BY ORDER OF THE SECRETARY
OF THE AIR FORCE

AIR FORCE MANUAL 33-274
1 JULY 1997

Communications and Information

ON-HOOK TELEPHONE SECURITY GUIDELINES

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This manual implements AFI 33-220. This manual provides guidelines established for on-hook telephone security within the federal government and applies to all Air Force organizations using administrative telephone systems in both sensitive and classified discussion areas.

1. Risk Associated with the Administrative Telephone System. The administrative telephone system, which also includes facsimile machines and computer MODEMs, has become so common place the risks associated with its use are often overlooked. When present in sensitive discussion areas these devices pose a great threat to technical security. Other publications address various methods of securing intentional transmissions of information. The objective of this manual is to provide guidance for countering the threat posed by equipment utilizing the administrative telephone system when in an on-hook condition.

1.1 It is generally accepted that all information carried over administrative telephone circuits is vulnerable to interception at any point along the path of the communication. It is also understood, there is not an effective method to protect discussions carried by communications circuits outside of a facility. Therefore the greatest possibility for success for on-hook security measures lies in preventing equipment at the source from transmitting discussions. Before determining specific countermeasures however, the sensitivity of the information to be protected and the specificity of the threat to that information should be considered.

2. Determining the Need for Protection. The sensitivity of the information and the degree of physical and personnel access control will determine the need for protective security devices and technical surveillance countermeasures. Classified information must always be protected. However, the bulk of the discussions in the Air Force involve sensitive information, as defined in AFI 33-202, Computer Security. This information must also be protected, but at an appropriately lower level. This manual provides Telephone Security Group (TSG) Standards (attachments 1-8) and recommendations which may be too stringent for sensitive, but unclassified information. The TSG Standards were intended for classified discussion areas or other compartmented program areas where on-hook vulnerabilities and the nature of the information generate significant risk regardless of the threat. Commanders requiring assistance assessing the local threat or determining the appropriate level of on-hook telephone security should contact their servicing AFOSI detachment.

3. Principal Security Vulnerabilities. Administrative telephone system components may be used to monitor nearby conversations or activity when the system is on-hook. This is particularly dangerous because personnel are not generally aware this type of monitoring can occur. Principal vulnerabilities include signals exploitation, equipment modification, and device installation all of which take advantage of the electrical path provided by the existing system to transmit information from an area. Areas with a secure perimeter defined by physical and personnel access controls are referred to as a physical control zone (PCZ).

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3.1. Signals exploitation involves intercepting signals generated by inherent system design characteristics which allow normal room conversation to be passed from an area.
3.2. Equipment modification causes existing telephone system equipment to generate signals that allow normal room conversation to be passed from an area.
3.3. Device installation involves placement of a technical surveillance device which collects and passes information from an area.

4. Technical Surveillance Countermeasures. The protective methods and equipment employed to deny the use of telephone system for other than intended communications constitutes technical surveillance countermeasures. These measures ensure on-hook audio signals are not available for interception or exploitation. Excluding all telephone equipment and wiring from discussion areas is the most effective, if least practical countermeasure. In all cases, limit telephone instruments to the minimum number required.
4.1. For sensitive compartmented information facilities (SCIF), remove all extraneous telephone system wiring and components which are not contained or protected within the PCZ. This may require the re-routing of telephone system wiring which does not service the facility. In areas where personnel routinely discuss classified information, add isolation or disconnect devices (as defined in attachment 1) to the telephone lines, either at the station equipment or at the point where the lines leave the PCZ. Proper installation of isolation or disconnect devices will prevent audio signals from being passed from the PCZ over telephone lines when the system is not in normal use, i.e., on-hook.
4.2. Isolating station equipment from all uncontrolled telephone lines prevents an on-hook audio compromise of classified or sensitive information. Installing isolation or disconnect devices is the first line of defense, however, occupants must ensure the protected equipment is not later modified or technical surveillance devices subsequently installed. This responsibility falls within the purview of physical security and access control. The implementation of TSG Standards (attachments 1-8) neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as EMSEC, COMSEC, or OPSEC.

5. Characterizing Telephone Systems. Telephone systems can be characterized according to their relationship to the PCZ. The system's relationship to the PCZ can be categorized as: Without external connection, with external connection, and systems in areas with limited security.
5.1. Internal Telephone System Without External Connections. This is a telephone system completely contained within a PCZ and not connected to, or served by any component extending beyond that perimeter. No components, to include wiring, are accessible by unauthorized personnel or vulnerable to surreptitious access. It is essentially a private telephone system and requires no special technical surveillance countermeasures or protective security devices.
5.2. Internal Telephone System With External Connections. These systems are located within a secure perimeter, but are connected to, or served by system components (including wiring) extending beyond the PCZ. If personnel discuss classified information within the area, the telephone equipment must be installed according to this manual. Routine discussion of sensitive information should be addressed on a case by case basis for each area, considering both the criticality of the information and frequency of discussion, to determine the applicability of this manual. For assistance, contact your servicing AFOSI detachment.
5.3. Telephone System in Area of Limited Security. These systems are located within a perimeter where only minimal physical security is provided. The telephone equipment is connected to, or served by system components extending beyond the perimeter and some or all of the components within the area may be accessible by unauthorized persons. In this situation, security can best be provided by excluding all discussion of classified or sensitive information. Where it is not possible to exclude classified discussion, the telephone system serving the area must be installed according to this manual. Routine discussion of sensitive information should be addressed on a case by case basis for each area; for assistance contact your servicing AFOSI detachment.

6. Types of Telephone Service. The type of service can be categorized as central office (CO) or private branch exchange (PBX). Central office service is generally provided by a commercial, local exchange carrier who provides the main hub for telephone communication within a geographic area. The CO serves both residential and business telephone subscribers within the community. A PBX operates as a private telephone sub-network and may be either manual or computerized. It ties an internal group of subscribers into an independent network and provides external connections to the CO. A Computerized Telephone System (CTS), analogous to the brains of a modern computerized PBX, uses stored programs to perform the necessary message switching functions. A typical CTS

incorporates a multitude of attractive features which enhance and extend basic telephone service. In addition to processing telephone calls, a CTS may also support data and word processing, energy consumption control, and communications traffic analysis.

7. Special Equipment Considerations. Installing specialized telephone equipment, such as cordless telephones, speakerphones and telephone answering devices within discussion areas can create additional security vulnerabilities. When protecting classified information, or sensitive information under the guidance of this manual, the following additional considerations apply:

7.1. Cordless telephones must not be installed within discussion areas.

7.2. Speakerphones in discussion areas must be installed so that all cabling, amplifiers and associated control units are contained within the boundaries of the PCZ.

7.3. Telephone answering devices must be installed outside the PCZ and be selectively activated by means of a line transfer or call forwarding function. The answering device and associated telephone equipment for the called number must not activate at the same time within the PCZ.

7.4. Do not install intercommunications systems within discussion areas except when operationally justified and the system is installed in accordance with the attached guidance.

7.4.1. If a dial intercommunications system capability is engineered into the administrative telephone system, no further action is required if the telephone system is installed according to this instruction.

7.4.2. If a separate telephone intercommunications system is installed, no station equipment or system wiring will be located outside of the discussion area.

8. Applying Protective Countermeasures. Given the wide variety of security considerations impacting the diversity of telephone systems in use throughout the USAF, the only effective approach for determining specific requirements is risk management. Classified information must always be protected and the guidance in this manual applies. Sensitive information must be evaluated on a case by case basis for each area, with consideration given to the criticality of the information, inherent system vulnerabilities and the specificity of the threat. When considering the type of telephone service, all protective countermeasures to deny on-hook audio now accepted for CO service and manual PBX systems are equally effective for a CTS. The attachments to this instruction are national level guidance published by the TSG.

8.1. Telephone systems incorporating accepted, conventional isolation/disconnect protective countermeasures to deny on-hook audio, as identified in this manual, are not subject to further installation or operational restrictions, unless it is to address concerns other than on-hook audio.

8.2. The type of information and frequency of discussion within the area to be serviced must determine the method of isolation. If classified information is routinely discussed, the entire area should be designated as a PCZ. The telephone system should be located within the PCZ and installed as outlined in attachment 1. If the majority of discussion involves sensitive, but unclassified information, a PCZ should be established only for those areas where classified, or sensitive information requiring this level of protection, is routinely discussed. If the telephone system is located in an area of limited security and information requiring protection is routinely discussed, the telephone installation within each PCZ should include proper individual isolation.

RICHARD T. SWOPE, Lt General, USAF
The Inspector General

Attachments
1. TSG Standard 1, *Introduction To Telephone Security*
2. TSG Standard 2, *TSG Guidelines For Computerized Telephone Systems*
3. TSG Standard 3, *Type-Acceptance Program For Telephones Used With The Conventional Central Office Interface*
4. TSG Standard 4, *Type-Acceptance Program For Electronic Telephones Used In Computerized Telephone Systems*
5. TSG Standard 5, *On-Hook Telephone Audio Security Performance Specifications*
6. TSG Standard 6, *Telephone Security Group Approved Equipment*
7. TSG Standard 7, *TSG Guidelines For Cellular Telephones*
8. TSG Standard 8, *Microphonic Response Criteria For Noncommunications Devices*

INTRODUCTION TO TELEPHONE SECURITY

TSG STANDARD 1

March 1990

PREFACE

This standard was prepared by the Telephone Security Group (TSG). The charter members of the TSG are: Department of the Air Force, Department of the Army, Central Intelligence Agency, Defense Intelligence Agency, Department of Energy, Federal Bureau of Investigation, Department of the Navy, National Security Agency, US Secret Service, and Department of State.

The TSG is the primary technical and policy resource in the US Intelligence Community for all aspects of the technical surveillance countermeasures (TSCM) program involving telephone systems. The TSG standards contain guidance for providing on-hook security to telephone systems in areas where sensitive government information is discussed. Implementation of TSG standards neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as TEMPEST, COMSEC, or OPSEC.

TSG Standard 1 is an introduction to telephone security that provides general information about the TSG standards.

INTRODUCTION TO TELEPHONE SECURITY

A1.1. Purpose. TSG Standard 1 provides background information on telephone security and explains some of the technical principles underlying the other TSG standards. This standard provides a systematic basis for determining the most appropriate telephone security measures to be applied. The TSG will revise the TSG standards or add additional standards as the need arises.

A1.2. Applicability. TSG Standard 1 applies to telephones located in government (or government contractor) sensitive discussion areas. It is concerned with on-hook audio security and does not apply to the interception of telephone conversations (COMSEC). This standard is only valid for telephones located in physically protected spaces (PPS).

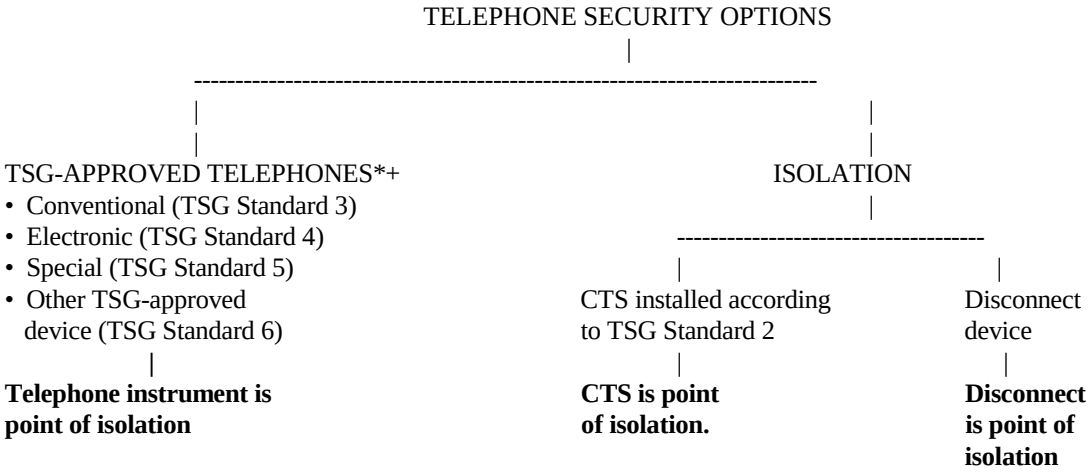
A1.3. Definitions. Many common telephone terms are not used consistently throughout the telephone industry. It is important when using the TSG standards that the terms defined in the glossary are not given any more or less meaning than specified. Definitions in other standards may be more narrowly specified than in this standard. This allows a more limited definition to be applied in a particular standard.

A1.4. Telephone Security Program.
A1.4.1 The Problem. One of the most serious technical security liabilities in the modern office environment is the presence of telephones. Telephones are connected to uncontrolled telephone lines. When the telephone is not in use, conversations occurring in its vicinity must not be transmitted out of the area. A serious security liability occurs when a telephone can pick up and transmit audio when on-hook.
A1.4.2. Telephones can be made to exhibit this behavior even if it is not inherent in their design and construction. Telephones can be caused to pass audio by one or more of the following actions:
A1.4.2.1. The modification or reconfiguration of existing components.
A1.4.2.2. The installation of a clandestine technical surveillance device.
A1.4.2.3. The application of externally generated electrical voltages or control signals onto the telephone line.
A1.4.2.4. The modification of the telephone equipment or control unit software.

NOTE: These actions are referred to as penetrations.

A1.4.3. Some telephones present an intrinsic audio security hazard because, while on-hook, they pick up and transmit conversations occurring in their vicinity. There have been instances in which telephones have created an audio security hazard for reasons aside from their connection to uncontrolled telecommunications media. Some voice terminals, including speakerphones, intercoms, and some telephones, employ electronic audio amplifiers. Audio amplifiers may generate unintended radio frequency (RF) parasitic oscillations that are modulated by the audio signals they are amplifying. These RF oscillations can be radiated through free space or coupled onto nearby conductors. A radio receiver tuned to the frequency of the RF oscillation may recover the original audio just as if it were an intended radio transmission.
A1.4.4. The unintended radio broadcast of telephone or intercom conversations is unacceptable. The relevant concern is that an on-hook voice terminal might generate a radio broadcast of normal room conversations occurring in its vicinity. This can occur if the voice terminal maintains active RF circuits or audio amplifiers that are connected to, or contain microphonic components.
A1.4.5. Measures taken to protect against these problems, either deliberate or unintentional, are known as on-hook telephone audio security.

A1.5. Countermeasures.
A1.5.1. The only way to ensure absolute telephone security is to exclude telephones from sensitive discussion areas. However, in today's communications-oriented environment, that solution is generally impractical. As a result, the TSG has developed standards that provide countermeasures for the security weaknesses of telephone equipment.
A1.5.2. There are two acceptable methods for attaining on-hook telephone audio security (see Telephone Security Options diagram):
A1.5.2.1 Use of a TSG-approved telephone that incorporates security features.
A1.5.2.2. Isolation of telephones from uncontrolled lines.
A1.5.3. Where either TSG-approved telephones or isolation measures are possible, usage of both is not necessary. Neither approach is regarded as being better than the other.



* All TSG-approved telephones are listed in TSG Standard 6.
\+ May not be cost effective for large facilities.

A1.6. TSG-Approved Telephones.
A1.6.1. TSG-approved telephones must have been evaluated by TSG and determined to meet on-hook audio security criteria. These telephones possess security properties that are intrinsic to the telephone itself. TSG type-accepted telephones are approved based on their compliance with design and construction criteria contained in TSG Standards 3 and 4. A telephone conforming to these standards contains specific physical disconnect and isolation measures that ensure:
A1.6.1.1. It cannot be caused to produce on-hook audio unless modified internally.
A1.6.1.2. Its basic design does not facilitate modifications that could compromise audio security.
A1.6.1.3. It can be easily inspected both physically and electrically to verify that the security measures are intact.
A1.6.2. Redundancy of protective features is an associated consideration for type-accepted telephones. The greater the redundancy, the greater the assurance that security will be maintained.
A1.6.3. The specifications and procedures for obtaining type-acceptance are provided in the following TSG standards:
A1.6.3.1. Standard 3 -- Telephones compatible with conventional central office interface.
A1.6.3.2. Standard 4 -- Electronic telephones used with computerized telephone systems.
A1.6.4. Equipment manufacturers requesting type-acceptance for their products must:
A1.6.4.1. Demonstrate their product's conformance with the appropriate standards.
A1.6.4.2. Supply technical data describing the product's design and supporting their technical claims.
A1.6.4.3. Provide assurances that all units of the type-accepted model will continue to be manufactured in conformance with the design and data submitted as the basis for type-acceptance.
A1.6.5. When the TSG approves a specific telephone model under the type-acceptance program, it may be used without additional isolation or disconnect measures.
A1.6.6. The TSG type-acceptance standards can be included directly in telephone procurement specifications. Manufacturers who wish to supply type-accepted telephones can use the TSG standards for product evaluation and development. In addition, TSG Standards 3 and 4 explain how to obtain type-acceptance and define how the telephone can be subsequently altered by the manufacturer without affecting its type-accepted status.
A1.6.7. TSG Standards 3 and 4 provide multiple categories of type-acceptance. This permits flexibility in selecting equipment so that the particular telephone security requirements of individual facilities can be met economically.
A1.6.8. Telephones with built-in speakerphones, speakerphone auxiliary units, and most other telephone accessory units may be type-accepted.

A1.7. Isolation.
A1.7.1. Line isolation may be achieved by the use of TSG-approved disconnect devices or a computerized telephone system (CTS) installed in accordance with TSG Standard 2.
A1.7.2. Disconnect devices separate the telephone from the uncontrolled line when the telephone is not in use. Telephone line isolation and disconnect devices prevent audio signals originating at the on-hook telephone from passing

to uncontrolled telecommunications media. The line isolation or disconnects are interposed in the telephone line within the physically protected space to eliminate the hard-wire conduction path when the telephone is on-hook.
A1.7.3. For both isolators and disconnects, when the telephone is on-hook, all electrical connections to unprotected lines are completely severed. However, when a telephone is actually in use, signals must pass to the line for communication to take place. During use, isolators establish a temporary communication channel between the off-hook telephone and the unsecured line without using metallic connection, whereas disconnects provide a temporary metallic connection.
A1.7.4. An approved isolator or disconnect device is one that has been evaluated by TSG and found to reliably prevent the passage of on-hook audio. TSG Standard 6 provides information on approved isolators and disconnects.
A1.7.5. TSG Standard 2 provides installation requirements applicable to computerized telephone systems. If those requirements are strictly followed, private branch exchanges (PBX) and computerized key systems can be installed without separate isolation or disconnect devices because the required isolation will be achieved in the system itself.
A1.7.6. Not all situations require the same level of security. A security countermeasure that is sufficient for one application could be inadequate for another. Generally, an appropriate level of security can be achieved with a selected combination of several countermeasures, including ones that would be deficient if applied individually.

