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DEFENSE COMMUNICATIONS AGENCY

CONUS AUTOVON

SWITCHING CENTER REQUIREMENTS

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Rev 5 Nov 65

FOREWORD

This specification describes the automatic voice switching equipment to be used in the CONUS AUTOVON (Continental United States Automatic Voice Network). This document is in two parts. The first part, Chapters I through VI, pertains primarily to the technical requirements of the switching equipment and will eventually apply to all switching equipment to be used in CONUS. It also includes a general system description of AUTOVON world-wide. Appendix A covers specific requirements for a particular switching center. A separate Appendix A will be published for each new switching center.

Since commercial communication carriers are to furnish CONUS AUTOVON as leased services, carriers providing these services must meet the requirements of the specifications.

Specifications for each switching center will be prepared by the Defense Communications Engineering Office (DECEO), a field activity of the Defense Communications Agency (DCA). Requests for proposals for services from commercial communication carriers will be issued by the Defense Commercial Communications Office (DECCO), also a field activity of the DCA. Evaluation of proposals will be made jointly by DECEO and DECCO. Orders for service will be issued by DECCO.

AUTOVON, which means AUTOmatic VOice Network, is to be the single, world-wide communications system for handling end-to-end circuit-switched communications for the Department of Defense and certain non-Department of Defense users. These communications will include voice, graphics and data. It will be one of two major switching networks being provided as a part of the Defense Communications System (DCS). The other is AUTODIN, the automatic digital network.

AUTOVON will consist of automatic switching equipment, transmission facilities and terminal equipment. The network will handle command and control, operational, administrative, logistical and intelligence traffic. Because the network is to be world-wide in scope, and many links are to be used in tandem to span great distances, high transmission standards are required. For this reason AUTOVON will be a four-wire network.

Since the network will be automatically switched, it will offer several advantages over the many point-to-point circuits presently used within the DCA. Among the advantages are survivability, economy and efficiency. It is also being designed to provide many special features such as: five levels of precedence and four levels of pre-emption; automatic and random conferencing; off-hook service, which will provide instantaneous connection to four-wire switches for priority subscribers; automatic alternate routing; abbreviated keying and special, or dedicated, service within the network for selected groups of users.

Present plans call for approximately 78 switching centers to be located in the United States, Canada and Alaska and 22 to be located in overseas areas. Centers in the U. S. will be common-carrier owned and operated and the Government will lease service on a line-by-line basis under tariffs to be filed with cognizant regulatory agencies.

Switching Center Location Criteria

Factors which will influence the location of switching centers and which DCA will consider in evaluating alternative plans for AUTOVON are:

1. Multiple toll access routes where a minimum amount of special route construction will be required. Each switching center must have a minimum of three toll access routes to other centers and certain centers serving priority users must be provided as many as ten routes, unless excessive costs dictate otherwise.

2. Switching centers must be located outside densely populated and highly industrialized areas and away from obvious target areas. It has been necessary to locate a few interim centers in proximity to concentrated areas in order to satisfy an immediate operational requirement, but these switches are planned for removal when permanent locations are phased in between FY-1967 and FY-1968.

3. Switching centers should be located near areas of high subscriber density in order to minimize the lengths of access lines (and thus costs) to the Government. It is envisioned that virtually every military installation in the United States will eventually be served by AUTOVON.

4. A minimum of building construction should be required at locations selected. Buildings will require ancillary items such as emergency power apparatus and air-conditioning and all new buildings must provide fall-out protection for personnel and equipment.

5. AUTOVON switching centers may be used to serve other subscribers, both government and non-government as long as AUTOVON requirements are met.

Systems planning is a major factor in the design of AUTOVON. Techniques to be employed to assure reliability, even under emergency conditions, include:

1. Mobile access facilities and remote group (12 circuits) switching to effect rapid restoral of interrupted transmission facilities.

2. Connecting priority subscribers to two (or more) switching centers (dual or multiple homing).

3. A responsive network control capability.

Transmission Facilities

Because of the long distances to be spanned by AUTOVON (12,000 to 15,000 miles), transmission facilities must conform to the highest technical standards. AUTOVON is to be designed for the interconnection of up to seven voice grade trunks in tandem; therefore, network transmission facilities will be four-wire except at main PBXs where two-wire connections to station equipment will normally be employed.

Up to four data grade trunks may be connected in tandem. Transmission standards for data grade trunks are similar to those for voice grade trunks, with the addition of more stringent attenuation vs frequency, and envelope delay distortion limits.

Terminal Facilities

Terminal facilities in AUTOVON consist of direct four-wire telephone instruments for certain users, special consoles for command and control users such as NORAD (North American Air Defense Command) and PBXs which will serve the great majority of users. Inasmuch as connections between the AUTOVON switches and PBXs will be on a four-wire basis and provision must be made to pre-empt PBX access lines, a PBX modification program will be required. Provision is also made for direct inward and outward dialing to and from station lines of PABXs.

Communications terminal facilities at posts, camps, stations and bases will continue to be partially leased and partially Government-furnished as in the past. It is anticipated that some terminal facility plants, both in CONUS and Overseas, will require improvement and/or modification in order to meet AUTOVON standards and to take advantage of new service features.

Responsibilities

Responsibilities for the overall implementation and operation of AUTOVON are vested in the Defense Communications Agency and its supporting field activities. Principal functions of each are:

1. Defense Communications Agency (DCA)

The DCA is responsible for overall policy and management direction of the program. DCA, through its Communications Services Division, performs day-to-day management and supervision of the trunk or backbone portion of the network.

2. Defense Communications Engineering Office (DECEO)

DECEO is responsible for the technical planning and implementation of AUTOVON. This includes planning, engineering, scheduling, installation, test and cutover, and the supervision of contractor efforts in each of these fields. DECEO provides technical evaluation of bids and proposals.

3. Defense Commercial Communications Office (DECCO)

DECCO is responsible for all ordering and contracting actions with franchised communications carriers for the provision of AUTOVON service in CONUS. DECCO provides administrative, legal and financial evaluation of bids and proposals.

4. Military Departments

The Military Departments (Army, Navy, Air Force) are responsible for all Government-owned plant and terminal facilities and for determining their requirements for AUTOVON services, including access and subscriber lines. Requests for AUTOVON access and subscriber lines are forwarded to DECCO for processing and ordering action.

LIST OF ABBREVIATIONS

ADMSC	-	Automatic Data Message Switching Center
AUTODIN	-	Automatic Digital Network
AUTOVON	-	Automatic Voice Network
bps	-	Bits per second
CBR	-	Chemical, Biological and Radiological
CONUS	-	Continental United States
cps	-	Cycles per second
db	-	Decibel. A unit of measure for transmission gain or loss; ratio of two powers
dbm	-	db referred to a one milliwatt standard
dbm0	-	dbm, referrred to the zero relative transmission level point
dbrn	-	db above reference noise
dbrnC0	-	db above reference noise at zero transmission level point, using C message weighting
dbrn0	-	db above reference noise at zero transmission level point
DCA	-	Defense Communications Agency
DCS	-	Defense Communications System
DECCO	-	Defense Commercial Communications Office
DECEO	-	Defense Communications Engineering Office
DOD	-	Department of Defense
DP	-	Dial Pulse
DSA	-	Dial Service Assistance
DTMF	-	Dual Tone Multi-Frequency

E and M - Signaling lead controls. The far end supervisory condition is reflected by the E lead and the near end supervisory condition is reflected by the M lead.

FSK - Frequency Shift Keying

IOC - Initial Operating Capability

kc - Kilocycle

KP - Key Pulse. A pulse used to prime the receiving switching center equipment for inter-office signaling.

MF - Multi-Frequency

MF 2/6 - Multi-Frequency, two out of six. This means any combination of two frequencies out of a total of six.

MODEM - Modulation/Demodulation Equipment

ms - Millisecond(s)

NID - Network-In-Dialing

NORAD - North American Air Defense Command

P(A)BX - Private (Automatic) Branch Exchange

P(0) - Precedence Level Zero, FLASH OVERRIDE - FO

P(1) - Precedence Level One, FLASH - F

P(2) - Precedence Level Two, IMMEDIATE - I

P(3) - Precedence Level Three, PRIORITY - P

P(4) - Precedence Level Four, ROUTINE - R

RC - Route Control

SF - Single Frequency

ST - Start Pulse. A pulse used to signal the end of pulsing to the receiving switching center equipment for inter-office signaling.

TLP - Transmission Level Point

TTY - Teletype

TUR - Traffic Usage Recorder

VF - Voice Frequency

VNL - Via Net Loss. A transmission design whereby individual facility losses are made as low as possible consistent with adequate echo performance.

vu - volume units

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FIGURES

FIGURES (Continued)

CHAPTER I

DESCRIPTION OF AUTOVON

1.1 Introduction

This document specifies the technical requirements for leased switching services to be provided within the continental United States (CONUS) as part of the Automatic Voice Network (AUTOVON), which is a portion of the Defense Communications System (DCS). The design criteria and detailed information contained in this document are intended to offer assistance to the lessor in providing facilities and equipment capable of delivering the required services. This chapter is provided to inform all concerned regarding pertinent operations of the system and features to be required. It is further provided to establish a common point of reference for the inter-relationship of one switching center with any other regardless of manufacture and whether the centers are Government-owned or leased. The lessor shall be responsive to the technical requirements delineated herein. Specific information pertaining to individual centers is contained in Appendix A. A separate Appendix A will be published for each switching center. Responses from bidders shall be furnished for the following:

1.1	1.2.4.1	1.3.3.1	1.3.3.2	1.3.4.1
1.3.4.2	1.6.1	1.6.2.1	1.6.2.2	1.6.2.3

1.2 Description of AUTOVON

1.2.1 AUTOVON is to be a DCS world-wide communication network which will provide the means for establishing communications automatically within the Department of Defense (DOD) and between DOD and certain non-DOD subscribers. One of the objectives of AUTOVON is to provide a means whereby a subscriber can obtain an interconnection with any other subscriber within 10 seconds. This assumes the average call is switched through three centers in establishing the connection. Although the system is expected to be used primarily for the exchange of voice communications, it will be capable of handling graphic and data information on a subscriber-to-subscriber basis. Secure communications can be provided by the installation of appropriate security equipment at subscriber locations. The network will permit traffic to be exchanged in accordance with its precedence. Thus the network will meet all needs for the handling of command and control, operational, logistic and administrative traffic through exercise of appropriate priorities. The network consists of three major components, all of which are to work compatibly. These are the automatic switching equipment, transmission media and terminal facilities. In addition, the network will permit interconnection with other Government and commercial networks.

1.2.2 The Overseas portion of AUTOVON generally will use Government-owned facilities. In CONUS, switching service and facilities generally will be leased from commercial carriers. Both portions of the network will provide the same service features.

1.2.2.1 <u>Overseas AUTOVON</u>

Overseas AUTOVON includes all of the network outside of the North American Continent, and Panama.

1.2.2.2 <u>CONUS AUTOVON</u>

CONUS AUTOVON includes all of the network within the North American Continent, except Panama.

1.2.3 <u>Switching Centers</u>

AUTOVON switching centers will include the necessary technical control equipment, switching equipment and Dial Service Assistance (DSA) operator positions. In some cases Overseas, manual four-wire switchboards may be designated as AUTOVON switchboards where limited transmission facilities do not warrant the cost of an automatic switching machine or where the transmission media are unsuited for automatic switching.

1.2.4 <u>Transmission Media</u>

Interconnecting transmission media will consist of a network of cable and radio facilities of the DCS. This network will provide inter-center trunks and subscriber access lines.

1.2.4.1 <u>Ownership</u>

The transmission media will be a combination of Government and commercially-owned facilities, both in CONUS and Overseas. In CONUS, carriers providing switching service in AUTOVON shall permit switching of channels owned by the Government, by other carriers or, in some cases, privately owned channels (see Paragraph 1.2.4.2).

1.2.4.2 Privately Owned Facilities

The Government may arrange for termination of some privately owned facilities in AUTOVON switching centers for use as alternate routes in times of emergency.

1.2.5 Terminal Equipment

Since AUTOVON is to be a four-wire system, its terminal equipment must also be arranged for four-wire operation. In cases where users are served through two-wire local switchboards, a four-wire/two-wire conversion is required at the local switchboard location. Terminal equipment which is a part of AUTOVON, or which can employ AUTOVON for service includes four-wire telephones, two- and four-wire local switchboards, special purpose consoles, facsimile machines and data subsets. Any terminal equipment employing on-line cryptographic devices must establish the connection before the cryptographic device is placed on-line.

1.2.5.1 AUTOVON Subscriber

An AUTOVON subscriber is any individual, installation, or activity having a direct connection to one or more AUTOVON switches.

1.2.5.2 AUTOVON Users

AUTOVON users are individuals, installations, or activities which have access to one or more AUTOVON switches through a local switchboard.

1.3 Services Available

AUTOVON is intended to offer identical services to its world-wide users and subscribers. These services will be available in a phased system implementation program. (See Paragraphs 1.8.1 and 1.8.2)

1.3.1 User Service

AUTOVON will provide the capability for users to call other users or subscribers on a world-wide basis. Two (2) types of service will be available for normal day-to-day, non-pre-emptive traffic. The first will enable users to dial desired numbers and accomplish a direct connection. Second, in many cases, in and out dialing through AUTOVON from local switchboards may not always be practical; therefore calls, particularly those through comparatively limited trunking facilities, will be placed through operators. Where users of this type service require priority calls, they must place the call through their local PBX or DSA operator.

1.3.2 Four-wire Service

Subscribers will be provided with special four-wire terminal equipment and will have direct access to one or more AUTOVON switching centers. This equipment may be a single or multi-line telephone instrument, or other subset that can employ a nominal four-kilocycle circuit. Data subscribers, requiring specially treated transmission channels, will be provided access to those AUTOVON circuits which are specially conditioned.

1.3.2.1 Signaling from four-wire subscribers will be on a Dual Tone Multi-Frequency (DTMF) basis.

1.3.2.2 Four-wire subscribers will be provided with up to five (5) levels of precedence (see Paragraph 2.3.1.2). Tentative date for provision of this automatic pre-emption capability is January 1966. Higher levels of precedence will pre-empt lower levels with which they are in contention. A four-wire subscriber may employ any level of precedence desired, up to and including his highest authorized level. Programming of authorized precedence levels to subscribers is to be accomplished at the serving switching center(s) and shall be readily changed when required.

1.3.3 "Off-Hook" Service

"Off-hook" service ("hot lines") shall be provided through the AUTOVON. An "off-hook" subscriber, upon lifting the handset of his telephone, will immediately be connected through the switched network to a pre-designated subscriber. A separate instrument (or one or more circuits in a multi-line instrument) shall be provided for each "off-hook" subscriber.

1.3.3.1 If an "off-hook" circuit is interrupted during the course of a call, the connection will be re-established by both subscribers going "on-hook" and then initiating a new call.

1.3.3.2 "Off-hook" service will normally be authorized on a high precedence level, but can be authorized at any precedence level.

1.3.4 Special Purpose Networks

Several types of special network operation must be accommodated by AUTOVON. These may afford privacy of service to subscribers of the networks. Trunks employed in network interconnection will be general purpose trunks. Two (2) of these networks are described hereafter:

1.3.4.1 Category 1

These networks will allow subscribers to employ abbreviated keying to certain other designated subscribers. Their instruments will also be used for normal AUTOVON four-wire service. This service is expected to be quite limited, but networks of up to eighty (80) subscribers can be accommodated. These networks may either be local or world-wide.

1.3.4.2 Category 2

These networks provide special treatment to subscribers within a community of interest over AUTOVON general purpose facilities. This community of interest network may be confined to a limited geographical area or may be world-wide. Features to provide privacy to members of a network will be necessary. Members may be restricted to calling within the network or have the additional capability of calling through world-wide AUTOVON. The normal AUTOVON subscriber may be prevented from calling into the network, or he may be capable of entering the network only with a precedence call. Designated subscribers may be included as members of two or more special networks. All members of a community of interest network will be capable of exercising a level of precedence within their network higher than that permitted them on the world AUTOVON.

1.3.5 Dial Service Assistance

Dial Service Assistance (DSA) operators will be provided at selected AUTOVON locations. These operators provide information assistance, establish conferences, and place precedence calls for AUTOVON users who cannot place such calls directly. They will also provide manual service through facilities such as high frequency radio links where the quality is not considered adequate for automatic switching.

1.3.6 Conferencing

Conferencing capabilities will be provided by AUTOVON. Conferences can be either random or preset.

1.3.6.1 Random Conferences

Random conferences, which can include any AUTOVON subscriber or user, may be established with precedence levels through a DSA operator. Two (2) types of random conference arrangements shall be provided: progressive and "meet me". In the progressive type, the operator contacts each conferee and connects him to the conference. In the "meet me" type, conferees initiate calls to individually assigned equipment. Assignments are made by contacting a DSA operator and scheduling conference time. Through an element of system design, operators are excluded from conference participation, except by invitation.

1.3.6.2 Preset Conferences

By keying specified digits, or by "off-hook" type of operation, authorized subscribers may be automatically conferenced with one or more pre-selected groups of subscribers.

1.4 Interconnection with Other Voice Systems

AUTOVON subscribers and users shall have access to subscribers and users served by other switching networks. These connections will be established over the trunks between the various switching systems. Interface requirements and methods of operation (manual or automatic) for these interconnections will be specified when the need for such interconnections is established. However, a routing digit, provided in the numbering plan, will permit automatic cross-over between networks, when so approved.

1.5 Description of CONUS Switching Centers

1.5.1 Under the routing plan being developed each office involved in the completion of a call is of equal rank with all other offices.

1.5.2 Grid patterns are established by the call procedure. A destination switching center on a particular call establishes, as a point of reference, the hub of a home grid. Home grid switching centers are defined as all switching centers surrounding, and directly connected to, the destination switching center.

1.5.3 A route control digit, provided in the numbering plan, will be utilized to process calls through the network.

1.5.4 The overall traffic routing pattern programmed for each switching center must be rigidly controlled in a network of equally ranked offices. Certain rules must be followed. These rules, and the programming information, will be provided in a traffic routing plan by the Government.

1.6 Special Requirements

1.6.1 Compatibility

In order to ensure compatibility with other AUTOVON switches, both Overseas and in CONUS, the technical requirements detailed in this document must be met. Continued upgrading of the services and service offering to match changes in specifications as they occur, is required.

1.6.2 Reliability

In addition to compatibility, reliability is of prime importance. The following considerations relating specifically to AUTOVON service must be observed in the switching centers.

1.6.2.1 The switching centers must be designed for continuous operation. They must be capable of carrying a continuous traffic load of at least ten percent above the peak busy-hour load capacity without degrading service.

1.6.2.2 Under no circumstance shall an equipment failure cause the loss of more than ten percent of the engineered switching capability through loss of processing equipment or access thereto.

1.6.2.3 The switching center shall be arranged for alternate switching procedures in the event of inability to complete service in the normal manner. (See Paragraphs 2.2.11.5 and 2.2.13)

1.6.3 AUTOVON/AUTODIN Interconnections

1.6.3.1 Provisions shall be made for serving AUTODIN subscribers and switches through AUTOVON.

1.6.3.2 AUTODIN is a global automatic digital network which provides store and forward automatic data message switching between machine terminals. An Automatic Data Message Switching Center (ADMSC) will derive trunks to other ADMSCs through AUTOVON.

1.6.3.3. AUTODIN stations at locations remote from any ADMSC may be homed on an AUTOVON switch and be connected to an ADMSC or to another AUTODIN station through AUTOVON.

1.6.3.4 Connections between an AUTOVON switch and an AUTODIN ADMSC or AUTODIN stations will be made over access lines conditioned for the grade of service required. AUTOVON equipment for these access lines will be similar to the AUTOVON four-wire subscriber line equipment.

1.6.3.5 Connections to or from an AUTODIN station will be made on a call-by-call basis. Connections between two (2) ADMSC's will usually be made for an extended period.

1.6.3.6 "Off-hook" Service will be provided on AUTODIN access lines when such service is desired. Other AUTODIN access lines will have key-pulsing for the origination of calls. The mode of signaling provided for AUTODIN ADMSC's and stations will conform to the signaling for an AUTOVON four-wire subscriber.

