) 158.04 MHz (receive),  
152.78 MHz (transmit)

Channel 11 (JR) 158.07 MHz (receive),  
152.81 MHz (transmit)

**Note 2:** Channel elements for the test transmitter are ordered separately. The test transmitter is capable of being changed for emergency use as a 50-watt transmitter. If an even number of channels are to be tested, half that number of 2-frequency channel elements KS-19618, List 18 should be ordered with the base station receiver frequencies specified.

If an odd number of channels are to be tested, a single-frequency channel element KS-19618, List 14 should be ordered for one of the channels and KS-19618, List 18 should be ordered for each remaining pair of channels. In addition, single-frequency channel elements KS-19618, List 14 may be ordered for emergency use on all base transmit frequencies which the test transmitter may be called upon to

replace. For example, if any MJ Mobile Radio Telephone System is equipped for three channels, YS, YR, and JK, the following channel elements may be ordered.

(a) For test transmitter use:

- (1) One KS-19618, List 18 (channel YS, 157.98 MHz and channel YR, 158.01 MHz).
- (2) One KS-19618, List 14 (channel JK, 158.04 MHz).

(b) For emergency transmitter use:

- (1) Three KS-19618, List 14 (channel YS, 152.72 MHz; channel YR, 152.75 MHz; and channel JK, 152.78 MHz).

**Note 3:** Specify the number of receivers and associated circuits (1 to 8) and list the channels required. Available channels are shown in Note 1. For example, if a 5-receiver indoor package with channels JL, YL, JP, YS, and YR is required, an order may be placed for KS-19618, List 125 to be equipped with channels 1 through 3 and 8 and 9 (for channels JL, YL, JP, YS, and YR).

RCVR QTY	INDOOR CABINET	OUTDOOR CABINET
1	KS-19618, L121	KS-19618, L131
2	KS-19618, L122	KS-19618, L132
3	KS-19618, L123	KS-19618, L133
4	KS-19618, L124	KS-19618, L134
5	KS-19618, L125	KS-19618, L135
6	KS-19618, L126	KS-19618, L136
7	KS-19618, L127	KS-19618, L137
8	KS-19618, L128	KS-19618, L138

**D. Base Station Radio Equipment (MK)**

**KS-20285 5- to 120-Watt Transmitter Unit**

**List 1**—5- to 120-Watt Transmitter. Indoor cabinet; includes List 111 crystal set, List 116 manual, and tuning tools. Refer to Note 1.

**List 102**—Diplexer for use where a common antenna is desired for a base transmitter and a base receiver package. Intended for installation in the transmitter cabinet.

**List 103**—Isolator (first add-to kit). Mounts on harmonic filter panel in transmitter cabinet. For use where the minimum separation loss to adjacent transmitters (antenna-to-antenna) is less than 65 dB.

**List 104**—Isolator (second add-to kit). Mounts below harmonic filter panel. Used in conjunction with List 103 isolator where separation loss to adjacent transmitters is between 15 and 40 dB.

**List 105**—Rain Shield. Used to convert transmitter cabinet for outdoor use.

**List 111**—Crystal Set. For use in exciter-driver chassis of transmitter. Consists of a channel element and crystal filter. Refer to Note 1.

**List 116**—Instruction Manual (transmitter). Contains information to install, operate, and maintain KS-20285 transmitter.

**KS-20285 Transmitter-Receiver Unit**

**List 2**—5- to 100-Watt Transmitter-Receiver. Indoor cabinet; includes List 112 crystal set, diplexer (similar to List 102 used in 5- to 120-watt transmitter), List 111 crystal set, List 117 manual, and tuning tools. Refer to Note 1.

**List 105**—Rain Shield. Used to convert transmitter-receiver cabinet for outdoor use.

**List 111**—Crystal Set. For use in exciter-driver chassis of transmitter-receiver. Consists of a channel element and crystal filter. Refer to Note 1.

**List 112**—Crystal Set. For use in receiver chassis of transmitter-receiver cabinet. It is the high IF filter and the second oscillator crystals. Refer to Note 1.