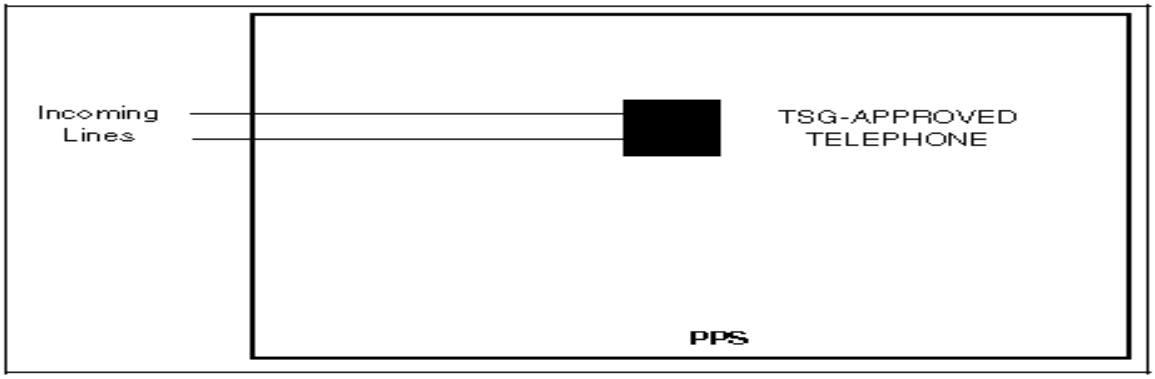
A1.8. Acceptable Telephone Security Configurations.
A1.8.1. The following diagrams show examples of commonly used acceptable telephone security configurations. These are not necessarily the only acceptable telephone security configurations. If another configuration is desired, the user should contact the cognizant security authority to determine if the desired configuration meets telephone security standards.

A1.9. TSG Standards. The TSG standards describe methods for achieving on-hook audio security and assist the user in selecting among available alternatives. A complete list of TSG standards is provided in the appendix. The TSG standards, a part of the national effort to protect information, are issued by the TSG. The TSG is composed of representatives of Federal agencies concerned with national security.

A1.10.1 Unattended Off-hook Telephone Security. When a telephone is left unattended during the course of a call (to retrieve a file, for example), others may not realize that the telephone is off-hook and engage in sensitive conversation. Positive security measures can prevent this type of compromise.
A1.10.2. Unattended off-hook security can be accomplished by one of the following:
A1.10.2.1. A hold feature that does not allow audio from the telephone to leave the PPS.
A1.10.2.1.1. A hold feature provided by a controlled CTS (TSG Standard 2).
A1.10.2.1.2. A hold feature internal to the telephone that prevents audio from exiting the telephone when the hold feature is activated.
A1.10.2.1.3. A hold feature that allows the handset to be cradled when the hold feature is activated.
A1.10.2.2. A push-to-operate handset can be used if an appropriate hold feature is not available. (See TSG Standard 6.)
A1.10.3. Speakerphones are designed to pick up and transmit nearby conversations when in use; they should be prohibited in common use office areas where sensitive conversations might be recovered.

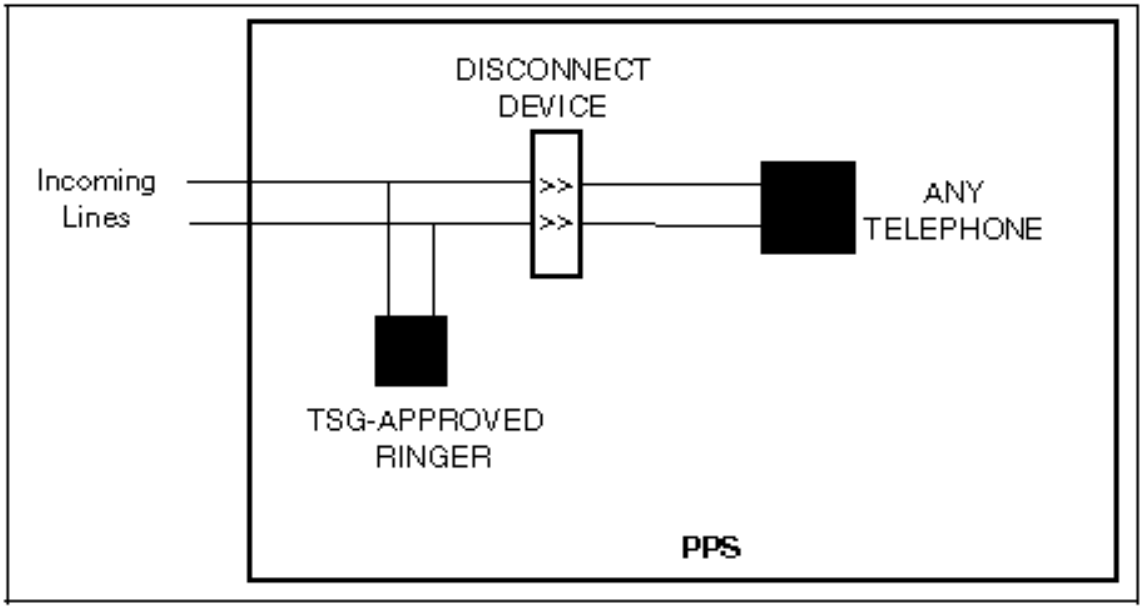
A1.11. Summary. Telephones are one of the most significant vulnerabilities to sensitive discussion areas. Telephones can be exploited for clandestine surveillance through inherent weaknesses (hazards) or by deliberate modification (penetration). Rapid advances in communication technology have made the development of user friendly telephone security solutions vital to the protection of sensitive discussion areas.

Figure A1.1. TSG - Approved Telephone.



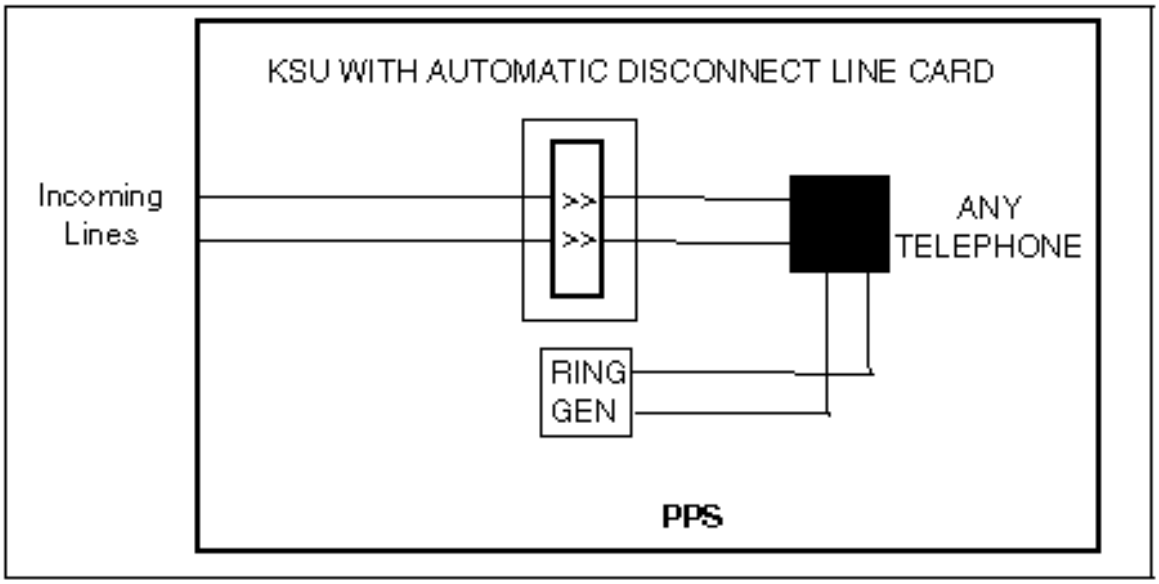
Notes:
No additional isolation/disconnect required
TSG Standard 6 will state whether additional ringer protection is required for each particular model of telephone. Additional ringer protection will not be required if a type-accepted telephone is used.

Figure A1.2. Disconnect Device.



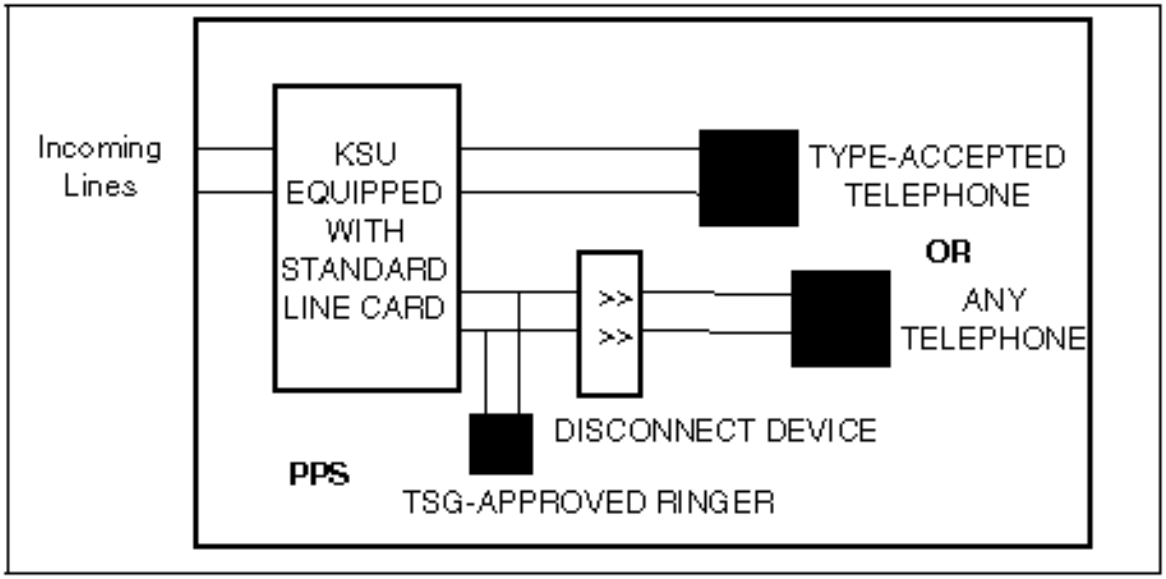
Notes:
1. TSG-approved telephone is not required.
2. TSG-approved ringer is required. TSG Standard 6 will state whether additional ringer protection is required for each particular model of telephone or disconnect.

Figure A1.3. Disconnection/Isolation Using an Automatic Disconnect Line Card in a Key Service Unit.



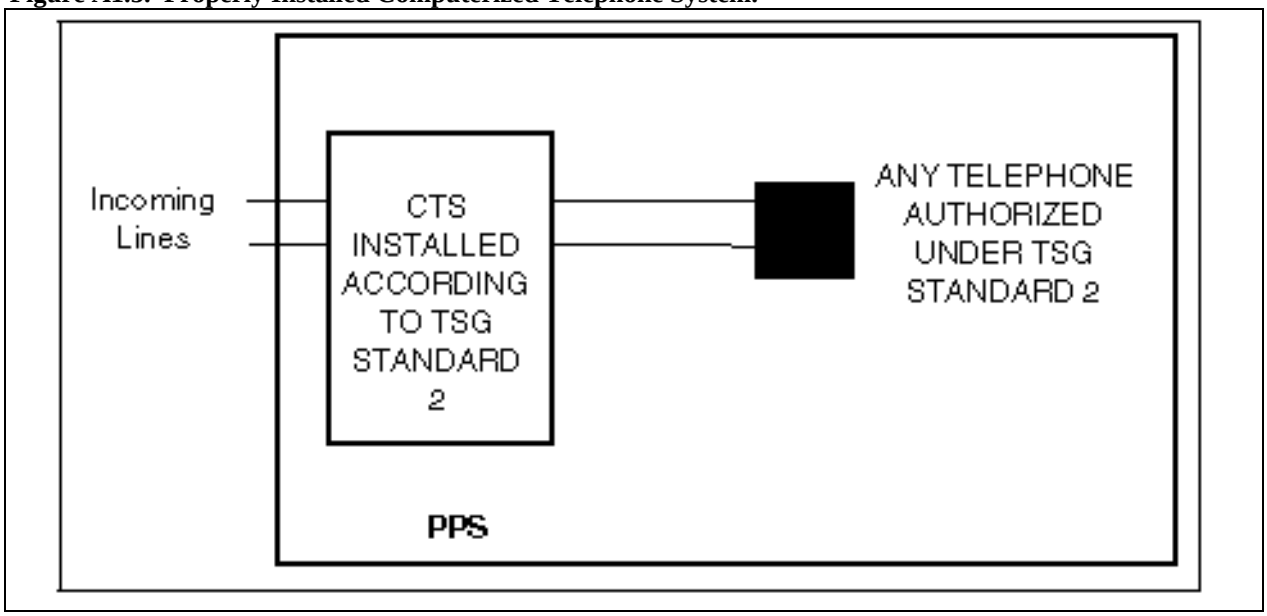
Notes:
TSG-approved telephone not required.
All wiring between the key service unit (KSU) and the telephone must be contained within the PPS.
No additional ringer protection is required because the KSU is equipped with a local ring generator.

Figure A1.4. Telephone Security for a KSU with Standard Line Cards Using a TSG- Approved Telephone.



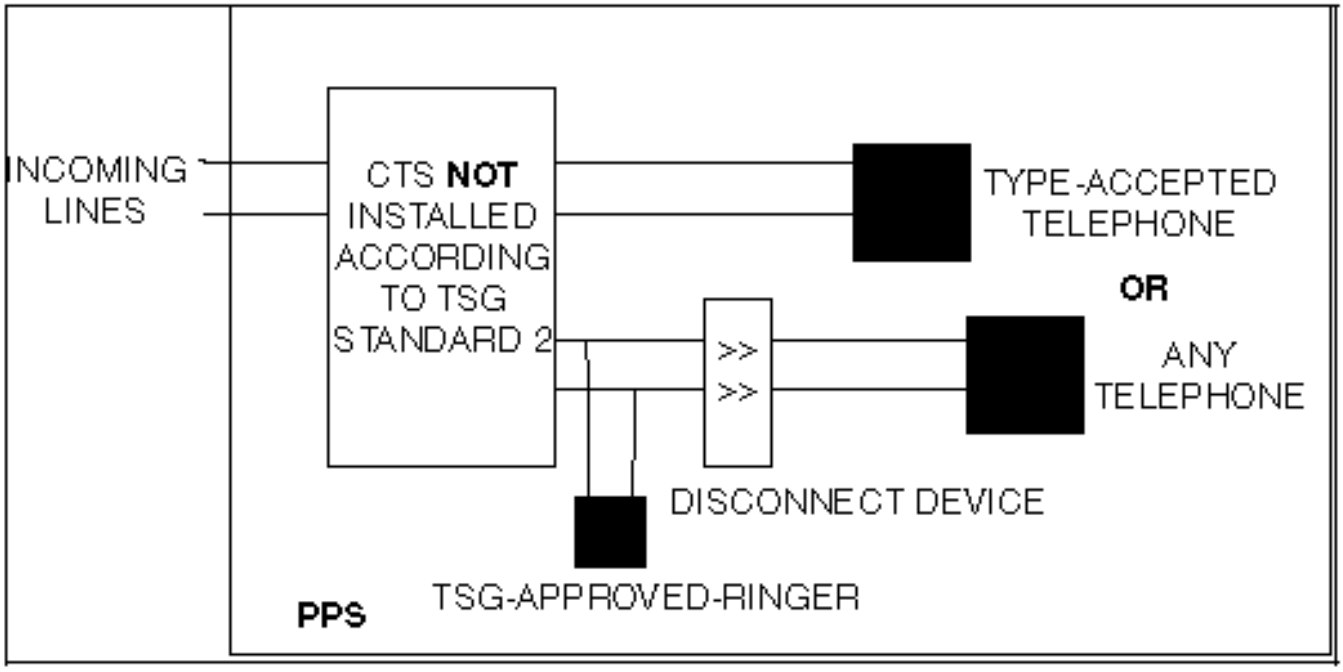
Notes:
Either TSG-approved telephone or disconnect device must be used.
TSG Standard 6 will state whether additional ringer protection is required for that particular model of telephone. Ringer protection is not required if a type-accepted telephone is used. Installing a local ring generator (see Figure A1.3.) with the KSU removes the need for additional ringer protection.

Figure A1.5. Properly Installed Computerized Telephone System.



Notes:
Neither TSG-approved telephone or disconnect device required if requirements of TSG Standard 2 are met. Additional ringer protection is not required

Figure A1.6. Computerized Telephone System Not Installed in Accordance with TSG Standard 2.



Notes:
Either a TSG-approved telephone or a disconnect device must be used.
TSG Standard 6 will state whether additional ringer protection is required for a particular model of telephone. Ringer protection is not required if a type-accepted telephone is used.

GLOSSARY OF TERMS

PRELIMINARY NOTE. The definitions in this glossary are for use with the TSG standards only. They are provided to ensure a precise, unambiguous meaning for terms used to describe TSG requirements. Many of the terms used have no related meaning in any other context. Where terms are involved that are employed by the telephone industry, the usages given are intended to be consistent with most common industry practices. Usage, however, can vary significantly from company to company, and this glossary is not a definitive study of all the ways in which these terms may be used. It is important in using the TSG standards, that these terms not be given any more or any less meaning than is specified here.

ANNUNCIATOR -- A device for producing an audible signal to announce an incoming call.

AUDIBLE SIGNAL -- A sound that is specifically emitted by the telephone to be audible anywhere in its immediate vicinity.

AUXILIARY UNIT -- A device connected to the telephone by means other than the mounting cord or the handset cord.

BUILT-IN MICROPHONE -- A microphone located in the body of the telephone rather than in the handset.

CONVENTIONAL C.O. INTERFACE -- The interconnection standard that is used by telephones (or other terminal equipment) designed and constructed in compliance with Part 68, FCC Rules and Regulations, for connection to the North American public switched telephone network.

CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors used to provide the electrical connections between the two separate, distinct units or component parts.

CRITICAL SUBASSEMBLY -- Any subassembly that is not a focal subassembly, but which contains components essential to the operation of positive security functions.

CTS (COMPUTERIZED TELEPHONE SYSTEM) -- A generic term used to describe any telephone system that uses centralized stored program computer technology to provide switched telephone networking features and services. CTSs are referred to commercially by such terms as computerized private branch exchange (CPBX), private branch exchange (PBX), private automatic branch exchange (PABX), electronic private automatic branch exchange (EPABX), computerized branch exchange (CBX), computerized key telephone systems (CKTS), hybrid key systems, business communications systems, and office communications systems.

CTS ELECTRONIC TELEPHONES -- Telephone sets expressly designed to operate with specific CTSs to obtain the various features and services offered by those CTSs. These telephones are not compatible with normal central office service and cannot be connected directly to standard central office lines.

DISCONNECT -- A device that [1] inserts a break at some point in the normal hard-wire conduction path that exists between a telephone and its telecommunications medium, and [2] only when the telephone is in the in-use state, establishes a temporary metallic connection across that break.

FOCAL SUBASSEMBLY -- Any subassembly that contains transducers or other potentially microphonic components.

HANDS-FREE ANSWERING -- A feature available on some telephones and telephone systems which, when certain types of incoming calls occur, either automatically places the telephone in the in-use state or allows the user, without any manual action, to initiate the in-use state by means of a voice-activated switch

HANDSET -- A combined telephone earpiece (containing a receiver element) and mouthpiece (containing a transmitter element) mounted on a handle.

HANDSET CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors used to provide the electrical connections between the handset and the main body of the telephone.