1.6.3.7 Pre-emption of AUTODIN circuits established through AUTOVON will be identical to the pre-emption of any other established connection in AUTOVON.

1.7 System Implementation

1.7.1 DECEO will provide technical information, technical specifications, and engineering assistance to all necessary DoD and other Government agencies, as required, and to cognizant contractors and contracting agencies.

1.8 Phasing

Implementation of AUTOVON will be accomplished in a series of evolutionary steps extending through 1970. The first step was taken on 19 April 1964 when the CONUS AUTOVON was established. The remaining steps are being planned.

1.8.1 CONUS Configuration

1.8.1.1 Background

On 19 April 1964, CONUS AUTOVON was established by combining the Department of Army SCAN Network and the Department of the Air Force NORAD/ADC Network into a single network. Coincident with this integration, SCAN voice subscribers were rehomed to the nearest AUTOVON switching center. Each trunk group was expanded so as to provide a P.03 grade of service within that trunk group. With the alternate routes available, a better than P.01 grade of service was obtained. The grade of service represents the percentage of busy conditions encountered in each 100 calls attempted. Therefore, "P.03 grade of service" means that during the busy hour of the day, no more than three (3) calls of 100 attempts would encounter a busy condition in the trunking system.

1.8.1.2 May 1964 - September 1964 Expansion

The first major step in the expansion of the network has brought into the switched system some agencies previously served by their own separate networks. From May to August, 470 subscriber lines were added. In August, a tenth switching center was integrated; and in September, approximately 350 additional subscribers were added. During each of these steps, the trunking system was augmented to maintain the desired grade of service, and an appropriate rehoming of subscribers was affected.

1.8.1.3 September 1964 - 1970 Expansion

The objective in the 1964-1970 timeframe for CONUS AUTOVON is to provide an expanded system which will meet esssntial requirements under emergency conditions and which will also meet day-to-day needs for local and long distance traffic during non-emergency conditions.

1.8.2 Overseas Configuration

1.8.2.1 The overseas system, as presently planned, will have twenty-one (21) Government-owned and one (1) leased switching center.

\# 1.8.2.2 The Initial Operating Capability (IOC) for the first overseas switching centers is anticipated to be November 1966.

CHAPTER II

AUTOMATIC SWITCHING EQUIPMENT

2.1 General

2.1.1 At the switching center, a four-wire electronic switching device with a stored program shall be provided to perform switching on a four-wire basis between any two (2) switched terminals.

2.1.2 Calls shall be completed through a switching center within an average of less than one (1) second during the busy hour. This time is measured from the end of subscriber signaling to either the beginning of equipment signaling to the next switching center or to the start of ring on a subscriber line or access line.

2.1.3 Recorded announcement facilities within the switching center shall be capable of furnishing at least five (5) simultaneous announcements with a minimum length of twelve seconds. Each announcement shall be accessible to at least five (5) trunks simultaneously.

2.1.4 The switching equipment, if so specified in Appendix A, shall be arranged for non-blocking within the switching matrix.

2.1.5 A numbering plan as described in Paragraph 4.1 shall be incorporated in the switch design.

2.1.6 A signaling plan as described in Paragraph 4.2 shall be incorporated in the switch design.

2.1.7 A transmission plan as described in Paragraph 4.3 shall be incorporated in the network design.

2.2 Features of Switching Machine

The switching center shall be equipped with features capable of automatically performing the switching functions listed in the following paragraphs. The switching center shall be designed to:

2.2.1 Provide control by stored program operation whereby rapid addition of new services, and modification or elimination of existing services, can be accomplished by suitable changes in the program.

2.2.2 Connect the line or trunk to a registering device, which shall furnish a ready-to-receive signal indicator. An originating office shall be capable of providing a momentary off-hook supervisory signal coincident with or in lieu of dial tone.

2.2.3 Provide class marks to indicate each separate privilege, restriction or special instruction for processing incoming and/or outgoing calls. Any number of these class marks may be required in any combination for assignment to a single subscriber line or access line. Provision shall be made for the capability of utilizing a minimum of 200 class marks.

2.2.4 Outpulse Multi-Frequency (MF) 2/6 or Dial Pulse (DP), or send no pulses out at all, and receive either MF 2/6, DP or DTMF signals, or receive no pulses at all.

2.2.5 Recognize start signal on inter-center trunks. Time out and seize another trunk if start signal is not received within four (4) seconds after seizure.

2.2.6 Recognize stop and go features on DP routes.

2.2.7 Accept procedence and/or routing information from all DTMF subscribers. Class of service marks shall be incorporated in the switch design so that routing information by dial pulse users can be accepted or denied.

2.2.8 Code-convert, as required, for routing.

2.2.9 Provide translation capabilities to permit the equipment to accept a variety of digits (up to 10), preceded by a precedence digit, a routing digit, and a route control digit where used. In anticipation of subscriber calling to other networks, and to avoid manual tandem operation, the machine will require translation of routing, area, and office codes for entering these networks at the proper point on the basis of routing as far as practicable on the AUTOVON.

2.2.9.1 Translation of the precedence digit shall be required when completing a call to a PBX. An option shall be provided to direct precedence calls to the PBX attendant or in-dialing equipment, depending on the requirements of a specific installation. For PBX locations without an attendant, the call shall be completed on a Network-In-Dialing (NID) PBX access line from the AUTOVON switch.

2.2.9.2 Translation of routing digit shall be required to (a) determine routing for voice grade calls,

(b) determine routing for special grade calls (including switching in of regenerative repeaters), (c) provide special routing and translation information for cross-over of calls to other networks, and (d) provide protection of "off-hook" subscriber terminals against misdirected dialing.

\# 2.2.9.3 Translation of the route control digit shall be required to determine the selection of one (1) of a number of traffic routing choice procedures.

\# 2.2.9.4 Translation of the address digits shall provide the following:

\# 2.2.9.4.1 Selection of a PBX that uses a full central office code (NNX).

2.2.9.4.2 Selection of a PBX where two (2) or more PBXs are served by the same NNX code.

2.2.9.4.3 Selection of four-wire station directly served by the switching center.

2.2.9.4.4 Selection of trunk group.

2.2.9.4.5 Selection of a preferred route when multiple routes are available to the desired area or switching center.

2.2.9.4.6 Selection of a seven (7) or ten (10) digit address from a two (2) digit abbreviated address and processing of the call.

\# 2.2.10 Employ translation of the routing digit, destination code, and class-of-service of the originating subscriber, either to permit restriction of precedence privilege to a sub-section of the switching network, or to restrict calling privileges within a community of interest section of the switching network.

2.2.11 Provide traffic routing capabilities to meet the following criteria:

2.2.11.1 Each route may consist of data grade and voice grade trunks. (See Paragraph 4.3.11.) A flexible sequence of trunk hunting is required over various combinations of data and voice grade facilities. The testing sequence may vary at each switching center employed in the call path.

2.2.11.2 The capability to designate separate route testing procedures for precedence traffic, which will differ from those for routine traffic.

2.2.11.3 Traffic shall be routed to offer calls to a primary route, and a maximum of nine (9) alternate routes toward the called destination.

2.2.11.4 A routing plan, provided by the Government, will prevent additional alternate routing at a switching center which would bring the call back to a previously used switching center (ring-around-the rosy)

2.2.11.5 The switching center shall employ a reprogrammable hunting sequence for primary and all available alternate routes. Means shall be provided for rapidly reprogramming the routing translation in the switching center through use of stored program information, such as prepared tapes, punched cards, or other memory devices.

2.2.11.6 The basic concepts established for the trunk hunting sequence are as follows:

2.2.11.6.1 For all calls, there shall first be a search for an idle trunk over that grade of facility required for the call, as indicated by the routing digit.

2.2.11.6.2 ROUTINE calls shall be connected to a "Trunk Busy" tone if no idle trunk is available.

2.2.11.6.3 Precedence calls shall re-examine the trunks on a pre-emptive basis.

2.2.11.6.4 The pre-emptive search pattern shall determine which trunks have the lowest level of precedence and whether an idle trunk is now available.

2.2.11.6.5 A trunk which is of the lowest level of precedence stored for all trunks in the route shall be pre-empted as described in Paragraph 2.3.3.

2.2.11.6.6 Precedence calls shall be connected to a recorded announcement in the event that calls in all routes involved are equal to or higher in precedence than the call waiting to be served.

\# 2.2.11.6.7 Hunting sequences may require scan of voice grade circuits for data grade calls, or data grade circuits for voice grade calls,as the last choice in trunk selection.

2.2.12 Have the ability to vary the following information on alternate routes:

2.2.12.1 Number of digits outpulsed.

2.2.12.2 Code conversion.

2.2.13 Have the ability to act on a group failure alarm signal by ignoring mass incoming seizure, preventing seizure for outgoing calls and releasing established calls in the affected group.

2.2.14 Provide the capability for confirmation (MF 2/6) signaling from this switching center over selected AUTOVON trunks to ensure that error-free digits are received at the destination. (See Paragraph 4.2.9)

2.2.15 Out-pulse a precedence digit, a routing digit, and, when required, a route control digit, followed by a seven (7) or ten (10) digit address. The route control digit shall not be transmitted to, or received from, switching centers outside of CONUS AUTOVON.

2.2.16 Re-establish automatically to one or more alternate addresses in sequence under control of the originating switching center, calls to selected subscribers which cannot be completed to their original destination within a prescribed time. Provision shall be made for a maximum of four (4) alternate addresses.

2.2.17 Spill-forward to the destination switching center the required combination of digits in accordance with the Routing Plan.

2.2.18 Translate at the destination switching center the digits received and complete to the PBX access line group, subscriber line, or other switching network, subject to the requirements of Precedence and Pre-emption. (See Paragraph 2.3)

2.2.18.1 There shall be no out-pulsing if a PBX switchboard is reached for manual completion to a PBX extension.

2.2.18.2 If the PBX is equipped for in-dialing to the extensions, the required address digits (up to seven (7)) will be out-pulsed. An option shall be provided which permits a DP precedence digit to be forwarded in advance of the address. (See paragraph 4.2.10.3)

2.2.18.3 Under the conditions described below, calls to selected subscribers shall automatically be routed by the destination switching center to an alternate subscriber line served from the same or another switching center such as the other line of a dual-homed subscriber:

2.2.18.3.1 Subscriber line is made busy by maintenance force.

2.2.18.3.2 Subscriber line is busy on equal or higher precedence call.

2.2.18.3.3 Subscriber line is out-of-service.

2.2.19 Extend supervision from the switching center over the subscriber line to the subscriber line terminating equipment and over a PBX access line to the PBX trunk circuit.

2.2.20 Provide a 3 to 5 second time buffer in subscriber and PBX access line circuits at the terminating switching center to delay disconnection from the called end and provide means to disable this time buffer when desired.

2.2.21 Provide abbreviated keying with repertories having a maximum of eighty (80) stored two-digit NX codes for selected subscribers. The NX codes will be translated to full addresses (7 or 10 digits) plus precedence and routing digits if required. Access to the repertory may be given to a single subscriber or to a number of subscribers homed on the same switching center. No subscriber line will have access to more than one repertory.

2.2.22 Provide "off-hook" service. The switching machine, upon receiving an indication that the selected telephone instrument has been placed off-hook, shall automatically process the call to a stored address, which will include the authorized precedence and routing information. The routing digit as assigned in the Numbering Plan shall protect an "off-hook" terminal against seizure by misdirected key pulsing. A busy signal or blocked precedence call announcement shall be returned on such misdirected calls. On a call from either direction, the originating switching center will transmit the authorized precedence, but one subscriber line shall be marked with a lower precedence for incoming calls to prevent blocking on simultaneous call attempts. An incoming call will be completed to the lower precedence terminal immediately without going through the pre-empt routine. The time-buffer (see Paragraph 2.2.20) shall be disabled in both subscriber lines.

2.2.23 Provide PBX line hunting features over access lines which may be split into two groups, a group preemptible for reuse and a group which is not preemptible for reuse. (See paragraph 4.2.10.2.)

2.2.23.1 Line hunting sequence for ROUTINE calls shall be:

2.2.23.1.1 Hunt for an idle access line in the nonpreemptible group.

2.2.23.1.2 Hunt for an idle access line in the preemptible group.

2.2.23.1.3 ROUTINE calls shall be completed over either group as indicated in paragraphs 2.2.18.1 and 2.2.18.2 or connected to "Line Busy" tone, if no idle access lines are available.

2.2.23.2 Line hunting sequence for precedence calls shall be:

2.2.23.2.1 Hunt for an idle access line in the preemptible group and either provide a precedence ringing signal or in-dial the precedence and address depending upon the requirements of a specific installation.

2.2.23.2.2 Reexamine the preemptible group on a preemptive search and preempt a call of the lowest precedence in progress. (See paragraph 2.3.)

2.2.23.2.3 If unable to preempt, hunt for an idle access line in the nonpreemptible group and complete the call to manual or in-dial as necessary. (See paragraphs 2.2.18.1 and 2.2.18.2.)

2.2.23.2.4 If unable to complete on any of the above, the call will be connected to a recorded announcement.

2.2.24 Provide echo suppressors (split operation) on all access lines to two-wire PBX's served from the switching center. These echo suppressors shall be provided with the capability of adding remote control disabling features.

2.2.24.1 On the initiation of a call from the PBX, the echo suppressor shall be held in the disabled condition until the complete address has been received in the switching center. If the call is to be completed to a subscriber or PBX homed on the same switching center, the echo suppressor shall not be enabled. If the call is routed through another switching center, the echo suppressor shall be enabled and shall remain in the enabled condition for the duration of the call.

2.2.24.2 Calls to the PBX from another switching center shall enable the echo suppressor when the PBX access line is seized, and shall hold the echo suppressor in the enabled condition for the duration of the call. Calls to the PBX, which originate from a subscriber or PBX homed on the same switching center, shall not enable the echo suppressor.

2.2.25 Provide line load control at the switching center. This shall consist of restricting originating call access to the AUTOVON switch by reducing groups of access lines in three (3) distinct steps. For example: A PBX line group may be subdivided into 40%, 40% and 20% of the total line group. Under the first steps of line load control, one (1) subgroup of 40% would be excluded. The second step would exclude an additional 40%; the third step would exclude all originating call access for those access lines under line load control. The percentages used in the foregoing example are for the purpose of illustration only. It shall be possible to use any assigned percentages specified by the Government. Line load control shall not affect completion of calls from the switching center to the PBX over any line. Plans for implementation of line load control practices at each switching center will be provided by the Government. (See paragraph 6.4.)

2.2.26 Provide automatic traffic overload protection. This control will function at a predetermined traffic load level to exclude all nonessential originating calls for the duration of the overload. Nonessential is used herein to denote that class-of-service mark used for subscribers having only ROUTINE level capabilities.

2.2.27 Route calls to the DSA switchboard. Calls at those switching centers where DSA switchboards are located shall be routed via operator trunks. Calls to DSA switchboards initiated at a switching center where there is not a DSA shall be routed via interoffice trunks to the switching center at which the serving DSA is located. Under either of the preceding conditions, a caller shall be able to signal or recall the DSA operator.

2.2.28 Provide common control equipment capable of expansion to serve an additional matrix for switching wideband channels, if required, (see paragraph 2.4.2), or a completely independent digital matrix, if required for future use. The equipment for the initial switch shall meet the following requirements for the future addition of a digital matrix:

2.2.28.1 It shall have an open ended capability to permit expansion and additions to satisfy features and requirements of an independent matrix.

2.2.28.2 The addition of the independent matrix shall not require discarding or modifying the initial common control equipment, but may require additional modules. The following anticipated requirements for an independent matrix are listed for guidance when determining the satisfactory design of the common control provided for the initial switch.

2.2.28.2.1 Synchronous digital data will be switched through the matrix.

2.2.28.2.2 An accurate timing source will be required for the control of peripheral equipment.

2.2.28.2.3 Separate registers and senders will be required.

2.2.28.2.4 The capacity of the matrix will be 50 lines minimum and 500 lines maximum.

2.2.28.2.5 Additional translations will be required.

2.2.28.2.6 Digital supervision and signaling will be required.

2.2.28.2 7 Crosstalk between any circuit in this matrix and any other circuit served by the common control shall be attenuated by at least 100 db.

2.2.28.2.8 Information from the memory to the independent matrix shall be transferred at the <u>minimum</u> practical rate.

2.2.29 Apply a permanent signal tone to a subscriber line or PBX access line within 25-30 seconds if no pulsing has been received.

2.3 Precedence and Pre-emption

2.3.1 Precedence Classification

2.3.1.1 Precedence levels, designated zero (0) through four (4), are required, with service preference according to rank. Precedence level four (4) will be used for normal routine calls. Precedence level zero (0) is the highest ranking precedence.

2.3.1.2 Precedence levels are as follows:

Number	Precedence Level
0	FLASH OVERRIDE
1	FLASH
2	IMMEDIATE
3	PRIORITY
4	ROUTINE

2.3.1.3 Each four-wire subscriber will have the capability of using any precedence up to, and including, the highest authorized for that subscriber. Except for certain cases, calls will automatically be established with a ROUTINE precedence unless a higher one is included in the address. A limited number of subscribers will be class marked so that their calls, without a precedence indicator in the address, shall automatically be assigned a higher than ROUTINE precedence.

2.3.1.4 The precedence level of a call will normally be determined by the caller.

2.3.1.5 If a subscriber attempts a higher precedence than that to which he is authorized, the call shall be routed to a recorded announcement.

2.3.2 Precedence Signaling

2.3.2.1 The precedence level of each call shall be signaled ahead to each AUTOVON switching center in the call path.

2.3.2.2 A pre-emption disconnect signal shall be provided to cause release, in all affected switching centers of any trunk selected for pre-emption by a call of a higher precedence. The pre-emption disconnect signal shall be extended through the switching center to each subscriber associated with the connection to be pre-empted.

2.3.2.3 The precedence level of each call shall be associated with each trunk employed whether or not pre-emption is exercised.

2.3.3 Pre-emption

2.3.3.1 Pre-emption shall be accomplished in the affected switching center by sending a measured supervisory pulse toward both ends of the established circuit which may be one or more switched links away from the pre-empting center. Four (4) pre-emption signal combinations exist, depending upon trunk condition and proposed disposition. These supervisory conditions shall be subject to the requirements defined in Paragraph 4.2.5. The affected switching center shall:

2.3.3.1.1 Initiate signal functions to cause release of all trunk linkages holding the original call.

2.3.3.1.2 Seize that portion of the pre-empted trunk desired and proceed with the establishment of the waiting call.

2.3.3.2 The pre-empt supervisory signal shall be extended through both terminal switching centers and the four-wire subscriber line or PBX access line to the subscriber line terminating equipment or the trunk circuit at the PBX.

2.3.3.3 The terminal switching centers shall:

2.3.3.3.1 Send the pre-emption signal specified in paragraph 4.2.5 and the pre-empt warning tone to the pre-empted subscriber or PBX, and maintain this tone either until the subscriber or PBX returns an "on-hook" signal or time-out occurs.

2.3.3.3.2 Hold the desired subscriber line or PBX access line against seizure by another call if pre-emption was initiated at the terminal switching center for a call to that subscriber or PBX.

2.3.3.3.3 Signal incoming precedence ringing to a called subscriber in accordance with Paragraph 4.2.2.4 when "on-hook" is received, or signal a called PBX as indicated in Paragraph 4.2.10.3.

2.4 Transmission Criteria

The following transmission criteria shall be met within the switching center to provide the quality of service demanded of AUTOVON.

2.4.1 4 kc Requirements

2.4.1.1 The input and output impedance of each 4 kc channel of the switching center shall be of a nominal

600 ohms balanced to ground with a minimum return loss against 600 ohms of 26 db with equipment lined up at correct levels.

\# 2.4.1.2 The insertion loss at 1000 cps shall not exceed 0.5 db. This shall include all cabling, crosspoints and associated wiring. The difference between any two (2) paths through the switching center shall not exceed 0.1 db.