**List 117**—Instruction Manual (transmitter-receiver). Contains information to install, operate, and maintain KS-20285 transmitter-receiver.

**KS-20285 Transmitter-Receiver Unit**

**List 3**—5- to 100-Watt Transmitter-Receiver. Same as the List 2 except the diplexer is omitted. Refer to Note 1.

**KS-20285 Receiver Package**

**List 5\***—Receiver package. Cabinet is suitable for indoor or outdoor installation. Includes List 112 crystal set or sets, List 115 dummy crystal set or sets, List 118 manual, and tuning tools, Refer to Note 2.

\*Replace asterisk with number (1 to 8) which indicates the number of receivers and associated units required in cabinet.

**List 112**—Crystal Set. For use in multicoupler, receiver chassis in transmitter-receiver cabinets, and receiver in receiver package. It is the high IF filter and second oscillator crystal. Refer to Note 1.

**List 115**—Dummy Crystal. Consists of two plug-mounted units which are for use in the inactive channels in multicouplers.

**List 121**—Receiver Cabinet Expansion Kit. Provides for complete field installation of the fifth receiver in a receiver package. Receiver package will accommodate up to 8 receivers after addition of this kit. Refer to Note 1.

**List 122**—Receiver Add-To Kit. Provides for complete field installation of one receiver in a receiver package (except receiver No. 5: see List 121). Refer to Note 1.

**List 118**—Instruction Manual (receiver). Contains information to install, operate, and maintain KS-20285 receiver.

**Notes For Use With MK Base Station Radio Equipment**

**Note 1:** Specify one of the following channels:

Channel 1 (QC) 459.375 MHz (receive),  
454.375 MHz (transmit)

Channel 2 (QJ) 459.400 MHz (receive),  
454.400 MHz (transmit)

Channel 3 (QD) 459.425 MHz (receive),  
454.425 MHz (transmit)

Channel 4 (QA) 459.450 MHz (receive),  
454.450 MHz (transmit)

Channel 5 (QE) 459.475 MHz (receive),  
454.475 MHz (transmit)

Channel 6 (QP) 459.500 MHz (receive),  
454.500 MHz (transmit)

Channel 7 (QK) 459.525 MHz (receive),  
454.525 MHz (transmit)

Channel 8 (QB) 459.550 MHz (receive),  
454.550 MHz (transmit)

Channel 9 (QO) 459.575 MHz (receive),  
454.575 MHz (transmit)

Channel 10 (QR) 459.600 MHz (receive),  
454.600 MHz (transmit)

Channel 11 (QY) 459.625 MHz (receive),  
454.625 MHz (transmit)

Channel 12 (QF) 459.650 MHz (receive),  
454.650 MHz (transmit)

**Note 2:** Specify the number of receivers (1 to 8) and list the channels required per Note 1. For example, if a 5-receiver package with channels QC, QJ, QD, QA, and QE is required, an order may be placed for KS-20285, List 55 to be equipped with channels 1 through 5 (for channels QC, QJ, QD, QA, and QE).

**E. Mobile Station Equipment (MJ)****KS-19609 Motorola**

**List 2**—Supervisory Unit. Mounts within the List 3 radio unit.

**List 3**—Radio Unit. Includes List 10 dummy channel elements in all unused channel positions.

List 7 tuning tools are supplied at a rate of one set per five radios or fraction thereof. See Note 1.

**List 5**—20-Foot Cable Assembly. For negative ground installations. Includes connector housing cover.

**List 7**—Set of Tuning Tools. See List 3.

**List 9**—20-Foot Cable Assembly. For positive ground installations. Includes connector housing cover.

**List 10**—Dummy Channel Element. See Note 1.

**List 11**—Channel Element. KS-19609 mobile only. Specify channel. See Note 2.

**Note:** Minimum KS-19609 mobile radio order for initial system: one each of KS-19609, List 2, List 3, and List 5 or 9 (whichever is required) plus a number of List 11s as required (max 11). Specify channels.