HANDSET MOUNTING -- The receptacle, bracket, cradle, or other support specifically provided on the main body of the telephone to hold the handset when it is not in use. The HANDSET MOUNTING is fitted with a means to detect whether or not the handset is in place in (or on) the HANDSET MOUNTING.

HAZARD (TELEPHONE SECURITY) -- A TELEPHONE SECURITY HAZARD occurs when the inherent properties of a telephone (or any telephone equipment) installed in a sensitive discussion area, render it capable of producing idle state microphonic signals on unprotected telecommunications media. When a HAZARD exists, audio surveillance of the sensitive discussion area is available from the idle state telephone without any nonstandard modifications to the telephone.

HEADSET -- A combined telephone earpiece (containing a receiver element) and mouthpiece (containing a transmitter element) assembly to be worn on the user's head.

HOOKSWITCH -- The device employed to determine if the handset is or is not in place in (or on) the handset mounting is termed the HOOKSWITCH regardless of how it operates. In some cases the HOOKSWITCH will not involve any sort of mechanical switch and/or break any incoming current loop.

HOUSE CABLING -- The wiring and associated frames that provide the electrical connections between the computer-controlled telephone system and the individual blocks or jacks for each telephone's mounting cord (station mounting cord).

IDLE STATE (VOICE TERMINAL) -- A voice terminal is in the IDLE STATE whenever it is not in the in-use state (see below).

IN-USE STATE (VOICE TERMINAL) -- A voice terminal is in the IN-USE STATE if it is communicating to its network system when a user is either initiating or actively engaged in communications via a temporary switched connection set up by that network system.

ISOLATOR -- A device that [1] inserts a break at some point in the normal hard-wire conduction path that exists between a telephone and its telecommunications medium, and [2] only when the telephone is in the in-use state, provides a temporary communications channel across that break without establishing an end-to-end metallic connection.

KEY TELEPHONE SYSTEM -- A system of telephones and connections to the public switched telephone network (PSTN) or to a private branch exchange (PBX) that provides the telephones with selective access to the PSTN or PBX connections by means of pick-up keys located at or near the telephones.

MANUAL ACTION -- An action that requires that the user touch, move, lift, or otherwise manipulate by hand, some control or part of the telephone. An operation that is actuated by the user's voice does not qualify as a MANUAL ACTION.

MICROPHONE -- Any component among whose intended functions include performing as a transducer to produce an electrical analogue output from an audio-frequency sound pressure waveform input.

MICROPHONIC -- Any component, regardless of its intended functions, that exhibits transducer behavior to produce an electrical analogue output from an audio-frequency sound pressure waveform input is termed MICROPHONIC.

NETWORK SYSTEM -- An assembly of member terminals, control facilities, and intercommunication facilities that can establish and maintain a communications link between any two of the member terminals.

OFF-HOOK (TELEPHONE) -- A telephone in the in-use state.

ON-HOOK AUDIO SECURITY/ON-HOOK TELEPHONE AUDIO SECURITY -- The use of positive measures to protect on-hook telephones against passing room audio is known as ON-HOOK AUDIO SECURITY or ON-HOOK TELEPHONE AUDIO SECURITY.

ON-HOOK (TELEPHONE) -- A telephone in the idle state.

OPERATIONALLY INACTIVE TRANSDUCER -- A telephone has many functional states, e.g., in-use, idle, incoming ring, incoming voice announcement, off-hook, speakerphone, programming, etc. When the specific state of the telephone does not require a particular transducer to perform any action, that transducer is referred to as an OPERATIONALLY INACTIVE TRANSDUCER for the state in question.

PBX (PRIVATE BRANCH EXCHANGE) -- A PBX is a local switched telephone network that is itself a member of the PSTN, and which provides access to the PSTN for its member terminals.

PHYSICALLY PROTECTED SPACE (PPS) -- The space inside one physically protected perimeter. Separated spaces of equal protection may be considered to be part of the same PPS if the communications links between them are provided sufficient physical protection.

PRESSURE RESPONSE LEVEL -- The PRESSURE RESPONSE LEVEL of a microphone is the ratio of voltage output to sound pressure level input.

PSTN (PUBLIC SWITCHED TELEPHONE NETWORK) -- The ordinary dial-up telephone system.

PUSH-TO-OPERATE HANDSET -- There are three forms of PUSH-TO-OPERATE HANDSETS.

[1] A telephone handset equipped with separate push-to-activate momentary-contact switches, one for the transmitter element and one for the receiver element. Either switch when not activated shorts the leads to its respective transducer and completely disconnects the transducer from the mounting cord.

[2] A telephone handset equipped with a single push-to-activate momentary-contact switch. When the switch is not activated, the leads for both the transmitter element and the receiver element are shorted and are disconnected from the mounting cord wires.

[3] A telephone handset equipped with both a single push-to-activate momentary- contact switch and with an isolation amplifier that allows audio signals to travel from the mounting cord to the receiver element, but not from the receiver element to the mounting cord. When the switch is not activated, the leads for the transmitter element are shorted together and are disconnected from the mounting cord wires.

RECEIVER ELEMENT -- The speaker located in the handset or headset earpiece. This transducer converts audio-frequency electrical signals to acoustic signals that are audible when the earpiece is held against the user's ear.

RINGER -- An annunciator that cannot be used for voice calls, announcements, or paging. A RINGER can only produce specific audible signals.

SPEAKER -- Any component among whose intended functions include performing as a transducer to produce a sound pressure analogue output from an input audio-frequency electrical waveform.

SPEAKER-MICROPHONE -- Any component whose intended functions include performing both as a microphone and as a speaker.

SPEAKERPHONE -- A feature that permits a telephone to be used without lifting the handset. A SPEAKERPHONE may be physically incorporated into the telephone set or it may consist of one or more auxiliary units. A usable SPEAKERPHONE contains a microphone or, microphone-amplifier combination, which is sensitive enough to pick up normal conversational speech levels at a distance of several feet and a speaker, or speaker-amplifier combination, which will transduce normal telephone signal levels to sound pressure levels which can be heard at a distance of several feet.

STATION MOUNTING CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors, used to provide the electrical connections between the main body of the telephone and the blocks or jacks that terminate the house cabling.

STATION PORT -- The dedicated circuits in a computerized telephone system (CTS) that are connected via wires in the house cabling to specific blocks or jacks supporting individual telephone sets.

SUBSIDIARY CONDUCTOR -- Refers to focal subassemblies that have been modified to incorporate positive security measures. A SUBSIDIARY CONDUCTOR is any metallic conductor that crosses the boundaries of the modified subassembly specifically to support the positive security measures. The SUBSIDIARY CONDUCTOR was not present in the original subassembly.

TELECOMMUNICATIONS MEDIUM -- A means of transporting electrical information from one communications terminal to another.

TELEPHONE -- A voice terminal that, regardless of whatever other functions it performs, is a member terminal of a telephone network and accomplishes all the incoming and outgoing signaling and voice interfacing necessary for operation in that network.

TELEPHONE NETWORK -- A network system that, regardless of whatever other functions it performs, provides temporary speech communications links between member voice terminals. The essential characteristics of a TELEPHONE NETWORK are: [1] that it recognize when a member terminal is initiating a call (goes off-hook), [2] it identifies the terminal being called (number dialed), [3] it annunciates the incoming call (rings the called terminal), and [4] it maintains a voice grade communications channel between the calling and called terminals only for the duration of the call.

TRANSDUCER -- A component of the telephone that either converts electrical signals to acoustic signals or acoustic signals to electrical signals, including microphones, ringers, speakers, and speaker-microphones.

TRANSMITTER ELEMENT -- The microphone located in the handset or headset mouthpiece. This transducer converts acoustic signals spoken directly into the mouthpiece to analogue audio-frequency electrical signals for transmission to the main body of the telephone.

TSG-APPROVED TELEPHONE -- TSG-approved status is awarded to telephones that have been technically evaluated by the government's Telephone Security Group and determined to meet all applicable on-hook audio security criteria. A TSG-APPROVED TELEPHONE provides all necessary security features as intrinsic properties of the telephone itself.

TYPE-ACCEPTED TELEPHONE -- A TSG-approved telephone model, evaluated by the TSG in response to a formal application by its manufacturer, which has been approved and awarded a TSG type-acceptance number. The TSG telephone type-acceptance program is the primary vehicle for evaluating commercial telephones for TSG approval. TSG issued type-acceptance standards specify the on-hook security design, construction, and performance characteristics required for various genres of telephones and type-acceptance classes.

UNCONTROLLED/UNPROTECTED LINE; UNCONTROLLED/UNPROTECTED TELECOMMUNICATIONS MEDIUM -- A telecommunications medium, such as a telephone wireline, which is not provided continuous positive, physical protection against unauthorized, clandestine intercept of the information it is being used to convey.

VOICE TERMINAL -- A generic term used to describe any device which, regardless of whatever other functions it performs, provides an intentional transmit and/or receive interface between a human talker/listener and an electric or electronic communications system. All VOICE TERMINALS contain transducers; a microphone is necessary if there is a transmit function and a speaker if there is a receive function. Telephones, speaker-phones, and intercom sets are common examples of VOICE TERMINALS.

APPENDIX
LIST OF THE TSG STANDARDS

TSG standards are available to all members of the United States Intelligence Community from their respective cognizant security authority (CSA). Individual standards may be released to nongovernment personnel who need them to accomplish work required by the US Government. Any such release is to be accomplished by a letter identifying the standard as an official government document, which may not be disseminated further without specific approval of the issuing agency.

Standard 1: Introduction to Telephone Security

- Provides telephone security background and TSG-approved options for telephone installations in US Government sensitive discussion areas.

- For all personnel concerned with telephone security.

Standard 2: TSG Guidelines for Computerized Telephone Systems

- Establishes requirements for planning, installing, maintaining, and managing a CTS.

- For personnel involved in writing contracts, planning, installing, maintaining, inspecting, and system administration.

Standard 3: TSG Type-Acceptance Program for Telephones Used With the Conventional Central Office Interface

- Identifies a program that outlines specifications for design and manufacture and procedures required for type-acceptance.

- For personnel involved in writing contracts, manufacturing, and inspecting.

Standard 4: TSG Type-Acceptance Program for Electronic Telephones Used in Computerized Telephone Systems

- Identifies a program that outlines specifications for design and manufacture and procedures required for type-acceptance.

- For personnel involved in writing contracts, manufacturing, and inspecting.

Standard 5: On-Hook Telephone Audio Security Performance Specifications

- Specifies the amount of audio leakage allowed in the on-hook condition of telephones without disconnects.

- For personnel involved in writing contracts, manufacturing, and inspecting telephones such as STU-IIIs.

Standard 6: Telephone Security-Group Approved Equipment

- Lists TSG-approved equipment.

- For all personnel concerned with procurement and use of TSG-approved equipment.

TSG GUIDELINES FOR COMPUTERIZED TELEPHONE SYSTEMS

TSG STANDARD 2

March 1990

PREFACE

This standard was prepared by the Telephone Security Group (TSG). The charter members of the TSG are: Department of the Air Force, Department of the Army, Central Intelligence Agency, Defense Intelligence Agency, Department of Energy, Federal Bureau of Investigation, Department of the Navy, National Security Agency, US Secret Service, and Department of State.

The TSG is the primary technical and policy resource in the US Intelligence Community for all aspects of the technical surveillance countermeasures (TSCM) program involving telephone systems. The TSG standards contain guidance for providing on-hook security to telephone systems in areas where sensitive government information is discussed. Implementation of TSG standards neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as TEMPEST, COMSEC, or OPSEC.

TSG GUIDELINES FOR COMPUTERIZED TELEPHONE SYSTEMS

A2.1. Purpose. This standard establishes requirements for planning, installing, maintaining, and managing a computerized telephone system (CTS). The requirements established in this standard are necessary in order to achieve on-hook audio security for computerized telephones located in sensitive discussion areas. For a CTS conforming to this standard, all protected *on-hook* telephones will be completely isolated from all transmission media and wires that are physically unprotected. This standard requires that the isolation for most telephones be achieved in the CTS itself.

A2.2. Background Information. TSG Standard 1 provides background information on telephone security and explains some of the principles underlying the requirements set in this standard.

A2.3. Applicability. This standard applies only to systems in which the CTS hardware, system wiring, and stations requiring isolation are located within a physically protected space (PPS). Stations outside the PPS cannot be isolated from the respective unprotected lines by the CTS. If on-hook audio security is required, telephones outside the PPS must either be type-accepted under TSG Standard 3 or 4 or must be protected by an approved isolator or disconnect device on conformance with TSG Standard 6.

A2.4. Definitions. A glossary of terms is provided for this standard. In some instances, the precise meaning of a technical term used in this standard may be at variance with its general use in industry. In those instances, the term will appear in the glossary with an exact definition of the intent with which it is used in this standard. It is important that the technical terms included in the glossary be understood to have only the specific meanings shown for them. Some additional terms not appearing in this glossary are defined in TSG Standard 1.

A2.5. Minimum System Requirements.

A2.5.1. Physical Security Requirements.

A2.5.1.1. A PPS must be established to provide positive physical protection for the CTS and all of its parts. This includes all stations, cables, lines, intermediate wiring frames, and distributed CTS modules necessary for the functioning of the stations.

A2.5.1.2. Only the equipment or wiring *not* intended to be isolated by the CTS can be located outside the PPS.

A2.5.1.3. All program media such as tapes or disks must be provided positive physical protection to prevent unauthorized alterations.

A2.5.1.4. An up-to-date master copy of the program must be maintained for confirmation and/or reloading of the operating program. This master copy must be verifiable as having been protected against unauthorized alteration. It must be kept in a physically protected storage container, separate from all other program media.

A2.5.2. System Configuration Requirements. The system equipment and physical layout must isolate protected stations from all wires and transmission media leaving the PPS. All system wiring interconnections will be organized on wiring frames in accordance with the following paragraphs. The wiring frames will be situated to facilitate their electrical testing and visual inspection.

A2.5.2.1. A means must be provided to electrically inspect all transmission paths leaving the PPS for the presence of audio.

A2.5.2.2. A set of external frames must be installed in the PPS to support CTS connections to the outside.

A2.5.2.2.1. The *first external frame* must be used to connect active trucks to the CTS. This may be in the form of a conventional telephone connecting block that allows inspection for unauthorized or concealed cross-connects to other frames.

A2.5.2.2.2. The *second external frame* must terminate all wiring leaving the PPS. The termination point of incoming central office trunks, referred to as a demarcation point, normally incorporates USOCRJ21X connecting blocks. The demarcation point must lie outside the second external frame. There can be additional frames, as necessary, between the demarcation pint and the second external frame.

A2.5.2.2.3. Cabling from the CTS to stations *located outside* the PPS will terminate on an *external service frame*. This frame will cross-connect to the second external frame for distribution outside the PPS. If non-CTS services inside the PPS require wiring connections outside the PPS, this wiring will also terminate at the external service frame and be cross-connected to the second external frame.

A2.5.2.2.4. Cross-connects between the external frames will be by separate single pair wires. No extra cross-connects will be permitted beyond the minimum number required to provide needed service.

A2.5.2.2.5. External frames will be physically separated by at least six inches from each other and by one foot from any other wiring frames or objects to allow visual inspection. Cross-connects between frames should be dressed neatly so that individual pairs can be visually traced from frame to frame.
A2.5.2.3. Internal frames will be used to terminate all connections from the CTS to PPS equipment and stations. There must never be any cross-connects between internal and external frames (see figure on page 91).
A2.5.2.4. Cable from internal and external frames must not be terminated in the same card rack. No two card racks may share common cabling to the wiring frames.
A2.5.2.5. Subscriber stations of the CTS and trunk lines must be wired only to CTS port circuits. The signal isolation between noncommunicating port circuits must exceed 70 dB. Audio coupling between port circuits is permitted only when their associated stations or trunks are *off-hook*. Coupling between a port circuit and a CTS distribution or multiplex bus is permitted only when the associated station or trunk is *off-hook*.
A2.5.2.6. Stations inside the PPS will not share CTS port circuits with stations outside the PPS. Stations inside the PPS will not have the same directory number as any station outside the PPS.
A2.5.2.7. When CTS programming is stored electronically inside the CTS, for CTSs in which removable programming media are *not* used, the system must be capable of generating a complete memory listing for comparison with the master program copy.

A2.5.3. CTS Operations Characteristics. Some CTSs offer operational features that are not consistent with good audio security practice. Such features may cause the CTS to execute electronic functions that are expressly prohibited. In general, prohibited functions can compromise the isolation that must be provided by the CTS under this standard. When an operational feature of the CTS uses a prohibited function, the feature must be positively disabled in hardware. The following paragraphs define both required and prohibited characteristics of a CTS.
A2.5.3.1. The *off-hook* condition of a subscriber station must be initiated by the user at the station. However, the CTS can place the station on-hook.
A2.5.3.1.1. The CTS, by itself, can never place a station *off-hook*. A person operating the CTS, or with access to CTS software, can never initiate any action that will take a station *off-hook*. The CTS cannot hold a station *off-hook* when a user places the station *on-hook*.
A2.5.3.1.2. The *on-hook* condition of a subscriber station absolutely must be under the control of the user. The ability of a user to place a station set *on-hook* must never be dependent on the rest of the system or on any system response or any other activity in the system. In addition to a station user, the CTS can place a station *on-hook*.

The *on-hook* condition of any station must not be dependent on CTS programming.

The *on-hook* condition cannot be canceled by the CTS, nor by anyone with access to the station mounting cord wiring.
A2.5.3.1.3. The transition from *off-hook* to *on-hook* may be directed by the user or by the CTS. If directed by the user, it may not be inhibited by the CTS. The transition from *on-hook* to *off-hook* can be directed only by the user, but there is no prohibition against necessary supporting action by the CTS.
A2.5.3.1.4. A station may not be used if any internal microphonic element can be electrically connected to, or caused to transmit audio to, the mounting cord when it is *on-hook*.
A2.5.3.2. Incoming calls to subscriber stations will always require manual answering. Annunciation is the only response a station is permitted to make to an incoming call. The following features of some of subscriber equipment are *prohibited*:
A2.5.3.2.1. Voice-activated call answering.
A2.5.3.2.2. Automatic call answering by any means, including telephones answering machines or ADP terminals.
A2.5.3.2.3. "Hands-free" answering.
A2.5.3.3. Any feature allowing remote or trunk line access to CTS services must be disabled. CTS services should be accessible only from subscriber stations or equipment.
A2.5.3.4. Remote diagnostic, maintenance, or programming functions are prohibited except as specified in paragraph 4c.

A2.5.4. Management of the Computerized Telephone System. As part of the ongoing management of the CTS, assurance is needed that the system will never be changed in a manner that could compromise its built-in security measures. Accordingly, some administrative procedures governing the management of the CTS are suggested in the following paragraphs. Elements of these procedures include:

- Physical security.
- Personnel security.
- Management of system configuration, hardware, software, and layout.
- Appropriate technical security countermeasures.