2.4.1.3 The longitudinal balance within the VF range shall be better than 40 db.

2.4.1.4 Crosstalk coupling loss between any two (2) circuits shall be greater than 80 db.

2.4.1.5 Crosstalk loss between the two (2) directions of a circuit shall be greater than 50 db when measured at equal level points.

2.4.1.6 Impulse noise generated within the switching center shall be numerically greater than -50 dbm as measured on the General Radio 1556A Impulse Noise Analyzer or equivalent.

\# 2.4.1.7 The absolute delay of a signal in passing through the switching center from input to output shall not exceed 660 microseconds.

2.4.1.8 The total harmonic distortion produced by any single test frequency at test tone level shall be at least 47 db below test tone level.

2.4.1.9 The rms sum of all intermodulation products of any two (2) frequencies within the same channel, at 3 db below test tone level, shall be at least 47 db below test tone level.

2.4.1.10 The power line frequencies, harmonics of power line frequencies, and noise introduced through the power supply shall have an rms sum at least 55 db below test tone level.

2.4.1.11 For all frequencies between 300 and 3400 cps the insertion loss relative to 1000 cps shall not exceed ± 0.1 db.

2.4.1.12 The envelope delay difference between any two (2) frequencies between 1000 and 2600 cps shall not exceed 20 microseconds.

\# 2.4.1.13 The test tone shall be applied to obtain a 0 dbm signal at the 0 dbm level points in the system.

2.4.2 Wideband Capability

\# 2.4.2.1 The switching equipment shall either include the inherent capability of switching 108 kc channels, or provide for the future installation of a separate matrix capable of switching 108 kc wideband channels. If the 108 kc switching is provided by the use of a separate matrix, it shall be served by the same common control as the 4 kc matrix. The wideband matrix criteria shall meet the following requirements:

2.4.2.1.1 For a nominal impedance of 150 ohms balanced, the insertion loss at mid-frequency (35 kc) of the 10 to 60 kc band shall not exceed 1.1 db. For all frequencies between 10 and 60 kc, the insertion loss relative to 35 kc shall not exceed ± 0.5 db. Also, for a nominal impedance of 135 ohms balanced, the insertion loss at mid-frequency (84 kc) of the 60 to 108 kc band, shall not exceed 1.5 db. For all frequencies between 60 to 108 kc, the insertion loss relative to 84 kc shall not exceed ± 0.5 db. Differential delay between mid-frequency and any other frequencies in the 15 to 55 kc band shall not exceed 5 microseconds. Differential delay between mid-frequency and any other frequencies in the 65 to 103 kc band shall not exceed five (5) microseconds.

2.5 Trunk Operation

Trunk operation shall be required to meet the various interconnection functions as shown. All trunks will be on a four-wire basis with E and M lead signaling control.

Typical Connecting Function	Signaling Conditions	
	Incoming	Outgoing
PBX access line, two-way	DTMF, DP	DP, Automatic
Inter-center, two-way	MF 2/6	MF 2/6
Four-wire subscriber lines	DTMF, Automatic	Automatic

2.6 Dial Service Assistance (DSA)

2.6.1 Where required, Dial Service Assistance will provide, but not be limited to, the following services:

2.6.1.1 Provide assistance in completing calls.

2.6.1.2 Provide information.

2.6.1.3 Accept trouble reports.

2.6.1.4 Provide intercept service.

2.6.1.5 Establish random conferences.

2.6.1.6 Originate calls to the AUTOVON.

2.6.1.7 Exercise all levels of precedence.

2.6.1.8 Completion of off-net incoming calls.

2.6.2 A means to provide visual indication of the specific level of precedence of the incoming call is required. (Administrative procedures may be established whereby the operator will not extend calls at a precedence level above the received call. However, it is anticipated that requirements will exist, possibly from an unattended PBX, for the operator to establish a precedence call for a user without a precedence capability. On such calls, the operator will call back the originating party with a precedence designator, thus protecting both ends of the call.)

2.6.3 Complete privacy of communications is a requirement of the AUTOVON. To safeguard this requirement, the Dial Service Assistance operator shall not have a "no test" capability.

2.7 <u>Conference Arrangements</u>

2.7.1 <u>Random Conferencing</u>

Random conferencing will be established by the Dial Service Assistance operator when requested to provide such service by an AUTOVON subscriber or user.

2.7.1.1 Circuitry shall provide for the inclusion of up to 26 conferees.

2.7.1.2 Operators will have no monitor access to a completely established conference.

2.7.1.3 Sidetone will not be provided on the conference bridge.

2.7.1.4 Adequate transmission improvement will be required within the conferencing equipment to compensate for bridge losses incurred, if any.

2.7.1.5 Two (2) types of Random Conferences shall be provided:

2.7.1.5.1 "Progressive" conferences are established by having the operator contact each individual, connecting him to the conference bridge.

2.7.1.5.2 "Meet me" conferences are established by having each conferee call into a conference bridge, as directed by the conference operator.

2.7.2 Preset Conferencing

2.7.2.1 Preset conferencing, as described herein, provides a method of establishing pre-programmed conferences and shall be provided when specified in paragraph 2.3.6 of Appendix A.

2.7.2.2 Operation

2.7.2.2.1 A preset conference shall be capable of initiation from a four-wire or a two-wire DTMF instrument by the generation of the desired precedence and the address that corresponds to the desired conference bridge group and preset list of the conferees to be called.

2.7.2.2.2 Access to preset conference equipment shall be by means of one or more NNX codes assigned solely to this use. The originating office shall screen the unique NNX codes by class-of-service to protect against unauthorized preset conference usage, and, where authorized, attempt the connection, either locally or via inter-office trunks. The unique NNX conference codes shall be translated as vacant codes on ten (10) digit calls.

2.7.2.2.3 The originator of a preset conference shall key the digits NNX XXXX. This address may be preceded by each an R digit, for choice of special grade or voice grade routing, and a P digit for precedence treatment. Thus the total address may be P R NNX XXXX.

2.7.2.2.4 Translation of the seven (7) digit address shall determine routing to the appropriate switching center to obtain conferencing equipment.

2.7.2.2.5 At the appropriate switching center the received address shall be translated to determine the conference group and the desired list of conferee addresses.

2.7.2.2.6 Number assignments shall be made in accordance with paragraphs 4.1.3.4 and 4.1.3.5 of the basic specification.

2.7.2.3 Conference Notification Tone

2.7.2.3.1 When the conference equipment receives the first off-hook supervisory signal from an answering conferee, conference notification tone shall be applied, and shall continue as an audible signal to answering conferees and to the originator until all conferees answer.

2.7.2.3.2 The conference notification tone shall automatically be removed two (2) seconds after the last conferee answers, indicating by such removal that the conferees have all answered and that the conference is ready to begin.

2.7.2.3.3 The originator shall have the ability to remove the conference notification tone and "force" the conference by depressing the "A" key on his DTMF instrument. Forcing the conference prematurely shall not interfere with attempts to complete the connections to unanswered conferees.

2.7.2.3.4 Where access to secondary and tertiary bridges is necessary in a conference, arrangements shall be made so that the conference notification tones generated at each bridge are not superimposed.

2.7.2.3.4.1 Each bridge shall generate notification tone which, initially, is audible only to those conferees on that bridge.

2.7.2.3.4.2 When all conferees on a bridge have answered, conference notification tone shall be removed automatically from that bridge.

2.7.2.3.4.3 When the conference notification tone is removed automatically from a bridge the notification tone from the adjacent bridge, if still continuing, will then become audible to the originator and to the conferees on the remaining bridge(s).

2.7.2.3.5 The conference notification tone shall be the individual, alternate presentation of each of the frequencies 852 cycles per second and 1336 cycles per second.

2.7.2.3.5.1 For general purpose conferences each of the frequencies shall be presented alternately for intervals of 300 milliseconds.

2.7.2.3.5.2 For alerting conferences each of the frequencies shall be presented alternately for intervals of 100 milliseconds.

2.7.2.4. Precedence

2.7.2.4.1 All addresses shall be processed at a precedence equal to that precedence furnished by the conference originator.

2.7.2.4.2 The preset conference equipment, and all switched connections associated with the conference, shall be protected from seizure by calls at the same precedence as that furnished in the address.

2.7.2.4.3 When a preset conference is initiated, an idle bridge, if available in the desired conference group, will be seized and the conference connections attempted.

2.7.2.4.4 If all the bridges in a conference group are busy, ROUTINE conference call attempts shall be connected to "Line Busy" tone and precedence call attempts shall re-examine all conference equipment bridges on a pre-emptive basis.

2.7.2.4.5 A conference bridge which is of the lowest level of precedence stored for all units shall be pre-empted by a higher precedence.

2.7.2.4.6 When a conference bridge is pre-empted, there will be a two second burst of pre-emption notification tone given to the conferee on the existing conference then pre-emption shall occur and the conferees for the new conference shall be called.

2.7.2.4.7 Where the requesting precedence is equal to, or lower than, that of the existing conference, the connection shall be denied and the call shall be handled in the same manner as any other incompleted precedence call.

2.7.2.5 Automatic Retrial and Alternate Address

2.7.2.5.1 Off hook supervision shall be returned to the originator from each bridge when all conferees have answered or when the originator has forced the conference.

2.7.2.5.2 Automatic retrial shall be provided which, if answer supervision is not returned from all conferee locations within an adjustable interval of fifteen (15) to sixty (60) seconds after each called conferee address in the preset list has been processed, will retry all unanswered connections.

2.7.2.5.3 One retrial shall be to the primary address through the specified interval.

2.7.2.5.4 Important conferences shall, where specified, be provided with alternate addresses for conferees which will be tried when the call fails to complete to the primary address.

2.7.2.5.5 The equipment shall recognize from the activating address if alternate addresses are provided.

2.7.2.5.6 If a call to a primary address fails to complete within two trials, the call shall be directed to the alternate address and two call attempts shall be directed to the alternate address.

2.7.2.5.7 Retrial attempts will be discontinued when off-hook supervision is received on each called conferee bridge leg, or the conference is released of after a maximum of two attempts, to each the primary and the alternate address, are made to complete the connection.

2.7.2.6 Bridge Release

2.7.2.6.1 Arrangements shall be made to release all connections and to restore the equipment to normal should on-hook supervision be received on the originator's leg or on all of the other conference bridge legs.

2.7.2.6.2 Any conference bridge shall be released after the full complement of attempts at call completion have been made and no answers are received on any leg.

2.7.2.7 Lost Connection

2.7.2.7.1 If a connection to a conferee is lost, due to disconnection or pre-emption, a distinctive disconnect signal. defined as a two (2) second burst of conference notification tone, shall call this fact to the attention of the originator of the conference.

2.7.2.7.2 If the originator is lost or pre-empted, the bridge shall be held up long enough for a two (2) second burst of pre-empt tone to be given to all conferees.

2.7.2.8 Secondary Conferencing

2.7.2.8.1 Secondary conferencing, which is the ability to interconnect with remote conference bridges, is required.

2.7.2.8.2 When a conference is activated and one of the addresses requires a secondary bridge. the address should be processed in a normal manner and directed toward the office serving the secondary equipment.

2.7.2.8.3 The design of the conference equipment shall be such that it may be used alternatively for primary or secondary conferences.

2.7.2.8.4 Identical operational features such as application and removal of conference notification tone, the latter under the originator's control, shall be provided for both primary and secondary operation.

2.7.2.9 Equipment

2.7.2.9.1 Equipment within a switching center to process normal calls, translate codes, and store data shall be shared as much as possible. Any additional equipment shall be provided consistent with the reliability and maintenance characteristics of the switching center.

2.7.2.10. Translation

2.7.2.10.1 One digit of the address shall be translated to identify a conference group.

2.7.2.10.2 Two digits of the seven (7) digit address shall be utilized to identify switching centers at which conferencing equipment is provided.

2.7.2.10.3 The last two digits of the seven (7) digit address shall be translated as an address to the memory in order to call the conferees in a particular repertory.

2.7.2.11 Memory

2.7.2.11.1 The memory serving all preset conferencing equipment in the switching center shall provide a capability for storing up to one thousand (1000) addresses, to be provided as ordered in increments of one hundred (100).

2.7.2.11.2 Provisions shall be made to include lists of up to twenty-five (25) addressees per conference.

2.7.2.11.3 The conference equipment shall read each address in a selected repertory from the memory and process it into the network so the connection may be established to each conferee.

2.7.2.11.4 The memory shall be shared among all the conferencing equipment at a switch and shall be seized only to obtain a particular list of addresses.

2.7.2.12 Conference Bridge

2.7.2.12.1 Preset conferences are intended for use by a minimum of three (3), a maximum of twenty-six (26), and an average of ten (10) participants, one of whom will be the originator of the conference.

2.7.2.12.2 Adequate transmission improvement will be required within the conferencing equipment to compensate for any bridge losses incurred in four-wire operation and to allow a maximum of fifteen two-wire participants in a preset conference.

2.7.2.13 Origination of Calls to Conferees

2.7.2.13.1 Origination of calls to conferees in a preset conference shall be provided consistent with call processing for other AUTOVON calls (e.g., signaling, supervision, routing, and pre-emption).

2.7.2.13.2 If a called conferee's telephone is not answered, disconnect is to take place within an adjustable interval of fifteen (15) to sixty (60) seconds after a bridge leg is first connected to the conferee line.

2.7.2.14 Conferee Add-on

2.7.2.14.1 Originators of preset conferences shall have the capability of adding up to five non-programmed conferees to the conference.

2.7.2.14.2 The originator shall have the capability of sequentially keying each add-on address and connecting the conferee to the bridge.

2.7.2.14.3 The capability shall be provided to the originator to remove himself from the conference and remove, add-on, or isolate (for private discussion or noise check) individual conferee legs. These operations shall not disrupt the existing conference.

2.8 Status and Control Equipment

SWITCHMAN (See Chapter VI) will require meaningful and current data concerning the condition of the network. This responsibility makes it mandatory that information concerning performance of facilities, switching equipment and traffic flow be provided in a relatively real-time basis. Relatively real-time is defined as the most rapid reporting system within practicable and reasonable limitations of technology and economics. The proposal shall indicate the capability of the switching equipment to furnish at least the following status information and control items.

2.8.1 Status Information

2.8.1.1 Extension of maintenance monitor indications to a location external to the switching center.

2.8.1.1.1 All sub-items of common control equipment busy; e.g., markers, registers, senders of equivalent.

2.8.1.1.2 All trunk busy (ATB) indications.

2.8.1.1.3 Ten percent (for example) of trunk group out of service.

2.8.1.1.4 Selected subscriber access line (Off-hook, FLASH and FLASH OVERRIDE) out of service.

2.8.1.1.5 Traffic Overload and/or Line Load Control imposed.

2.8.1.1.6 Selected peg count, overflow and TUR data on a real-time basis.

2.8.1.2 Extension of traffic measurements to a location external to the switching center at desired reporting intervals via automatic or manual methods.

2.8.2 Control Equipment Features

2.8.2.1 Extension of control systems to a location external to the switching center. These controls are to modify rapidly the normal operating characteristics of the switching center. Such features accomplish:

2.8.2.1.1 Remote cancellation of alternate routing.

2.8.2.1.2 Preprogrammed routing changes.

2.8.2.1.3 Remote implementation of Line Load Control in individual steps.

CHAPTER III

TERMINAL EQUIPMENT

3.0 General

Many different types of subscriber equipment may be used at AUTOVON stations. These include various types of telephone terminal apparatus and all types of data equipment such as teletypewriters, card readers, and facsimile instruments. Requirements for data devices are not included in these specifications. The contractor supplying terminal equipment in AUTOVON shall meet the criteria of this Chapter for applicable equipment.

3.1 Subscriber Station Equipment

3.1.1 Basic Four-wire Telephone Instrument

Detailed requirements for the four-wire telephone instrument shall meet the criteria of DECEO Engineering Publication H500-27-65 "AUTOVON Basic and Special Purpose Telephone Subscriber Equipment". The following sub-paragraphs cover a general description of the pertinent provisions of this document.

3.1.1.1 The basic four-wire telephone instrument shall include a telephone handset, Dual Tone Multi-Frequency (DTMF) key pulsing equipment with fifteen (15) or sixteen (16) control keys, a switch hook, a tone ringer and the circuitry necessary to perform the required functions.

3.1.1.2 Provision shall be made to connect a repertory key pulser to the telephone instrument.

3.1.1.3 The telephone handset shall contain a transmitter and receiver. The handset, with its associated circuitry in the telephone instrument, shall meet the transmission standards of a Western Electric 500-type telephone, a Kellogg K-500 type telephone, an Automatic Electric type AE-023 telephone, or other equivalent.

3.1.1.4 The DTMF oscillator shall provide a group of four (4) low frequencies and a group of four (4) high frequencies.

3.1.1.5 A key shall be provided for each numeral from 0 to 9 and shall be so marked. The other five (5) keys shall be marked A, FO, F, I and P. The A key will be used to indicate "End of Address" when an abbreviated address is keyed. The remaining four (4) keys are used to indicate the precedence of the call being originated.

3.1.1.6 The precedence keys may be arranged in either a horizontal or vertical group. The order from left to right (or from top to bottom) shall be FO, F, I and P.

\# 3.1.1.7 Operation of any DTMF key shall select one frequency from the high group and one frequency from the low group and shall transmit them simultaneously on the station transmit line. Each key shall transmit a discrete pair of frequencies. The frequency characteristics and assignments for each key are included in Paragraph 4.2.6.1, Signaling Plan.

3.1.1.8 The switch hook shall perform the normal telephone signaling control functions. In the on-hook position, it will disconnect and short-circuit the receiver and connect the tone ringer to the station receive line; open the transmit line, disconnecting and short-circuiting the transmitter; and may perform any other suitable functions.

3.1.1.9 The tone ringer shall consist of an oscillator and transducer. The oscillator shall produce a modulated tone which is acceptable as an alerting signal when reproduced by the transducer. A typical acceptable tone might be 2000 cycles modulated by 12 cycles.

3.1.1.10 The tone ringer shall operate from the talking battery supply.

3.1.1.11 Sidetone shall be provided.

3.1.1.12 A number plate to identify the station line number shall be provided on the face of the set.

3.1.1.13 The normal color of the instrument shall be beige, unless specified otherwise by the contracting agency.

\# 3.1.2 <u>Station Terminating Equipment</u>

Detailed requirements for the station terminating equipment shall meet the criteria of DECEO Engineering Publication H500-27-65, "AUTOVON Basic and Special Purpose Telephone Subscriber Equipment". The following sub-paragraphs cover a general description of the pertinent provisions of this document.

3.1.2.1 The station terminating equipment shall include the following features:

3.1.2.1.1 Conversion between E and M, and loop signaling.

3.1.2.1.2 Application of battery supply to the four-wire telephone instrument, for talking and tone ringer operation.

3.1.2.2 Loss of ac power at the subscriber station shall not affect telephone service.

3.1.2.3 Loop signaling (open and closed) shall be used on the four-wire connection between the telephone instrument and the station terminating equipment. Conversion from loop signaling to E and M lead signaling shall be made in the station terminating equipment.

3.1.2.4 When an idle line is seized by the switching center, the off-hook signal appearing on the station receive line shall cause the tone ringer to operate. Alternate off-hook, on-hook signals from the switching center shall create an interrupted tone ringing signal while the telephone instrument itself is on-hook.

3.1.2.5 Lifting the handset shall silence the tone ringer and shall transmit an off-hook signal to the switching center. It shall also place the subscriber equipment in the talking condition. The tone ringer shall be disabled until on-hook conditions are established in both directions.

3.1.2.6 Provide as an optional service feature:

3.1.2.6.1 Capability for up to six (6) voice grade four-wire telephone extensions to the main station.

3.1.2.6.2 A pre-empt signal detector which will provide an audible and/or visual signal.

3.1.3 <u>Subscriber Equipment for Special Services</u>

3.1.3.1 Subscriber terminal equipment for voice/data service will be required.

3.1.3.2 Controls are required on the special service telephone instrument to permit switching of the voice transmission circuit from the telephone to a data set. After the connection is established, the subscribers must be able to switch back and forth between the two (2) modes of transmission at will.

\# 3.1.3.3 The line terminating equipment at the instrument shall detect a pre-empt signal transmitted from the switching center. The detector signal may be used to activate an audible or visual signal located as specified by the subscriber. While in the voice mode, the pre-empt tone from the switching center will be audible in the subscriber instrument.