**KS-19852 General Electric**

**List 2**—Supervisory Unit. Mounts within the List 4 radio unit.

**List 4**—Radio Unit. Tuning tools are supplied at a rate of one set per five radios or fraction thereof.

**List 5**—20-Foot Cable Assembly. For negative ground installations. Includes connector housing cover.

**List 7**—Oscillator Channel-Hunting Circuit. Provides the oscillators and also the channel-hunting circuit for the List 4 radio unit.

**List 9**—20-Foot Cable Assembly. For positive ground installations. Includes connector housing cover.

**List 11**—Channel Element. KS-19852 mobile only. Specify channel. See Note 2.

**Note:** Minimum KS-19852 mobile radio order for initial system: one each of KS-19852, List 2, List 4, List 7, and List 5 or 9 (whichever is required) plus a number of List 11s as required (max 11). Specify channels.

**KS-19626 Control Unit ITT**

**List 1**(\*)—Control Unit (Fig. 7).

**List 2**—Auxiliary Mounting Bracket. Used in conjunction with mounting bracket furnished with List 1 if additional rigidity is required.

**List 3**(\*)—Replacement Housing Kit. For use in

case of breakage. Front and rear assembly for List 1 control unit. [Handset used is WECO G5KR-(\*).]

\*Replace asterisk with number indicating color of unit desired as follows:

Black	3
Moss Green	51
White	58
Light Beige	60
Light Grey	61

**Notes for Use with MJ Mobile Station Equipment**

**Note 1:** The KS-19609, List 3 radio unit does not include supervisory unit or channel elements. The radio has 11 sockets which must be filled with either channel elements or dummy channel elements. Hence, if the radio is to be equipped for *N* channels, 11 minus *N* dummy channel elements (List 10) will be supplied with the *N* channel elements (List 11).

One channel element is used for both transmitter and receiver. Specify channels per Note 2.

**Note 2:** List of channels available is as follows:

Channel 1 (JL) 155.77 MHz (transmit), 152.51 MHz (receive)

Channel 2 (YL) 157.80 MHz (transmit), 152.54 MHz (receive)

Channel 3 (YP) 157.83 MHz (transmit), 152.57 MHz (receive)

Channel 4 (YP) 157.86 MHz (transmit), 152.60 MHz (receive)

Channel 5 (YJ) 157.89 MHz (transmit),  
152.63 MHz (receive)

Channel 6 (YK) 157.92 MHz (transmit),  
152.66 MHz (receive)

Channel 7 (JS) 157.95 MHz (transmit),  
152.69 MHz (receive)

Channel 8 (YS) 157.98 MHz (transmit),  
152.72 MHz (receive)

Channel 9 (YR) 158.01 MHz (transmit),  
152.75 MHz (receive)

Channel 10 (JK) 158.04 MHz (transmit),  
152.78 MHz (receive)

Channel 11 (JR) 158.07 MHz (transmit),  
152.81 MHz (receive)

**List 5**—Negative Ground Cable. For use between the radio, control unit, and vehicular power supply. Cable is 20 feet long and is equipped with appropriate connectors for each terminating point. Includes List 12 cover.

**List 6**—Positive Ground Cable. Same as List 5 except it is arranged for positive ground use.

**List 7**—Channel Element. This is the frequency-determining element which is used to activate channels in the List 3 radio unit. See Note 2.

**List 8**—Dummy Channel Element. Used to replace the List 7 element for the inactive channels in the List 3 radio unit.

**List 11**—Instruction Manual (mobile). Contains information to install, operate, and maintain KS-20282 radios.

**List 12**—Cover. Connector cover for connector on the control unit end of Lists 5 and 6 cables.

**List 13**—Channel Strapping Board. Used to provide channel selection at time of installation.

#### F. Mobile Station Equipment (MK)

##### KS-20282 Motorola

**List 1**—Consists of List 3 radio unit (with List 13 strapping ground); supervisory unit KS-19609, List 2; List 7 channel elements; and, if required, List 8 dummy channel elements. In addition, a set of List 9 tuning tools and a List 11 manual will be furnished at a rate of one per five radios or a fraction thereof. Specify channels. See Notes 1 and 2.