A2.5.4.1. Access to station equipment, CTS components, wiring, and distribution frames within the PPS must be limited to personnel with appropriate security clearances. Uncleared maintenance and installation personnel may be used only if closely escorted by *cleared, technically competent* escorts who can ensure the system's security integrity.
A2.5.4.2. The system software should be modified only from established maintenance stations located inside the PPS. Positive barriers must be established to prevent software modifications from originating anywhere else. Routine remote maintenance or diagnostics may be conducted only from cleared remote diagnostic support (RDS) facilities over a secure communication links, except as specified in paragraphs 4c and 4d.
A2.5.4.3. In an isolated instance, if a remote maintenance procedure over an unsecured communication link is necessary, it may be provided by an uncleared RDS facility with the following restrictions:
A2.5.4.3.1. The RDS facility must not be able to access the CTS except through a port dedicated to infrequent RDS activity.
A2.5.4.3.2. Unless in use, the RDS port must remain disconnected from all trunks and lines leaving the PPS. If ancillary equipment such as modems or telephones are necessary for connection, they must be completely disconnected when not in use.
A2.5.4.3.3. Connection between the RDS port and the RDS facility must be established only by a call to the RDS facility that is initiated from a designated station inside the PPS.
A2.5.4.4. Specific personnel must be designated to ensure the security of the RDS services. They must ensure all of the following for each RDS operation:
A2.5.4.4.1. Verify the immediate need for RDS.
A2.5.4.4.2. Telephone the RDS facility and verify that the support activity can begin and the facility is ready to transmit.
A2.5.4.4.3. Make the necessary connections between the RDS port, ancillary equipment, and outgoing trunks or lines.
A2.5.4.4.4. Dial the RDS facility to establish the RDS port connection, and verify with the facility that the connection was established.
A2.5.4.4.5. If the capability exists, monitor in real time (with hardcopy printout) all communications between the RDS facility and the CTS. Terminate the session immediately if any improper activity is noted.
A2.5.4.4.6. If real-time monitoring is not available, or not in an immediately comprehensible form, the following procedure must be accomplished as soon as RDS is terminated: reload the system from the safeguarded master program copy. If the program medium is nonremoveable, read the complete memory listing and compare it to the safeguarded master copy. This may cause interruption of CTS service on some systems. If the RDS service cannot be scheduled to make such interruption operationally and administratively acceptable, the system must permit real-time monitoring.
A2.5.4.4.7. When RDS service is terminated, disconnect all connections needed for the RDS service.
A2.5.4.5. System software or hardware may be changed only by designed appropriately cleared individuals. Only these individuals are permitted physical access to the programming stations.
A2.5.4.6. The integrity of the protective measures must be ensured by countermeasures inspections.
A2.5.4.7. The operating program must frequently be reloaded from the protected master copy to ensure that no unauthorized changes have occurred. A log will be maintained that will indicate the person performing the action and the date and time which the loading was accomplished.
A2.5.4.8. Complete copies of all system documentation are to be kept with the CTS in the PPS. This documentation should include instructions, manuals, service practices, system configurations records, maintenance records, etc.
A2.5.4.9. Dial access or barrier codes are *not* adequate for denying unauthorized access to any CTS feature or control operation; they are unacceptable for this purpose.

A2.6. Additional Security Considerations.
A2.6.1. Security Enhancements. The following measures will help maximize the overall security of the CTS but are not expressly required to achieve *on-hook* audio security.
A2.6.1.1. Positive barriers should be placed into the system to prevent access to features that would allow monitoring of station off-hook audio from outside the PPS. Examples include line or trunk verification, executive override, etc.
A2.6.1.2. Central dictation features should be disabled.
A2.6.1.3. Central loudspeaker paging features should *not* be activated.
A2.6.1.4. All operator consoles should be located within the PPS.

A2.6.1.5. The number of central answering positions should be minimized.
A2.6.1.6. Except for operator consoles, all stations should be single-line, 2500-type instruments.
A2.6.1.7. The call detail recording information to support switching and auxiliary features should be maintained by the CTS only temporarily, unless positive barriers exist to prevent access to this information from outside the PPS.
A2.6.1.8. The CTS should not maintain speed calling lists.
A2.6.1.9. The CTS and all critical station equipment should be powered by uninterruptable power supplies.
A2.6.1.10. The CTS should curtail service for facilities outside the PPS when required to provide priority service for internal communications.
A2.6.1.11. All switching, maintenance, or operational conditions set up from a subscriber station should be capable of being selectively canceled at an operator console inside the PPS.

GLOSSARY

CALL DETAIL RECORDING (CDR) -- A record maintained by the computerized telephone system (CTS), or auxiliary equipment, of specified types of calls. Typically, a CDR system will record the CTS identity, date, time, duration of call, called number, and trunk group type. Also called Station Message Detail Recording (SMDR).

CARD RACK -- A circuit card rack, card subrack, card cage, or shelf that is a mounting for computerized telephone system circuit cards. The card rack has edge connectors to receive the circuit cards and is equipped with all the wiring and hardware needed to house and interconnect the system circuit assemblies.

COMMON CONTROL CABINET -- A cabinet that contains equipment supporting more than one subnetwork of a CTS. See also: Module.

CTS (COMPUTERIZED TELEPHONE SYSTEM) -- A generic term used to describe any telephone system that uses centralized stored program computer technology to provide switched telephone networking features and services. CTSs are referred to commercially by such terms as computerized private branch exchange (CPBX), private branch exchange (PBX), private automatic branch exchange (PABX), electronic private automatic branch exchange (EPABX), computerized branch exchange (CBX), computerized key telephone system (CKTS), hybrid key systems, business communications systems, and office communications systems.

DISCONNECT -- A device that (1) inserts a break at some point in the normal hardwire conduction path that exists between a telephone and its telecommunications medium, and (2) only when the telephone is in the in-use state, establishes a temporary metallic connection across that break.

EXTERNAL FRAME -- A wiring frame used to support wiring leaving the physically protected space (PPS).

EXTERNAL SERVICE FRAME -- An intermediate frame used to terminate the computerized telephone system (CTS) cabling for stations located outside the physically protected space (PPS) and to terminate wiring associated with non-CTS services leaving the PPS.

FRAME (OR WIRING FRAME OR CROSS-CONNECT FRAME) -- A clearly defined point of interconnection between physically separated components of the system. Wiring frames consist of an array of terminal blocks serving to organize the system interconnections that are typically unique to an individual installation. For example, connections between the central office trunks and the computerized telephone system (CTS) switching network, or between telephone sets and the CTS switching network. The types of terminal blocks used are usually some variation of the common 66-type blocks. See also: External Frames, External Service Frames, and Internal Frames.

HANDS-FREE ANSWERING -- A feature available on some telephones and telephone systems that, when certain types of incoming calls occur, either automatically places the telephone in the in-use state or allows the user, without any manual action, to initiate the in-use state by means of a voice-activated switch.

INTERNAL FRAME -- A wiring frame used to support wiring to computerized telephone system equipment and stations inside the physically protected space (PPS).

ISOLATOR -- A device or assembly of devices that has been accepted by TSG as a means to isolate a computerized telephone system or on-hook station from wires that exit the physically protected space (PPS). An isolator never establishes a metallic electrical path between the protected equipment and any external wiring.

LINE -- The wires or other transmission media that connect the station equipment to the computerized telephone system. The uncontrolled communication circuits of the commercial network.

MICROPHONIC -- Any component, regardless of its intended functions, that exhibits transducer behavior to produce an electrical analogue output from an audio-frequency sound pressure waveform input is termed microphonic.

MODULE -- The cabinet or cabinets that contain the complete switching equipment for a subnetwork of the computerized telephone system (CTS). Some CTSs divide the internal telephone network into separate subnetworks organized around switching node points. Calls between subnetworks are carried by intermodule links or through a switching node hierarchy. Control of the subnetworks may be accomplished by processors resident in the modules or from a central, common control processor. Any cabinet that contains equipment in support of more than one subnetwork is designated a common control cabinet and not a module cabinet.

NETWORK, SUBNETWORK -- A system of individual stations arranged that any station can communicate with any other station (subject to service constraints imposed on it that are not inherent to the system) by means of temporary connections at central switching nodes.

OFF-HOOK -- A station or trunk is off-hook when it initiates or engages in communications with the computerized telephone system (CTS) or with another station or trunk using a link established through the CTS.

ON-HOOK -- A station or trunk is on-hook when it is not being actively used in communications via the computerized telephone system(CTS).

PORT CIRCUIT -- An input/output interface circuit in the computerized telephone system (CTS) that connects the CTS to the communications link or a station or trunk.

PHYSICALLY PROTECTED SPACE (PPS) -- A space inside one physically protected perimeter. Separate areas of equal protection may be considered part of the same PPS if the communications links between them are provided sufficient physical protection.

PSTN (PUBLIC SWITCHED TELEPHONE NETWORK) -- The ordinary dial-up telephone system.

REMOTE ACCESS TO CTS SERVICES -- A computerized telephone system (CTS) feature that allows incoming callers to access the CTS as if they were calling from a CTS station.

REMOTE DIAGNOSTICS SUPPORT (RDS) -- Off-premises diagnostic, maintenance, and programming functions performed on the computerized telephone system (CTS) via external network trunk connections. There is no universal term in use throughout the telephone industry to designate this feature. Manufacturers refer to it by various descriptive names (such as RMATS and INADS) which are unique to particular systems.

STATION MESSAGE DETAIL RECORDING (SMDR) -- Same as Call Detail Recording.

STATION MOUNTING CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors; used to provide the electrical connections between the main body of the telephone and the blocks or jacks that terminate the house cabling.

STATION, STATION EQUIPMENT, STATION SET, SUBSCRIBER STATION -- Any telephone, voice terminal console, data terminal, or other component of the network that is connected to a communications port of the computerized telephone system (CTS) and is used to communicate with another station or trunk by means of a temporary connection switched by the CTS.

TRUNK -- Any connection from an external network to a communications port of the computerized telephone system (CTS) that can be accessed by station equipment via the CTS switched network. Central office access to the public switched network, private lines, tie lines to another CTS, etc., are examples of trunks.

TYPE-ACCEPTED TELEPHONE -- Any telephone, specified by manufacturer and model number, that has been evaluated and approved by the TSG and given a TSG type-acceptance number. Type-accepted telephones incorporate features of design and construction that conform to the criteria stipulated in TSG Standards 3 or 4.

UNCONTROLLED/UNPROTECTED LINE; UNCONTROLLED/UNPROTECTED TELECOMMUNICATIONS MEDIUM -- A telecommunications medium, such as a telephone wireline, that is not provided continuous positive protection against unauthorized, clandestine intercept of the information it is being used to convey.

VOICE TERMINAL -- A station or station set that carries voice telecommunication when in operational use.

TYPE-ACCEPTANCE PROGRAM FOR TELEPHONES USED WITH THE CONVENTIONAL CENTRAL OFFICE INTERFACE

TSG STANDARD 3

March 1990

PREFACE

This standard was prepared by the Telephone Security Group (TSG). The charter members of the TSG are: Department of the Air Force, Department of the Army, Central Intelligence Agency, Defense Intelligence Agency, Department of Energy, Federal Bureau of Investigation, Department of the Navy, National Security Agency, US Secret Service, and Department of State.

The TSG is the primary technical and policy resource in the US Intelligence Community for all aspects of the technical surveillance countermeasures (TSCM) program involving telephone systems. The TSG standards contain guidance for providing on-hook security to telephone systems in areas where sensitive government information is discussed. Implementation of TSG standards neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as TEMPEST, COMSEC, or OPSEC.

TSG Standard 1 is an introduction to telephone security that provides general information about the TSG standards.

PART I

INTRODUCTION

A3.1.1. Purpose. TSG Standard 3 specifies the design and construction criteria, the application procedures, the manufacturer's testing requirements, and the documentation necessary for TSG type-acceptance of telephones compatible with the conventional central office interface.

A3.1.2. Application. TSG Standard 3 may be referenced or included in US Government-sponsored procurement specifications to define TSG type-accepted telephones. This standard may be made available to telephone manufacturers who are responding to US Government requirements for TSG type-accepted telephones.

A3.1.3. Definitions. Words and terms that are defined in the glossary for Standard 3 are printed in italics. The definitions in this glossary are for use with this standard only. They are provided to ensure a precise, unambiguous meaning for terms used to describe TSG requirements. Many of the terms used have no related meaning in any other context. Where terms are involved that are employed by the telephone industry, the usages given are intended to be consistent with most common industry practices. Usage, however, can vary significantly from company to company, and this glossary is not a definitive study of all the ways in which these terms may be used. It is important in using TSG Standard 3 that these terms not be given any more or any less meaning than is specified here.

A3.1.4 TSG Type-Acceptance Program.

A3.1.4.1. The TSG maintains a program for the specification, evaluation, and type-acceptance of telephones that incorporate the design and construction characteristics necessary for them to be considered free from intrinsic vulnerabilities. The type-accepted telephone concept is a viable and important approach for verifiable telephone security that has long been employed by the US Government. It is the intent of this program that when a telephone model has been TSG type-accepted, every telephone marketed as this TSG type-accepted model will, by virtue of its design and construction, incorporate all the essential properties that protect against its passing on-hook audio.

A3.1.4.2. This TSG standard specifies the design and construction criteria for TSG type-accepted telephones that are compatible with the traditional nonproprietary central office interface. A fundamental requirement of the basic TSG type-accepted telephone defined by this standard is that all external wirelines entering the telephone are disconnected from all internal circuitry (except the annunciator) when the telephone is in the idle state. Many proprietary computerized telephone system (CTS) electronic telephones, even when they are in the idle state, need power continuously from the CTS and/or to exchange information with it on a regular basis. These telephones, therefore, cannot support the requirement for total physical disconnect from the external wirelines. TSG Standard 4 addresses these telephones.

A3.1.4.3. In order that maximum flexibility is provided to produce the most economical, fully effective security program for every individual application, TSG has developed a system of multiple categories of type-accepted telephones. A set of specific type-acceptance criteria is used to determine qualification for each type-acceptance class. The specifications provided in this standard assign the qualification criteria for each of several security classes that are applied to type-accepted conventional central office interface telephones. All conventional central office interface type-acceptance classes are designated by the letter X followed by a number that indicates the specific security level; Class X1 has the highest security. Increasing numerical values indicate decreasing security level.

A3.1.4.4. The following elements of the TSG telephone type-acceptance program are essential.

A3.1.4.4.1. The design and construction specifications that describe the conditions under which telephones are considered to be:

Physically incapable (by reason of design and construction) of producing microphonic audio on any wires leaving the instrument while it is in the idle state.

Capable of being individually subjected to routine on-site physical and electrical inspections that will adequately and expeditiously determine if the protective measures remain effective and if any intrusive audio surveillance modifications have been installed.

A3.1.4.4.2. The standardized evaluation and qualification conditions that are used to determine each type-acceptance class.

A3.1.4.4.3. The requirements for documentation and sureties to be provided to a member agency of the TSG. These must properly demonstrate and guarantee that a particular model telephone conforms to all required criteria. Any telephone model, whose design and construction is shown by adequate documentation, backed by the necessary surety,

to conform to the required criteria, will be type-accepted by the TSG and approved for installation and use without any requirement for additional isolation or disconnect measures.
A3.1.4.4.4. The type-acceptance application process.
A3.1.4.4.5. Limited requirements on product stability. These are applied, for the most part, only to those components of the type-accepted telephone that are used to implement mandatory security features. The manufacturer is largely free to change all nonrelated areas without affecting its type-acceptance status.
A3.1.4.4.6. Labeling requirements for type-accepted telephones.
A3.1.4.4.7. Guidelines for use by participating agencies of the United States Government to enable them to identify and select telephones suitable for use in sensitive discussion areas.
A3.1.4.5. It is expected that many commercial instruments now being marketed will qualify for type-acceptance at the minimum security level with little or no need for special modifications at additional cost. Most telephone installations by the member agencies of TSG, however, will require more than the minimum level of security. Compliance with specific criteria concerning security methodology can produce eligibility for the higher security classifications.
A3.1.4.6. While it is not expected that many telephones now being commercially produced will inherently meet the criteria for the higher classifications, the great majority of models currently on the market can probably be economically modified (in production quantities) to do so. The production of economical type-accepted telephones in the higher security classes is expected to result in the closing of a large portion of the government telephone market to all products that do not have this status. It is anticipated that a significant number of manufacturers will recognize that it is to their commercial advantage to produce modified versions of their various telephone models that will qualify for high-classification type-acceptance.
A3.1.4.7. The TSG type-acceptance program is mutually beneficial to the government and to the telephone industry. The TSG design and construction criteria for type-acceptance are provided both to government agencies and to qualified members of the industry. The identification of the type-accepted telephone models allows government agencies (who are concerned about on-hook telephone security) to exclude from consideration for procurement all telephones not acceptable; the TSG type-acceptance requirements may be included as part of the telephone procurement specifications. Manufacturers who wish to compete in this market can readily determine if their products are acceptable and, if not, what modifications are necessary to make them acceptable. Also, the type-acceptance procedure clearly defines what portions of the telephone can be subsequently altered by the manufacturer without affecting its type-accepted status. Changes of this sort can be made at the discretion of the manufacturer without involvement of the government.
A3.1.4.8. The numerical type-acceptance classes rate the telephones on the basis of idle-state security only. The security of many installations, however, also depends on the characteristics of the telephones when they are in the in-use state. Manufacturers may wish to indicate special in-use state qualities of their products to communicate special suitability for those situations. A system of optional alphabetical suffixes may be appended to the type-acceptance class number to indicate the following:

A3.1.4.8.1. Suffix A. The handset requires a push-to-talk operation for the transmitter element and either a push-to-listen operation or an isolation amplifier for the receiver element. Only handset operation is available with this unit; any other functions that employ microphonic activity (such as headset, hands-free answering units, speakerphones, or speaker-microphones) are not possible. Except for the handset transmitter element, the telephone contains no microphones.

A3.1.4.8.2. Suffix B. Only handset operation is available with this unit; any other functions that employ microphonic activity (such as headset, hands-free answering units, speakerphones, or speaker-microphones) are not possible. Except for the handset transmitter element, the telephone contains no microphones.

A3.1.4.8.3. Suffix C. Either handset or headset operation is available with this unit; any other functions that employ microphonic activity (such as hands-free answering units, speakerphones, or speaker-microphones) are not possible. Except for the handset or headset transmitter element, the telephone contains no microphones.

PART 2

PROCEDURE FOR OBTAINING AND MAINTAINING TSG TYPE-ACCEPTANCE

A3.2.1. Type-acceptance procedures cannot be applied effectively to any telephone without the full cooperation of the manufacturer. The type-acceptance concept involves the manufacturer on a continuing basis, to include but not be limited to the following:
A3.2.1.1. Design of the original telephone.
A3.2.1.2. Design of modifications, if necessary, to comply with the type-acceptance requirements.
A3.2.1.3. Testing the candidate telephone to establish it does perform in accordance with the type-acceptance criteria.
A3.2.1.4. Documentation of all claims relating to the type-acceptance requirements.
A3.2.1.5. Technical information to support the development of field inspection procedures.
A3.2.1.6. Continued production of the type-accepted version in support of systems purchased by the government or by a government contractor.
A3.2.2. When a manufacturer applies for and receives type-acceptance, it is for the specific configuration described in the application documentation. TSG assigns a type-acceptance number to this configuration. This number cannot be used on any alternative configuration that involves a change in any portion of the telephone that has been designated a critical subassembly for the type-acceptance class in question. The type-acceptance may be revoked at any time it becomes apparent that the telephone is not providing adequate idle-state audio security.

