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PRELIMINARY

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TECHNICAL REFERENCE

Protective Connecting Arrangement

GTS

Interface Specification

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PRELIMINARY

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TECHNICAL REFERENCE

PROTECTIVE CONNECTING ARRANGEMENT GTS

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PRELIMINARY

PROTECTIVE CONNECTING ARRANGEMENT GTS

1. GENERAL

1.1 Introduction

F.C.C. tariffs and corresponding intrastate tariffs filed by the Bell System Companies provide for the electrical connection of customer-provided voice transmitting and receiving terminal equipment and communications systems to the Bell System telecommunications network by means of a protective connecting arrangement. The connecting arrangement includes circuit elements to provide network control signaling unit functions as well as certain other network protection functions and is furnished, installed, and maintained by the Telephone Company. In addition, the tariffs require compliance by the customer-provided equipment with network protection criteria specified therein.

1.2 Application

Protective Connecting Arrangement GTS provides the means for connecting customer-provided automatic answering devices to the telecommunications network via a central office, PBX station, key system station, Centrex station line or WATS access line. The customer-provided terminal equipment must respond to ringing and disconnect from the line at the end of its answering or recording cycle. Protective Connecting Arrangement GTS presents a two-wire interface to the customer-provided answering device. Connection of the customer-provided device is accomplished by means of a 4-conductor telephone jack mounted on the cover of the connecting arrangement to receive the 4-prong plug furnished on the customer-provided device.

This protective connecting arrangement offers an alternative to those manufacturers who do not elect to participate in the Conformance Program for Answering Devices Incorporating Authorized Protective Connecting Modules. Also, Protective Connecting Arrangement GTS supplements Voice Connecting Arrangements RDL, RDM, RDMZR and RDY which will continue to be made available for use with customer-provided devices previously designed to those specifications.

Recording of two-way telephone conversations is not permitted with Protective Connecting Arrangement GTS; to record two-way conversations, Voice Connecting Arrangement RCZ must be used in order that the "beep" tone required under F.C.C. regulations and applicable tariffs can be transmitted to the distant party to insure communications privacy. Protective Connecting Arrangement GTS is only offered for speech transmission and shall not be used for data transmission. This service is available only for single-party lines.

1.3 Ordering and Identification

The protective connection service described in this Technical Reference is identified by the Bell System as Uniform Service Order Code (USOC) GTS. When ordering this service, the customer should specify this code. One protective connecting arrangement should be ordered for each telephone line to which the customer-provided device is to be connected. The local Telephone Company business office or marketing representative will provide information regarding availability and rates for this service and will accept orders for this service.

2. DESCRIPTION

2.1 Functions

The major functions of this protective connecting arrangement are:

(a) To prevent the introduction to the telecommunications network of hazardous voltages which could cause harm to Telephone Company personnel and facilities.

(b) To provide isolation against longitudinal imbalance.

(c) To limit abnormally high speech and signal levels.

(d) To provide speech transmission to and from the telecommunications network.

(e) To provide for on-hook and off-hook signals to the telecommunications network.

(f) To transmit ringing signals on the telephone line via the interface pair to the customer-provided device.

(g) To apply, after ringing is detected, a dc source to the interface pair to provide the equivalent of line current.

(h) To prevent line seizure except in response to ringing.

2.2 Physical

Protective Connecting Arrangement GTS consists of a single printed circuit board housed in an apparatus box, measuring approximately 7-1/2 inches square and 3-1/2 inches deep, and is intended for either shelf or wall mounting (Fig. 1). The arrangement weighs approximately 4-1/2 pounds and has a steel base with cover in a light olive gray finish.

A standard 4-conductor telephone jack is provided on the cover of the unit to accommodate the 4-prong plug furnished on the customer-provided device. The customer must provide a 105- to 130-volt, 60 Hz outlet near the connecting arrangement. This outlet should not be under control of a wall switch and should be fused with a 15 ampere fuse.

