

MOBILE TELEPHONE SYSTEM

INTRODUCTION

The Improved Mobile Telephone System utilizes multi-channel radio equipment to provide fully automatic dial-telephone service between mobile telephone subscribers and central-office telephone facilities. The method of operation and quality of service afforded by multi-channel IMTS very closely approximates conventional wireline telephony with single-party telephone lines.

SIGNALING

The terminal equipment provides selective-signaling over the radio channels and, in addition, provides idle marking tone to allow mobiles in the system to seek the channel next to be used. Information is also supplied from the terminal to indicate channel seizure to the mobiles to ensure that no mobile will attempt to connect while selective-signaling is in progress.

These signals are encoded by means of two audio frequency tones: "idle-marking tone" (Fi) at 2000-Hz, and "seize tone" (Fs) at 1800-Hz. Selective-signaling to the mobiles is conveyed by frequency-shift keying between these two tones.

In the case of land-originated calls, the mobile station conveys acknowledgement that signaling has been received by transmitting a 750-millisecond burst of 2150-Hz "guard tone" (Fg). Answer supervision is provided by a 400-millisecond burst of 1633-Hz "connect tone" (Fc).

In the case of mobile-originated calls, the mobile station provides seizure control by the transmission of 2150-Hz guard tone (Fg) for a minimum of 150 milliseconds, after which the transmitted tone is shifted to 1633-Hz "connect tone" (Fc) for 50 milliseconds. Following this connect signal interval, the "guard tone" remains on the air.

Numerical identification is encoded by pulses of 1633-Hz "connect tone" with 2150-Hz "guard tone" pulses transmitted after each cumulatively totalled even pulse. No tone is transmitted after each cumulatively totalled odd pulse. The detection of an error in the automatic-numerical-identification (ANI) code causes the information to be rejected by the terminal and (if such facilities are provided) routes the call to an operator. Otherwise the call is simply aborted.

Dial impulses from the mobile stations consists of frequency-shift keying between 1633-Hz (mark) and 2150-Hz (space) with tone off when the dial is not off-normal. Disconnect supervision is transmitted by the mobile as mark-space keying (at 20 pps) of 2150 -Hz "guard tone" and 1336-Hz disconnect tone (Fd) for 750 milliseconds.

MODES OF OPERATION

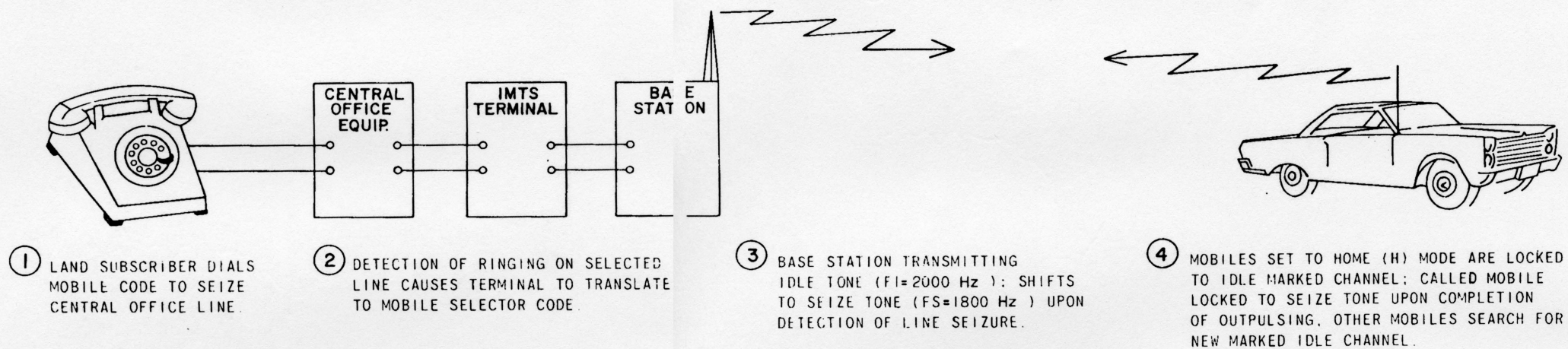
Each mobile station may operate in any of three modes: HOME, ROAM or MANUAL. In the HOME mode, the mobile equipment scans only a pre-selected group of channels corresponding to the channels assigned in the home area of the mobile subscriber. When operating in the HOME mode, the mobile subscriber receives fully automatic service placing and receiving calls through the central office. (See Figures 1 and 2.)