A3.2.3. Initial Contact
A3.2.3.1. A manufacturer responding to a specific procurement requirement (whether a direct request or a public announcement) of an agency of the US Government submits the application for type-acceptance to that agency.
A3.2.3.2. A manufacturer wishing to obtain type-acceptance to gain entry into the portion of the government market affected by the type-acceptance program can apply to any TSG participating agency.

A3.2.4. Procedure
A3.2.4.1. **Ascertain the type-acceptance class(es) required**, if appropriate.
A3.2.4.2. **Evaluate the proposed products** to determine the degree of compliance with the criteria for the class intended.
A3.2.4.3. **Develop and implement any modifications** necessary to meet the requisite criteria. Documentation of the proposed modifications may be submitted to the agency in question for preliminary evaluation before actual implementation. Preliminary approval of the approach, based on the documentation submitted, means only that no obvious deficiencies are in evidence. Actual type-acceptance requires that the modified telephone be fully tested in accordance with the requirements for the type-acceptance class in question. There is no assurance that an approach that has received preliminary approval will pass these tests.
A3.2.4.4. **Perform all required tests** on an actual modified telephone which is exactly like the production unit.
A3.2.4.5. **Submit the following documentation** to the agency performing the type-acceptance evaluation. Documents identified as containing proprietary information will be used to evaluate and confirm the necessary conditions only. All proprietary information will be treated with strict confidentiality. The format used here to list the required documentation is for convenience in presentation and to facilitate application. The manufacturer is encouraged to use existing manuals, drawings, brochures, or other publications that may be available. It is not necessary to extract and repeat specific information in order to meet the documentation requirements in each of the categories listed below. It will be sufficient to state where the information can be found in the publications provided.
A3.2.4.5.1. **Letter of application**, signed by an authorized company official, containing the following:

Identification of product - manufacturer, product line, and models involved. Include whatever additional descriptive information is necessary to eliminate all possibility of ambiguity or confusion with any other product.

The class number for which application is being made.

Certification that the product meets the criteria for that class, and that it may be opened for visual and electrical inspection (to verify that it conforms to all type-acceptance criteria) at any time without invalidating the normal product warranties.

Point of contact for inquiries - name, title, address, telephone number.

A3.2.4.5.2. **Summary of product offering**, including manufacturer's sales and/or technical literature for the product.
A3.2.4.5.3. **Summary of test results**, explaining basis for asserting that the proposed telephone meets the appropriate type-acceptance criteria.
A3.2.4.5.4. **Functional description**, containing the following:

Operation of telephone.
Appearance.
Installation requirements.
Operations manual.
Identification of all systems with which the telephone is compatible.
Features, options, and auxiliary units available with the version being evaluated. Options available on the standard commercial model may, at the manufacturer's discretion, be excluded from the version being submitted for type-acceptance.

A3.2.4.5.5. **Electrical description**, containing the following:

Complete theory of operation, including descriptions of the lineswitch and the interface connection.
Block diagrams, including complete descriptions of signals between functional blocks.
Schematic diagrams and circuit descriptions.
Component listing.
Installation/maintenance manual.

A3.2.4.5.6. **Detailed security evaluation** - must include all features, options, and auxiliary units included in paragraph A3.2.4.5.4. All applicable criteria are applied to the basic telephone and to the composite formed when the auxiliary units are attached and operational.

Provide component layout diagrams, including location and function of test points.

Provide circuit descriptions and diagrams of all audio circuits, focal subassemblies, and critical subassemblies.

Identify all components (manufacturer and model number) added to implement positive security measures.

Document all software/firmware involved in the implementation of the positive security measures.

Cite each applicable type-acceptance criterion by its paragraph number in part 3 of this standard (the paragraph numbers themselves indicate if the criterion being addressed is in the annex specific to the class for which application is being made). Show how the proposed telephone complies with the criterion.

A3.2.4.5.7. **Laboratory test report**, containing the following:

Abstract.
Objectives of tests.
List of test equipment used.
Test equipment configuration used for each test.
Test data and conclusions.

A3.2.4.5.8. **Support documentation for field tests and inspections** - to be distributed to field inspection teams for use during on-site testing. The information provided for this purpose should be nonproprietary.

Component layout diagrams, including location and function of test points.
Instructions for assembly and disassembly of the telephone.
Photographs showing the appearance of all circuit boards and assemblies.

A3.2.4.5.9. **Supplementary information** requested by the government in order to complete the evaluation of the application.

A3.2.5. Marketing of Type-Accepted Telephones.

A3.2.5.1. Telephones being marketed to agencies or departments of the US Government as TSG type-accepted telephones must be permanently marked to show the TSG type-acceptance number and either a serial number or the month and year of manufacture.

A3.2.5.2. Regardless of the agency to which the initial application was made, once a TSG type-acceptance number is assigned to a telephone, it will be recognized as a type-accepted item by all the member agencies of the TSG without need for further evaluation.

PART 3

DESIGN AND CONSTRUCTION SPECIFICATIONS

Preliminary Note: The general approach and those requirements that are applicable to all type-acceptance classes are presented. Specific requirements for individual type-acceptance classes are provided in separate dedicated annexes for each class.

A3.3.1. **Operational Limitations.**
A3.3.1.1. The telephone must not be capable of cordless operation. Wireline connections between the telephone and the switched network are required for the telephone to function. All communications and information interchange between the telephone, its component parts, and auxiliary units, and with the telephone network, must be on metallic wirelines.
A3.3.1.2. There must not be any hands-free answering capability. A manual action on the part of the user is necessary to initiate, answer, join, or maintain a call. The telephone can be in the in-use state only if:
A3.3.1.2.1. The handset is physically removed from the handset mounting, or
A3.3.1.2.2. A manual speakerphone or headset switch is activated, or
A3.3.1.2.3. An auxiliary unit is manually activated.
A3.3.1.3. Some telephones may require additional action by the user (such as pressing a line select key) to be in the in-use state; this is entirely acceptable.
A3.3.1.4. The telephone is immediately restored to and remains in the idle state if:
A3.3.1.4.1. the hold feature has not been activated, and
all auxiliary units are manually deactivated, and
the headset and speakerphone switches are turned off, and
the handset is positioned in the handset mounting.
A3.3.1.5. When a call is terminated, or placed on hold, all required idle-state security measures automatically and immediately become effective.
A3.3.1.6. Positive security measures cannot include any software-dependent or firmware-dependent functions.
A3.3.1.7. Type-accepted telephones may contain line-hold circuitry only if the activation of the line-hold feature requires that the handset be placed in the handset mounting and that all other manual operations normally associated with the telephone being in the idle state have been accomplished.

A3.3.2. Telephone Security and Inspections Support Measures.

A3.3.2.1. Electrical Requirements.
A3.3.2.1.1. TSG has determined that in most cases the full objective of the telephone type-acceptance program can only be achieved if metallic-contact disconnect devices are used to perform the disconnect and shorting functions that are specified below and in the annexes.

All metallic-contact devices used for audio security must be rated for at least 10,000 operations under the conditions that exist in the telephone.

When metallic-contact devices are required to short across sensitive elements, the opening and closing of the contacts must occur with no voltages applied across them.

A3.3.2.1.2. Examples of ways in which metallic-contact disconnects can be implemented are:

Directly actuated - mechanically operated switches, magnetic proximity switches, position sensitive mercury switches, etc. These could be located in the handset, or in the handset mounting, so that they operate directly by the placement or removal of the handset.

Indirectly actuated - metallic-contact mechanical relays that could be controlled by whatever form of hookswitch is used in the conventional (before modification for type-acceptance) version of the telephone.

A3.3.2.1.3. It is recognized that the modern telephone industry often regards these devices as obsolete technology. Their requirement here, however, does not derive merely from their functional performance but also from physical and electrical characteristics that make the performance readily confirmable by electrical and physical inspection. It is emphasized, therefore, that whenever the type-acceptance criteria specifically designate metallic-contact disconnect devices, functionally equivalent operational alternatives employing more modern technologies will not be acceptable.

A3.3.2.1.4. When positive security measures that perform disconnect and shorting operations are applied, normal operation of the telephone necessitates that provision be made to suspend these measures when the telephone is in the in-use state.

With the exception of the annunciator, the suspension of the positive security measures required for the intended type-acceptance class, however, must never occur without a manual action by the user that is unequivocally associated with placing the telephone in the in-use state (e.g., lifting the handset or activating a speakerphone switch).

The security measures are completely controlled at the telephone. All security measures must restore to full effect when the user performs any normal telephone operation intended to terminate the in-use state.

Regardless of which state the telephone is in (in-use, idle, programming, etc.), no change (temporary or permanent) in any of the security features required for its type-acceptance class (except those for the annunciator) can result from any acoustic or electromagnetic signals, from action by the servicing switch, or from signals on any of the station mounting cord wires or power supply wires. The security features are independent of the voltages (or absence thereof) on any of these wires.

A3.3.2.1.5. No electrical paths or circuitry used to convey in-use state control signals from the manually actuated component (e.g., hookswitch, headset switch, speakerphone switch) to the devices that implement the positive security measures (e.g., relays) may include or share components or devices that are used for any other purpose. Items such as switches, transformers, relays, integrated circuits, or multicomponent packages that cannot be readily opened for maintenance on the individual components must be entirely dedicated to the control of the protective device.

A3.3.2.1.6. Telephones are treated as being comprised of components, devices, and subassemblies that may be categorized as being either idle-state-inactive, idle-state-active, idle-state-disconnecting, or idle-state-shorting.

Idle-state-inactive components and subassemblies are those that only need to be functionally operational when the telephone is in use. These components/subassemblies may be disconnected from all external wires when the telephone is in the idle state without interfering with any idle-state functions.

Idle-state-active components and subassemblies are used to perform functional operations while the telephone is in the idle state. They require an idle-state source of electrical power. Examples of electric power sources commonly used by telephone manufacturers are the AC ringing signal on the tip-ring pair, DC trickle current from the tip-ring pair, internal batteries, and external power sources not connected to the tip-ring wires. If a telephone contains idle-state-active components/ subassemblies that are supported in the idle state by an external power source, it cannot be completely disconnected electrically from all external wiring without causing some loss of function. Therefore, restrictions on idle-state power sources occur as a result of the fundamental TSG type-acceptance requirements. These restrictions are explained below and in the annexes.

Idle-state-disconnecting devices and subassemblies establish temporary electrical connections between two conductors when the telephone is in use. When the telephone is in the idle state, the connections are removed, and there is no electrical path between these conductors.

Idle-state-shorting devices and subassemblies place temporary electrical connections between two conductors so they are shorted together when the telephone is in the idle state. When the telephone is in use, the shorting connections are removed.

A3.3.2.1.7. All devices and subassemblies that perform functions required for the TSG type-acceptance of a telephone are designated critical subassemblies for that telephone.

The annunciator is the only idle-state-active component/subassembly that is permitted to contain transducers, or audio functions.

If the annunciator conforms to the following requirements, it may remain connected to external wires when the telephone is in the idle state:

It is an identifiable two-terminal device or subassembly.

There are no electrical or magnetic connections to any idle-state-inactive components or subassemblies.

Across the two terminals, the open-circuit microphonic response to a 2 Pa sound pressure level (2 Pa equals 100 dB above 20 mPa; 20 mV_{rms} is the conventional value for the threshold of hearing) must be less than 1 mV_{rms} for the frequency range 100 Hz to 15 kHz.

If the annunciator subassembly does not comply with the above criteria, the following protective measures must be applied to the annunciator transducer unit at all times that it is not actually producing an audible signal.

All terminals or wires for the transducer unit must be shorted by metallic contacts.

All terminals or wires for the transducer unit must be disconnected from all other components in the telephone by metallic-contact devices.

A3.3.2.1.8. The various type-acceptance classes contain different requirements for idle-state-inactive components and subassemblies. Some classes specify focal subassemblies. In order for a telephone to qualify for a particular type-acceptance class, it must short and disconnect the focal subassemblies designated for that class. The following positive security measures must be applied at the boundary of every focal subassembly.

Signals may only couple across the boundary when the telephone is in use.

The only coupling medium (intentional or fortuitous) that is allowed to cross the boundary of a focal subassembly is electrical conduction on metallic conductors.

The conductors crossing the focal subassembly boundary must be shorted by metallic-contact idle- state-shorting devices and broken by metallic-contact idle-state-disconnect devices.

A3.3.2.1.9. Except as specified below, focal subassemblies cannot include any components other than transducers or microphonic elements and the components used to implement the positive security measures.

Wires and printed circuit conductors may be included if they connect directly to a transducer and are operationally necessary. Wires in the cord connecting an external member (e.g., handset, headset, auxiliary unit) to the main body of the telephone must meet this criterion to be included in a focal subassembly.

Components connected directly across the terminals of the transducers may be included if the transducers in question are located in a member external to the main body of the telephone and the positive security measures are located within the main body itself.

Some transducers are contained in sealed packages which also contain other components. Electret microphone-based transmitter elements are typically constructed in this way. For purposes of

assigning the focal subassembly, sealed packages that do not permit direct access to the actual transducer may be treated as if the entire package were the transducer.

A3.3.2.1.10. The type-acceptance classes also differ in the limitations assigned to idle-state-active components and subassemblies that do not contain transducers or audio functions. Whenever an idle-state-active component or subassembly (other than the annunciator) is used, it must have been tested and shown to comply with the following requirement: For all idle-state-active components or subassemblies the open-circuit microphonic response to a 2 Pa (100 dB above 20 mPa) sound pressure level must be less than 1 mV_{rms} for the frequency range 100 Hz to 15 kHz.
A3.3.2.1.11. When the telephone is in the idle state, all idle-state-inactive components/subassemblies are disconnected from (and are incapable of receiving, processing, or in any way acting upon) all electrical power, signals, or instructions that originate outside of the telephone-auxiliary unit composite.

All idle-state-inactive components/subassemblies must be isolated from all wires, coupling devices, and transmission media that are not wholly contained within the telephone-auxiliary unit composite. This isolation must be accomplished with metallic-contact idle-state disconnecting devices or subassemblies.

Normal-open metallic-contact idle-state disconnect devices and/or subassemblies must be incorporated such that, when the telephone is in the idle state, they completely sever all electrical connections between every idle-state-**inactive** component/subassembly and:

All external wiring.

All idle-state-**active** components and subassemblies.

A3.3.2.1.12. Idle-state-disconnect and idle-state-shorting devices and subassemblies must be tested and shown to be non-microphonic. The open-circuit pressure response level must be measured across every pair-wise combination of connections to the component or subassembly. Within the range 100 Hz to 15 kHz, the microphonic response must be less than 1 mV_{rms} for a sound pressure level of 2 Pa (100 dB above 20 mPa).
A3.3.2.1.13. The following technical criteria apply to the selection of idle-state-disconnect and idle-state shorting devices and subassemblies used to meet the security requirements of these standards.

The initial contact breakdown voltage rating for disconnect devices must be at least 1.5 kV. The resistance across the open contacts must exceed 100 MW.

The capacitance across the open contacts of the disconnect devices must be lower than 7 pF. The closed resistance across the closed contacts of shorting devices must be less than 150 MW, and the contact surfaces must be either mercury, 5-percent gold alloy, or gold clad.

A3.3.2.1.14. The following requirements apply to the selection of idle-state-inactive components and subassemblies. Only Electret type microphones may be used. Carbon microphones, dynamic microphones, and piezoelectric types are expressly excluded.
A3.3.2.1.15. A visual indication is to be provided whenever any of the idle-state protective measures are not in effect. If the protective measures are disabled because the handset was removed from the handset mounting, no further visual indication is necessary. If there are ways by which the user can cause the telephone to be in the in-use state without lifting the handset, such as with a speakerphone, the telephone must be fitted with a lamp indicator that will unambiguously show when the protective measures have been disabled. This lamp must respond to all activities that disable the protective measures while the handset is in the handset mounting. There is no need for it to respond to the lifting of the handset, but there is also no objection to it doing so.
A3.3.2.1.16. A type-accepted telephone may not draw more than 0.1 mA DC current from its station mounting cord when it is in the idle state. It is anticipated that once placed into service, the telephone will be subjected to intermittent situations in which high-level AC and/or DC voltages occur on station mounting cord wires. The telephone is required to be able to withstand voltages as high as 1.5 kV without temporary or permanent change in its idle-state properties, or damage to any components. When the telephone is in the idle state, the maximum DC current it may draw, in either

polarity is 0.1 ImA. This limit applies to any voltage source less than or equal to 1.5 kV applied to its station mounting cord wires.
A3.3.2.1.17. Transducers that have an open-circuit microphonic pressure response level (regardless of whether they are functionally transmit or receive elements) of more than 30 mV/Pa (60 mV_{rms} response for 100 dB above 20 mPa SPL) in the frequency range 200 Hz to 8 kHz must be protected with disconnect and shorting devices. When the telephone is in the idle state, all the electrical leads and/or terminals of any transducer that has an open-circuit microphonic pressure response level of more than 30 mV/Pa in the frequency range 200 Hz to 8 kHz must be shorted together and disconnected from all other conductors. Metallic contacts must be used.

A3.3.2.2. **Mechanical Requirement.**
A3.3.2.2.1. The construction of the telephone set must provide (at any time before, during, or after installation) a means for the physical inspection of all security measures to ensure they are functioning properly. All security functions must be verifiable by physical inspection and/or electrical measurement.
A3.3.2.2.2. The telephone must be capable of repeated disassembly without physical damage or deterioration occurring.
A3.3.2.2.3. The telephone must afford the means for easy safe electrical access to perform measurements at the following without risk of damage:

Every metallic contact used as a protective measure.

Every terminal of every transducer.
Note: If the transducer is enclosed in a sealed package, the access may be to the terminals or wires of that package.

All wires leaving the telephone.

All places where power is available when the telephone is in the idle state.

A3.3.2.2.4. If a type-acceptance class requires test points (e.g., to permit the electrical verification of security protective conditions), these test points must be placed so they can be safely accessed while the telephone is operational. The location of the test points must be such that they can be accessed without danger of touching any other component or wiring. Under no circumstances shall the security-related test points be accessible without the telephone case being opened.
A3.3.2.2.5. All transducers not specifically allowed must be physically removed from the telephone set, not merely disconnected. Depending on class/ suffix, this may include, but is not limited to, speakers for voice announcements, speakerphones, and built-in microphones.
A3.3.2.2.6. The construction of the telephone must preclude any possibility that internal components or wiring can obstruct the operation of any switch or device used to provide or control the physical protective measures.
A3.3.2.2.7. Any use of multiple hookswitch plungers will be fully redundant. Depressing any one alone will fully operate all the idle-state protective measures.
A3.3.3. **Manufacturing Restrictions.** Once a telephone is type-accepted, design or construction changes are permitted unless they affect some aspect of the criteria required for its type-acceptance class. Any design or construction change in the designated focal subassemblies or critical subassemblies automatically cancels the type-acceptance status.

A3.3.4. Electrical Test Requirements.