\# 3.1.3.4 On disconnection, the subscriber equipment shall revert to the telephone mode.

3.1.3.5 All requirements of the basic instrument and line terminating equipment (Paragraphs 3.1.1 and 3.1.2 thru 3.1.2.5) shall also be provided.

3.1.4 Off-Hook Service Instrument

3.1.4.1 A manual four-wire instrument (without key pulsing feature) may be provided for individual line service.

3.1.4.2 All other requirements for the basic instrument under sub-paragraphs 3.1.1 shall be provided.

\# 3.1.5 Multi-Line Subscriber Instrument

Detailed requirements for the multi-line subscriber instrument shall meet the criteria of DECEO Engineering Publication H500-27-65 "AUTOVON Basic and Special Purpose Telephone Subscriber Equipment".

3.1.6 Secretarial Units

3.1.6.1 Secretarial equipment shall be provided for serving a principal and secretary. The following features shall be provided:

\# 3.1.6.1.1 Multi-line service with Pick Up and Hold features.

3.1.6.1.2 Disconnection of audible signal on principal's set.

3.1.6.1.3 Two-way signaling and intercom service between principal and secretary.

3.1.6.1.4 Exclusion of secretary by principal.

3.2 Local Switchboard (PBX)

3.2.1 The basic service features provided at local switchboards shall conform to DECEO Engineering Publication H500-10-64 "AUTOVON System Interface Criteria". Additional service features required in CONUS (such as precedence in-dialing) shall not relieve the contractor from complying with the provision of H500-10-64.

3.2.2 Four-wire access lines shall be provided between the switching center and all local switchboards.

CHAPTER IV

NUMBERING, SIGNALING AND TRANSMISSION PLANS

4.0 General

This chapter describes the numbering, signaling and transmission plans to be used in AUTOVON.

4.1 Numbering Plan

A uniform numbering plan which generally follows the North American commercial system will be used in the world-wide AUTOVON. Two additional parts are added to meet special requirements of military users. This numbering plan must be adhered to in the interest of world-wide uniformity of customers' operation.

4.1.1 Numbering System Parts

The numbering system consists of five parts:

4.1.1.1 Precedence.

\# 4.1.1.2 Routing.

4.1.1.3 Area Code.

4.1.1.4 Destination Office Code.

4.1.1.5 Specific Line Identification.

4.1.2 Subscriber Keying Requirements

\# Subscriber keying will be by DTMF operation. The maximum keyed heading available to the subscriber consists of the precedence, routing and address in the following format:

P 1X NYX NNX XXXX

where:

P is any DTMF key, FO, F, I or P
N is any DTMF digit 2 to 9
Y is any DTMF digit 0 or 1
X is any DTMF digit 0 to 9

It will not be necessary for the subscriber to key the entire five parts of the numbering system on each call. The AUTOVON equipment at both the subscriber's location and at the receivers in the originating office shall conform to the numbering plans for each class of subscriber service as described below.

4.1.2.1 <u>Four-Wire Subscriber</u>

The originator of a call will key a minimum address of seven digits:

NNX XXXX

In addition, the prefix (NYX) may be used for extended area calling, a routing digit (1X) may be used for special route treatment and a prefix (P) may be used to exercise precedence. One, two or all three prefixes may be used by the subscriber to denote his requirements for a particular call. For example, no prefixes will be used for a ROUTINE voice call within the same numbering plan area. The switching center receiver shall accept any combination of digits as described above with the following exceptions:

4.1.2.1.1 The order of received DTMF signals must be in the sequence shown in Paragraph 4.1.2 from left to right. Any other sequence of delivery will create a misdirected call or "no-such-service" condition.

\# 4.1.2.1.2 All calls shall be routed to a "No-Such-Service Announcement" when a subscriber uses a restricted routing digit. (See Paragraphs 4.1.3.2 and 4.2.1.4)

\# 4.1.2.1.3 Calls shall be restricted within the bounds of precedence, routing area codes and address as defined by class-of-service assignment.

4.1.2.2 <u>Abbreviated Keying Subscriber</u>

This subscriber shall have all the capabilities and restrictions of a four-wire subscriber as defined in Paragraph 4.1.2.1. In addition, his class-of-service in the switching center shall mark his line with an additional capability, abbreviated keying. Use of this privilege is indicated to the switching center by the receipt of the DTMF frequencies assigned the "A" key (see Paragraph 4.[illegible].6 at the subscriber instrument. The code structure for abbreviated keying shall be a minimum of two digits:

NX A

N is any DTMF digit 2 to 9
X is any DTMF digit 0 to 9
A is the DTMF key A

\# The prefixes P and 1X may be used, subject to the same order of delivery and/or restriction of routing digit usage as described in Paragraph 4.1.2.1. Thus, the total keyed address available on an abbreviated keying basis is:

P 1X NX A

4.1.2.3 "Off-Hook" Subscriber

These subscribers will not key address information to the originating office. The routing digit as assigned in the Numbering Plan shall protect an "off-hook" terminal against seizure by misdirected key pulsing.

4.1.2.4 PBX Access Lines

PBX access lines shall have the capability of presenting address information to the switching center via two methods:

4.1.2.4.1 Operators, at switchboard positions so equipped, may address the switching center by DTMF key pulsing. Thus, a PBX operator has capabilities equivalent to a four-wire subscriber and subject to the same restrictions.

\# 4.1.2.4.2 PBX users will normally present seven or ten digit numbers to the AUTOVON switching center on a dial pulsed basis:

NYX NNX XXXX

4.1.3 Numbering Plan Assignment

4.1.3.1 Precedence Assignment

Precedence classifications are listed in Paragraph 2.3.1. Assignment of highest level of precedence authorized (class-of-service in switching center) will be furnished by DECCO when subscriber line service is requested.

\# 4.1.3.2 Routing Digit Assignment

Routing digit assignment shall determine the type or grade of circuit utilized, and whether call is destined for another network. Certain routing digits are machine generated and are not accepted from any subscriber. Route digits assigned initially are:

Digits	Assignment
10	Voice Grade - World AUTOVON
11	Data Grade - World AUTOVON
12	Unassigned and restricted
13	Unassigned and restricted
14	Unassigned and restricted
15	Off-hook service, Voice - Restricted*
16	Off-hook service, Data - Restricted*
17	Unassigned and restricted
18	Unassigned and restricted
19	Unassigned and restricted

* Not accepted from Subscribers
See Paragraph 4.1.2.3 for use.

4.1.3.3 Area Code Assignments

The area code to be used in the world-wide AUTOVON is a three digit code representing the geographical area of the world to which a call is being directed. Area codes 300-319 are reserved for Overseas AUTOVON. Of these, only three will be used initially:

311 European - Mediterranean
313 Caribbean - South America
315 Pacific - Asia

In CONUS, area codes have not been determined, but it is expected that no more than two will be used initially. Assignments will be made by the DCA through DECCO.

4.1.3.4 Office Code Assignments

The three digit NNX codes are used to identify a PBX or switching center. These will be assigned by the DCA through DECCO.

4.1.3.5 Station Number Assignment

The four digits are used to identify PBX access lines and four-wire subscribers. Number assignments will be made by the DCA through DECCO.

4.1.3.6 Service Code Assignment

The numbering plan for special services is still being coordinated. It is expected that it will consist of seven digit numbers. Tentative assignments being considered are:

NNX - 1211	Inward
NNX - 1311	Information
NNX - 1611	Trouble Reporting
NNX - 1001	Noise Balance Termination
NNX - 1011	Toll Testboard
NNX - 1021	1 Milliwatt Supply
NNX - 1031	Supervisory and Signal Test
NNX - 1041	Far End Transmission and Noise Check
# NNX - 1061	Loop-Around Test
# NNX - 1071	Preempt Test
0	Assistance Operator and Random Conference

4.1.4 Interoffice Numbering Plan

The means of signaling information between AUTOVON switching centers shall conform to the following numbering plan:

Precedence	Routing	Route Control	Area	Office	Line
P	R	RC	NYX	NNX	XXXX

where: P is any digit 0 to 4
R is any digit 0 to 9
*RC is any digit 0 to 3
N is any digit 2 to 9
Y is any digit 0 to 1
X is any digit 0 to 9

*Not sent to or received from Overseas AUTOVON.

Route Control (RC) digit assignment will be specified in the Traffic Routing Plan. The Key Pulse (KP) and Start Digit (ST) are a part of the office signaling control features and are not shown in the numbering plan. (See paragraph 4.2.8.1).

4.2 Signaling Plan

With automatic switching, a complex system of signals is needed to pass information over the network. The signals are used for information and supervisory and control purposes. Some signals actuate the switching and transmission systems. Other signals are designed for human recognition. Considerable technical information regarding the signaling requirements is listed herein in order to ensure both uniformity and compatibility among dissimilar systems.

4.2.1 Information Signals

Signals in this category give audible information regarding progress or disposition of a call to the subscribers on the network. The Government has no objection to different tone frequencies being supplied, but must be assured that these tones will not be used to perform some machine-recognizable function without prior approval of the Defense Communications Agency (DCA). Interruption rates and other information designated by an asterisk (*) must be met to provide uniformity of operation on a worldwide basis. It is intended that the information tones received by the subscriber or user be at a level of approximately 60 to 68 dba. (See paragraph 4.2.1.2, "Typical Values"**)

4.2.1.1 Preferred Information Tones

Frequencies shall be accurate within ± 1/2 of 1%. Powers shall be accurate within ± 3 db.

Signal	Frequencies (cps)	Power per Frequency
Dial Tone	350 + 440 (Mixed)	-13 dbm0
Busy	480 + 620 (Mixed)	-24 dbm0
Reorder	480 + 620 (Mixed)	-24 dbm0
No Circuit (Trunk Busy)	480 + 620 (Mixed)	-24 dbm0
Audible Ringing	440 + 480 (Mixed)	-16 dbm0
*Preemption	440 + 620 (Mixed)	-18 dbm0
# Conference notification	852 + 1336 (Alternated)	-24 dbm0
Permanent	350 + 480 (Mixed)	-17 dbm0

*For normal conference the tones will alternate at 300 millisecond interval. For alert conference the tone will alternate at 100 millisecond interval.

4.2.1.2 Other Acceptable Information Tones (Typical Values**)

	Frequencies (cps)	Power
Dial Tone	600/120	-24 dbm0
Busy	600/120	-16 dbm0
Reorder	600/120	-22 dbm0
No Circuit	600/120	-16 dbm0
Audible Ringing	400/40 or 420/40	-24 dbm0
Preemption (Preferred tone is the only one acceptable)		
Permanent	600/120	-10 dbm0

(* and **, See requirement listed in paragraph 4.2.1)

4.2.1.3 Interruption Rates for the Above Tones:

Signal	Interruption Rate	Tone On	Tone Off
* Dial Tone	Continuous	--	--
* Line Busy	60 IPM	0.5 sec	0.5 sec
Re Order	120 IPM	0.2 sec	0.3 sec
Trunks Busy	120 IPM	0.2 sec	0.3 sec
* Audible Ringing (ROUTINE call)	10 IPM	2.0 sec	4.0 sec
* Audible Ringing (Precedence call)	30 IPM	1.64 sec	0.36 sec
* Pre-emption	Continuous	--	--
* No-Such-Service	Recorded Announcement	--	--
* Precedence Call Blocked	Recorded Announcement	--	--
Permanent	Continuous	--	--

(* and **, See requirement listed in Paragraph 4.2.1)

4.2.1.4 A recorded announcement shall be returned under the following conditions:

4.2.1.4.1 A precedence call is blocked.

4.2.1.4.2 "No-such-service", vacant code or use of restricted routing digit is attempted.

4.2.1.4.3 Unauthorized precedence level is attempted.

4.2.1.4.4 Operating or equipment irregularities are encountered.

4.2.1.5 Signaling the called subscriber's line, even though an information signal to that subscriber, shall be provided in the switching center by E and M lead control. This is covered under "Supervisory Signals". (See Paragraph 4.2.2)

4.2.2 Supervisory Signals

4.2.2.1 Both off-hook and on-hook signals, when not used to convey numerical information (DP), are referred to simply as "supervision". These terms are used to designate the two supervisory signaling conditions of an inter-switch trunk, a subscriber line or a PBX access line.

4.2.2.2 Supervision on trunks between switching centers shall be accomplished by single frequency (SF) signaling. The system delivers and accepts a ground and dc

signal voltages from the switch trunk equipment via the E and M lead controls. The local dc signals are converted to ac on the line side and vice versa. A 2600 cycle (in-band) frequency shall be used for transmitting supervision in both directions over the four-wire inter-office trunk facilities. On subscriber lines, and PBX access lines, other types of signaling may be used to perform the supervisory function providing that E and M lead operations, signaling tone frequency and timing conditions are compatible at the switching center and the station end of the line. SF signaling is required when other types of signaling are not suitable and when continuity supervision is desired.

4.2.2.3 The station instrument should transmit supervisory signals to its associated line circuit within the station location on a dc loop signaling basis. The station line circuit provides conversion between the loop signaling and E and M lead signaling for transmission to and from the serving switching center through E and M lead signaling equipment.

4.2.2.4 Ringing is to be directed toward the subscriber instrument by M-lead pulses at the switching center. These pulses ultimately control the Tone Ringer within the instrument over the station line circuit E-lead. Normal (ROUTINE) ringing is controlled by the switching center transmitting two seconds off-hook for ring and four seconds on-hook for silent interval, repeated until answered. Precedence ringing is also controlled by the switching center transmitting 1.64 seconds off-hook for ring and 0.36 seconds on-hook for silent interval, repeated until answered.

4.2.3 <u>Control Signals</u>

4.2.3.1 Digital signaling over inter-office trunks between switching centers shall be multi-frequency (MF) 2/6 signaling.

4.2.3.2 Digital signaling from four-wire subscriber stations to the switching center shall be DTMF pulses.

4.2.3.3 Digital signaling from local switchboards (PBX's) shall be dial pulses from the PBX extensions and may be either dial pulses or DTMF key pulses from a PBX operator.

4.2.3.4 Digital signaling to a local switchboard (PBX) shall be dial pulses.

4.2.3.5 Dial pulses (when used) will be transmitted over the E and M lead signaling path. Multifrequency signals will be transmitted over the normal voice path.

4.2.4 Signaling Requirements

Signaling equipment in the switching center shall provide means to:

4.2.4.1 Indicate the status of the trunk, whether idle or busy.

4.2.4.2 Maintain trunk status during momentary periods of high noise and/or the momentary disappearance of the SF signal that may occur, for example, during a radio fade. (See Paragraph 4.2.7.5)

4.2.4.3 Transmit an off-hook (request-for-service) signal to alert a PBX or a distant switch and receive start pulse from PBX or distant switch.

4.2.4.4 Receive an off-hook (request-for-service) signal from a line or trunk and return ready-to-receive-signals indication (dial tone, wink-start, stop-go, etc).

4.2.4.5 Transmit DP or MF signals.

4.2.4.6 Transmit an on-hook or disconnect signal, denoting the end of a call, to the distant switching equipment or subscriber.

4.2.4.7 Ring forward when manual positions are employed. Ring forward is momentary on-hook of 100 ± 5 milliseconds.

4.2.4.8 Signal on a switch-to-switch (link-by-link) basis.

4.2.4.9 Assure reliability of machine signaling such that:

4.2.4.9.1 Not more than one error occurs in 10,000 digits.

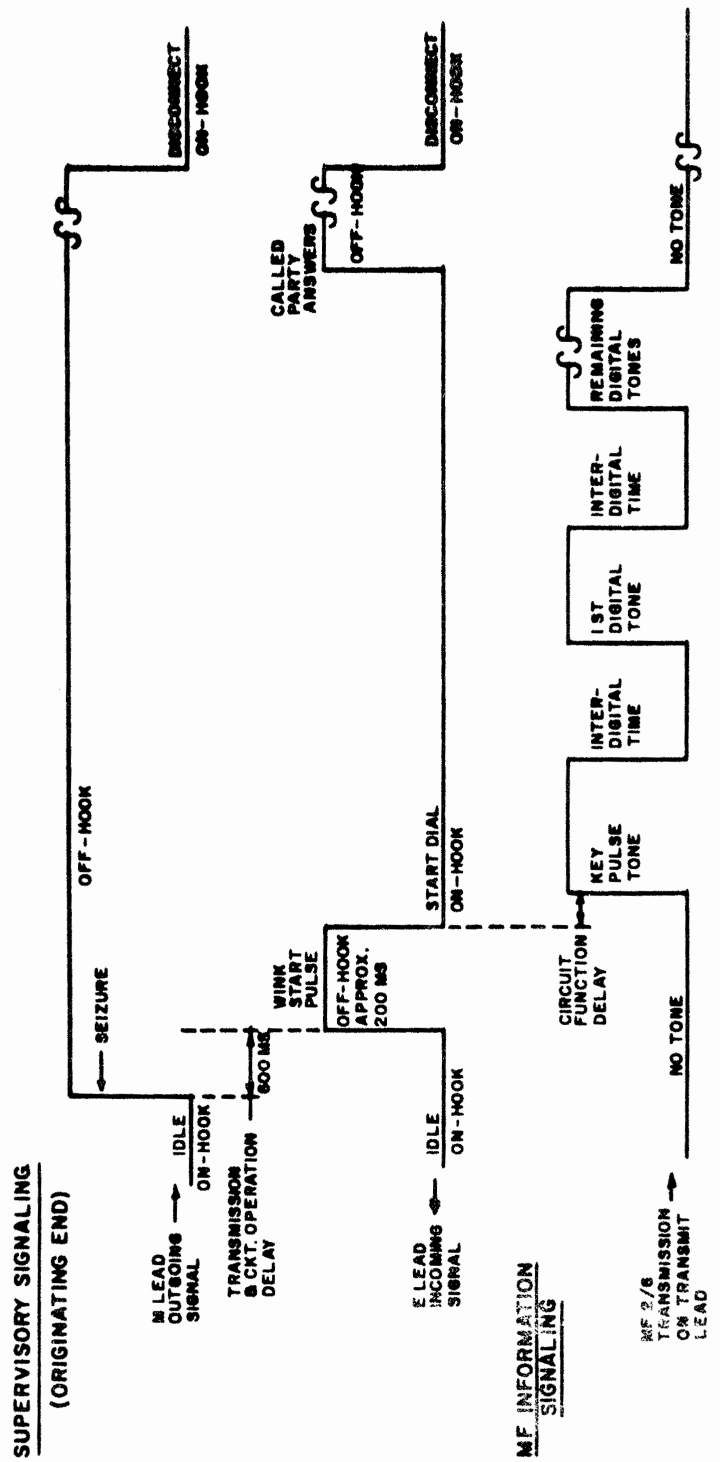

FIGURE 1

MF 2/6 INTER-OFFICE TRUNK SIGNALING AND SUPERVISION

4.2.4.9.2 Not more than one false disconnect because of speech-imitated signals occurs in 100 call hours.

4.2.4.9.3 Not more than one false request for service occurs in 1000 requests.

4.2.4.10 Signal detectors for timed on or off-hook signals shall be capable of recognizing intervals which have been distorted by $\pm$ 50 milliseconds. This increment is in addition to the allowable tolerances of signals at the point of generation as specified herein.

4.2.5 <u>Pre-emptive Signaling</u>

Pre-emption is accomplished at the affected switching center by sending a measured supervisory signal pulse toward both ends of the established circuit, which may be one or several switched links away from the pre-empting switching center. Four pre-emption signals exist, depending upon trunk condition and intended disposition.

4.2.5.1 <u>Trunk in Use and Re-seized</u>:

This trunk will be signaled by a 328 to 363 ms on-hook pulse followed by normal off-hook seizure.

4.2.5.2 <u>Trunk in Use and Not Re-seized</u>:

This trunk will also be signaled by the 328 to 363 ms on-hook pulse, but will be followed by an off-hook "pedestal" of 100 $\pm$ 5 ms before returning to the on-hook condition.