The mobile subscriber, when operating in a foreign area, places his mobile in the ROAM mode. The channels assigned in this foreign area are selected by means of the channel selector switch on the mobile control unit. The mobile equipment will now scan only this group of channels. Otherwise, operation of the system is the same as when in the HOME mode except that ANI will be rejected by the terminal and the call referred to the mobile service operator. (See Figures 3 and 4.)

In areas not equipped for IMTS service, the mobile subscriber places his equipment in the MANUAL mode. The local channel is selected manually. In this mode the mobile is effectively converted to a standard MTS manual mobile responding only to 600/1500-Hz signaling. All calls to and from the mobile are placed through the service operator in accordance with conventional MTS manual procedure. (See Figure 5.)

1MT

LAND - TO - MOBILE CALL (MOBILES IN HOME MODE)



SIGNALING SEQUENCE

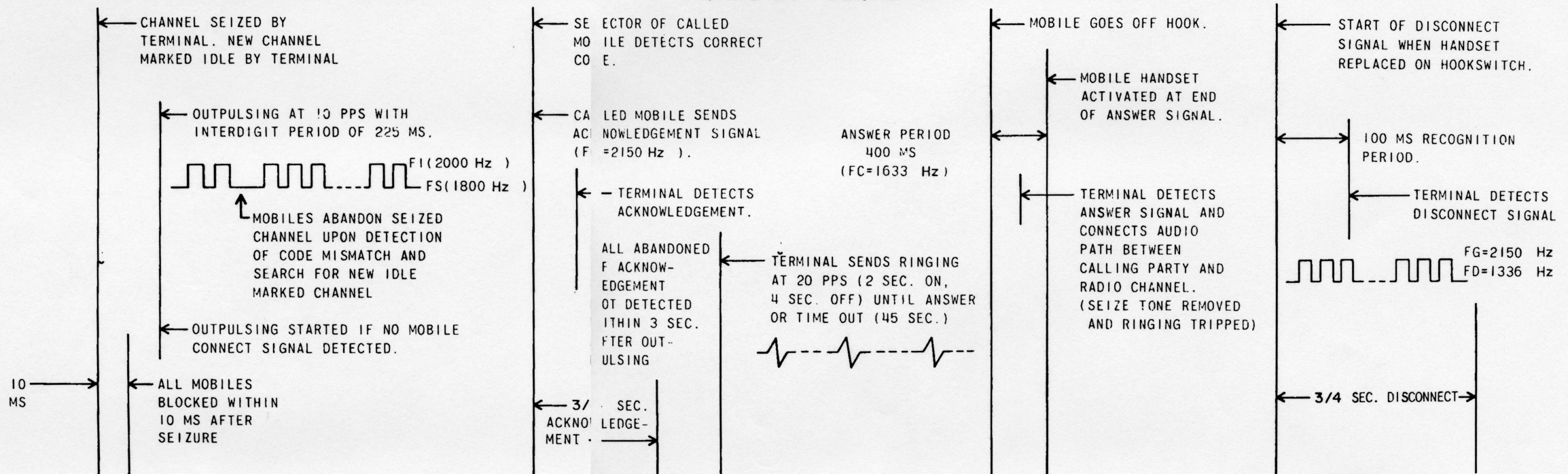
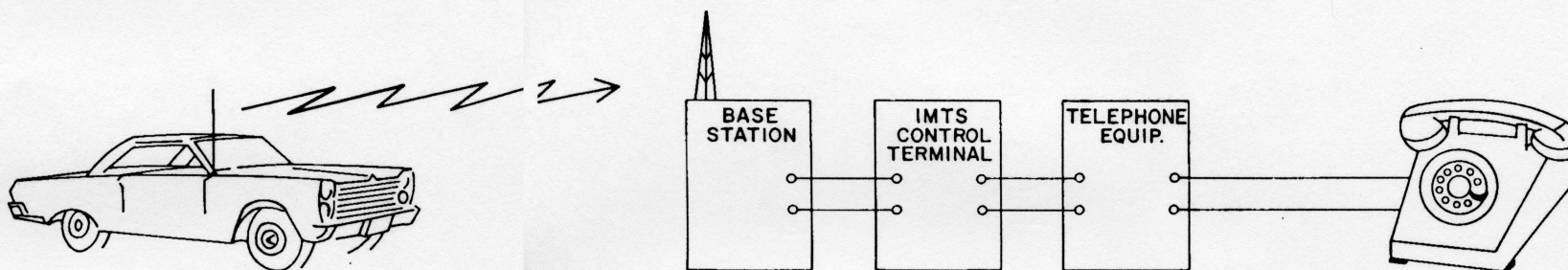