2.3 Interface Leads

The two interface leads, CT and CR, present ringing to the customer-provided device and provide a two-way transmission path for speech (Fig. 2). They also provide local direct current from the connecting arrangement to the customer-provided device to be used as talking battery (typically used to provide dc power to the transmitter) and signaling battery (typically used for switchhook signaling). The connecting arrangement power supply shall not be used to provide power for operation of the customer-provided equipment.

3. OPERATION

3.1 Answer

When a ringing signal is detected by the RINGING DETECTOR circuit, ringing voltage is supplied over the CT and CR leads to the customer-provided device. The ringing signal will be a minimum of 40 volts RMS at 17 to 35 Hz. To answer, the customer-provided device shall place a dc load (175 $\pm$ 25 ohms) across the CT and CR leads. This resistive termination is recognized as a signal to disconnect the ringing detector circuit, trip the ringing signal, and cut through the 2-way transmission path to the customer-provided device.

3.2 Disconnect

To effect disconnect, the customer-provided device must remove the resistive termination across the CT and CR leads. The customer-provided device must be arranged for fixed cycle disconnect or voice-control disconnect. Interruptions of line current are not passed through the protective connecting arrangement.

4. SPECIFIC DESIGN CONSIDERATIONS

4.1 Transmission Path (Leads CT and CR)

4.11 Insertion Loss

When terminated in an ac impedance of 600 ohms, the insertion loss of Protective Connecting Arrangement GTS is a nominal 2.5 dB at 200 Hz, 2.3 dB at 1000 Hz, and 3 dB at 3500 Hz. No voice signal amplification is provided.

4.12 Bandwidth

The nominal voice-frequency bandwidth of the telecommunications network extends from about 300 to 3000 Hz. In general, an end-to-end connection may be expected to have a loss characteristic which increases on either side of this band.

4.13 Voice Signal Power Level

The tariffs state that to prevent excessive noise and crosstalk in the network, it is necessary that power of the signal at the central office not exceed -12 dBm below one milliwatt when averaged over any three second interval. To meet this specification, the maximum available power from a customer-provided source when averaged over any 3-second interval (measured at the customer leads that connect to the CT and CR terminals with a 600 ohm load substituted for the connecting arrangement) should not exceed -7 dBm. This limit has been set so that when the average loss of loops in the Bell System are considered (including the insertion loss of the protective connecting arrangement), the limit of -12 dBm at the local central office will be met.

Using measuring Method A (see Paragraph 4.14), in almost all cases, the speech power averaged over any 3-second interval, will not exceed -7 dBm if the maximum meter swing does not exceed 86 dBrn. With the additional damping of measuring Method B, the power averaged over any 3-second interval will not exceed -7 dBm if the maximum meter swing does not exceed 84 dBrn.

When this arrangement is used on foreign exchange or private line service, the local Telephone Company may specify lower levels.

4.14 Measuring Maximum Available Inband Power

The measuring methods described below are satisfactory for estimating the maximum power averaged over a 3-second interval to determine that the inband signal power criteria specified in Paragraph 4.13 are being met.

Method A

Operate the customer-provided equipment into a 600 ohm load (this assumes that the customer-provided equipment has a 600 ohm source impedance), bridged by a Hewlett-Packard Transmission and Noise Measuring Set - Model 3555B, or a Western Electric 3-Type Noise Measuring Set, or the equivalent.* To insure a proper measurement technique, the control settings on these meters should be as shown below.

Western Electric 3-Type Noise Measuring Set		Hewlett-Packard Transmission and Noise Measuring Set Model 3555B	
Control	Setting	Control	Setting
FUNCTION (Switch)	BRDG	INPUT (Switch)	NOISE/BRDG
NORM/DAMP (Switch)	DAMP	FUNCTION (Pushbutton)	VF/Nm-600 BAL
WTG (Plug-in Network)	3Kc FLAT	NOISE WTG (Switch)	3k Hz FLAT
		NORM/DAMP (Switch)	DAMP

*These meters do not have a 3-second averaging time but, when used to measure speech, they give a reliable estimate of a 3-second average. The use of meters with shorter time constants, such as VU meters or standard voltmeters, is not recommended.