4.2.5.3 <u>Unanswered Trunk to be Re-seized Toward Calling End</u>:

This trunk is signaled by a preliminary "pedestal" of 100 $\pm$ 5 ms off-hook to establish an answer signal to the far end and then followed with the 328 to 363 ms on-hook followed by steady off-hook for re-seizure.

4.2.5.4 <u>Unanswered Trunk and Not to be Re-seized Toward Calling End</u>:

This trunk is signaled by a preliminary "pedestal" of 100 $\pm$ 5 ms off-hook to establish an answer signal to the far end, followed by the 328 to 363 ms on-hook with a second 100 $\pm$ 5 ms "pedestal" before returning to the on-hook condition.

4.2.5.5 Subscriber Line

4.2.5.5.1 Unless otherwise specified the signal transmitted toward the subscriber shall be the same as that of an answered or unanswered "Trunk in Use and Not Re-seized" (Paragraphs 4.2.5.2 and 4.2.5.4) whether the pre-empting call is for the station or not.

4.2.4.4.2 Where required by the terminal equipment, the signal transmitted toward the subscriber shall be the same as the signals transmitted on inter-office trunks under corresponding circumstances (see Paragraphs 4.2.5.1 to 4.2.5.4).

4.2.5.6 PBX Access Line

The signals transmitted to a PBX shall be the same as the signals transmitted on inter-office trunks (see Paragraphs 4.2.5.1 to 4.2.5.4) except for PBX switch-boards without in- or out-dialing. The latter may be treated as a four-wire subscriber with the signaling specified in Paragraph 4.2.5.5.1.

4.2.6 DTMF Signaling

4.2.6.1 The following list of frequencies shall be used in the Dual-Tone calling devices. The frequencies of the transmitted signals shall be within ± 1.3 percent of the nominal values listed:

Signal		Pushbutton Designation	Tone Pair (cps)
Digit	1	1	697 + 1209
	2	2	697 + 1336
	3	3	697 + 1477
	4	4	770 + 1209
	5	5	770 + 1336
	6	6	770 + 1477
	7	7	852 + 1209
	8	8	852 + 1336
	9	9	852 + 1477
	0	0	941 + 1336
Spare Combination		-	941 + 1209
End of Signaling		A	941 + 1477
0 (FLASH OVERRIDE)		FO	697 + 1633
1 (FLASH)		F	770 + 1633
2 (IMMEDIATE)		I	852 + 1633
3 (PRIORITY)		P	941 + 1633
4 (ROUTINE)		-	None

4.2.6.2 The receiver shall respond to tones over a voltage range from 0.95 to 0.075 volt (rms) per frequency and with a difference in amplitude of 0 to at least 5 db between the two frequencies.

4.2.6.3 The receiver shall respond to dual tone-pair signals having a minimum duration and a minimum interpulse interval of 40 milliseconds at a maximum rate of 12 pulses per second.

4.2.6.4 The receiver shall accept tone pairs falling within ± 1.5 percent of the nominal frequency.

4.2.6.5 The output pulse from a repertory DTMF dialer shall not be less than 45 milliseconds in duration with an interdigital interval of not less than 45 milliseconds. The maximum speed shall not exceed 10 digits per second.

4.2.6.6 The output of the station set terminated in 900 ohms shall be as indicated below:

	Nominal Output		
Group	50 ma Line Current	70 ma Line Current	100 ma Line Current
Low Group (697-941)	-5.7±1dbm	-7.3±1dbm	-8.5±1dbm
High Group (1209-1633)	-3.2±1dbm	-4.8±1dbm	-6.0±1dbm

Variations in output due to all causes may exceed the nominal tolerances by ±2.5db if the 2.5±2 db nominal difference in amplitude of the frequencies in the high and low groups is maintained. Therefore, the amplitude of any frequency in the high group will always be at least 0.5 db higher, but not more than 4.5 db higher, than any frequency in the low group.

4.2.6.7 DTMF receivers shall be insensitive to speech.

4.2.6.8 The receiver shall operate satisfactorily with a signal-to-noise of 22 db per tone (thermal noise, flat weighting) with minimum allowable received signals and maximum allowable frequency error.

4.2.6.9 The receiver shall check that two (2), and only two (2), frequencies are present, one from each group (high and low), thus receiving a bona-fide signal.

4.2.7 Single Frequency E and M Lead Signaling

4.2.7.1 Four-wire, single-frequency (SF) signaling units shall be used for supervision on all inter-office trunks and on subscriber and PBX access lines when dc signaling is not suitable.

4.2.7.2 Conventional E and M lead signals shall be used on the local side of the SF signaling units. The "M" lead controls the application and removal of the transmitted SF signal. The "E" lead indicates the presence or absence of a received SF signal. The following conditions apply:

Supervision	Operation	SF Signal	E Lead	M Lead
On-hook	Transmitting	On	--	Ground
	Receiving	On	Open	--
Off-hook	Transmitting	Off	--	Battery
	Receiving	Off	Ground	

4.2.7.3 The frequency of the transmitted SF signal shall be 2600 ± 5 cps. On each initiation of the on-hook condition the SF signal shall be applied at a power level of -8 ± 1.5 dbm0 for the duration of the signal or a minimum of 300 ms (whichever is shorter) and a maximum of 800 ms after which the power will be reduced to -20 ± 1.5 dbm0 for the remainder of the on-hook condition.

4.2.7.4 The local transmitting voice path shall be cut-off within 15 ms whenever the SF signal is removed and shall remain cut-off for a minimum of 75 ms and a maximum of 160 ms.

4.2.7.5 The local receiving voice path shall suppress the transmission of the 2600 cycle SF signal within 20 ms (see note) after an incoming SF signal is received. This shall be done by inserting a 2600 cycle band elimination filter having an attenuation of at least 30 db or by temporarily cutting off the receiving voice path until a filter is inserted. The filter shall be inserted within 275 ms after an SF signal is received. The 2600 cycle band elimination filter shall be removed within 100 ms after the SF signal is removed. (NOTE: The maximum time for the suppression of the 2600 cycle signal should not exceed 20 ms under normal operating conditions or 25 ms under any operating condition.)

4.2.7.6 The signal circuit shall include a guard feature to prevent false disconnection due to presence of data modem carrier or signal imitation by speech. Normal operation shall not be affected by:

4.2.7.6.1 Steady noise in the message channel not exceeding 58 dbrnC0 when received signal levels are within the limits stated in Paragraph 4.2.7.3.

4.2.7.6.2 Data modem carrier at frequencies between 300 and 2400 cycles or between 2800 and

3400 cycles at a level not exceeding -8 dbm0, when the off-hook condition exists in both directions.

4.2.7.6.3 Occasional noise bursts of power not exceeding -8 dbm0 for a period of 10 ms or less.

4.2.7.6.4 Variations in received signal power of not more than ±7 db from the nominal values stated in Paragraph 4.2.7.3. (±1 db for variations in 2600 cycle source and ±6 db in transmission facility.)

4.2.7.7 The following additional requirements apply to SF signaling units used on interswitch trunks.

4.2.7.7.1 The local transmitting voice path shall be cut-off prior to or within 5 ms after the application of the SF signal and shall remain cut-off for a minimum of 350 ms and a maximum of 750 ms. The local transmitting voice path may be cut-off when the trunk is in the idle condition (on-hook in both directions).

4.2.7.7.2 The SF signaling unit receiver shall respond to presence or absence of SF signals of 50 ± 5 ms duration. (Under extreme abnormal conditions, the variation may be ±7 ms.)

4.2.7.7.3 The distortion over a single SF signaling link shall not exceed ±10 ms for any combination of conditions including:

4.2.7.7.3.1 Temperature variations 32° to 130°F.

4.2.7.7.3.2 Battery variations 42 to 53 volts.

4.2.7.7.3.3 Level variations ±7 db.

4.2.7.7.3.4 Frequency variations ±15 cycles (±5 cycles in 2600 cycle source, ±10 cycles in transmission system).

4.2.7.7.3.5 Aging of components.

4.2.7.7.3.6 Variations in transmitters and receivers in the interval between tests.

4.2.7.7.4 Internal distortion contributed by the transmitting signaling equipment shall be less than 2 ms.

4.2.7.8 The following additional requirements apply to SF signaling units used on PBX access lines and any other lines where dial pulse signaling is required.

4.2.7.8.1 The signaling unit shall accept dial pulses at any speed between 9 and 12 pulses per second with 49 to 72% break intervals. Signals within these limits delivered to the SF unit at the transmitting end of the line shall be delivered by the receiver at the other end with break intervals between 44 and 76%.

4.2.7.8.2 The local transmitting voice path shall be cut-off within 15 ms whenever the SF signal is applied and shall remain cut-off for a minimum of 350 ms and a maximum of 750 ms.

4.2.8 MF 2/6 Signaling

MF 2/6 Signaling shall be used for inter-office digital signaling and the following standards shall apply:

4.2.8.1 The signaling frequencies shall be transmitted in pairs as follows:

Digit	Frequency (cps)
1	700 + 900
2	700 + 1100
3	900 + 1100
4	700 + 1300
5	900 + 1300
6	1100 + 1300
7	700 + 1500
8	900 + 1500
9	1100 + 1500
0	1300 + 1500
* KP	1100 + 1700
** ST	1500 + 1700

* A Key Pulse shall be used to prime the common control tone receiving equipment in the switching center.

** A Start Pulse shall be used to signal the end of pulsing or call heading information.

4.2.8.2 The amplitude of each frequency tone in the transmitted signal shall be -6±1dbm0 with a maximum difference between the two tones of 0.5db.

4.2.8.3 The accuracy of the transmitted frequencies shall be ± 1.5 percent.

\# 4.2.8.4 The nominal signaling speed shall be 7 digits per second.

\# 4.2.8.5 The transmitted key pulse (KP) for alerting the signal receiver shall be 100 $\pm$ 15 milliseconds.

\# 4.2.8.6 The duration of each sender transmitted digital pulse or interdigital interval shall be 69 $\pm$ 8 ms (6.5-8.2 digits per seconds).

\# 4.2.8.7 The receiver shall respond to a KP of not less than 55 milliseconds duration and to other pulses of not less than 30 milliseconds duration.

4.2.8.8 The receiver shall respond to frequencies varying not more than $\pm$ 1.5 percent, $\pm$ 10 cycles of the nominal value.

4.2.8.9 The receiver shall check for reception of two (2), and only two (2), frequencies to allow for routing calls with any other combinations of frequencies to reorder.

4.2.8.10 Operation shall not be affected by:

4.2.8.10.1 Steady noise in the message channel not exceeding 58 dbrnc0.

\# 4.2.8.10.2 Variation in received power from -22 dbm minimum to 0 dbm maximum per frequency at the input of the receiver.

\# 4.2.8.10.3 A difference in received power between the two (2) frequencies of any pair not exceeding 6.5 db.

4.2.9 Confirmation MF 2/6 Signaling

When confirmation signal is required on selected trunks, (see Figure 2) the following requirements shall be met:

4.2.9.1 The signaling frequencies shall be transmitted in pairs as described in Paragraph 4.2.8.1. One (1) additional frequency assignment is made as follows:

Digit	Frequency (cps)
Inter-digital	1300 + 1700

4.2.9.2 Each digit shall be sent until confirmation is accomplished by return of the same digit or a predetermined limit on sender outpulsing delay is reached. At this time the trunk shall be released and another trunk seized in the same or alternate route over which the sender shall again attempt to outpulse the digits required to extend the connection.

4.2.9.3 Factors influencing the speed of signaling include:

4.2.9.3.1 Phase differences between scan cycles in the two (2) affected switching centers.

4.2.9.3.2 Filter delay.

4.2.9.3.3 Tone insertion delay.

4.2.9.3.4 Trunk quality.

4.2.9.4 The amplitude of each frequency tone in the transmitted signal shall be -6 ± 1 dbm0 with a maximum difference between the two (2) tones of 0.5db.

4.2.9.5 The accuracy of the transmitted frequencies shall be ± 1.5 percent.

4.2.9.6 The MF receiver shall meet the requirements stated under 4.2.8.

4.2.9.7 Confirmation signaling shall operate directly with Overseas AUTOVON. It is anticipated that confirmation signaling will not be used over circuits to communications satellites.

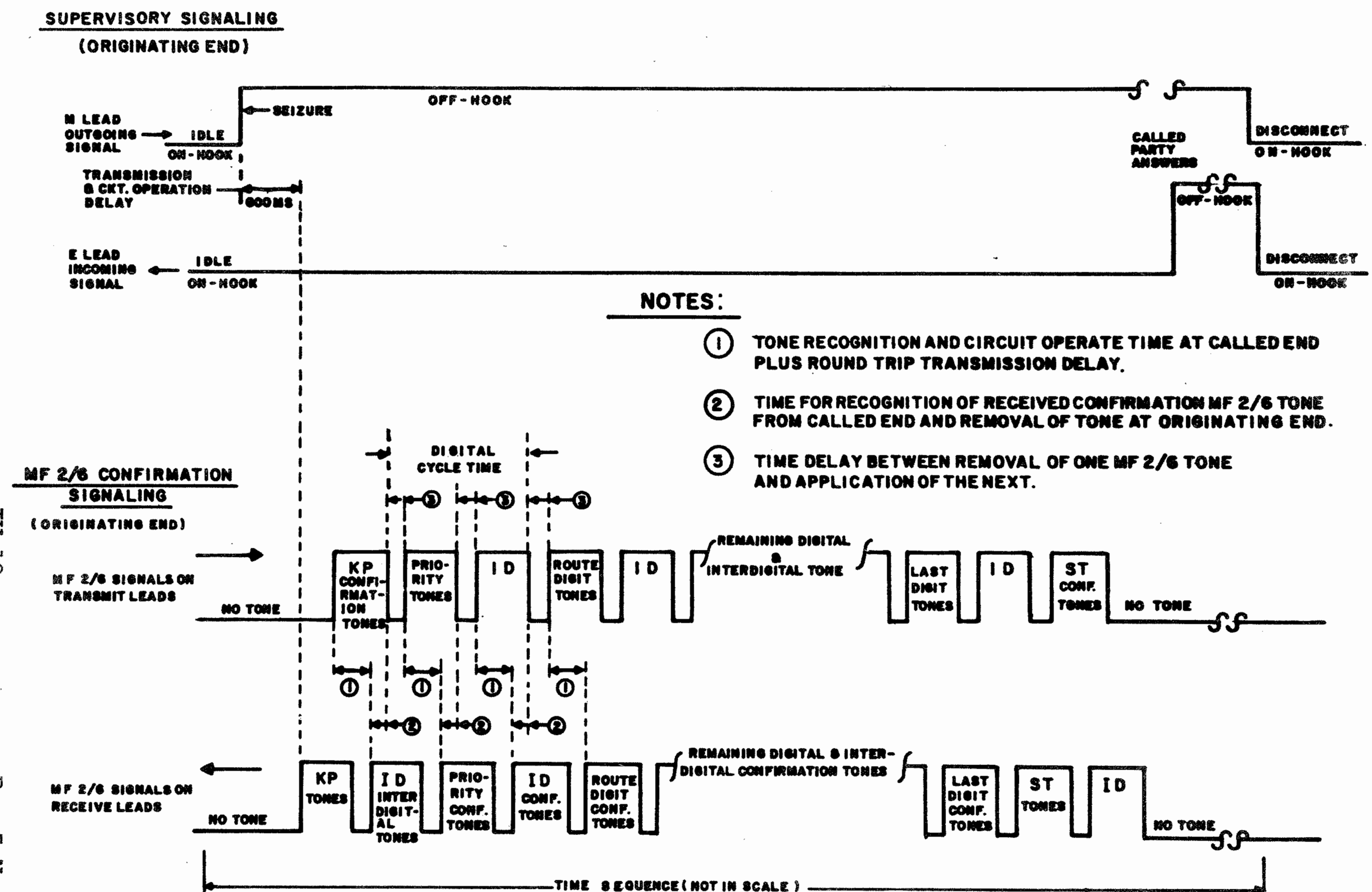

FIGURE 2
CONFIRMATION MF 2/6 INTER-OFFICE TRUNK SIGNALING AND SUPERVISION

4.2.10 Signals to Local Switchboards (PBX's)

4.2.10.1 ROUTINE or precedence audible ringing tone, as appropriate, shall be provided at the switching center for all incoming calls to a PBX except those calls which are in-dialed. Information tones such as audible ringing or busy tone shall be applied in the PBX on all in-dialed calls. Audible ringing tone from a PBX will be the normal audible ringing tone provided in the PBX for all calls.

4.2.10.2 Pre-emption for reuse can only be exercised on PBX access lines in a pre-emptible group. Pre-emption not for reuse may occur on any PBX access line when another link in the established connection is pre-empted for reuse.

4.2.10.3 Signals transmitted from and received at the switching centers shall be in accordance with the signaling in paragraphs 4.2.10.3.1 through 4.2.10.3.5. The signals shown as on-hook-winks shall meet the requirements for pre-emption signals specified in the paragraphs under 4.2.5. The off-hook=winks shall be timed off-hook intervals between the limits of 140 to 290 milliseconds.

4.2.10.3.1 BASIC SIGNALING FUNCTIONS FOR MANUAL SWITCHBOARDS NOT EQUIPPED TO RECOGNIZE PRE-EMPTION

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
PBX incoming call - ROUTINE	Idle	On-hook		On-hook	
	Seizure	Off-hook		On-hook	
	Attendant Answers	Off-hook		Off-hook	
PBX incoming call - Precedence	Idle	On-hook		On-hook	
	Seizure	Precedence alerting		On-hook	
	Attendant Answers	Off-hook		Off-hook	
Established call pre-empted by higher precedence call (access line not reused)	Established call	Off-hook		Off-hook	
	Pre-empt signal	On-hook-wink		Off-hook	
		= On-hook	Pre-empt tone		
	Attendant disconnects	On-hook	Pre-empt tone removed	On-hook	
	Idle	On-hook		On-hook	

		Signal from AUTOVON Switch		Signal to AUTOVON Switch	
Type Call	Call Progress	M Lead	Voice Path	E Lead	Voice Path
Established call pre-empted by higher precedence call to PBX (access line reused)	Established call	Off-hook		Off-hook	
	Pre-empt signal	On-hook-wink		Off-hook	
		= On-hook	Pre-empt tone		
	Attendant disconnects	On-hook	Pre-empt tone removed	On-hook	
	Reseizure	Precedence alerting		On-hook	
	Call proceeds as in precedence incoming call				
PBX outgoing call - ROUTINE	Idle	On-hook		On-hook	
	Seizure by attendant	On-hook	Dial tone	Off-hook	
	Dial Pulse address	On-hook	Dial tone removed after 1st digit	dial pulses	
	or				
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones

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Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
(cont)	Busy or	On-hook	Busy tone	Off-hook	
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	
PBX outgoing call - Precedence	Idle	On-hook		On-hook	
	Seizure by attendant	On-hook	Dial tone	Off-hook	
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Call blocked or	On-hook	Recorded Announcement	Off-hook	
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
Established call pre-empted by PBX attendant	Established call	Off-hook		Off-hook	
	Pre-emption	Off-hook		Off-hook	Voice challenge by attendant
	Attendant disconnects	Off-hook		On-hook	
	AUTOVON releases	On-hook		On-hook	
	Seizure by attendant	On-hook	Dial tone	Off-hook	
	Call proceeds as in precedence outgoing call				
Disconnect	PBX disconnects first	Off-hook On-hook		On-hook On-hook	
	AUTOVON disconnects first	On-hook On-hook		Off-hook On-hook	

4.2.10.3.2 SIGNALING FOR UNATTENDED PBX - NID Calls

PBX Not Equipped to Recognize Pre-emption

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
ROUTINE or precedence call to PBX	Idle	On-hook		On-hook	
	Seizure	Off-hook		On-hook	
	Dial pulsing	Pulses		On-hook	
	Busy or	Off-hook		On-hook	Busy tone
	Awaiting answer	Off-hook		On-hook	Audible ringing tone
	Called party answers	Off-hook		Off-hook	Audible ringing tone removed
Disconnect	Called party disconnects first	Off-hook On-hook		On-hook On-hook	
	Calling party disconnects first	On-hook On-hook		Off-hook On-hook	