FIGURE 1

HOME MODE - OUTWARD SIGNALING SEQUENCE

MOBILE - TO - LAND CALL (MOBILES IN HOME MODE)



① MOBILE SUBSCRIBER COMES OFF HOOK. STARTS DIALING LAND-LINE CODE AFTER RECEIVING DIAL TONE FROM CENTRAL OFFICE.

② IDLE TONE REMOVED. SEIZE TONE APPLIED TO CHANNEL UPON DETECTION OF CONNECT TONE (FC = 1633 Hz) FROM MOBILE

③ DIAL PULSING FROM MOBILE (FSK) CONVERTED TO LAND-LINE PULSING TO RING CALLED TELEPHONE.

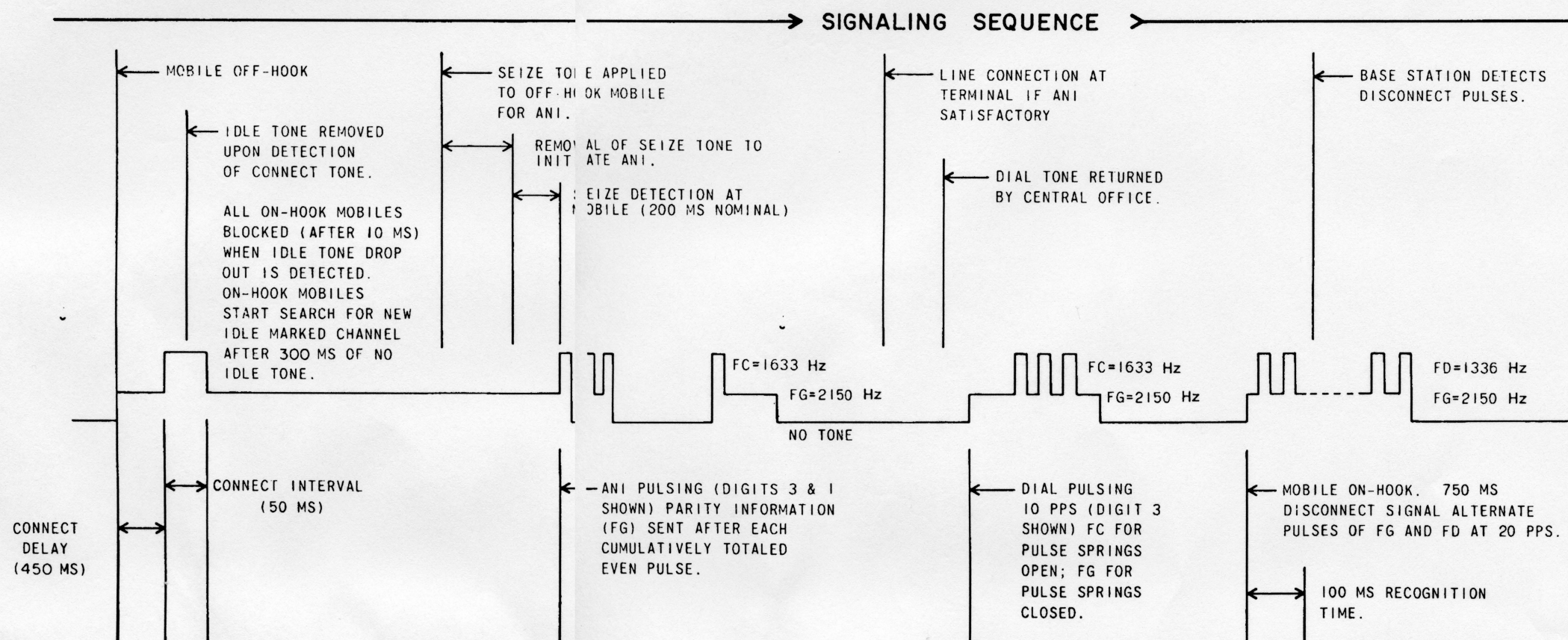
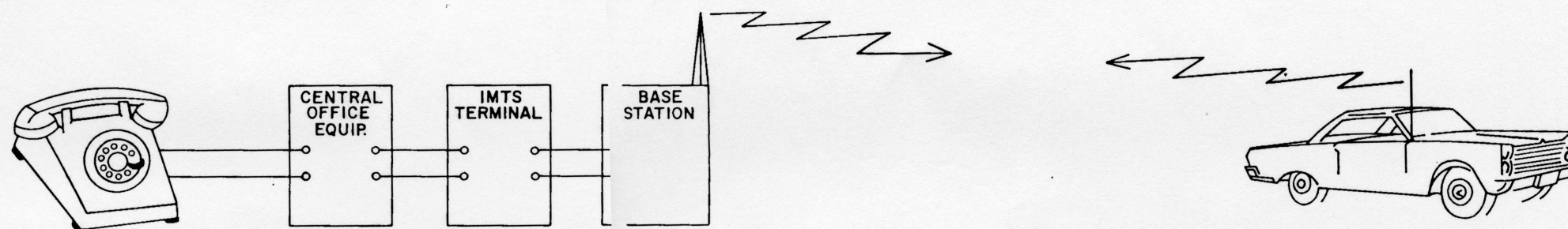