Method B

The accuracy of Method A can be somewhat improved by increasing the size of the damping capacitance in the Western Electric 3-Type Noise Meter by 150 microfarads. To do this, connect the negative lead of a 150 microfarad capacitor to either terminal of the NORM/DAMP switch and connect the positive lead to ground. This allows the meter to more nearly approximate a 3-second averaging meter. (NOTE: This modification does not necessarily hold for the Model 3555B or noise meters other than the Western Electric 3-Type.)

4.15 Signal Power Distribution

The telecommunications network incorporates tone signaling devices that are used for interoffice network control functions. These devices, which are connected at all times to the telephone circuit, are designed to detect a single-frequency tone at 2600 Hz. They are, however, relatively insensitive to energy at this frequency if sufficient energy is present at the same time at other frequencies in the voiceband.

In order to prevent the interruption or disconnection of a call, or interference with network control signaling, it is necessary that the signal applied by the customer-provided equipment to the protective connecting arrangement at no time have energy solely in the 2450 to 2750 Hz band. If signal power is in the 2450 to 2750 Hz band, it must not exceed the power present at the same time in the 800 to 2450 Hz band.

4.16 Out-of-Band Signal Power Limits

To protect other services, it is necessary that the signal which is applied by the customer-provided equipment to the Telephone Company interface,

located on the customer's premises, meet the following limits:

(a) The power in the band from 3995 Hz to 4005 Hz shall be at least 26 dB below one milliwatt.

(b) The power in the band from 4005 Hz to 10,000 Hz shall not exceed 16 dB below one milliwatt.

(c) The power in the band from 10,000 Hz to 25,000 Hz shall not exceed 24 dB below one milliwatt.

(d) The power in the band from 25,000 Hz to 40,000 Hz shall not exceed 36 dB below one milliwatt.

(e) The power in the band above 40,000 Hz shall not exceed 50 dB below one milliwatt.

4.17 Signal Limiting

A voice signal limiter is incorporated in the transmission path of Protective Connecting Arrangement GTS to protect the Bell System telecommunications network from applications of abnormally high signal levels. This has no effect on normal voice or normal tone address signal levels. This limiter does not abrogate the customer's responsibility to comply with the criteria as prescribed in the tariffs and as outlined in Paragraph 4.13.

4.2 Customer Interface (Leads CT and CR)

In addition to being used for the transmission of speech and ringing signals, leads CT and CR are also used to supply talking and signaling battery to the customer-provided device. Maximum resistance for each customer lead shall be no more than 25 ohms. The on-hook termination across these leads shall have a dc component greater than 1 megohm (measured at 28 volts dc) and an ac

component less than 100,000 ohms (measured at 40 through 80 volts RMS and 16 through 35 Hz). The off-hook termination shall be a dc load resistance of 175 ± 25 ohms (200 ± 50 ohms including resistance of the customer leads) and an ac impedance of approximately 600 ohms (resistive) measured over the range 300-3000 Hz. With this termination, the protective connecting arrangement will provide somewhere from 20 to 36 mA dc over the leads CT and CR. The ac impedance introduced from leads CT and CR to ground by the customer-provided device shall be greater than 100,000 ohms over the frequency range of 5 through 3500 Hz and the dc resistance from either CT or CR to ground shall be greater than 1 megohm.

To assure ring detector operation on loops up to 1300 ohms, no more than two Telephone Company-provided ringers shall be bridged across leads T and R. Under this condition, the ringing signal supplied to a customer-provided ring detector which has an impedance equivalent to a 15,000-ohm resistor in series with an 0.5 microfarad capacitor will be approximately 40 volts RMS at 17 to 35 Hz.