A3.3.4.1. Sound Pressure Response Tests. The pressure response level measurements are to determine if there are any microphonically produced signals that are in excess of permitted levels. Acoustic energy is projected at the telephone at a specified sound pressure level; ground-referenced and differential voltage measurements are performed on every conductor that leaves the telephone.

A3.3.4.1.1. Test Conditions.

The sound pressure level for these tests is 2 Pa (100 dB above 20 mPa).

If the telephone uses local power, it must be tested both with the power applied and with the power disconnected.

Online tests are performed in the idle state. The telephone is provided an electrically quiet connection connection to a simulated 50-volt central office. Both polarities are tested. All connections are accomplished in the manner normal for the telephone being tested.

Offline tests are performed with the telephone completely disconnected from all real or simulated central offices. In both online and offline tests, all contacts used for positive security measures are in their normal condition (normal-open are open, normal-closed are closed).

Incremental voltage tests are performed with the telephone connected to the online test configuration, but with the applied voltage varied smoothly between -50 and 50 volts taking five $\pm$two seconds to complete the transition.

A3.3.4.1.2. Acoustic Signals. A frequency range is specified for each required test. The tests are performed with single-frequency tones and may be conducted continuously over the test frequency range or at intervals not to exceed one-half octave below 400 Hz and one-third octave above 400 Hz. The test signal sound pressure levels at the telephone are not lower than 2 Pa for all tests. The test frequencies may be modulated to facilitate recognition during recovery, but the rms value must not be lower than 2 Pa for at least 50 percent of the measurement period.

A3.3.4.1.3. Signal Recovery. A set of conductors to be evaluated is designated for each category of pressure response level test; ground is always included in this set. Voltage measurements are performed for all the pair-wise combinations of these conductors. For each such conductor pair (e.g., wire-to-ground or wire-to-wire), measure the differential voltage produced as the result of microphonic response to the test signal. The measurements may use either matching impedances or any impedance not lower than 100 kW. The choice is at the option of the tester.

For offline voltage measurements on a conductor pair, the test equipment may be matched to the internal terminating impedance that is presented by the idle-state telephone across that pair.

The voltages measured on the tip-ring, tip-ground, and ring-ground pairs during the online tests will be loaded by the simulated central office. The impedance of this loading must be stated with the test data.

For online voltage measurements on a tip-ring, tip-ground, or ring-ground pair, the test equipment impedance may be matched to either:

The internal terminating impedance that is presented by the idle-state telephone across that pair, or

The internal terminating impedance that is presented by the simulated central office across that pair.

A3.3.4.1.4. Acceptance Criteria. Voltage measurements are only valid if they are performed on wires or wire pairs for which the aggregate loading of all external connections, including the test instrumentation and any other article external to the telephone, produces a net impedance not less than the allowed amount. The test instrumentation must be capable of detecting and accurately measuring voltages one-tenth the specified maximum value. A maximum allowed microphonic response voltage is specified for each of the required tests.

A3.3.4.1.6. Functional Microphonic Sound Pressure Response Limit.

Online, offline, and incremental voltage tests are required. The pressure response level tests are conducted for the telephone equipped and configured exactly as described in the type-acceptance application. All measurements are performed with the telephone in the idle state.

The telephone is examined for microphonics as if it were an actual elemental microphone, only the overall behavior of the entire telephone-auxiliary unit composite is considered for these tests.

Microphonic response voltage measurements are performed for all the conductors (wires) that leave the telephone-auxiliary unit composite. The handset, headset, or auxiliary unit cords are not considered to be "conductors that leave the telephone-auxiliary unit composite" and therefore need not be tested.

The maximum allowed microphonic response voltage applies over the frequency range 100 Hz to 15 kHz.

Acceptance Criterion. No microphonic voltages are permitted that exceed 1 mV_{rms} when measured across an impedance that is not less than the lower value of:

The proper matching impedance, or

100 kW.

A3.3.4.1.7. Fortuitous Microphonic Sound Pressure Response Limit.

Online, offline, and incremental voltage tests are required. These pressure response level measurements are to determine if there are any incidental microphonic components in the telephone that are capable of causing microphonically produced signals to be present on the external wires.

Microphonic response voltage measurements are performed for all the conductors (wires) that leave the telephone-auxiliary unit composite. The handset, headset, or auxiliary unit cords are not considered to be "conductors that leave the telephone-auxiliary unit composite" and therefore need not be tested.

The pressure response level tests are conducted for the telephone equipped and configured as follows:

All components whose proper functions require that they be acoustic transducers are removed from inside the telephone.

The handset cord is disconnected.

The telephone is in the idle state.

Acceptance Criterion. No microphonic voltages are permitted that exceed 1 mV_{rms} when measured across an impedance that is no less than the lower value of:

The proper matching impedance, or

100 kW.

A3.3.4.1.8. Idle-State-Disconnect/Shorting Devices or Subassemblies: Microphonic Sound Pressure Response Level Limit.

The sound pressure response level tests are conducted on the idle-state-disconnect and idle-state-shorting devices/subassemblies with these units not installed in the telephone.

Microphonic response voltage measurements are performed for all the terminals of the device being evaluated and for all the conductors (wires) that are used to connect it to other components.

The maximum allowed microphonic response voltage applies over the frequency range 100 Hz to 15 kHz.

Acceptance Criterion. No microphonic voltages are permitted that exceed 1 mV_{rms} when measured across an impedance that is no less than the lower value of:

The proper matching impedance, or

100 km. *

A3.3.4.1.9. Transducers: Microphonic Sound Pressure Response Level Limit.

The pressure response level tests are conducted on all transducers, (speakers and receiver elements as well as microphones), and on all other components in the telephone identified as being microphonic.

The transducers are tested not installed in the telephone.

Microphonic response voltage measurements are performed for all the terminals of the device being evaluated and for all the conductors (wires) that are used to connect it to other components.

The maximum allowed microphonic response voltage applies over the frequency range 200 Hz to 8 kHz.

Acceptance Criterion. The transducer must be disconnected and shorted if voltages are produced that exceed 60 mV_{rms} when measured across an impedance that is not less than the lower value of:

The proper matching impedance, or 100 kW.

A3.3.4.2. Contact Capacitance Test.

A3.3.4.2.1. This test need not be performed if the manufacturer of the component in question has specified for it a minimum performance that meets or exceeds the acceptance criterion.

A3.3.4.2.2. All normal-open metallic-contact pairs used for positive security measures must be measured (installed or not installed, at the manufacturer's option) to confirm compliance with the criterion for maximum capacitance. The test instrumentation must be capable of detecting and accurately measuring capacitances one-tenth the specified maximum value.

A3.3.4.2.3. Acceptance Criterion. The capacitance across the normal-open contacts must be lower than 7 pF.

A3.3.4.3. Contact Resistance Tests.

A3.3.4.3.1. These tests need not be performed if the manufacturer of the component in question has specified for it a minimum performance that meets or exceeds the acceptance criteria.

A3.3.4.3.2. All normal-closed metallic-contact pairs used for positive security measures must be measured (installed or not installed, at the manufacturer's option) to confirm compliance with the criteria for maximum closed resistance. The test instrumentation must be capable of detecting and accurately measuring resistances one-tenth the specified maximum value.

A3.3.4.3.3. All normal-open metallic-contact pairs used for positive security measures must be measured (installed in the telephone) to confirm compliance with the criteria for minimum open resistance. The test instrumentation must be capable of detecting and accurately measuring resistances 10 times the specified minimum value.

A3.3.4.3.4. Acceptance Criteria.

The closed resistance of normal-closed contacts must be lower than 150 mW.

The open resistance across normal-open contacts must exceed 100 mW.

A3.3.4.4. Voltage Breakdown Tests.

A3.3.4.4.1. These tests need not be performed if the manufacturer of the component in question has specified for it a minimum performance that meets or exceeds the acceptance criterion.
A3.3.4.4.2. All normal-open metallic-contact pairs used for positive security measures must be measured (installed or not installed in the telephone at the manufacturer's option) to confirm that their resistance remains in excess of 100 MW when 1.5 kV is placed across them. The test instrumentation must be capable of detecting and accurately measuring resistances 10 times the specified minimum value.
A3.3.4.4.3. All components at risk from voltages applied at the station mounting cord wires must be measured (installed or not installed at the manufacturer's option) to confirm that they do not draw more than 0.1 mA when 1.5 kV is placed across them. The test instrumentation must be capable of measuring currents one-tenth the specified level.

A3.3.4.4.4. Acceptance Criterion. The initial breakdown point for normal-open contact devices and for components that are subject to station mounting cord voltages must not be lower than 1.5 kV.

PART 3 (ANNEX 1)

SUPPLEMENTARY DESIGN AND CONSTRUCTION SPECIFICATIONS TYPE-ACCEPTANCE CLASS X1

Preliminary Note: This Annex to Part 3 of TSG Standard 3 describes the specific supplementary requirements for TSG type-acceptance Class X1. The general type-acceptance approach and those requirements that are applicable to all the type-acceptance classes were presented in Part 3 itself.

A3.3.5. No external connections are permitted except to the station mounting cord.

A3.3.6. The number of contacts permitted in the station mounting cord jack is restricted and depends on the type of service for which the telephone is intended.

A3.3.6.1. Two-wire Service Without Provision for System Control. Two contacts are permitted. These are dedicated to the central office tip-ring pair.

A3.3.6.2. Two-wire Service With Provision for System Control. Four contacts are permitted. One contact pair is dedicated to the central office tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open hookswitch contacts, which are completely isolated from all other components in the telephone. When the telephone is in the in-use state, the hookswitch will provide a closure between the wire pair used for system control. When the telephone is in the idle state, the hookswitch maintains an open across that wire pair.

A3.3.6.3. Four-wire Service Without Provision for System Control. Four contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and the other to the central office receive tip-ring pair.

A3.3.6.4. Four-wire Service With Provision for System Control. Six contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and one to the central office receive tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open hookswitch contacts, which are completely isolated from all other components in the telephone. When the telephone is in the in-use state, the hookswitch provides a closure between the wire pair used for system control. When the telephone is in the idle state, the hookswitch maintains an open across that wire pair.

A3.3.7. If the telephone provides neither four-wire service nor an isolated set of hookswitch contacts to terminate a second station mounting cord wire pair, only one pair of wires, the tip-ring pair, is permitted to connect to the telephone.

A3.3.8. Last number redial (LNR) memory is permitted if it does not require external electric power when the telephone is in the idle state.

A3.3.9. LNR memory is permitted if it is supported by a capacitor that charges only when the telephone is in use and is provided with a positive means of discharge when it is idle so that it is completely discharged in less than 20 minutes.

A3.3.10. Except as specifically allowed, idle-state electrical power, including internal batteries, is not permitted.

A3.3.11. The only idle-state-active components or subassemblies permitted are the annunciator and the LNR. The LNR may only remain active for 20 minutes after the idle state is established.

A3.3.12. A line-hold circuit is permitted if it is connected on the line side of the normal-open metallic contacts that terminate the tip-ring pair and, if its operation requires, that the handset be placed in the handset mounting. The line-hold circuit must be completely isolated from all other idle-state-inactive components and subassemblies when the handset is in the handset mounting.

A3.3.13. Local auxiliary power may be used to support idle-state-inactive subassemblies if idle-state-shorting and idle-state-disconnect operations (using metallic-contact devices) are performed on the power leads at their point of entry into the telephone.

A3.3.14. The focal subassemblies designated for type-acceptance are:

A3.3.14.1. The transmitter element.

A3.3.14.2. The receiver element.

A3.3.14.3. All transducers and microphonic components.

A3.3.15. The critical subassemblies designated for type-acceptance Class X1 are:

A3.3.15.1. The focal subassemblies.

A3.3.15.2. The idle-state-active components and subassemblies.

A3.3.15.3. The idle-state-disconnect devices and subassemblies.

A3.3.15.4. The idle-state-shorting devices and subassemblies.

A3.3.15.5. The station mounting cord jack.

A3.3.15.6. The transducers and microphonic components.
A3.3.15.7. The auxiliary power connections.
A3.3.15.8. The line-hold circuit (if included).
A3.3.16. Test points that permit the electrical verification of all security protective conditions are included. At a minimum, these test points must provide electrical access to the following:
A3.3.16.1. Every metallic contact used as a protective measure.
A3.3.16.2. All terminals on the annunciator transducer or ringer package.
A3.3.16.3. All wires leaving the telephone.

PART 3 (ANNEX 2)

SUPPLEMENTARY DESIGN AND CONSTRUCTION SPECIFICATIONS TYPE-ACCEPTANCE CLASS X2

Preliminary Note: This annex to Part 3 of TSG Standard 3 describes the specific supplementary requirements for TSG type-acceptance Class X2. The general type-acceptance approach and those requirements that are applicable to all the type-acceptance classes were presented in Part 3 itself.

A3.3.17. No external connections are permitted except to the station mounting cord or to local auxiliary power sources as specified below.

A3.3.18. The number of contacts permitted in the station mounting cord jack is restricted and depends on the type of service for which the telephone is intended.

A3.3.18.1. Two-wire Service Without Provision for System Control. Two contacts are permitted. These are dedicated to the central office tip-ring pair.

A3.3.18.2. Two-wire Service With Provision for System Control. Four contacts are permitted. One contact pair is dedicated to the central office tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open hookswitch contacts, which are completely isolated from all other components in the telephone. When the telephone is in the in-use state, the hookswitch will provide a closure between the wire pair used for system control. When the telephone is in the idle state, the hookswitch maintains an open across that wire pair.

A3.3.18.3. Four-wire Service Without Provision for System Control. Four contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and the other to the central office receive tip-ring pair.

A3.3.18.4. Four-wire Service With Provision for System Control. Six contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and one to the central office receive tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open hookswitch contacts, which are completely isolated from all other components in the telephone. When the telephone is in the in-use state, the hookswitch provides a closure between the wire pair used for system control. When the telephone is in the idle state, the hookswitch maintains an open across that wire pair.

A3.3.19. If the telephone provides neither four-wire service nor an isolated set of hookswitch contacts to terminate a second station mounting cord wire pair, only one pair of wires, the tip-ring pair, is permitted to connect to the telephone.

A3.3.20. Last number redial (LNR) memory is permitted if it does not require external electric power when the telephone is in the idle state.

A3.3.21. LNR memory is permitted if it is supported by a capacitor that charges only when the telephone is in use and is provided with a positive means of discharge when it is idle so that it is completely discharged in less than 20 minutes.

A3.3.22. LNR and repertory dial are permitted if powered by a replaceable internal battery instead of a capacitor. The battery must be the minimum physical size necessary to provide 12-month service. The battery leads must feed directly to a current-limiting resistor that prevents current in excess of 0.1 mA from being drawn from the battery.

A3.3.23. Except as specifically allowed, idle-state electrical power, including internal batteries, is not permitted.

A3.3.24. The only idle-state-active components or subassemblies permitted are the annunciator, the LNR, and the repertory dialer.

A3.3.25. A line-hold circuit is permitted if it is connected on the line side of the normal-open metallic contacts that terminate the tip-ring pair and, if its operation requires, that the handset be placed in the handset mounting. The line-hold circuit must be completely isolated from all other idle-state-inactive components and subassemblies when the handset is in the handset mounting.

A3.3.26. Local auxiliary power may be used to support idle state-inactive subassemblies if idle-state-shorting and disconnect operations, using metallic-contact devices, are performed on the power leads at their point of entry into the telephone.

A3.3.27. There are no special focal subassemblies in this type-acceptance class that require individual shorting and disconnect operations in addition to those already specified in the main portion of Part 3 to this standard.

A3.3.28. The receiver element must be shorted by an acceptable idle-state-shorting device or subassembly when the telephone is not in use.

A3.3.29. The critical subassemblies designated for type acceptance Class X2 are:

A3.3.29.1. The idle-state-active components and subassemblies.
A3.3.29.2. The idle-state-disconnect devices and subassemblies.
A3.3.29.3. The idle-state-shorting devices and subassemblies.
A3.3.29.4. The station mounting cord jack.
A3.3.29.5. The transducers and microphonic components.
A3.3.29.6. The internal battery connections.
A3.3.29.7. The auxiliary power connections.
A3.3.29.8. The line-hold circuit (if included).
A3.3.30. Test points that permit the electrical verification of all security protective conditions must be included. At a minimum, these test points must provide electrical access to the following:
A3.3.30.1. Every metallic contact used as a protective measure.
A3.3.30.2. All terminals on the annunciator transducer or ringer package.
A3.3.30.3. All wires leaving the telephone.

PART 3 (ANNEX 3)

SUPPLEMENTARY DESIGN AND CONSTRUCTION SPECIFICATIONS TYPE-ACCEPTANCE CLASS X3

Preliminary Note: This annex to Part 3 of TSG Standard 3 describes the specific supplementary requirements for TSG type-acceptance Class X3. The general type-acceptance approach and those requirements that are applicable to all the type-acceptance classes were presented in Part 3 itself.

A3.3.31. No external connections are permitted except to the station mounting cord or to local auxiliary power sources as specified below.

A3.3.32. The number of contacts permitted in the station mounting cord jack is restricted and depends on the type of service for which the telephone is intended.

A3.3.32.1. Two-wire Service Without Provision for System Control. Two contacts are permitted. These are dedicated to the central office tip-ring pair.

A3.3.32.2. Two-wire Service With Provision for System Control. Four contacts are permitted. One contact pair is dedicated to the central office tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open hookswitch contacts, which are completely isolated from all other components in the telephone. When the telephone is in the in-use state, the hookswitch will provide a closure between the wire pair used for system control. When the telephone is in the idle state, the hookswitch maintains an open across that wire pair.

A3.3.32.3. Four-wire Service Without Provision for System Control. Four contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and the other to the central office receive tip-ring pair.

A3.3.32.4. Four-wire Service With Provision for System Control. Six contacts are permitted. One contact pair is dedicated to the central office transmit tip-ring pair and one to the central office receive tip-ring pair. The other contact pair is the system control pair and may only be connected across normal-open hookswitch contacts, which are completely isolated from all other components in the telephone. When the telephone is in the in-use state, the hookswitch provides a closure between the wire pair used for system control. When the telephone is in the idle state, the hookswitch maintains an open across that wire pair.

A3.3.33. If the telephone provides neither four-wire service nor an isolated set of hookswitch contacts to terminate a second station mounting cord wire pair, only one pair of wires, the tip-ring pair, is permitted to connect to the telephone.

A3.3.34. Last number redial (LNR), repertory dial, and other idle-state-active components and subassemblies are permitted if they do not contain transducers or audio circuits.

A3.3.35. Power for idle-state-active components and subassemblies may be provided from a capacitor that charges only when the telephone is in use and is provided with a positive means of discharge when it is idle so that it is completely discharged in less than 20 minutes.

A3.3.36. Power for idle-state-active components and subassemblies may be provided from a replaceable internal battery instead of a capacitor. The battery must be the minimum physical size necessary to provide 12-month service. The battery leads must feed directly to a current-limiting resistor that prevents current in excess of 1 mA from being drawn from the battery.

A3.3.37. Local auxiliary power may be used to support idle-state-inactive subassemblies if idle-state-shorting and -disconnect operations (using metallic-contact devices) are performed on the power leads at their point of entry into the telephone.