**List 3**—Radio Unit. Consists of main transmit and receive facilities and all 12 dummy channel elements. This unit has been made available primarily for field replacement use. Includes List 13 channel strapping board.

**List 4**—Mounting Base. Consists of base plate with key-operated locking facilities on which the List 1 radio can be mounted. For use when easy removal of set is desired.

##### KS-20283 Control Unit—Motorola

**List 1**(\*)—Control Unit. See Fig. 7.

**List 2**—Auxiliary Mounting Bracket. Used in conjunction with regularly furnished bracket where additional rigidity is required.

**List 3**(\*)—Replacement Housing Kit. For use in case of breakage. Front and rear housing for List 1 control units. [Handset used is WECO G3AR-(\*).]

\*Replace asterisk with number indicating color of unit desired as follows:

Black	3
Moss Green	51
White	58
Light Beige	60
Light Grey	61

##### Notes For Use With MK Mobile Station Equipment

**Note 1:** The KS-20282, List 1 radio will be furnished with the proper number of List 7

channel elements and List 8 dummy channel elements to satisfy the subscriber's particular order. Hence, if the radio is to be equipped for *N* channels, 12 minus *N* dummy channel elements (List 8) will be supplied with the *N* channel elements (List 7).

**Note 2:** List of channels available is as follows:

Channel 1 (QC) 459.375 MHz (transmit),  
454.375 MHz (receive)

Channel 2 (QJ) 459.400 MHz (transmit),  
454.400 MHz (receive)

Channel 3 (QD) 459.425 MHz (transmit),  
454.425 MHz (receive)

Channel 4 (QA) 459.450 MHz (transmit),  
454.450 MHz (receive)

Channel 5 (QE) 459.475 MHz (transmit),  
454.475 MHz (receive)

Channel 6 (QP) 459.500 MHz (transmit),  
454.500 MHz (receive)

Channel 7 (QK) 459.525 MHz (transmit),  
454.525 MHz (receive)

Channel 8 (QB) 459.550 MHz (transmit),  
454.550 MHz (receive)

Channel 9 (QO) 459.575 MHz (transmit),  
454.575 MHz (receive)

Channel 10 (QR) 459.600 MHz (transmit),  
454.600 MHz (receive)

Channel 11 (QY) 459.625 MHz (transmit),  
454.625 MHz (receive)

Channel 12 (QF) 459.650 MHz (transmit),  
454.650 MHz (receive)

**G. Special Test Equipment (MJ and MK)**

**4.03** The following is a list of special test equipment required for maintenance and line-up of the

MJ and MK mobile station equipment; it is not intended to include test equipment required for overall system line-up and maintenance.

Motorola Model T1257A Supervisory Unit Test Set

Motorola Model S1056A Test Set for Mobile Radio Unit

Motorola Model TEN6055A Test Set Adapter for use with S1056A

Motorola Model TEK-31 Audio Tone Generator 400 Hz, 1000 Hz, Adjustable Level

General Electric Model 4EX5A10 Test Set for Supervisory Unit

General Electric Model 4EX3A10 Test Set for Radio Unit

Motorola Part No. 40-8466A78 Channel Selector Test Adapter

**H. List of Mfr Disc. Equipment**

**4.04** The following equipment has been replaced as indicated:

EQUIPMENT	RATING	DETAILS LAST SHOWN IN ISSUE	REPLACING EQUIPMENT
J41644B, Lists 1 through 10	Mfr Disc	1	J41644G, Lists 1 through 9

**Note:** The G and B bays are essentially the same except that the basic duplicate switching equipment which was included in the B bay is not included in the G bay. The duplicate switching equipment for the G bay can now be ordered as required. In the past it was furnished as part of the bay whether its use was required or not.