4.3 Grounding

Protective Connecting Arrangement GTS is normally ungrounded and customer-provided signaling and power supply ground connections to the connecting arrangement should be isolated from ground. It is expected that the customer's equipment where required will comply with applicable electrical codes such as the National Electrical Code (NEC).

5. SERVICE RESPONSIBILITIES

5.1 Responsibility of the Manufacturer

The manufacturer of the automatic answering device equipment is responsible for the following:

a) Informing the purchaser as to which protective connecting arrangement his device has been designed to work with.

b) Advising the purchaser to order this protective connecting arrangement by code (GTS) from the Telephone Company.

c) Providing information to the purchaser that specifies installation, operational, routine maintenance, and repair procedures which, if properly employed by the purchaser, will assure compliance with this Technical Reference.

d) All patent or other liability arising out of the use, offering or distribution of such devices by or to them.

5.2 Responsibility of the Customer

The tariffs regulating the connection of customer-provided terminal equipment or communications systems through connecting arrangements to the telecommunications network state that the operating characteristics of such equipment or systems shall be such as not to interfere with any of the services offered by the Telephone Company. Such use is subject to the further provisions that the equipment or systems provided by a customer do not endanger the safety of Telephone Company employees or the public; damage, require change in or alteration of, the equipment or systems or other facilities of the Telephone Company; interfere with the proper functioning of such equipment or systems

or facilities; impair the operation of the telecommunications network or otherwise injure the public in its use of the Telephone Company's services. Upon notice from the Telephone Company that the equipment or system provided by a customer is causing or is likely to cause such hazard or interference, the customer shall take such steps as shall be necessary to remove or prevent such hazard or interference.

The customer desiring to use a customer-provided automatic answering device is responsible for the following:

a) Informing the Telephone Company of his intention to use such a device and ordering the protective connecting arrangement by code (GTS).

b) Connecting the device to the 4-conductor telephone jack mounted on the protective connecting arrangement.

c) Assuring that the device in use continues to comply with all the requirements of the applicable tariffs and this Technical Reference.

d) Following the installation, operational, routine maintenance and repair procedures specified by the manufacturer.

e) Removing the device from use if the customer detects that it is defective or if the Telephone Company notifies the customer that the device is causing a hazard or interference as specified above.

5.3 Responsibility of the Telephone Company

The Telephone Company shall not be responsible for the installation, operation, or maintenance of any customer-provided terminal equipment devices. Telecommunications service is not represented as adapted to the use of customer-provided equipment and where such equipment is connected to Telephone Company equipment or facilities, the responsibility of the Telephone Company shall be limited to the furnishing of facilities suitable for telecommunications service and to the maintenance and operation of such facilities in a manner proper for such telecommunications services. Subject to this responsibility the Telephone Company shall not be responsible for (1) the through transmission of signals generated by the customer-provided equipment or for the quality of, or defects in, such transmission or (2) the reception of signals by customer-provided equipment.

The Telephone Company shall not be responsible to the customer or otherwise if changes in minimum network protection criteria contained in the tariffs and the technical specifications in this Technical Reference, or in any of the facilities, operations, or procedures of the Telephone Company render any customer-provided equipment obsolete or require modification or alteration of such equipment or otherwise affect its use or performance.

6. MAINTENANCE OF SERVICE

Maintenance of equipment supplied by the Telephone Company shall be done only by the Telephone Company.