A3.3.38. Power for idle-state-active and idle-state-inactive components and subassemblies may be provided from an external auxiliary DC source (AC power must be converted to DC externally to the telephone). The DC source must be externally current-limited to 1 mA or less when the telephone is in the idle state. The telephone must filter the power at the point of entry to attenuate by not less than 60 dB all frequencies above 100 Hz. The point of entry for this DC power must be separated from the point of entry for the station mounting cord.

A3.3.39. A line-hold circuit is permitted if it is connected on the line side of the normal-open metallic contacts that terminate the tip-ring pair and, if its operation requires, that the handset be placed in the handset mounting. The line-hold circuit must be completely isolated from all other idle-state-inactive components and subassemblies when the handset is in the handset mounting.

A3.3.40. There are no special focal subassemblies in this type-acceptance class that require individual shorting and disconnect operations in addition to those already specified in the main portion of Part 3 to this standard.
A3.3.41. The receiver element must be shorted by an acceptable idle-state-shorting device or subassembly when the telephone is not in use.
A3.3.42. The critical subassemblies designated for type-acceptance Class X3 are:
A3.3.42.1. The idle-state-active components and subassemblies.
A3.3.42.2. The idle-state-disconnect devices and subassemblies.
A3.3.42.3. The idle-state-shorting devices and subassemblies.
A3.3.42.4. The station mounting cord jack.
A3.3.42.5. The transducers and microphonic components.
A3.3.42.6. The internal battery connections.
A3.3.42.7. The auxiliary power connections.
A3.3.42.8. The line-hold circuit (if included).

GLOSSARY

Preliminary Note: The definitions in this glossary are for use with the TSG standards only. They are provided to ensure a precise, unambiguous meaning for terms used to describe TSG requirements. Many of the terms used have no related meaning in any other context. Where terms are involved that are employed by the telephone industry, the usages given are intended to be consistent with most common industry practices. Usage, however, can vary significantly from company to company, and this glossary is not a definitive study of all the ways in which these terms may be used. It is important in using the TSG standards, that these terms not be given any more or any less meaning than is specified here.

ANNUNCIATOR -- A device for producing an audible signal to announce an incoming call.

AUDIBLE SIGNAL -- A sound that is specifically emitted by the telephone to be audible anywhere in its immediate vicinity.

AUXILIARY UNIT -- A device connected to the telephone by means other than the station mounting cord or the handset cord.

BUILT-IN MICROPHONE -- A microphone located in the body of the telephone rather than in the handset.

CONVENTIONAL CENTRAL OFFICE INTERFACE -- The interconnection standard that is used by telephones (or other terminal equipment) designed and constructed in compliance with Part 68, FCC Rules and Regulations, for connection to the North American public switched telephone network.

CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors, used to provide the electrical connections between two separate, distinct units or component parts.

CRITICAL SUBASSEMBLY -- Any subassembly that is not a focal subassembly, but which contains components essential to the operation of positive security functions.

CTS (COMPUTERIZED TELEPHONE SYSTEM) -- A generic term used to describe any telephone system that uses centralized stored program computer technology to provide switched telephone networking features and services. CTSs are referred to commercially by such terms as computerized private branch exchange (CPBX), private branch exchange (PBX), private automatic branch exchange (PABX), electronic private automatic branch exchange (EPABX), computerized branch exchange (CBX), computerized key telephone systems (CKTS), hybrid key systems, business communications systems, and office communications systems.

DISCONNECT -- A device that (1) inserts a break at some point in the normal hardwire conduction path that exists between a telephone and its telecommunications medium, and (2)only when the telephone is in the in-use state, establishes a temporary metallic connection across that break.

FOCAL SUBASSEMBLY -- Any subassembly that contains transducers or other potentially microphonic components.

HANDS-FREE ANSWERING -- A feature available on some telephones and telephone systems that, when certain types of incoming calls occur, either automatically places the telephone in the in-use state or allows the user, without any manual action, to initiate the in-use state by means of a voice-activated switch.
HANDSET -- A combined telephone earpiece (containing a receiver element) and mouthpiece (containing a transmitter element) mounted on a handle.

HANDSET CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors; used to provide the electrical connections between the handset and the main body of the telephone.

HANDSET MOUNTING -- The receptacle, bracket, cradle, or other support specifically provided on the main body of the telephone to hold the handset when it is not in use; the handset mounting is fitted with a means to detect whether or not the handset is in place in (or on) the handset mounting.

HEADSET -- A combined telephone earpiece (containing a receiver element) and mouthpiece (containing a transmitter element) assembly to be worn on the user's head.

HOOKSWITCH -- The device employed to determine if the handset is or is not in place in (or on) the handset mounting is termed the hookswitch regardless of how it operates. In some cases the hookswitch will not involve any sort of mechanical switch and/or break any incoming current loop.

HOUSE CABLING -- The wiring and associated frames that provide the electrical connections between the computer-controlled telephone system and the individual blocks or jacks for each telephone's station mounting cord.

IDLE STATE (VOICE TERMINAL) -- A voice terminal is in the idle state whenever it is not in the in-use state (see below).

IN-USE STATE (VOICE TERMINAL) -- A voice terminal is in the in-use state if it is communicating to its network system that a user is either initiating or actively engaged in communications via a temporary switched connection set up by that network system.

ISOLATOR (ISOLATION) -- A device that (1) inserts a break at some point in the normal hardwire conduction path that exists between a telephone and its telecommunications medium, and (2) only when the telephone is in the in-use state, provides a temporary communications channel across that break without establishing an end-to-end metallic connection.

KEY TELEPHONE SYSTEM -- A system of telephones and connections to the public switched telephone network (PSTN) or to a private branch exchange (PBX) that provides the telephones with selective access to the PSTN or PBX connections by means of pick-up keys located at or near the telephones.

MANUAL ACTION -- An action that requires that the user touch, move, lift, or otherwise manipulate by hand, some control or part of the telephone. An operation that is actuated by the user's voice does not qualify as a manual action.

MICROPHONE -- Any component among whose intended functions include performing as a transducer to produce an electrical analogue output from an audio-frequency sound pressure waveform input.

MICROPHONIC -- Any component, regardless of its intended functions, that exhibits transducer behavior to produce an electrical analogue output from an audio-frequency sound pressure waveform input is termed microphonic.

NETWORK SYSTEM -- An assembly of member terminals, control facilities, and intercommunication facilities that can establish and maintain a communications link between any two of the member terminals.

OFF-HOOK (TELEPHONE) -- A telephone in the in-use state.

ON-HOOK (TELEPHONE) -- A telephone in the idle state.

ON-HOOK TELEPHONE AUDIO SECURITY -- The use of positive measures to protect on-hook telephones against passing room audio is known as on-hook telephone audio security.

PRESSURE RESPONSE LEVEL -- The pressure response level of a microphone is the ratio of voltage output to sound pressure level input.

PUSH-TO-OPERATE HANDSET -- There are three forms of push-to-operate handsets.

(1) A telephone handset equipped with separate push-to-activate momentary-contact switches, one for the transmitter element and one for the receiver element. Either switch, when not activated, shorts the leads to its respective transducer and completely disconnects the transducer from the station mounting cord wires.

(2) A telephone handset equipped with a single push-to-activate momentary-contact switch. When the switch is not activated, the leads for both the transmitter element and the receiver element are shorted and are disconnected from the station mounting cord wires.

(3) A telephone handset equipped with both a single push-to-activate momentary-contact switch and with an isolation amplifier that allows audio signals to travel from the station mounting cord to the receiver element but not from the receiver element to the station mounting cord. When the switch is not activated, the leads for the transmitter element are shorted together and are disconnected from the station mounting cord wires.

RECEIVER ELEMENT -- The speaker located in the handset or headset earpiece. This transducer converts audio-frequency electrical signals to acoustic signals that are audible when the earpiece is held against the user's ear.

RINGER -- An annunciator that cannot be used for voice calls, announcements, or paging. A ringer can only produce specific audible signals.

SPEAKER -- Any component among whose intended functions include performing as a transducer to produce a sound pressure analogue output from an input audio-frequency electrical waveform.

SPEAKER-MICROPHONE -- Any component whose intended functions include performing both as a microphone and as a speaker.

SPEAKERPHONE -- A feature that permits a telephone to be used without lifting the handset. A speakerphone may be physically incorporated into the telephone set or it may consist of one or more auxiliary units. A usable speakerphone contains a microphone, or microphone-amplifier combination, which is sensitive enough to pick up normal conversational speech levels at a distance of several feet and a speaker, or speaker-amplifier combination, which will transduce normal telephone signal levels to sound pressure levels that can be heard at a distance of several feet.

STATION MOUNTING CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors; used to provide the electrical connections between the main body of the telephone and the blocks or jacks that terminate the house cabling.

TELECOMMUNICATIONS MEDIUM -- A means of transporting electrical information from one communications terminal to another.

TELEPHONE -- A voice terminal that, regardless of whatever other functions it performs, is a member terminal of a telephone network and accomplishes all the incoming and outgoing signaling and voice interfacing necessary for operation in that network.

TELEPHONE NETWORK -- A network system that, regardless of whatever other functions it performs, provides temporary speech communications links between member voice terminals. The essential characteristics of a telephone network are (1) that it recognize when a member terminal is initiating a call (goes off-hook), (2) that it identify the terminal being called (number dialed), (3) that it annunciate the incoming call (rings the called terminal), and (4) that it maintain a voice grade communications channel between the calling and called terminals only for the duration of the call.

TRANSDUCER -- A component of the telephone that either converts electrical signals to acoustic signals or acoustic signals to electrical signals; includes microphones, ringers, speakers, and speaker-microphones.

TRANSMITTER ELEMENT -- The microphone located in the handset or headset mouthpiece. This transducer converts acoustic signals spoken directly into the mouthpiece to analogue audio-frequency electrical signals for transmission to the main body of the telephone.

TSG-APPROVED TELEPHONE -- TSG-approved status is awarded to telephones that have been technically evaluated by the government's Telephone Security Group and determined to meet all applicable on-hook telephone audio security criteria. A TSG-approved telephone provides all necessary security features as intrinsic properties of the telephone itself.

TYPE-ACCEPTED TELEPHONE -- A TSG-approved telephone model that the TSG has evaluated in response to a formal application by its manufacturer, and has been approved and awarded a TSG type-acceptance number. The TSG telephone type-acceptance program is the primary vehicle for evaluating commercial telephones for TSG approval. TSG has issued type-acceptance standards that specify the on-hook security design, construction, and performance characteristics required for various genres of telephones and type-acceptance classes.

VOICE TERMINAL -- A generic term used to describe any device that, regardless of whatever other functions it performs, provides an intentional transmit and/or receive interface between a human talker/listener and an electric or electronic communications system. All voice terminals contain transducers; a microphone is necessary if there is a transmit function and a speaker if there is a receive function. Telephones, speakerphones, and intercom sets are common examples of voice terminals.

TYPE ACCEPTANCE PROGRAM FOR ELECTRONIC TELEPHONES USED IN COMPUTERIZED TELEPHONE SYSTEMS

TSG STANDARD 4

MARCH 1990

PREFACE

This standard was prepared by the Telephone Security Group (TSG). The charter members of the TSG are: Department of the Air Force, Department of the Army, Central Intelligence Agency, Defense Intelligence Agency, Department of Energy, Federal Bureau of Investigation, Department of the Navy, National Security Agency, US Secret Service, and Department of State.

The TSG is the primary technical and policy resource in the US Intelligence Community for all aspects of the technical surveillance countermeasures (TSCM) program involving telephone systems. The TSG standards contain guidance for providing on-hook security to telephone systems in areas where sensitive government information is discussed. Implementation of TSG standards neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as TEMPEST, COMSEC, or OPSEC.

TSG Standard 1 is an introduction to telephone security that provides general information about the TSG standards.

PART 1

INTRODUCTION

A4.1. Purpose. TSG Standard 4 specifies the design and construction criteria, the application procedures, the manufacturer's testing requirements, and the documentation necessary for TSG type-acceptance of electronic telephones used in computerized telephone systems (CTS).

A4.2. Application. TSG Standard 4 may be referenced or included in US Government-sponsored procurement specifications to define TSG type-accepted telephones. This standard may be made available to telephone manufacturers who are responding to US Government requirements for TSG type-accepted telephones.

A4.3. Definitions. Words and terms that are defined in the glossary for Standard 4 are printed in italics. The definitions in this glossary are for use with this standard only. They are provided to ensure a precise, unambiguous meaning for terms used to describe TSG requirements. Many of the terms used have no related meaning in any other context. Where terms are involved that are employed by the telephone industry, the usages given are intended to be consistent with most common industry practices. Usage, however, can vary significantly from company to company, and this glossary is not a definitive study of all the ways in which these terms may be used. It is important in using TSG Standard 4 that these terms not be given any more or any less meaning than is specified here.

A4.4. TSG Type-Acceptance Program.

A4.4.1. The TSG is a part of the omnibus program dedicated to assuring the audio security of all sensitive discussion areas maintained directly by these agencies or by companies under contract to them. The specific purpose of TSG is to develop and coordinate measures for the prevention, detection, and correction of on-hook audio from telephone equipment. In pursuing this objective, TSG endeavors to assure that, for any situation, the cognizant authorities in each agency will always be in a position to select and adapt the most appropriate means to effectively and economically obtain the necessary level of security.

A4.4.2. TSG recognizes that not all situations require the same level of security. A measure that is completely proper and sufficient for some applications could be inadequate for other applications; however, the appropriate level of security for any specific application may generally be achieved with a selected combination of several measures. The cumulative effect of properly selected complementary measures (which would have been deficient individually) can be used to produce the desired result. Accordingly, every telephone-related security problem of which TSG is made aware is examined in detail so the government may be provided with the greatest possible diversity of approaches for its correction.

A4.4.3. A viable and important approach for telephone security, which has long been employed by the US Government is the concept of the type-accepted telephone. This is a telephone instrument, which, by virtue of its design and construction, has the following properties:

A4.4.3.1. The telephone cannot be caused to produce audio when it is in the idle state except by intrusive physical modifications within the telephone set itself.

A4.4.3.2. The telephone is not tractable to the implementation of intrusive modifications.

A4.4.3.3. Electrical and physical inspection can readily determine if an intrusive modification has been placed within the telephone and if the design/construction security measures are operating properly.

A4.4.4. TSG Standard 3 specifies the design and construction criteria for the TSG type-acceptance of telephones that are compatible with the traditional nonproprietary central office interface of the public switched telephone network (PSTN). A fundamental requirement of the basic TSG type-accepted telephone defined by TSG Standard 3 is that all external wirelines entering the telephone are disconnected from all internal circuitry (except the annunciator) when the telephone is in the idle state. Many proprietary CTS electronic telephones, even when they are in the idle state, need power continuously from the CTS and need to exchange information with it on a regular basis. Therefore, they cannot support the requirement for total physical disconnect from the external wirelines. The TSG type-acceptance requirements to be applied for this type of CTS electronic telephone are provided here in TSG Standard 4, rather than in TSG Standard 3.

A4.4.5. Without type-accepted telephones, telephone installations can be considered a priori secure only if the telephones are isolated or disconnected from all unprotected wires. This is achieved by means of supplementary isolator or disconnect devices placed on the wires or by using a CTS specially configured to conform with TSG Standard 2.

A4.4.6. On-hook telephone security based on isolation or disconnect methods cannot be universally applied to CTS electronic telephones.
A4.4.6.1. Most of these telephones are not compatible with conventional isolator/disconnect devices that are designed for the normal central office interface.
A4.4.6.2. As the result of system characteristics or operational constraints, some installations, and some telephones in particular, physically cannot be made to conform with the TSG Standard 2. Also, in many cases the cost of applying the TSG Standard 2 is not commensurate with the number of telephones that must be protected. Even though there may only be a few specific telephones in the installation that require on-hook security, the entire system would have to comply with the standard.
A4.4.7. The type-acceptance of CTS electronic telephones that have been demonstrated to incorporate intrinsic on-hook audio security provides a means to assure the security of an installation when isolation/disconnect measures (supplementary devices and/or the TSG installation guidelines) are either physically incompatible or economically infeasible. Neither method, the type-acceptance program nor the application of isolation/disconnect measures, is regarded as being better than the other. They are both equally acceptable alternative methods for obtaining audio security. There will be situations where either the isolation/disconnect approach or the type-accepted telephones will be the preferred method.
A4.4.8. The following elements of the TSG telephone type-acceptance program are essential.
A4.4.8.1. The design and construction specifications that describe the conditions under which telephones are considered to be:
A4.4.8.1.1. Physically incapable (by reason of design and construction) of producing microphonic audio on any wires leaving the instrument while it is in the idle state.
A4.4.8.1.2. Capable of being individually subjected to routine, on-site physical and electrical inspections that will adequately and expeditiously determine if the protective measures remain effective and if any intrusive audio surveillance modifications have been installed.
A4.4.8.2. The standardized evaluation and qualification conditions that are used to determine each type-acceptance class.
A4.4.8.3. The requirements for documentation and sureties to be provided to a member agency of the TSG. These must properly demonstrate and guarantee that a particular model telephone does conform to all required criteria. Any telephone model whose design and construction is shown by adequate documentation, backed by the necessary surety, to conform to the required criteria will be type-accepted by the TSG and approved for installation and use without any requirement for additional isolation or disconnect measures.
A4.4.8.4. The type-acceptance application process.
A4.4.8.5. Limited requirements on product stability. These are applied, for the most part, only to those components of the type-accepted telephone that are used to implement mandatory security features. The manufacturer is largely free to change all nonrelated areas without affecting its type-acceptance status.
A4.4.8.6. Labeling requirements for type-accepted telephones.
A4.4.8.7. Guidelines for use by participating agencies of the US Government to enable them to identify and select telephones suitable for use in sensitive discussion areas.
A4.4.9. Type-acceptance programs are mutually beneficial to the government and to the telephone industry. The TSG design and construction standards for type-acceptance are provided both to government agencies and to qualified members of the industry. The identification of the type-accepted telephone models allows government agencies (who are concerned about on-hook telephone security) to exclude from consideration for procurement all telephones that are not acceptable; the TSG type-acceptance standards may be included directly in telephone procurement specifications. Manufacturers who wish to compete in this market can readily determine if their products are acceptable and, if not, what modifications are necessary to make them acceptable. Also, the type-acceptance procedure clearly defines what portions of the telephone can be subsequently altered by the manufacturer without affecting its type-accepted status. Changes of this sort can be made at the discretion of the manufacturer without involvement of the government.
A4.4.10. In order that maximum flexibility is provided to produce the most economical, fully effective security program for every individual application, TSG has developed standards for multiple categories of type-accepted electronic telephones.
A4.4.11. It is the intent of these standards that all telephones that receive a TSG type-acceptance are, at the very least, determined to be physically incapable (by reason of design and construction, without the need for individual electrical testing) of producing any microphonic audio on any wires leaving the instrument while it is in the idle state. It is expected that many commercial instruments now being marketed will qualify under this minimal criterion with little or no need for special modifications at additional cost.