FIGURE 2

HOME MODE - INWARD SIGNALING SEQUENCE

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LAND - TO - MOBILE CALL (MOBILE IN ROAM MODE)



- ① LAND SUBSCRIBER GIVES MOBILE OPERATOR DESIRED MOBILE CODE.
- ② OPERATOR DIALS SELECTIVE SIGNALING CODE OF DESIRED MOBILE. RINGING IS PROVIDED DURING SIGNALING. OPERATOR EXTENDS CALL TO RADIO CHANNEL THROUGH SWITCHBOARD.
- ③ BASE STATION TRANSMITTING IDLE TONE (FI=2000 Hz) SHIFTS TO SEIZE TONE (FS=1800 Hz) UPON DETECTION OF LINE SEIZURE BY OPERATOR AT SWITCHBOARD.
- ④ FOREIGN MOBILE SET TO ROAM (R) MODE. LOCKED TO IDLE MARKED CHANNEL; CALLED MOBILE LOCKED TO SEIZE TONE UPON COMPLETION OF OUTPUTSING. OTHER MOBILES (SET TO HOME MODE) SEARCH FOR NEW MARKED IDLE CHANNEL.

SIGNALING SEQUENCE

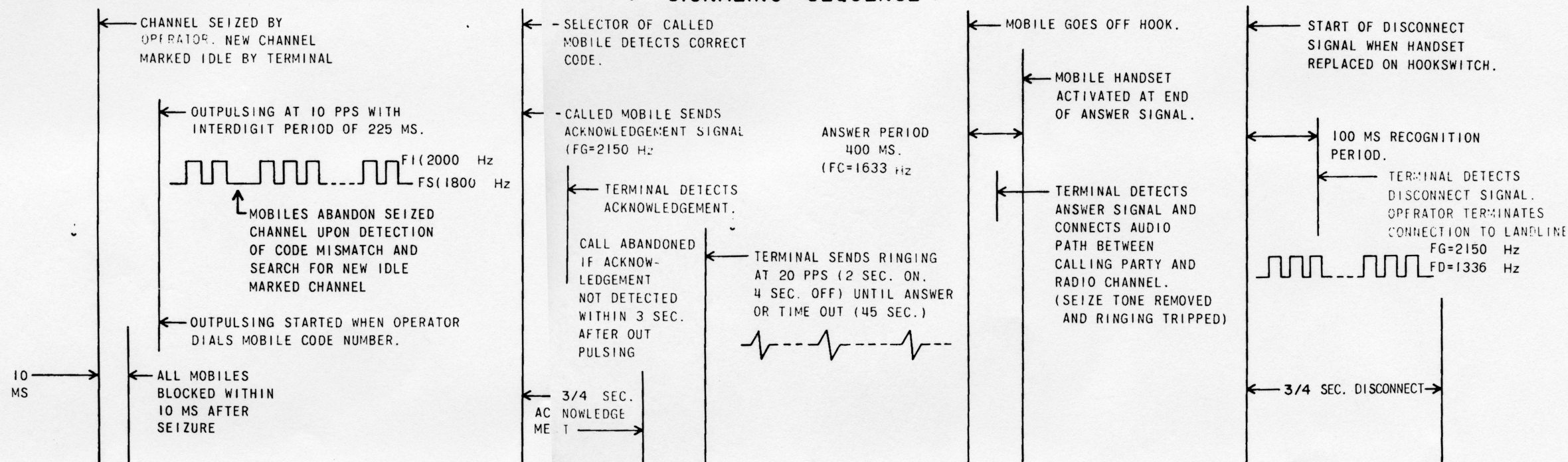
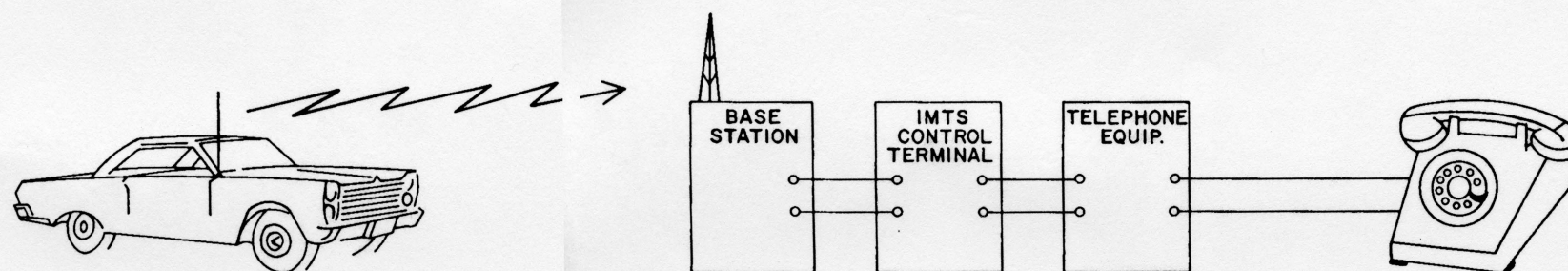


FIGURE 3

ROAM MODE - OUTWARD SIGNALING SEQUENCE

IMTS
Roam

MOBILE - TO - LAND CALL (MOBILES IN ROAM MODE)



① MOBILE SUBSCRIBER GOES OFF HOOK, GIVES MOBILE OPERATOR LAND LINE TELEPHONE NUMBER.

② IDLE TONE REMOVED, SEIZE TONE APPLIED TO CHANNEL UPON DETECTION OF CONNECT TONE (FC = 1633 Hz) FROM MOBILE.

③ MOBILE OPERATOR DIALS REQUESTED LAND LINE NUMBER TO RING CALLED TELEPHONE.