When trouble is experienced, the customer should disconnect the answering device to determine if it is in any way defective. If the answering device is determined to be defective, the customer shall immediately discontinue its use until such time as the customer has it repaired and brought into compliance with the specifications herein. If the customer believes that the problem is being caused by Telephone Company equipment, a trouble report should be promptly referred to the Telephone Company's "Repair Service" whose number can be found in the front of the telephone directory. The repair attendant should be given:

A. Customer's name

B. Customer's address

C. Listed telephone number

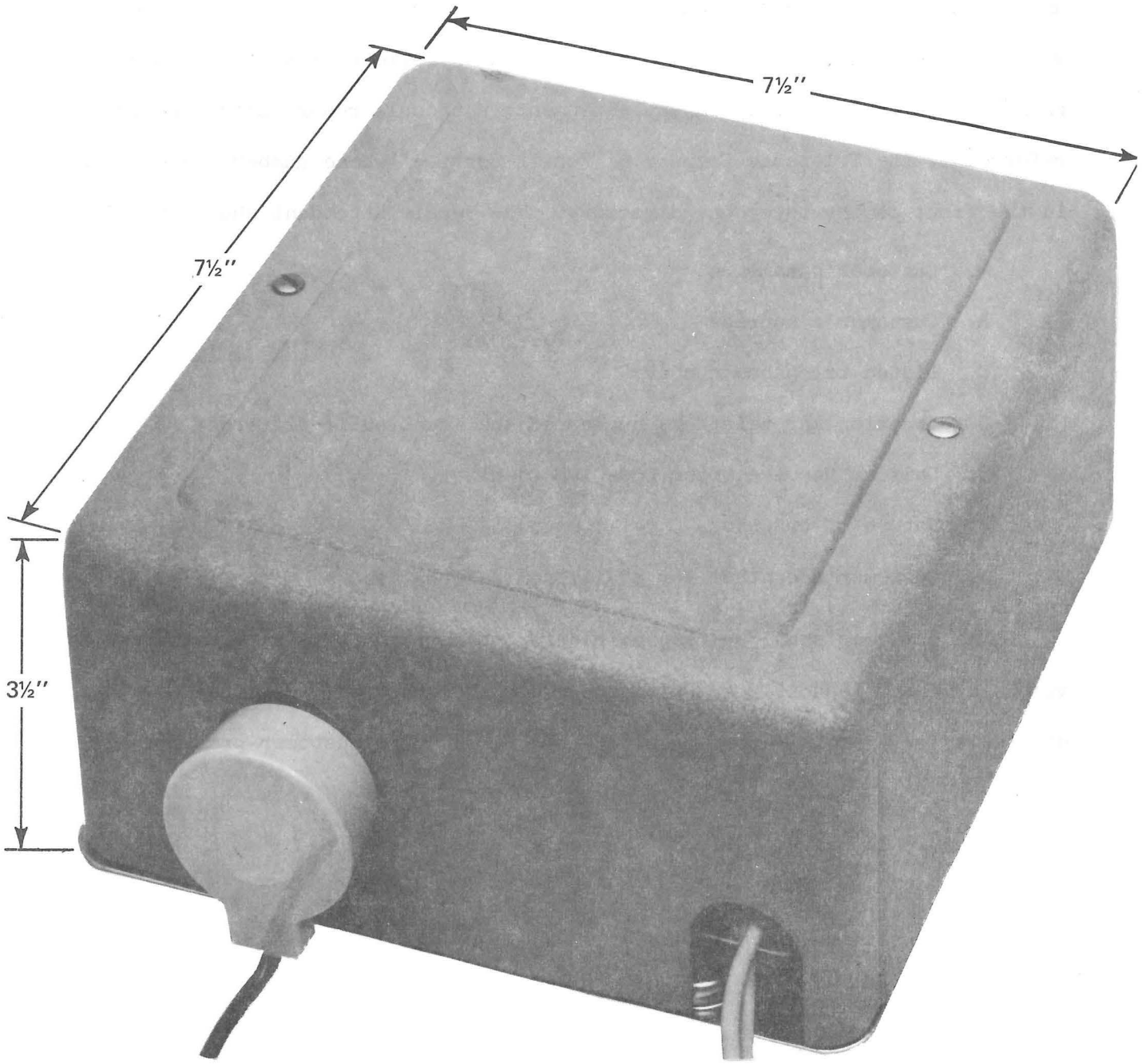
D. Location and telephone number of the location if different