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
Pre-emption: Established connection	Established connection	Off-hook		Off-hook	
	Pre-empt signal	On-hook - wink		Off-hook	
		On-hook	Pre-empt tone		
	Awaiting dis- connect by pre-empted user	On-hook		Off-hook	
	Pre-empted user disconnects	On-hook	Pre-empt tone removed	On-hook	
Pre-emption: Call not yet answered	Awaiting answer	Off-hook		On-hook	Audible ringing tone
	Pre-empt signal and disconnect	On-hook - wink		On-hook	Audible ringing removed
		On-hook			

4.2.10.3.3 SIGNALING FOR UNATTENDED PBX - NOD Calls

PBX Not Equipped to Recognize Pre-emption

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
ROUTINE call from PBX	Idle	On-hook		On-hook	
	Seizure	On-hook	Dial tone	Off-hook	
	Dial pulsing	On-hook		Pulses	
	Busy or	On-hook	Busy tone	Off-hook	
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	
Disconnect	Called party disconnects first	On-hook On-hook		Off-hook On-hook	
	or Calling party disconnects first	Off-hook On-hook		On-hook On-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
Pre-emption: Established connection	Established connection	Off-hook		Off-hook	
	Pre-empt signal	On-hook-wink		Off-hook	
		On-hook	Pre-empt tone		
	Awaiting dis-connect by pre-empted user	On-hook		Off-hook	
	Pre-empted user disconnects	On-hook	Pre-empt tone removed	On-hook	
Pre-emption: Call not yet answered	Awaiting answer	On-hook	Audible ring-ing tone	Off-hook	
	Pre-empt signal	On-hook-wink		Off-hook	
		On-hook	Pre-empt tone		
	Awaiting dis-connect by pre-empted user	On-hook		Off-hook	
	Pre-empted user disconnects	On-hook	Pre-empt tone removed	On-hook	

4.2.10.3.4

SIGNALING FOR ATTENDED PBX EQUIPPED
TO RECOGNIZE PRE-EMPTION
Attendant Completion of All Precedence Calls
NID and/or NOD for ROUTINE Calls

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
Switchboard incoming call - ROUTINE (No NID)	Idle	On-hook		On-hook	
	Seizure	Off-hook		On-hook	
	Attendant Answers	Off-hook		Off-hook	
Switchboard incoming call - Precedence	Idle	On-hook		On-hook	
	Seizure	Precedence alerting		On-hook	
	Attendant Answers	Off-hook		Off-hook	
NID Call to PBX	Idle	On-hook		On-hook	
	Seizure	Off-hook		On-hook	
	Dialing	Dial pulses		On-hook	
	Busy or	Off-hook		On-hook	Busy tone
	Awaiting Answer	Off-hook		On-hook	Audible Ringing Tone

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
(cont)	Called Party Answers	Off-hook		Off-hook	
Established ROUTINE call pre-empted by precedence call to PBX	Established call	Off-hook		Off-hook	
	Pre-empt Signal	On-hook-Wink		Off-hook	
		Off-hook	Pre-empt tone		
	End 3 sec time-out	Off-hook	Pre-empt tone removed	On-hook	
	Reseizure	Precedence alerting pulses		On-hook	
	Attendant Answers	Off-hook		Off-hook	
Established precedence call pre-empted by higher level precedence call to PBX	Established precedence call	Off-hook		Off-hook	
	Pre-empt signal	On-hook-wink		Off-hook	
		Off-hook	Pre-empt tone		

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
(cont)	Attendant disconnects	Off-hook	Pre-empt tone removed	On-hook	
	Reseizure	Precedence alerting		On-hook	
	Attendant answers call	Off-hook		Off-hook	
Established call pre-empted by AUTOVON for non-reuse	Established call	Off-hook		Off-hook	
	Pre-empt signal	On-hook-wink			
		On-hook	Pre-empt tone		
	End 3 sec time-out or user or attendant disconnects	On-hook	Pre-empt tone removed	On-hook	

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
Unanswered call to PBX pre-empted by AUTOVON for non-reuse	Unanswered	Off-hook		On-hook	Audible ringing tone
	Pre-empt signal	On-hook-wink* = On-hook		On-hook	Audible ringing tone removed

*The on-hook wink may be omitted.

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
Unanswered call to PBX pre-empted by AUTOVON for reuse	Unanswered	Off-hook		On-hook	Audible ringing tone
	Pre-empt signal	On-hook-wink = Off-hook		On-hook	Audible ringing tone removed
	Reseizure	Precedence alerting		On-hook	
	Attendant answers call	Off-hook		Off-hook	
Unanswered call from PBX pre-empted by AUTOVON for non-reuse	Unanswered	On-hook	Audible ringing tone	Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
(cont)	Pre-empt signal	On-hook-wink		Off-hook	
		=			
		On-hook	Pre-empt tone		
	User or attendant disconnect	On-hook	Pre-empt tone removed	On-hook	
Unanswered call from PBX pre-empted by AUTOVON for reuse	Unanswered	On-hook	Audible ringing tone	Off-hook	
	Pre-empt signal	On-hook-wink		Off-hook	
		=			
		Off-hook	Pre-empt tone		
	End 3 sec time-out or user or attendant disconnect	Off-hook	Pre-empt tone removed	On-hook	
	Reseizure	Precedence alerting		On-hook	
	Attendant answers	Off-hook		Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch M Lead	Signal from AUTOVON Switch Voice Path	Signal to AUTOVON Switch E Lead	Signal to AUTOVON Switch Voice Path
Switchboard outgoing call - ROUTINE	Idle	On-hook		On-hook	
	Seizure	On-hook	Dial tone	Off-hook	
	Dial address	On-hook	Dial tone removed after 1st digit	Dial pulses	
	or				
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Busy	On-hook	Busy tone	Off-hook	
	or				
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook		Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
Switchboard outgoing call - Precedence	Idle	On-hook		On-hook	
	Seizure	On-hook	Dial tone	Off-hook	
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Call blocked	On-hook	Recorded Announcement	Off-hook	
	or				
	Awaiting Answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook		Off-hook	
NOD call from PBX (ROUTINE only)	Idle	On-hook		On-hook	
	Seizure	On-hook	Dial tone	Off-hook	
	Dial pulse address	On-hook	Dial tone removed after 1st pulse	Dial pulses	
	Busy	On-hook	Busy tone	Off-hook	
	or				
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
(cont)	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	
Established outgoing ROUTINE call pre-empted by PBX attendant	Established call	Off-hook		Off-hook	
	Seizure	Off-hook		Off-hook	Pre-empt tone
	End of 3 sec time-out	Off-hook		On-hook	Pre-empt tone removed
	AUTOVON releases	On-hook		On-hook	
	Reseizure	On-hook	Dial tone	Off-hook	
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Call blocked	On-hook	Recorded Announcement	Off-hook	
	or				
	Awaiting Answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
Established incoming ROUTINE call pre-empted by PBX attendant	Established call	Off-hook		Off-hook	
	Seizure	Off-hook		On-hook	Pre-empt tone
	End of 3 sec time-out	Off-hook		On-hook	Pre-empt tone removed
	AUTOVON releases	On-hook		On-hook	
	Reseizure	On-hook	Dial tone	Off-hook	
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Call blocked	On-hook	Recorded Announcement	Off-hook	
	or				
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
Unanswered ROUTINE call from PBX pre-empted at PBX for reuse	Unanswered	On-hook	Audible ringing tone	Off-hook	
	Pre-empt signal	On-hook		Off-hook	Pre-empt tone
	End of 3 sec time-out	On-hook		On-hook	Pre-empt tone removed
	Reseizure	On-hook	Dial tone	Off-hook	
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Call blocked	On-hook	Recorded Announcement	Off-hook	
	or				
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
Disconnect	Established call	Off-hook		Off-hook	
	AUTOVON disconnects first	On-hook On-hook		Off-hook On-hook	
	PBX disconnects first	Off-hook On-hook		On-hook On-hook	

4.2.10.3.5

SIGNALING FOR ATTENDED PBX EQUIPPED TO RECOGNIZE IN-DIALED PRECEDENCE

Attendant Completion of All Outgoing Precedence Calls
Network Out-Dialing for ROUTINE Calls
Network In-Dialing for All Incoming Calls

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
ROUTINE Incoming call to PBX	Idle	On-hook		On-hook	
	Seizure	Off-hook		On-hook	
	Start dial	Off-hook		Off-hook-wink	
	Dialing	Dial pulses		On-hook	
	Busy or	Off-hook		On-hook	Busy tone
	Awaiting answer	Off-hook		On-hook	Audible ringing tone
Precedence incoming call to PBX	Idle	On-hook		On-hook	
	Seizure	Off-hook		On-hook	
	Start dial	Off-hook		Off-hook-wink	
	Dialing	Dial pulses		On-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
(cont)	Awaiting answer	Off-hook		On-hook	Audible ringing tone
	Answer by called party or attendant	Off-hook		Off-hook	Audible ringing tone removed
Established call pre-empted by higher level precedence call to PBX	Established call	Off-hook		Off-hook	
	Pre-empt signal	On-hook-wink		Off-hook	
		Off-hook	Pre-empt tone		
	Attendant or user disconnects*	Off-hook	Pre-empt tone removed	On-hook	
	Start dial	Off-hook		Off-hook-wink	
	Dialing	Dial pulses		On-hook	
	Awaiting answer	Off-hook		On-hook	Audible ringing tone

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
(cont)	Answer by called party or attendant	Off-hook		Off-hook	Audible ringing tone removed

*Automatic disconnect after 3 seconds for other than attendant completed calls.

Type Call	Call Progress	M Lead	Voice Path	E Lead	Voice Path
Established call pre-empted by AUTOVON for non-reuse	Established call	Off-hook		Off-hook	
	Pre-empt signal	On-hook-wink			
		On-hook	Pre-empt tone		
	End 3 sec time-out or user or attendant disconnects	On-hook	Pre-empt tone removed	On-hook	

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
Unanswered call to PBX pre-empted by AUTOVON for non-reuse	Unanswered	Off-hook		On-hook	Audible ringing tone
	Pre-empt signal	On-hook - wink* = On-hook		On-hook	Audible ringing tone removed

*The on-hook wink may be omitted.

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
Unanswered call to PBX pre-empted by AUTOVON for reuse	Unanswered	Off-hook		On-hook	Audible ringing tone
	Pre-empt signal	On-hook - wink = Off-hook		On-hook	Audible ringing tone removed
	Start dial	Off-hook		Off-hook-wink	
	Dialing	Dial pulses		On-hook	
	Awaiting answer	Off-hook		On-hook	Audible ringing tone
	Answer by called party or attendant	Off-hook		Off-hook	Audible ringing tone removed

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
Unanswered call from PBX pre-empted by AUTO-VON for non-reuse	Unanswered	On-hook	Audible ringing tone	Off-hook	
	Pre-empt signal	On-hook-wink		Off-hook	
		On-hook	Pre-empt tone		
	User or attendant disconnect	On-hook	Pre-empt tone removed	On-hook	
Unanswered call from PBX pre-empted by AUTO-VON for reuse	Unanswered	On-hook	Audible ringing tone	Off-hook	
	Pre-empt signal	On-hook-wink		Off-hook	
		Off-hook	Pre-empt tone		
	End 3 sec time-out or user or attendant disconnect	Off-hook	Pre-empt tone removed	On-hook	

Type Call	Call Progress	Signal from AUTOVON Switch M Lead	Signal from AUTOVON Switch Voice Path	Signal to AUTOVON Switch E Lead	Signal to AUTOVON Switch Voice Path
(cont)	Start dial	Off-hook		Off-hook-wink	
	Dialing	Dial pulses		On-hook	
	Awaiting answer	Off-hook		On-hook	Audible ringing tone
	Answer by called party or attendant	Off-hook		Off-hook	Audible ringing tone removed

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
PBX outgoing call - ROUTINE	Idle	On-hook		On-hook	
	Seizure	On-hook	Dial tone	Off-hook	
	Dial address	On-hook	Dial tone removed after 1st digit	Dial pulses	
	or				
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Busy	On-hook	Busy tone	Off-hook	
	or				
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
PBX outgoing call - Precedence	Idle	On-hook		On-hook	
	Seizure	On-hook	Dial tone	Off-hook	
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Call blocked	On-hook	Recorded Announcement	Off-hook	
	or				
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	

Type Call	Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
Established ROUTINE call pre-empted by PBX attendant	Established call	Off-hook		Off-hook	
	Seizure	Off-hook		Off-hook	Pre-empt tone
	End of 3 sec time-out	Off-hook		On-hook	Pre-empt tone removed
	AUTOVON releases	On-hook		On-hook	
	Reseizure	On-hook	Dial tone	Off-hook	
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Call blocked or	On-hook	Recorded Announcement	Off-hook	
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch		Signal to AUTOVON Switch	
		M Lead	Voice Path	E Lead	Voice Path
Unanswered ROUTINE call from PBX pre-empted at PBX for reuse	Awaiting	On-hook	Audible ringing tone	Off-hook	
	Pre-empt signal	On-hook		Off-hook	Pre-empt tone
	End of 3 sec time-out	On-hook		On-hook	Pre-empt tone removed
	Reseizure	On-hook	Dial tone	Off-hook	
	Key pulse address	On-hook	Dial tone removed after 1st digit	Off-hook	DTMF tones
	Call blocked	On-hook	Recorded Announcement	Off-hook	
	or				
	Awaiting answer	On-hook	Audible ringing tone	Off-hook	
	Called party answers	Off-hook	Audible ringing tone removed	Off-hook	

Type Call	Call Progress	Signal from AUTOVON Switch: M Lead	Signal from AUTOVON Switch: Voice Path	Signal to AUTOVON Switch: E Lead	Signal to AUTOVON Switch: Voice Path
Disconnect	Established call	Off-hook		Off-hook	
	AUTOVON disconnects first	On-hook On-hook		Off-hook On-hook	
	PBX discon-nects first	Off-hook On-hook		On-hook On-hook	

4.3 Transmission Plan

4.3.1 Satisfactory performance of a world-wide communications network utilizing automatic switching requires extremely long circuits of an acceptable quality.

4.3.2 A voice communications system is effective to the extent that it must deliver speech that is intelligible, natural and which requires a minimum of effort on the part of the listener.

4.3.3 A data transmission system is effective to the extent that it reliably delivers to the subscriber, signals that are an accurate representation of the input.

4.3.4 It must be recognized that facilities employed in intra-continental connections will also be involved in inter-continental connections. The transmission characteristics must therefore be better than those necessary for intra-continental calls.

4.3.5 In view of these considerations, the transmission requirements will be as strict as can be reasonably met in the field with presently known techniques.

4.3.6 The transmission plan provides for satisfactory voice communications and for data transmission at speeds up to 2400 bits/second (bps).

4.3.7 Transmission Characteristics.

The following are the transmission characteristics and requirements of the CONUS AUTOVON:

	POINTS OF INTER-CONNECTION			
	4-WIRE SWITCH	4-WIRE SWITCH	MAIN PBX	4-WIRE STATION
4.3.7.1				
Network Connections				
(1) Inter-Center Trunks	├─ 4-Wire ───	───┤		
(2) Access Lines	├─ 4-Wire ───	──────	───┤	
(3) 4-Wire Subscriber Line	├──────	──────	── 4-Wire ──	───┤

4.3.7.2

Circuit Loss
Design (1000 cps)
(1) Network Trunks 0 db

(2) Access Lines

(a) No tributary	VNL+2 design, 4.0db minimum (4.0 to 4.5 db)
(b) With tributary	VNL design plus 2db switchable pad, 4.0 db minimum (4.0 to 4.5 db, including pad)

(3) 4-Wire Subscriber Line	6 db transmitting and receiving (does not include additional 4 db in receiver circuit)

4.3.7.3 Over-all 1000-cps Loss Design in db (1)

CONNECTION	AVERAGE	MAXIMUM
4-Wire/4-Wire		
Voice	12 (2)(3)	---
Data	12 (2)	---
4-Wire/2-Wire	12 (3)	18 (3)

NOTES: (1) Net loss variations from the design value are not included.
(2) Fixed design loss.
(3) Does not include an additional 4db loss inserted in the 4-wire telephone receiving circuit to compensate for removal of the station hybrid's loss.

4.3.7.4 Echo Suppressors

Suppressors are to be provided at the switching center on all access lines to two-wire PBXs. These should be fixed suppressors of the split type. (See Paragraph 2.2.24)

4.3.7.5	PBX Terminal Balance (Measures at the PBX from access line to on-premise station, off-hook, through a 2db pad in trunk circuit.)	Echo Return Loss: 12db average, 9db minimum. Singing Point: 8db average, 6db minimum.

4.3.7.6	Transmission Level at the 4-wire Switch	-2dbm0 (except -4.0 to -4.5 dbm0 receiving from PBX Access Lines)
4.3.7.7	Assumed Speech Volume at the telephone set	-11 vu, sigma = 5db
4.3.7.8	DATA/TTY Levels (maximum in voice channel)	Data: -10dbm0 FSK (TTY): -9 dbm0*
4.3.7.9	Data Regeneration	Not required for CONUS intra-continental traffic. May be applied on overseas connections.

4.3.7.10 Over-all Connection Attentuation-Frequency Characteristics For Voice Grade Facilities (seven trunk connections):

Frequency Range - cps	Attentuation-Frequency Limits - db**
700-2300	-3 to + 6
300-3000	-6 to +24

4.3.8 The subscriber will have a choice between voice grade and data grade facilities.

4.3.9 Data grade facilities shall be conditioned to provide the over-all characteristics shown below. Since these characteristics would be exceeded by connecting an excessive number of links in tandem, routing capabilities will be provided to insure that data grade facilities are not deteriorated by traversing an excessive number of links in a statistically important number of connections between any given pair of users. Data grade facilities shall be designed to meet the following over-all terminal-to-terminal characteristics (four trunks and two subscriber lines:

* For more than one subchannel, this level should be reduced by (10 log n) db where n is the number of subchannels.

** Compared to 1000 cycle loss. (+) is more loss; (-) is less loss.

Frequency Range - cps	Minimum Attenuation-Frequency Limits - db*
300-499	-2 to + 6
500-2800	-2 to + 3
2801-3000	-2 to + 6

Frequency Range - cps	Envelope Delay Distortion Limits - Microseconds
1000-2600	500
600-2600	1500
500-2800	3000

4.3.10 Network switching operations require at least the capability of inter-connection with other networks, Government and commercial. Inter-connections may be required with transoceanic cables. There will be situations where it will be desirable to gain access with military-owned and operated transmission facilities. It must be recognized that access to and the use of high frequency, tropo-scatter and satellite radio systems may be necessary to provide adequate alternate routing and survivability capabilities. Where the latter facilities do not meet the defined specified requirements, it will be the Government's responsibility to decide whether to up-grade such facilities or accept transmission performance as presented.

4.3.11 Inter-Center Trunk Design

4.3.11.1 Inter-center trunk design shall be standardized as far as possible. Some of the features required are:

4.3.11.1.1 All trunks shall be four-wire.

4.3.11.1.2 Trunk equipment shall be arranged in standard combinations as far as possible to permit rapid patching and replacement of units.

4.3.11.1.3 Transmission facilities shall be high velocity throughout; principally carrier. Compandors shall not be used.

4.3.11.1.4 Trunks shall be operated at zero db, 1000 cycle net loss.

* Compared to 1000 cycle loss. (+) is more loss; (-) is less loss.

4.3.11.1.5 Where data grade facilities are provided, identical attenuation and delay equalization standards shall apply to all. The transmission characteristics of data grade trunks shall be as follows:

Frequency Range - cps	Attentuation-Frequency Limits - db *
300-499	-0.7 to + 2.0
500-2800	-0.7 to + 1.0
2801-3000	-0.7 to + 2.0

Frequency Range - cps	Envelope Delay Distortion Limits - Microseconds
1000-2600	80
600-2600	260
500-2800	500

4.3.11.1.6 The attenuation-frequency response of voice grade trunks shall be maintained within the following limits:

Frequency Range - cps	Attenuation-Frequency Limits - db *
700-2300	-1.0 to + 2.0
300-3000	-3.0 to + 8.0

4.3.11.1.7 Noise requirements for inter-center trunks are provided in Paragraph 4.3.14.

4.3.12 Four-Wire Subscriber Facilities Design

4.3.12.1 The facilities for four-wire subscribers may be conditioned for data communications at speeds up to 2400 bps. The facilities should be high velocity wherever possible. Compandors shall not be used.