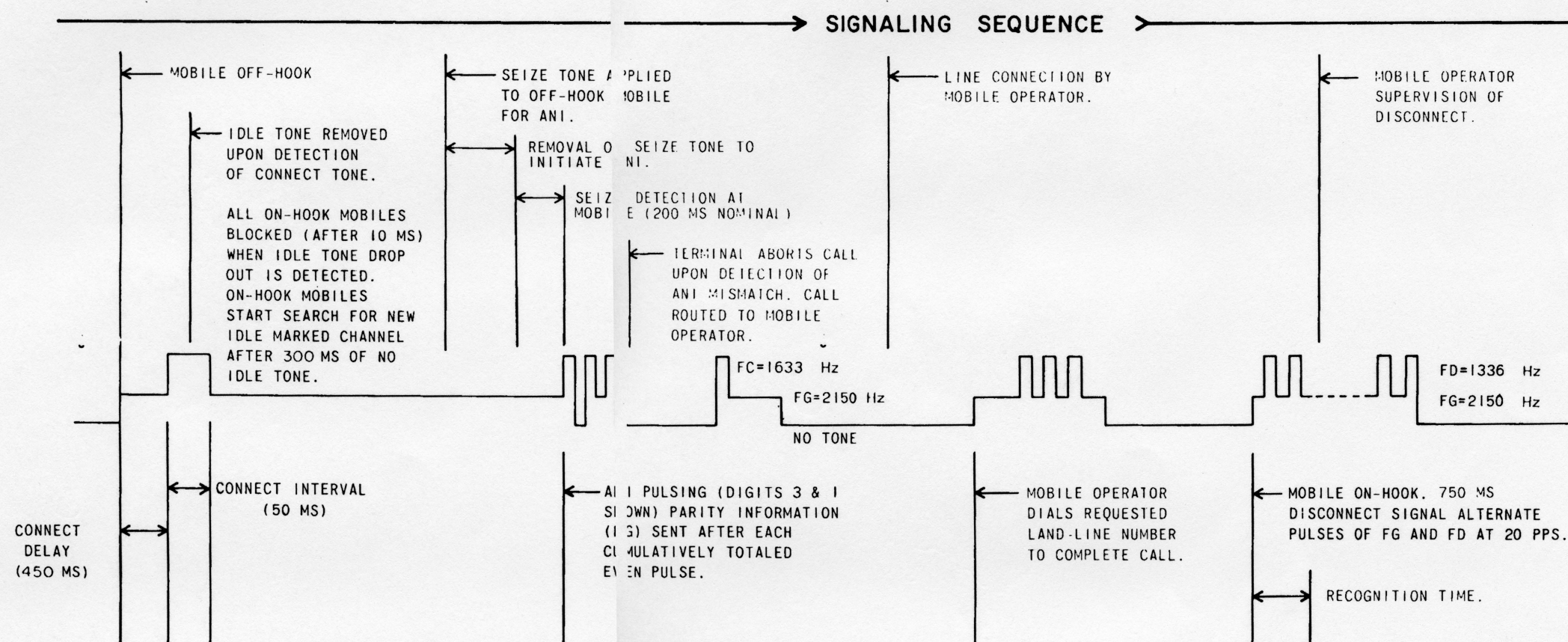
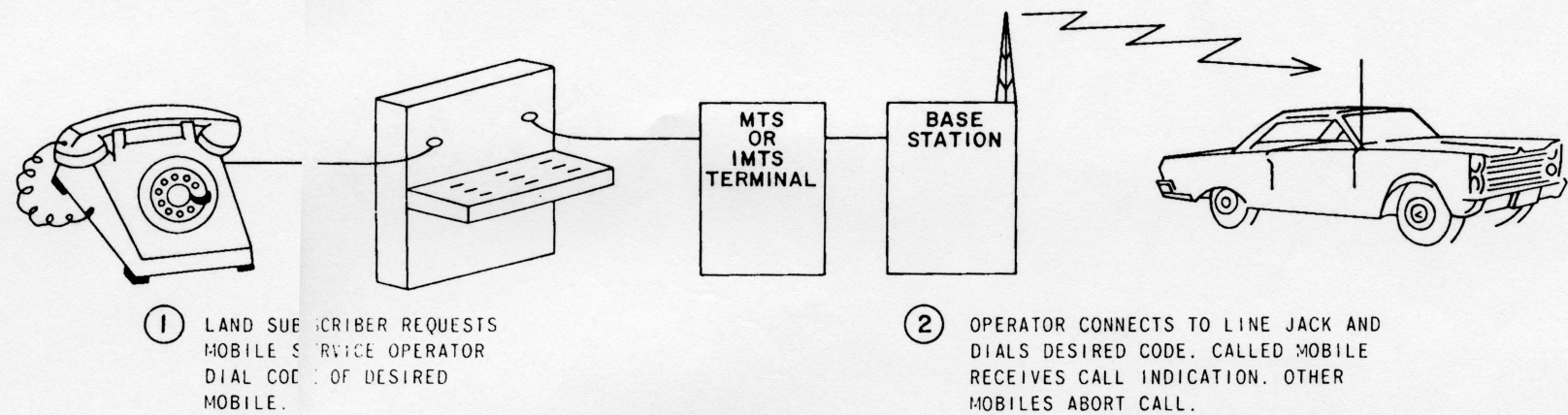