E. Uniform Service Order Code (USOC) GTS

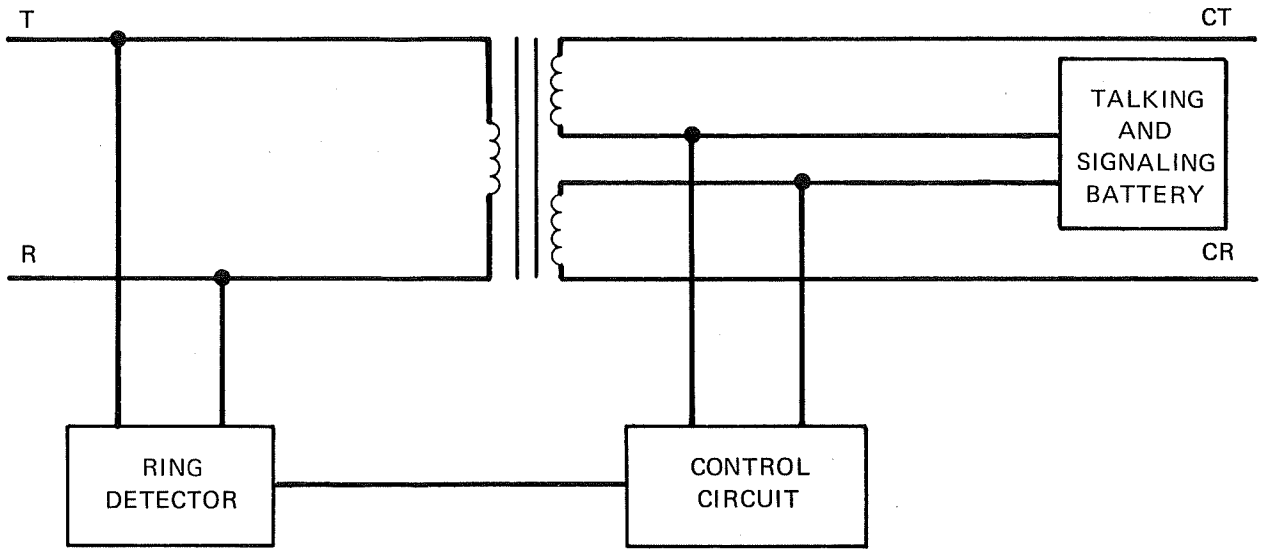
F. Nature of trouble

G. Customer's contact for additional information

The customer shall be responsible for the payment of a service charge for visits by the Telephone Company to the customer's premises where the service difficulty or trouble report results from the use of a customer-provided device.



PROTECTIVE CONNECTING ARRANGEMENT GTS
FIG. 1



PROTECTIVE CONNECTING ARRANGEMENT GTS
FIG. 2

PRELIMINARY

APPENDIX A

GLOSSARY

ADDRESS SIGNALS - denotes dc dial pulses or appropriate pairs of tone signals transmitted to a central office that represent the telephone number of the distant party.

COMMUNICATIONS SYSTEM - denotes channels and other facilities which are capable, when not connected to the Long Distance Message Telecommunications Service, of communications between customer-provided terminal equipment or Telephone Company stations.

CUSTOMER - the term "Customer" denotes the person, firm or corporation which orders service and is responsible for the payment of charges and compliance with Telephone Company regulations.

CUSTOMER-PROVIDED TERMINAL EQUIPMENT - denotes devices or apparatus and their associated wiring, provided by a customer, which do not constitute a communications system and which, when connected to the communications path of the telecommunications network, are so connected either electrically, acoustically, or inductively.

DIAL PULSE RATE - repetition of pulses for switching purposes, usually expressed in pulses-per-second.