4.3.12.2 Where cable facilities are used, it may be possible to meet data transmission requirements with non-loaded cable pairs or cable pairs with light loading such as H44. Wherever loading is used, the loading coil spacing should be uniform to reduce irregularities in the transmission characteristics.

4.3.12.3 Four-wire subscribers' facilities must be made uniform from a net loss standpoint, to provide

* Compared to 1000 cycle loss. (+) is more loss; (-) is less loss.

a consistent high quality service between any two (2) subscribers. The 1000-cycle transmitting loss from the station shall be 6 db and the receiving loss to the station shall be 10 db.

4.3.12.4 Where four-wire subscriber lines are used on an alternate voice/data basis, they shall be equalized and losses controlled to the degree necessary for data requirements.

\# 4.3.12.5 Losses should be adjusted by the use of pads to provide overall transmission requirements for data.

4.3.12.6 Voice grade subscriber facilities shall meet the following minimum attenuation-frequency requirements:

Frequency Range - cps	Attenuation-Frequency Limits - db *
700-2300	-1 to +2
300-3000	-3 to +8

4.3.12.7 Where data grade subscriber facilities are required, they shall meet the following minimum requirements:

Frequency Range - cps	Attenuation-Frequency Limits - db *
300-499	-1.0 to + 3.0
500-2800	-1.0 to + 1.5
2800-3000	-1.0 to + 3.0

Frequency Range - cps	Envelope Delay Distortion Limits - Microseconds
1000-2600	110
600-2600	300
500-2800	650

4.3.12.8 Noise requirements for four-wire subscriber lines are provided in Paragraph 4.3.14.

\# 4.3.13 PBX Access Lines

\# 4.3.13.1 Access lines shall be designed on a VNL + 2 db basis when there are no tributary or satellite

* Compared to 1000 cycle loss. (+) is more loss; (-) is less loss.

PBXs and on a VNL basis and equipped with 2 db pads where there are tributary or satellite PBXs. This should not be less than 4 db. Via Net Loss (VNL) design is a method wherein individual facility losses are made as low as possible, consistent with adequate echo performance. Standard loss factors related to echo delay are assigned to each type facility. Compandors shall not be used.

4.3.13.2 Access line facilities should be of the four-wire, high velocity type as far as possible. Hybrids, for conversion to two-wire operation, will be at the PBX. Carrier facilities should be extended as close as possible to the PBX.

4.3.13.3 The attenuation-frequency response of voice grade lines shall be maintained within the following limits:

Frequency Range - cps	Attenuation-Frequency Limits - db *
700-2300	-1.0 to + 3.0
300-3000	-3.0 to + 8.0

4.3.13.4 Noise requirements for PBX access lines are provided below.

4.3.14 Noise Requirements

4.3.14.1 Noise requirements are based on consideration of expected performance on connections on the order of 12,000 miles in length.

4.3.14.2 Steady noise requirements for individual trunks, subscriber and access lines are as follows:

Length of Circuit-Miles	Fully Satisfactory Values dbrnc0 ** at or Below	Turn-Down Values dbrnc0 ** or Over
0 - 50	31	44
51 - 100	34	44
101 - 400	37	44
401 - 1000	41	50
1001 - 1500	43	50
1501 - 2500	45	50
2501 - 4000	47	50

4.3.14.3 Impulse noise will have a limit of 59 dbrn0 for each link.

* Compared to 1000 cycle loss. (+) is more loss, (-) is less loss.

** db above reference noise at o TLP, C Msg Weighting.

CHAPTER V

INSTALLATION, OPERATION AND MAINTENANCE

5.1 General

The installation and maintenance of the switching center, associated facilities and leased terminal equipment and the operation of the Dial Service Assistance (DSA) positions shall be the responsibility of the contractor.

5.1.1 The contractor shall provide fully qualified personnel to perform the above services on a 24-hour per day, seven day a week, basis.

5.1.2 The contractor shall maintain a 120-day supply of component spares to ensure against loss of facilities and degradation of service because of such shortage.

5.2 Traffic Data

The following traffic data are provided but are subject to change as operational experience is gained:

5.2.1 Incoming (originating and/or terminating) requests for service shall meet a grade of service such that no more than one in 1000 calls are delayed over three seconds by the marker or equivalent common control equipment.

5.2.2 Items of common control equipment, specifically registers, senders and/or transceivers, shall be engineered to meet delay criteria equal to or better than one in 1000 calls encountering a delay

5.2.3 Assume 65% of originating ROUTINE traffic attempts will become completed messages.

5.2.4 Assume 85% of terminating ROUTINE traffic will become completed messages.

5.2.5 Assume that each four-wire subscriber line will be in use 15 minutes during the busy hour. The average holding time approximates six minutes.

5.2.6 PBX access lines shall be engineered on the probability basis of one in 100 (P.01) ROUTINE calls lost in the busy hour. Weighted holding time is approximately six minutes exclusive of PBX attendant work time.

5.2.7 Inter-office trunks shall be engineered on the probability of one in 100 (P.01) ROUTINE calls lost in the busy hour.

5.2.8 Inter-office trunks shall be engineered on the basis that FLASH (P1) precedence calls, or better, will be completed on a no-lost-call basis under contingency overload conditions.

5.2.9 Less than five percent of originating calls will require Dial Service Assistance (DSA).

5.3 Test Arrangements

In order to provide a satisfactory degree of maintenance and operation of the trunking facilities to adjacent AUTOVON switching center, trunk testing equipment shall be provided which will be compatible with that of both the Government-owned switches and leased switches.

5.3.1 Government-owned switches will use automatic trunk routiners to test inter-office trunks. Test terminations are required at the distant ends of the trunks as well. In conjunction with these test terminations, the trunk routiner measures transmission loss and noise level referenced to a threshold value, and tests functional operation of the trunk circuits. The routiner accesses the test termination at the distant end by sending the appropriate digits (MF 2/6, confirmation MF 2/6) over the trunk to operate the connecting equipment.

5.3.2 The routiner tests each seized trunk for the following:

5.3.2.1 Proper seizure.

5.3.2.2 Proper start-stop send signal reception.

5.3.2.3 Occurrence of stop-send signal during out-pulsing.

5.3.2.4 Proper supervisory signal reception.

5.3.2.5 All trunk busy or test termination busy condition.

5.3.2.6 Transmission loss, at 1000-cps, in each direction.

5.3.2.7 Noise referenced to a fixed level.

5.3.2.8 Proper pre-emption.

5.3.3 While testing is in progress, the test frame will render the unit of switching center equipment out of service to normal traffic. However, the test frame may be required to compete with service traffic for seizure of the equipment to be tested.

5.3.4 The test frame shall provide facilities that will permit maintenance personnel to aurally monitor circuits under test for the purpose of checking tones, noise and cross-talk.

5.3.5 Test facilities, similar to those provided by a Toll Type Testboard, should be provided so as to maintain trunks at the required transmission and signaling standards and to assist in clearing trunk troubles.

5.3.6 The commercial communications carrier shall be prepared to produce records of transmission and noise check results.

5.4 Traffic Administration Features

Measurements of traffic volume and various equipment operations must be made at a multitude of critical points to provide adequate engineering, administration and control of AUTOVON and each of its component parts.

5.4.1 The usual data provided in telephone switching systems consist of either counts of events, such as peg counts and overflows, or periodic counts of states, i.e., usage measurements.

5.4.2 Register readings of various equipment operations are desired by the Government (see paragraph 6.4). Figure 3, "Traffic Measurements for the Four-Wire AUTOVON", shows the items that will be requested.

5.4.2.1 A block of general purpose registers shall be provided for variable assignment.

5.4.2.2 A second group of registers shall be provided on a one (or more) per office basis, as specified.

5.4.2.3 A third group of registers shall be associated with a group of trunks or office equipment. Plan for:

5.4.2.3.1 Eighty destinations and one hundred dual-homed PBX's or 180 NNX codes.

5.4.2.3.2 Twenty-five trunk groups per office.

5.4.2.3.3 Groups to three other networks.

5.4.2.3.4 The number of four-wire subscriber, PBX access line and PBX group registers specified in appendix A, published separately.

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON

A. ACCESS LINES

Item	Measure PC*	U*	OFL*	Provide	Comments
1. Four-wire subscriber	-	X	X	One each per line	Measure traffic data per terminal assigned.
2. PBX Access Lines:					
Outgoing to PBX	X	-	X	One each per group	Measure traffic data for PBX engineering. See figure 4.
Incoming from PBX	X	-	-	One per group	
Total	-	X	-	One per group	
3. Access Line Groups containing subgroups or preemptable and nonpreemptable circuits to manual and dial PBX's.					
Precedence call overflow from preempt group	-	-	X	One per group	Score precedence calls not carried by preempt subgroup on a preempt search. This item, in addition to data required in item 2 above, will permit the total access group and the preempt subgroup to be engineered independently. See figure 4.

*PC = Peg Count
U = Usage
OFL = Overflow

Figure 3

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON (Continued)

B. TRUNK GROUPS BETWEEN DSA SWITCHBOARDS AND SWITCH

Item	Measure PC*	U*	OFL*	Provide	Comments
1. Information	X	X	X	One per trunk group	
2. Other network to DSA switchboard	X	X	X	One per trunk group	To be provided when required
3. Dial 0 - Routine	X	X	X	One per trunk group	
4. Dial 0 - Precedence	X	X	X	One per trunk group	
5. Intercept	X	X	X	One per trunk group	
6. 121-type trunks	X	X	X	One per trunk group	
7. Operator completing trunks	X	X	X	One per trunk group	Data to be used for trunk estimating, engineering and administration.

*See footnote, page V-5

Figure 3 (Continued)

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON (Continued)

Item	Measure PC*	U*	OFL*	Provide	Comments
C. INTERSWITCH TRUNKS					
Trunk Group					
Outgoing	X	-	X	One each per group	These are normal registers associated with all intermachine trunk groups. Routine calls should score each peg count and overflow register in turn as the groups in the routing program are searched. Likewise precedence calls should also score the registers in the "nonpreempt" or "friendly" search of the trunk groups; however, trunk group peg count and overflow registers should not be scored in the preempt search. See figure 7.
Incoming	X	-	X	One each per group	
Total	-	X	-	One per group	
D. ANNOUNCEMENT TRUNKS AND JUNCTORS					
1. Announcement Trunks	X	X	X	One each per trunk group	
2. Trunk to Trunk (Junctors)	-	X	-	One per group	Junctor group usage measurement required for engineering and administration; total usage including reserve. Machines designed for nonblocking do not require usage measurements.

*See footnote, page V-5

Figure 3 (Continued)

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON (Continued)

E. TRUNK ROUTING ADMINISTRATION

Item	Measure PC*	U*	OFL*	Provide	Comments
1. Destination Traffic					
Originating - Routine	X	-	-	One per destination per type traffic (voice grade and special grade).	This register should score on each routine attempt originated toward a particular destination by any access line homed on this machine. An access may be a station, a manual or dial PBX, or a Centrex. A destination may be defined as a switching center or dual homed PBX. See note 1 on page V-10 and figures 5 and 6.
2. Destination Traffic					
Originating - Precedence	X	-	-	One per destination per type of traffic (voice and special grade).	This register should score on each precedence (PO-3) attempt originated toward a particular destination by any access line homed on this machine. An access line may be a station, a manual or dial PBX, or a Centrex. The requirement for originating traffic to be split into routine and precedence traffic where a direct trunk group does not exist, is dictated by the trunk group selection differences of the two types of calls. See note 1 on page V-10 and figures 5 and 6.

*See footnote, page V-5

Figure 3 (Continued)

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON (Continued)

E. TRUNK ROUTING ADMINISTRATION (Continued)

Item	Measure PC*	U*	OFL*	Provide	Comments
3. Routine Overflows	-	-	X	One per office per type of traffic (voice and special grade).	Originating or tandem attempts which fail to find an idle outgoing intermachine trunk to another AUTOVON switching center, in the particular routing program, should score on these registers depending on whether it was a voice or special grade call. The counts should not include intraoffice calls (access line to access line) or incoming terminating calls to access line groups (station, manual or dial PBX's, or Centrex). See note 1 on page V-10 and figure 7.
2. Preemption Exercised	X	-	-	One per office per type of traffic (voice and special grade).	Scores total office precedence calls, separated by voice and special grade, both originating and tandem which are unable to find an idle interswitch trunk in the program and successfully exercises preemption. This count must not include any preemptions which occur on any type of access line. See note 1 on page V-10 and figure 7.

*See footnote, page V-5

Figure 3 (Continued)

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON (Continued)

E. TRUNK ROUTING ADMINISTRATION (Continued)

Item	Measure PC*	U*	OFL*	Provide	Comments
5. Preemption Failed	-	-	X	Four per office per type of traffic (voice and special grade). Total eight registers.	Each register of a set of four, scores calls of a particular precedence, which after attempting to preempt all circuit groups within the routing program, fails and is routed to recorded announcement. See note 1 below and figure 7.

NOTE 1: The capability must also be provided to obtain the same traffic register counts, as outlined in items E-1 thru 5 inclusive on calls entering CONUS AUTOVON via specific intermachine trunks such as Overseas AUTOVON, Alaska or other special networks.

NOTE 2: (a) The sum of items E-1, E-2 and E-3 shows total network overflow.

(b) The sum of items E-1 and E-2 shows total network originating destination peg count.

(a) divided by (b) shows overall network probability of blocking or grade-of-service.

*See footnote, page V-5

Figure 3 (Continued)

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON (Continued)

Item	Measure PC*	U*	OFL*	Provide	Comments
F. SERVICE CIRCUITS					
1. Dial Pulse - Dual Tone Multi-frequency Signaling transmitter Receive Unit Combined Transmitting and Receiving Unit	X	X	X	One per group	Scan for total usage. These measurements required to determine adequacy of the equipment that is used on a time shared basis. Inadequate service could be encountered by access lines and intermachine trunks if insufficient signaling units are not available at the switch.
2. MF 2/6	X	X	X	One per group	
G. ORIGINATING OFFICE TOTALS					
1. Total originating station and PBX lines	X	-	-	One per office	Traffic measured is the traffic originating from access lines, connected to the switch, which utilize intermachine trunks or access line to complete the call.
2. Originating intraoffice attempts	X	-	-	One per office	
3. Originating FLASH attempts	X	-	-	One per office	See figure 7
4. Originating FLASH OVERRIDE attempts	X	-	-	One per office	See figure 7

*See footnote, page V-5

Figure 3 (Continued)

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON (Continued)

Item	Measure PC*	U*	OFL*	Provide	Comments
G. ORIGINATING OFFICE TOTALS (Continued)					
5. Originating immediate attempts	X	-	-	One per office	See figure 7
6. Originating priority attempts	X	-	-	One per office	See figure 7
H. INCOMING OFFICE TOTALS					
1. Total office	X	-	-	One per trunk link network	Total incoming peg count. Traffic measured is incoming from intermachine trunks both terminating and through.
2. Through switched calls	X	-	-	One per office	All calls received via trunks from other AUTOVON centers on which the called number is served by another.
I. OTHER TOTALS					
1. Originating MF 2/6 signaling unit. Release on time out.	X	-	-	One per office.	This register is scored when originating MF 2/6 signaling unit is released after time-out period while waiting for a distant office. MF 2/6 signaling unit to be attached.
2. Incoming MF 2/6 signaling unit. Release on time out.	X	-	-	One per office.	This register is scored when an incoming MF 2/6 signaling unit released after time-out period while waiting for distant MF 2/6 signaling unit to transmit.

*See footnote, page V-5

Figure 3 (Continued)

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON (Continued)

I. OTHER TOTALS (Continued)

Item	Measure PC*	U*	OFL*	Provide	Comments
3. Partial dial abandoned	X	-	-	One per office	This register scores when one or more digits have been received but the call is abandoned before the connection is completed. This item can be combined with item I-5.
4. Partial dial timed out	X	-	-	One per office	This register is scored when one or more digits have been received but a time-out period has elapsed since the last digit on a call was received where the office code indicates another digit is required.
5. False starts	X	-	-	One per office	This register is scored when a dial tone attempt is abandoned with no digits received after the digit receiver was connected. This item can be combined with item I-3.
6. Line permanent signals	X	-	-	One per office	This register scores when a line requests service but no digits are received and appropriate DTMF or DP times out.

*See footnote, page V-5

Figure 3 (Continued)

TRAFFIC MEASUREMENTS FOR FOUR-WIRE AUTOVON (Continued)

J. DIAL TONE SPEED

Item	Measure PC*	U*	OFL*	Provide	Comments
1. Dial tone tests	X	-	-	One per office per type of receiver	Scores total dial tone tests initiated.
2. Dial tone delays	X	-	-	One per office per type	Scores the total number of dial tone tests on which a delay in excess of 3 seconds is encountered. Counts separately for DP or DTMF line terminations.

NOTE: Items I-3, 4, 5, and J-1 provide data for analyzing misuse of the switch by subscribers.

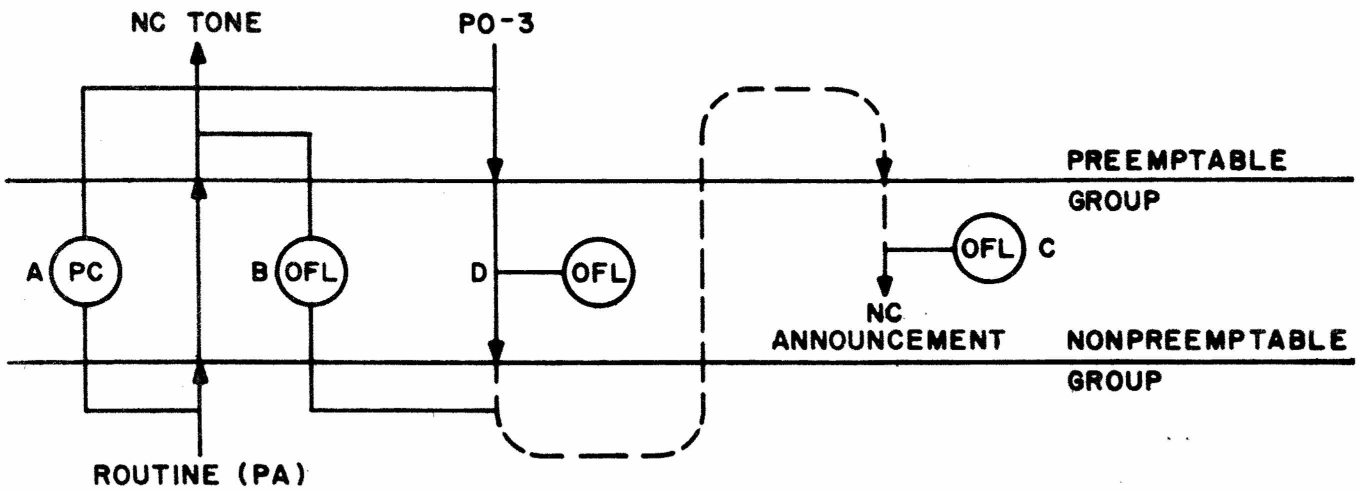
K. MISCELLANEOUS DATA

Item	PC*	U*	OFL*	Provide	Comments
1. **Special Services	X	-	-	One per office per special service	Data will be required for special services, such as abbreviated keying, conferencing, off-hook etc., and shall be provided as required.
2. **Class-of-Service	X	-	-	One per class-of-service	Class-of-service measurements.

*See footnote, page V-5
**Above two items are deferred requirements.