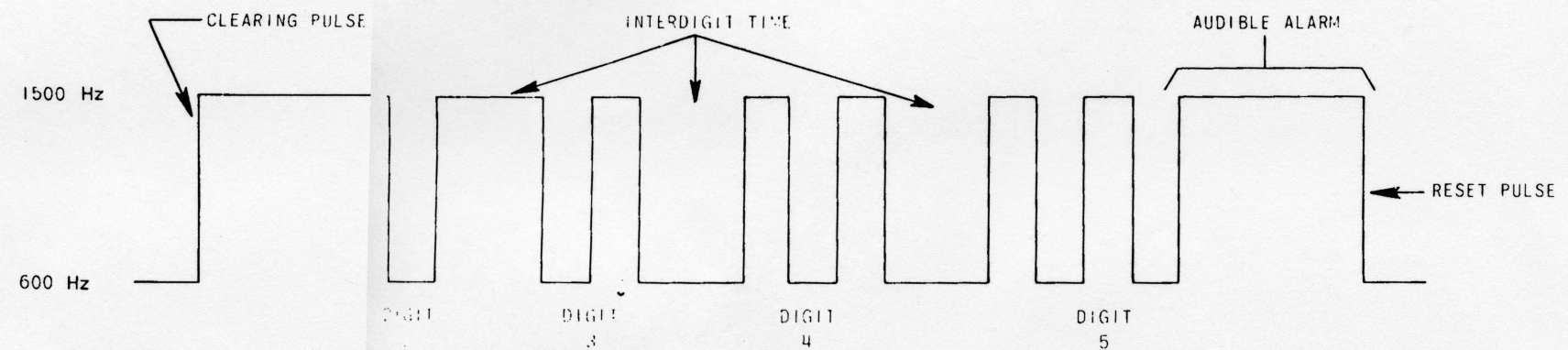
FIGURE 4

ROAM MODE - INWARD SIGNALING SEQUENCE

LAND-TO-MOBILE CALL



SIGNALING SEQUENCE



MOBILE-TO-LAND CALL

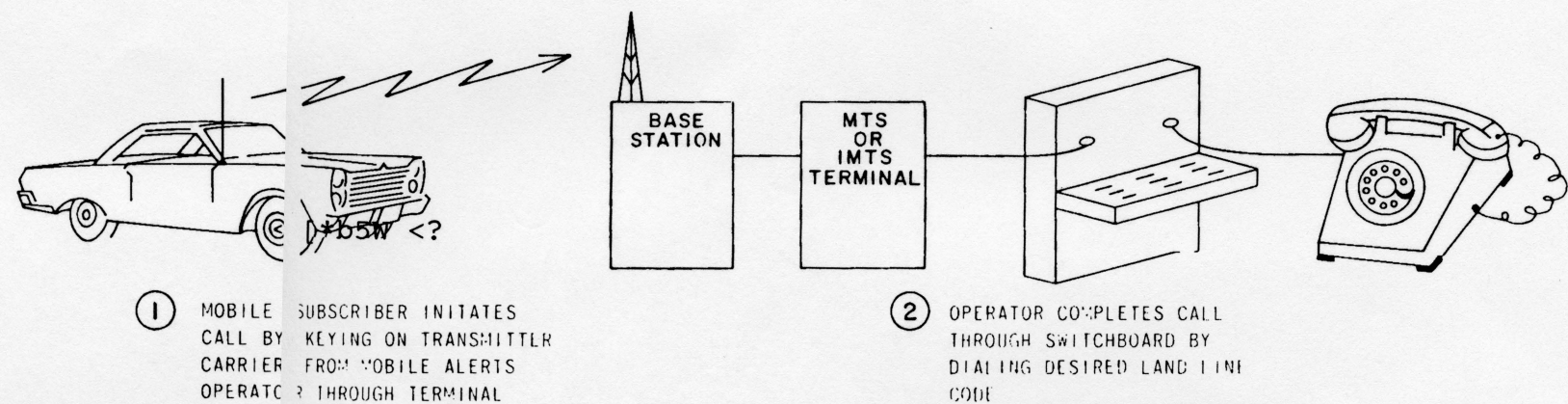


FIGURE 5