INTERDIGITAL TIMING - the minimum time required between digits for the switching equipment to respond to the last digit received and ready itself for receiving the next digit.

INTERFACE CONNECTING BLOCK - the Telephone Company-provided connecting point to which the customer brings and connects the leads of his equipment and to which the Telephone Company brings and connects leads from the protective connecting arrangement.

NETWORK CONTROL SIGNALING - denotes the transmission of signals used in the telecommunications network which perform functions such as supervision (control, status, and charging signals), address signaling (dialing), calling and called number identification, audible tone signals (call progress signals indicating reorder or busy conditions, alerting, coin denominations, coin collect and coin return tones) to control the operation of switching machines in the telecommunications network.

NETWORK CONTROL SIGNALING UNIT - denotes the terminal equipment furnished, installed, and maintained by the Telephone Company for the performance of network control signaling. (See Note below.)

OFF-HOOK SUPERVISION - the conditioning of the interface leads by the customer-provided equipment which indicates that it is answering or originating a call.

ON-HOOK SUPERVISION - the conditioning of the interface leads by the customer-provided equipment which indicates that it has disconnected and is idle.

PERCENT BREAK - the period of time of an open interval in a dial pulse sequence compared to the total time of an open and closed interval, expressed as a percentage.

PROTECTIVE CONNECTING ARRANGEMENT - protective equipment provided by the Telephone Company to accomplish the electrical connection of customer-provided equipment with the telecommunications network. It is designed to transmit speech signals as contrasted to one designed to transmit data signals.

NOTE: Under the tariff regulations, the terms "connecting arrangement" and "network control signaling unit" are separate and distinct from each other; however, the term "connecting arrangement" is generally used to include the functions of network control signaling.

SUPERVISORY SIGNALS - signals used to initiate a request for service by the calling party (off-hook); to notify the called party that he is being called (ringing); to indicate an answered call (off-hook); to indicate a disconnect (on-hook); and to recall an operator or distant party to a connection (switchhook flash).

TELECOMMUNICATIONS NETWORK - central office switching equipment, associated interoffice and intraoffice facilities, and terminal equipment which provide Long Distance Message Telecommunications Service or private line service.

TELEPHONE COMPANY - denotes the American Telephone and Telegraph Company, the Long Lines Department, its concurring carriers, and its connecting carriers, either individually or collectively.

PRELIMINARY

APPENDIX B

REFERENCES

Some references describing various transmission characteristics of the telecommunications network are listed below:

*(a) McAdoo, K. L., "Speech Volumes on Bell System Message Circuits - 1960 Survey," Bell System Technical Journal (BSTJ), Vol. 42, No. 5 (September 1963), P. 1999.

*(b) Gresh, P. A., "Physical and Transmission Characteristics of Customer Loop Plant," BSTJ, Vol. 48, No. 10 (December 1969), P. 3337.

*(c) Breen, C., and Dahlbom, C. A., "Signaling Systems for the Control of Telephone Switching," BSTJ, Vol. 39, No. 6 (November 1960), P. 1381.

*(d) Bodle, D. W., and Gresh, P. A., "Lightning Surges in Paired Telephone Cable Facilities," BSTJ, Vol. 40, No. 2 (March 1961), P. 547.

**(e) Bell System Data Communications Technical Reference - PUB 41007 - 1969-1970 Switched Telecommunications Connection Survey (Reprints of Bell System Technical Journal articles) - April, 1971.

***(f) "Principles of Electricity Applied to Telephone and Telegraph Work," by American Telephone and Telegraph Company, New York, New York.

***(g) "Switching Systems," by American Telephone and Telegraph Company, New York, New York.

(h) "Notes on Transmission Engineering," by United States Independent Telephone Association, Washington, D.C.

***(i) "Transmission Systems for Communications," by Bell Telephone Laboratories, Inc.

***(j) "Notes on Distance Dialing - 1968," by American Telephone and Telegraph Company, New York, New York.

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