Figure 3 (Continued)

REGISTER REQUIREMENTS
PREEMPTABLE AND NONPREEMPTABLE ACCESS LINE GROUPS TO MANUAL AND DIAL PBX'S



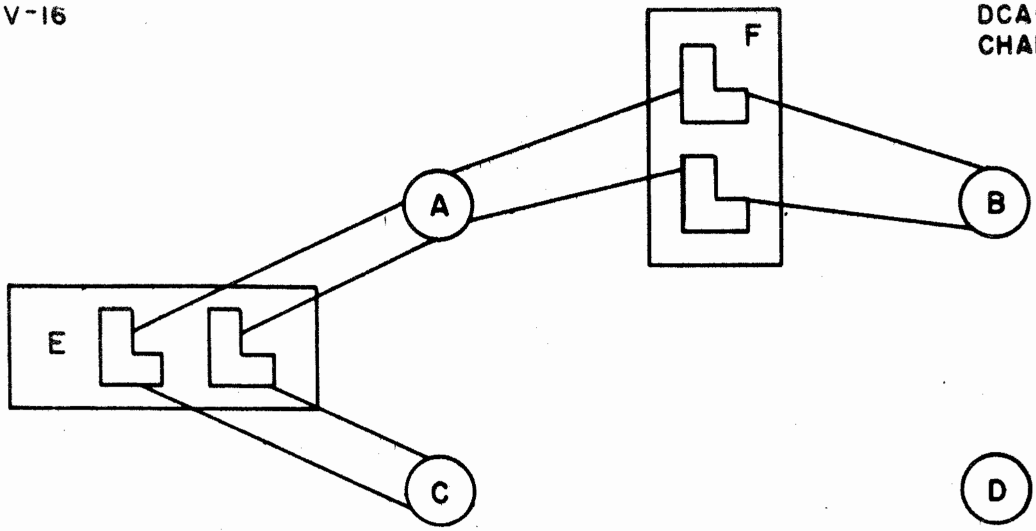
A TOTAL PEG COUNT (ROUTINE & PRECEDENCE).

B TOTAL OVERFLOW (ROUTINE & PRECEDENCE OVERFLOW FROM NONPREEMPT CYCLE).

C IF "PRIORITY NETWORK IN-DIALING" (PNID) OR OPERATOR DIVERSION IS NOT PROVIDED FOR THE PARTICULAR ACCESS LINE GROUP, THEN OVERFLOW REGISTER C IS REQUIRED IN ADDITION TO A AND B. THIS INFORMATION WILL PROVIDE DATA TO DETERMINE IF PREEMPTABLE SUBGROUP IS LARGE ENOUGH TO AVOID LOSING PRECEDENCE CALLS.

D ON ACCESS LINE GROUPS WITH PNID OR OPERATOR DIVERSION, OVERFLOW REGISTER D WILL PROVIDE INFORMATION TO PERMIT ENGINEERING OF A PREEMPTABLE SUBGROUP OF SUFFICIENT SIZE TO ASSURE THAT PRIORITY CALLS RECEIVE PNID TREATMENT.

FIGURE 4



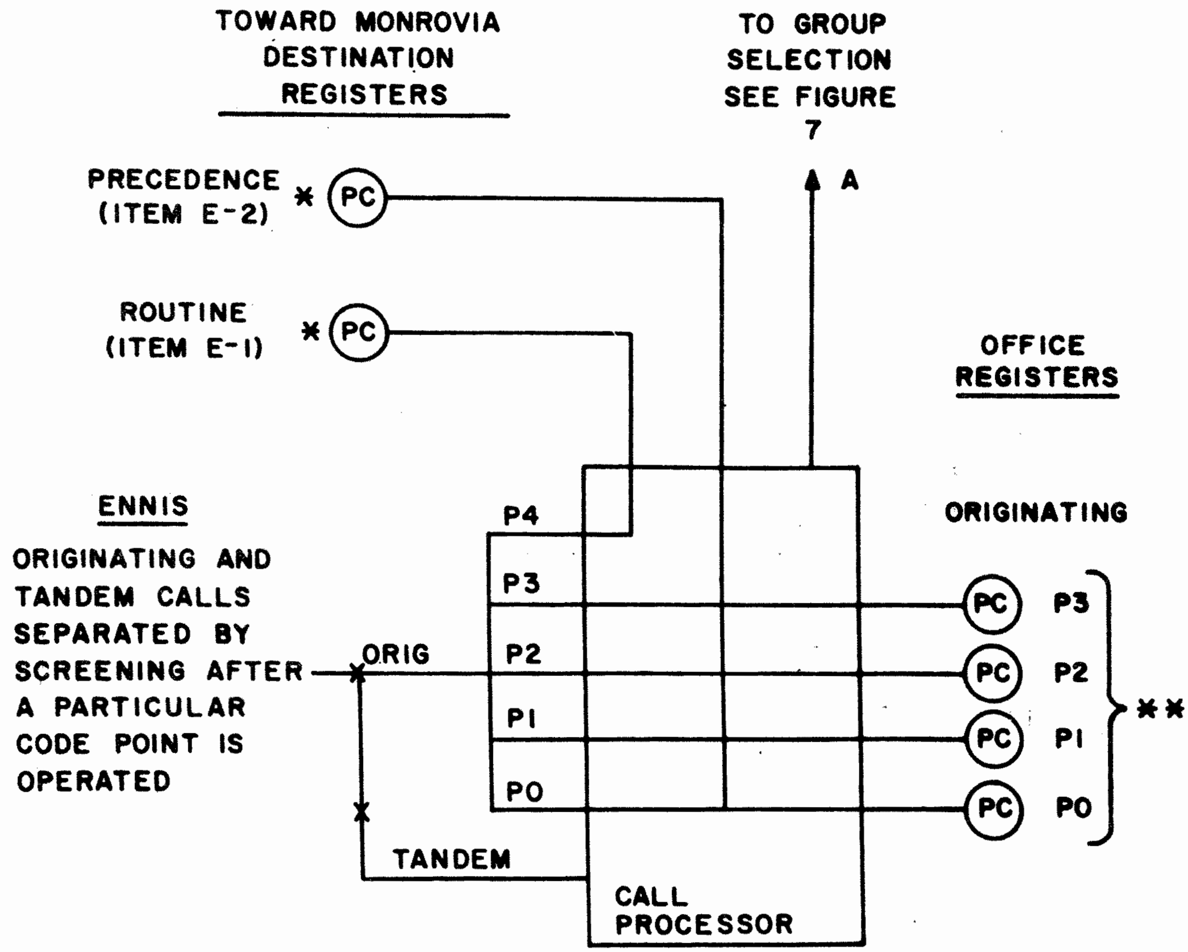
TYPICAL EXAMPLE
ORIGINATING TRAFFIC ONLY
DESTINATION REGISTERS REQUIRED - VOICE GRADE NETWORK *

AT OFFICE	DESTINATION REGISTERS ROUTINE	PRECEDENCE
A	C	C
	D	D
	B	B
	E	E
	F	F
B	A	A
	C	C
	D	D
	E	E
	F	F
C	A	A
	B	B
	D	D
	E	E
	F	F
D	A	A
	B	B
	C	C
	E	E
	F	F

* DUPLICATE REGISTERS FOR SPECIAL GRADE

FIGURE 5

TRAFFIC MEASUREMENTS
DESTINATION AND OFFICE READINGS



NOTE:
THIS IS A TYPICAL CONFIGURATION AT A SWITCHING CENTER; e.g. ENNIS TOWARD A DESTINATION (MONROVIA)

* 1 FOR VOICE GRADE
1 FOR DATA GRADE

** REFER TO ITEMS G-3,4,5 & 6
4 FOR VOICE GRADE
4 FOR DATA GRADE

FIGURE 6

TRAFFIC MEASUREMENTS
DESTINATION AND OFFICE READINGS

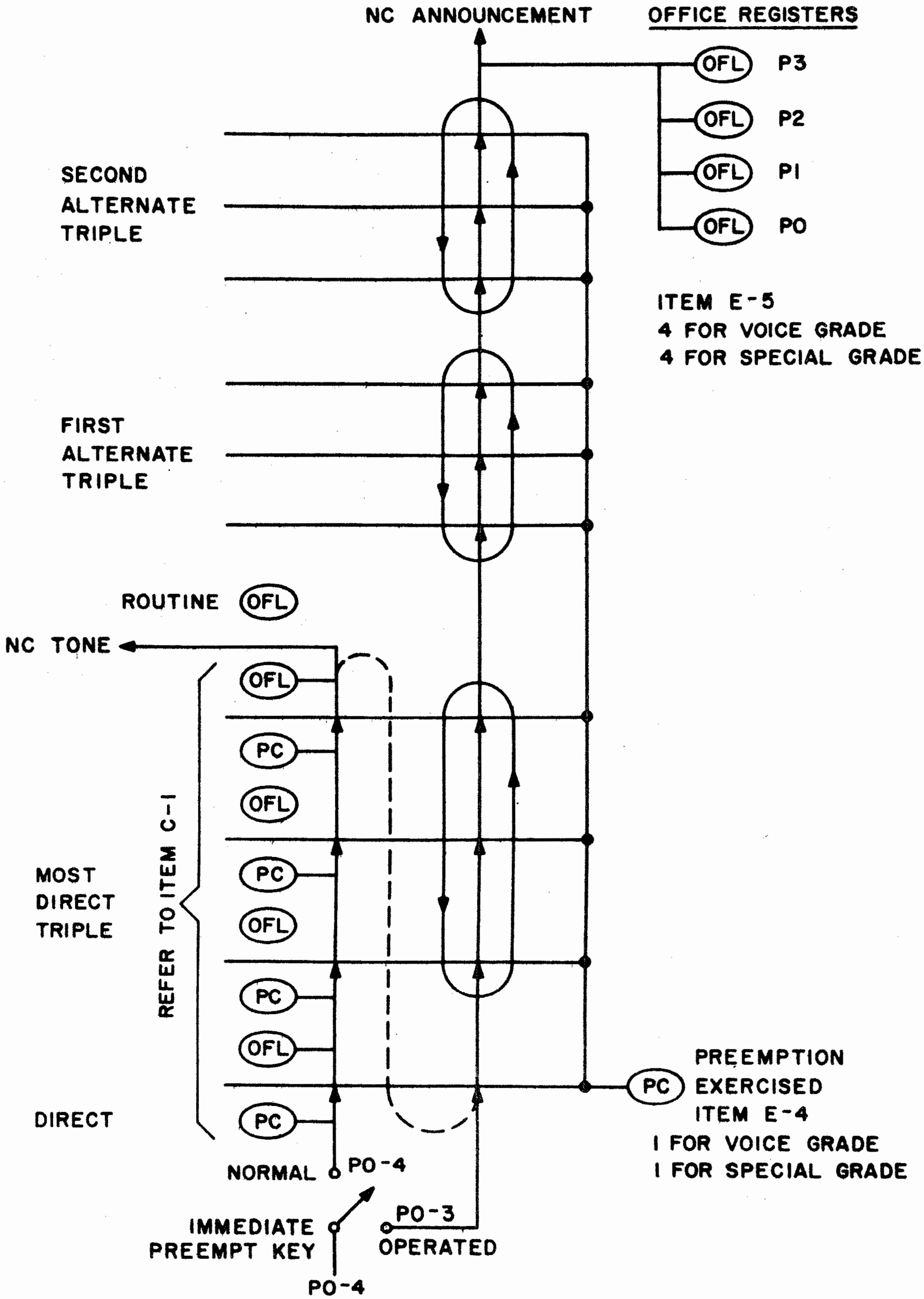


FIGURE 7

5.5 Traffic Data Collection Plan

A uniform collection plan must be integrated into the CONUS AUTOVON traffic analysis program in the interest of providing timely and accurate traffic data statistics. This data has to be summarized and analyzed to detect and correct potential sources of service difficulty and also project accurate engineering requirements.

5.5.1 Switching Centers. Each switching center within the network must be capable of compiling and preparing traffic measurements identified with figure 3 in a prescribed format. The traffic measurements of specified events constitute the raw data which will be transmitted by electrical means to a designated centralized collection point for further processing. The data is required to be in a prescribed format in order that compatability can be achieved with the computer system at the collection point. The collected data for the traffic analysis program can also be used by the switching center for local administration.

5.5.2 Categories of Traffic Measurements. Traffic measurements for this Data Collection Plan can be divided into two major categories.

5.5.2.1 Traffic Data for Network Administration. This consists of various peg counts, overflows, and usage measurements concerning events associated with intermachine trunks, access lines, destination traffic, and certain office register readings. This data will be utilized for the traffic analysis program and for local administration by the switching center.

5.5.2.2 Traffic Data Required for Switch Administration. This consists of various peg counts, overflows, and usage measurements concerning events associated with dialing irregularities, common use equipment, designated cross office readings, applicable DSA positions, and announcement trunks. This data will be primarily used for local administration but must be available for submission to DCA Switchmen, upon request.

5.5.3 Schedule and Assignment of Traffic Measurements. There are two methods currently being utilized in CONUS AUTOVON which transmit traffic measurements to a central collection point within specified time periods. The first method involves storing the accumulated traffic measurements for a specified period, converting the data to 8-level ASCII teletype code utilizing fully perforated paper tape, and transmitting the data to a central collection point, upon request. The second method involves converting the required traffic data from electrical pulse to a 12-bit binary code and transmitting the intelligence on a full-time basis to a summarizer at a central location. This traffic data collection plan is not applicable to the second method which is used by other than electronic switching machines.

5.5.3.1 Each switching center will be required to accomplish traffic measurements on a prescribed schedule. The individual counts of the various events will be accumulated and summarized for a specific period of time. Elapsed time will normally be for a 60-minute period or an increment thereof. All traffic measurements identified for collection to meet a prescribed schedule will be accomplished simultaneously and recorded in a temporary storage device.

5.5.3.2 The individual measurements comprising the scheduled collection will be stored on a temporary basis for a period not to exceed 60 minutes or increment thereof. At the conclusion of the scheduled collection period, the recorded measurements will be summarized or totaled on an individual basis and transferred to a record copy; i.e., printed page copy and fully perforated paper tape. The data recorded on paper tapes will be transmitted to the centralized collection point, upon their request. Capability will be provided to accomplish this function on an hourly, daily, or weekly basis. Provisions will be made to transfer the summarized measurements within any increment of time up to 60 minutes following the termination of the collection period. The transfer of data in storage to record copy will be accomplished in such a manner so that the collection process may continue on an uninterrupted basis. This process must be completed within the time allocated in order that the same function can be repeated for subsequent collection periods.

5.5.4 Output Format for Store and Forward.

5.5.4.1 Each message format schedule (Figure 8 and 9) will consist of a heading, the text or traffic data, and an ending. The following is a description of the basic format required.

5.5.4.2 Heading.

(a) Assignable Unblind Code (1 Character, Alpha or Numeric).

This code is used to activate the equipment to prepare a paper tape. The presence or absence of this code is controlled by the measurement schedule. This character will not print and should be followed by a carriage return and line feed.

(b) Schedule Identity (11 Alpha Characters).

Used to identify the schedule type. The schedule type character is repeated 5 times for verification and identification.

(c) Office Identify (6 Alpha-Numeric Characters).

Used to identify the type of office and the office name.

(d) Time (4 Numeric Characters).

This is the hour and minute expressed in 24-hour clock local machine time, which is the end of the traffic data collection period contained in the printout.

(e) Month, Day, Year (10 Numeric Characters).

This is the month, day, and year. Month-day and day-year are separated by a slash.

5.5.4.3 Text or Traffic Data. All traffic totals will appear in this portion of the message in a fielded format identified by lines, columns, and characters per column. The traffic totals reflected in this portion of the message shall be the exact count of events that have occurred during the specified time.

(a) Lines. Each line in the text of the message shall be identified by a line number. Any number of lines will remain constant throughout any one schedule. Sufficient spare lines should be provided for growth.

(b) Columns. Any number of columns of data from one to ten may be used per schedule; however, the number of columns must remain constant throughout any one schedule. The column number will not be printed because columns will be identified by field position. Each column will be separated by one space character.

(c) Characters per Column. Four, five, or six characters per word comprising a column of data may be printed; however, words within a column for any one schedule must contain the same number of characters. All characters must be numerical.

5.5.4.4 Ending. The ending shall consist of the following information printed on one line.

(a) Finish (10 Alpha Characters).

(b) Month, Day and Year (10 Numeric Characters).

(c) Day of the Week and Time of the Day (Alpha-Numeric Characters).

(d) End of the Message (1 Alpha or Numeric Character). This one character is transmitted to blind the receiving-only typing reperforator to all transmission until the next unblind code is received (See paragraph 5.5.4.2(a)).

5.5.5 Operational instructions that will delineate the procedures for collecting and processing traffic data will be published and distributed as a separate document. These instructions will include the events or items to be counted including the collection periods and the transmission schedule to the centralized collection point.

TYPICAL MESSAGE FORMAT

HOURLY NETWORK ADMINISTRATIVE SCHEDULE

SCHEDULE IDENTITY:	ELEVEN ALPHA CHARACTERS
OFFICE IDENTITY:	SIX ALPHA-NUMERIC CHARACTERS
TIME:	FOUR NUMERIC CHARACTERS
MONTH, DAY AND YEAR:	TEN NUMERIC CHARACTERS

(0)
Each word consists of four, five, or six digits *
------ ------ ------ ------ ------ ------ ------ ------ ------ ------

(1)
Each word, once quantity of digits is assigned, remains the same
------ ------ ------ ------ ------ ------ ------ ------ ------ ------
throughout schedule

(2)

------ ------ ------ ------ ------ ------ ------ ------ ------ ------

**(70)

------ ------ ------ ------ ------ ------ ------ ------ ------ ------

FINISH:	TEN ALPHA CHARACTERS
MONTH, DAY, AND YEAR:	TEN NUMERIC CHARACTERS
DAY OF THE WEEK AND TIME OF THE DAY:	ELEVEN ALPHA NUMERIC CHARACTERS
END OF MESSAGE:	ONE ALPHA OR NUMERIC CHARACTER

*Number of columns can vary from one to ten, but once a message format is established, no change can be made unless it has been previously coordinated with the computer program.
**Number of lines in message is contingent with quantity of traffic measurements and projected growth for spare.

Figure 8

TYPICAL MESSAGE FORMAT

QUARTER-HOUR SWITCH ADMINISTRATIVE SCHEDULE

SCHEDULE IDENTITY:	ELEVEN ALPHA CHARACTERS
OFFICE IDENTITY:	SIX ALPHA-NUMERIC CHARACTERS
TIME:	FOUR NUMERIC CHARACTERS: 24-HOUR CLOCK
MONTH, DAY, AND YEAR:	TEN NUMERIC CHARACTERS

```
(0)
------*
(1)
------
(2)
------
(3)
------
(4)
------
(5)
------        Each word consists of six numeric characters
(6)
------
(7)
------
(8)
------
(9)
------
(10)
------**
```

*Maximum of one column
**Maximum of ten lines

Figure 9

CHAPTER VI

NETWORK MANAGEMENT

6.1 The foreword of this document states that AUTOVON, when fully implemented, will be a world-wide network comprised of a large number of automatic switching machines, inter-center trunks, access lines and terminal equipment, and that it will be implemented in an evolutionary manner through 1970.

6.2 Effective management, administration and operational direction of a network of this scope and complexity are essential in order that:

6.2.1 Facilities are available at all times to meet minimum essential requirements of priority subscribers.

6.2.2 Grade-of-service objectives are maintained.

6.2.3 Responsiveness to changing conditions is insured.

6.2.4 Restoration is accomplished in a timely manner under any condition of stress.

6.3 Because AUTOVON service is to be provided primarily by common carriers in CONUS, effective management and administration of this portion of the network can best be accomplished by a group consisting of both Government and industry representatives. This group already is functioning and is known as the Switched Network Management Center (Switchman). Switchman receives its policy guidance and operational direction from the Defense Communications Agency.

6.4 To carry out its mission, the Switchman organization consists of plant, traffic and engineering personnel. So that these personnel are continuously aware of network conditions, and thus can be responsive to all situations, plant traffic and engineering data must be provided by carriers supplying service within the network, particularly those providing switched services and transmission facilities. A list of types of information and data, which the carrier providing the switching center and transmission lines can be expected to provide, is listed in Paragraph 5.4. Specific hardware required to obtain certain of this information will be contained in orders for service to be issued by DECCO. In addition to providing data to Switchman, the carrier must be responsive to this group when conditions dictate the need for timely actions such as implementation of line load control, effecting facility restoration or performing other tasks necessary to insure continuous operation of essential communication circuits.