A4.4.12. Most telephone installations by the member agencies of TSG will require more than the minimum level of security. Compliance with specific criteria concerning the security methodology can produce eligibility for a higher security classification; the highest classification being Class 1. While it is not expected that many telephones now being commercially produced will inherently meet the criteria for the higher classifications, the great majority of models now on the market can probably be economically modified (in production quantities) to do so. The establishment of realistic type-acceptance standards for the higher security classifications will result in the closing of a large portion of the government telephone market to all products that do not qualify for the higher security classifications. It is anticipated that a significant number of manufacturers will recognize that it is to their commercial advantage to produce modified versions of their various telephone models that will qualify for high-classification type-acceptance.

A4.4.13. The numerical classes rate the telephones on the basis of idle-state security only. In-use security considerations are of importance in some situations, and manufacturers may wish to indicate special virtues of their products that are applicable to those situations. A system of optional alphabetical suffixes may be appended to the type-acceptance class number to indicate the following:

A4.4.13.1. Suffix A. The handset requires a push-to-talk operation for the transmitter element and either a push-to-listen operation or an isolation amplifier for the receiver element. Only handset operation is available with this unit; any other functions that employ microphonic activity (such as headset, hands-free answering units, speakerphones, or speaker-microphones) are not possible. Except for the handset transmitter element, the telephone contains no microphones.

A4.4.13.2. Suffix B. Only handset operation is available with this unit; any other functions that employ microphonic activity (such as headset, hands-free answering units, speakerphones, or speaker-microphones) are not possible. Except for the handset transmitter element, the telephone contains no microphones.

A4.4.13.3. Suffix C. Either handset or headset operation is available with this unit; any other functions that employ microphonic activity (such as hands-free answering units, speakerphones, or speaker-microphones) are not possible. Except for the handset or headset transmitter element, the telephone contains no microphones.

PART 2
PROCEDURE FOR OBTAINING AND MAINTAINING TSG TYPE-ACCEPTANCE

A4.5. Type-acceptance procedures cannot be applied effectively to any telephone without the full cooperation of the manufacturer. The type-acceptance concept involves the manufacturer on a continuing basis, to include but not be limited to the following:
A4.5.1. Design of the original telephone.
A4.5.2. Design of modifications, if necessary, to comply with the type-acceptance requirements.
A4.5.3. Testing the candidate telephone to establish that it does perform in accordance with the type-acceptance criteria.
A4.5.4. Documentation of all claims relating to the type-acceptance requirements.
A4.5.5. Technical information to support the development of field inspection procedures.
A4.5.6. Continued production of the type-accepted version in support of systems purchased by the government or by a government contractor.
A4.6. When a manufacturer applies for and receives type-acceptance, it is for the specific configuration described in the application documentation. TSG assigns a type-acceptance number to this configuration. This number cannot be used on any alternative configuration that involves a change in any portion of the telephone that has been designated a critical subassembly for the type-acceptance class in question. The type-acceptance may be revoked at any time it becomes apparent that the telephone is not providing adequate idle-state audio security.

A4.7. Initial Contact.
A4.7.1. A manufacturer responding to a specific procurement requirement (whether a direct request or a public announcement) of an agency of the US Government submits the application for type-acceptance to that agency.
A4.7.2. A manufacturer wishing to obtain type-acceptance to gain entry into the portion of the government market affected by the type-acceptance program can apply to any TSG participating agency.

A4.8. Procedure.

A4.8.1. Ascertain the type-acceptance class(es) required, if appropriate.

A4.8.2. Evaluate the proposed products to determine the degree of compliance with the criteria for the class intended.

A4.8.3. Develop and implement any modifications necessary to meet the requisite criteria. Documentation of the proposed modifications may be submitted to the agency in question for preliminary evaluation before actual implementation.

[Preliminary approval of the approach, based on the documentation submitted, means only that no obvious deficiencies are in evidence. Actual type-acceptance requires that the modified telephone be fully tested in accordance with the requirements for the type-acceptance class in question. There is no assurance that an approach that has received preliminary approval will pass these tests.]

A4.8.4. Perform all required tests on an actual modified telephone that is exactly like the production unit.

A4.8.5. Submit the following documentation to the agency performing the type-acceptance evaluation. Documents identified as containing proprietary information will be used to evaluate and confirm the necessary conditions only. All proprietary information will be treated with strict confidentiality.

[The format used here to list the required documentation is for convenience in presentation and to facilitate application. The manufacturer is encouraged to use existing manuals, drawings, brochures, or other publications that may be available. It is not necessary to extract and repeat specific information in order to meet the documentation requirements in each of the categories listed below. It will be sufficient to state where the information can be found in the publications provided.]

A4.8.5.1. Letter of application, signed by an authorized company official, containing the following:

A4.8.5.1.1. Identification of product - manufacturer, product line, and models involved. Include whatever additional descriptive information is necessary to eliminate all possibility of ambiguity or confusion with any other product.
A4.8.5.1.2. The class number for which application is being made.
A4.8.5.1.3. Certification that the product meets the criteria for that class, and that it may be opened for visual and electrical inspection (to verify that it conforms to all type-acceptance criteria) at any time without invalidating the normal product warranties.
A4.8.5.1.4. Point of contact for inquiries - name, title, address, telephone number.

A4.8.5.2. Summary of product offering, including manufacturer's sales and/or technical literature for the product.

A4.8.5.3. Summary of test results, explaining basis for asserting that the proposed telephone meets the appropriate type-acceptance criteria.

A4.8.5.4. Functional description, containing the following:
A4.8.5.4.1. Operation of telephone.
A4.8.5.4.2. Appearance.
A4.8.5.4.3. Installation requirements.
A4.8.5.4.4. Operations manual.
A4.8.5.4.5. Identification of all systems with which the telephone is compatible.
A4.8.5.4.6. Features, options, and auxiliary units available with the version being evaluated. Options available on the standard commercial model may, at the manufacturer's discretion, be excluded from the version being submitted for type-acceptance.

A4.8.5.5. Electrical description, containing the following:
A4.8.5.5.1. Theory of operation, including description of connection to CTS and any other external connections.
A4.8.5.5.2. Block diagrams, including complete descriptions of signals between functional blocks.
A4.8.5.5.3. Schematic diagrams and circuit descriptions.
A4.8.5.5.4. Component listing.
A4.8.5.5.5. Installation/maintenance manual.

A4.8.5.6. Detailed security evaluation - must include all features, options, and auxiliary units included in paragraph A4.8.5.4.6. All applicable criteria are applied to the basic telephone and to the composite formed when the auxiliary units are attached and operational.
A4.8.5.6.1. Provide component layout diagrams, including location and function of test points.
A4.8.5.6.2. Provide circuit descriptions and diagrams of all audio circuits, focal subassemblies, and critical subassemblies.
A4.8.5.6.3. Identify all components (manufacturer and model number) added to implement positive security measures.
A4.8.5.6.4. Document all software/firmware involved in the implementation of the positive security measures.
A4.8.5.6.5. Cite each applicable type-acceptance criterion by its paragraph number in part 3 of this standard (the paragraph numbers themselves indicate if the criterion being addressed is in the annex specific to the class for which application is being made). Show how the proposed telephone complies with the criterion.

A4.8.5.7. Laboratory test report, containing the following:
A4.8.5.7.1. Abstract.
A4.8.5.7.2. Objectives of tests.
A4.8.5.7.3. List of test equipment used.
A4.8.5.7.4. Test equipment configuration used for each test.
A4.8.5.7.5. Test data and conclusions.

A4.8.5.8. Support documentation for field tests and inspections - to be distributed to field inspection teams for use during on-site testing. The information provided for this purpose should be nonproprietary.
A4.8.5.8.1. Component layout diagrams, including location and function of test points.
A4.8.5.8.2. Instructions for assembly and disassembly of the telephone.
A4.8.5.8.3. Photographs showing the appearance of all circuit boards and assemblies.

A4.8.5.9. Supplementary information requested by the government in order to complete the evaluation of the application.

A4.9. Marketing of Type-Accepted Telephones.

A4.9.1. Telephones being marketed to agencies or departments of the US Government as TSG type-accepted telephones must be permanently marked to show the TSG type-acceptance number and either a serial number or the month and year of manufacture.

A4.9.2. Regardless of the agency to which the initial application was made, once a TSG type-acceptance number is assigned to a telephone, it will be recognized as a type-accepted item by all the member agencies of the TSG without need for further evaluation.

PART 3

DESIGN AND CONSTRUCTION SPECIFICATIONS

Preliminary Note: The general approach and those requirements that are applicable to all type-acceptance classes are presented here. Specific requirements for individual type-acceptance classes are provided in a separate dedicated annex for each class.

A4.10. Introduction.

A4.10.1. The standards are used to determine qualification for type-acceptance in one of several numerically designated security classes applied to CTS type-accepted electronic telephones. Class 1 has the highest security. Increasing numerical values indicate decreasing security classifications.

A4.10.2. The primary intent of these standards is to ensure that no signals containing microphonic information (produced due to the microphonic behavior of any component part or device in the telephone) can leave the telephone unless it is in the in-use state.

A4.10.3. The telephone must be demonstrably physically incapable of producing any microphonic audio on any wires leaving the instrument while it is not in use.

A4.10.4. Regardless of which state the telephone is in (in-use, idle, programming, etc.), no change (temporary or permanent) in any of the security features required for its type-acceptance class (except those for the annunciator) can result from any acoustic or electromagnetic signals, or from action by the parent system, or from signals on any of the station mounting cord wires or power supply wires. The security features are independent of the voltages (or absence thereof) on any of the wires.

A4.10.5. The higher security type-acceptance classes (lowest class numbers) require that positive security measures that interfere with the normal in-use functions be employed for operationally inactive transducers. In these cases, provision must, of course, be made so that with the exception of the annunciator when the telephone is in the in-use state, and at no other time, these measures are suspended. The suspension of nonannucicator positive security measures required for the intended type-acceptance class, however, must never be able to occur without a manual action by the user that is unequivocally associated with placing the telephone in the in-use state (e.g., lifting the handset or activating a speakerphone switch). The CTS must not be able to have any affect on the state of the positive security measures. The security measures are completely controlled at the telephone. The security measures must all restore to full effect when the user performs any normal telephone operation intended to terminate the in-use state.

A4.10.6. TSG has concluded that in most cases the objectives of this program are best achieved by using metallic-contact disconnect devices (switches and relays). It is recognized that the modern telephone industry often regards these devices as obsolete technology. Their requirement here, however, does not derive merely from their functional performance but also from physical and electrical characteristics that make that performance readily confirmable by electrical and physical inspection. It is emphasized, therefore, that whenever the type-acceptance standards specifically designate metallic-contact disconnect devices, functionally equivalent operational alternatives employing more modern technologies will not be acceptable. The metallic-contact disconnect devices used to isolate and short the various transducers and handset functions may be switches located in the handset mounting that are operated directly by placing and removing the handset, or they may be relays that are controlled by whatever form of hookswitch is used.

A4.11. Operational Limitations.

A4.11.1. The telephone must not be capable of cordless operation. Wireline connections between the telephone and the CTS are needed for the telephone to function. All communications and information interchange among the telephone, its component parts, auxiliary units, and the CTS must be on physical wirelines.

A4.11.2. There must not be any hands-free answering capability. A manual action on the part of the user is necessary to initiate, answer, join, or maintain a call. The telephone can be in the in-use state only if:

A4.11.2.1. The handset is physically removed from the handset mounting, or

A4.11.2.2. A manual speakerphone or headset switch is activated, or

A4.11.2.3. An auxiliary unit is manually activated.

A4.11.3. Some telephones may require additional action by the user (such as pressing a line select key) to be in the in-use state; this is entirely acceptable.

A4.11.4. The telephone is immediately restored to and remains in the idle state if:

A4.11.4.1. All auxiliary units are manually deactivated, and

A4.11.4.2. All headset and speakerphone switches are turned off, and
A4.11.4.3. The handset is positioned in the handset mounting.
A4.11.5. When a call is terminated, all required idle-state security measures automatically and immediately become effective.
A4.11.6. Positive security measures cannot include any software-dependent or firmware-dependent functions.

A4.12. Telephone Security and Inspection Support Measures.

A4.12.1. Electrical Requirements.
A4.12.1.1. In implementing the design standards, the telephone is to be treated as an ensemble of electrical and electronic subassemblies, some of which contain microphonic components. Evaluation with respect to security principles and the implementation of security measures are then to be confined to those subassemblies (the handset for example) that actually contain the microphonic components rather than to the entire telephone. A microphonic component, by definition, produces electrical signals in response to audio acoustic signals. Defining a subassembly for the component sets the idle-state limits allowed for its microphonic signals; they are not permitted outside of the defined subassembly. No microphonic signals may extend to the boundary points of the containing subassembly, and these points, therefore, become the cardinal points for the application of positive security measures and security testing.
A4.12.1.2. A designated subassembly may, in principle, be as large as the entire telephone (excluding external wires and transmission media) or as small as a single component. Every subassembly is connected either directly or indirectly (via other internal subassemblies) to wires or transmission media that leave the telephone.
A4.12.1.3. All means by which signals may be coupled between the internal subassemblies and to external wires and media are of concern. These include, but are not limited to, direct metallic connections, electric field coupling, magnetic field coupling, electro-optics, powerline modulations, and modulated radio-frequency (conducted and/or radiated).
A4.12.1.4. Subassemblies that contain transducers or other potential microphonic components are termed focal subassemblies.
A4.12.1.5. Subassemblies that are not focal subassemblies but that contain components that are essential to the operation of positive security functions are termed critical subassemblies. Any electrical paths or circuitry used to convey in-use state control signals from the manually actuated component (e.g., hookswitch, headset switch, speakerphone switch) to the components that implement the positive security measures are included in the critical subassemblies.
A4.12.1.6. The description of the telephone as an ensemble of subassemblies is for convenience in specifying, applying, describing, and evaluating the protective measures. Limits are placed on the scopes of the focal and the critical subassemblies in the individual specific standards for the various type-acceptance classes. Some type-acceptance classes are much more restrictive with regard to what is allowed in these subassemblies than are others. The analysis of the telephone into internal subassemblies is performed by the submitting manufacturer or his marketing agent. The analysis must allow all audio transducers and their attendant protective measures to be precisely identified and explained. For the most part, this theoretical division of the telephone into subassemblies will follow natural functional divisions inherent in the instrument (such as handset, ringer, or dial), but this need not be the case, and any arbitrary boundaries may be used providing that:
A4.12.1.6.1. They do not violate the specific requirements for the intended type-acceptance class.
A4.12.1.6.2. They do not divide any elemental component packages. Any item such as a switch, transformer, relay, integrated circuit, or multicomponent package (which cannot be readily opened for maintenance on the individual components) must be placed entirely in a single subassembly.
A4.12.1.6.3. All connections to a subassembly are by means of metallic conductors only. Any use of any other coupling mechanisms must be contained wholly within a single subassembly. It is recognized that fortuitous coupling between physically separate components that have no significance with respect to the operational performance of the telephone can be expected to occur. Maximum allowable fortuitous coupling between focal subassemblies and any other part of the telephone or external wiring will be specified for all classes of type-accepted telephone. As long as these couplings do not exceed the allowable limits, they need not be taken into account when assigning subassembly boundaries.
A4.12.1.6.4. Any components employed as positive security measures to prevent unwanted signals from being transmitted on the metallic conductors crossing the boundary of a focal subassembly are included within that focal subassembly.
A4.12.1.7. Components or devices included in focal subassemblies as positive security measures must be tested and shown to be non-microphonic. The open-circuit pressure response level must be measured across every pair-wise

combination of connections to the component/device. In the range 200 Hz to 8 kHz, the microphonic response must be less than 1 mV_{rms} for a sound pressure level of 2 Pa.
A4.12.1.8. A distinction is recognized between the original focal subassembly and the resultant focal subassembly produced when positive security measures have been included. Primary connectors are the conductors that connect to the original focal subassembly and that must be retained in the resultant, protected configuration for proper operation of the telephone. The term ancillary connector is used to describe any metallic conductors not present in the original subassembly that must cross the boundaries of the resultant subassembly specifically to support the positive security measures.
A4.12.1.9. Except for annunciators, critical subassemblies must not include components that receive, process, or in any way act on electrical signals or instructions that originate outside the telephone-auxiliary unit composite.
A4.12.1.10. All transducers, except the annunciator, are operationally inactive, except when the telephone is in the in-use state. The annunciator transducer is operationally inactive except when an incoming call is being announced.
A4.12.1.11. The open-circuit microphonic pressure response level for unpowered transducers (regardless of whether they are functionally transmit or receive elements) must be less than 30 mV/Pa over the frequency range 200 Hz to 8 kHz.
A4.12.1.12. A visual indication is to be provided whenever any of the protective measures other than those for the annunciator is not in effect.
A4.12.1.12.1. If the protective measures are disabled because the handset was removed from the handset mounting no further visual indication is necessary.
A4.12.1.12.2. If there are ways by which the user can cause the telephone to be in the in-use state without lifting the handset, such as with a speakerphone, the telephone must be fitted with a lamp indicator that will unambiguously show when the protective measures have been disabled. This lamp must respond to all activities that disable the protective measures while the handset is in the handset mounting; there is no need for it to respond to the lifting of the handset, but there is also no objection to its doing so.

A4.12.2. Mechanical Requirements.
A4.12.2.1. The construction of the telephone set must provide (at any time before, during, or after installation) a means for the physical inspection of all security measures to ensure they are functioning properly. All security functions must be verifiable by physical inspection and/or electrical measurement.
A4.12.2.2. The telephone must be capable of repeated disassembly without physical damage or deterioration occurring.
A4.12.2.3. All connections and coupling mechanisms (intentional or fortuitous) that cross the boundaries of the focal assemblies must be identified.
A4.12.2.4. If a type-acceptance class requires test points (e.g., to permit the electrical verification of security protective conditions), these test points must be placed so they can be safely accessed while the telephone is operational. The location of the test points must be such that they can be accessed without danger of touching any other component or wiring. Under no circumstances shall the security-related test points be accessible without the telephone case being opened.
A4.12.2.5. All transducers not specifically allowed must be physically removed from the telephone set, not merely disconnected. Depending on class/suffix, this may include, but is not limited to, speakers for voice announcements, speakerphones, and built-in microphones.
A4.12.2.6. The construction of the telephone must preclude any possibility that internal components or wiring can obstruct the operation of any switch or device used to provide or control the physical protective measures.
A4.12.2.7. Any use of multiple hookswitch plungers will be fully redundant. Depressing any one alone will fully operate all the idle-state protective measures.

A4.13. Manufacturing Restrictions. Once a telephone is type-accepted, design or construction changes are permitted unless they affect some aspect of the criteria required for its type-acceptance class. Any design or construction change in the designated focal subassemblies or critical subassemblies automatically cancels the type-acceptance status.

A4.14. Electrical Test Requirements.

A4.14.1. Sound Pressure Response Tests.
A4.14.1.1. The pressure response level measurements are to determine if there is excessive coupling of microphonically produced signals from the focal subassemblies to conductors in their vicinity or to the external wires. Acoustic energy is

projected at the microphonic element at a specified sound pressure level; ground-referenced and differential voltage measurements are performed at the conductors of interest.

A4.14.1.2. Acceptance Criteria. For sound pressure levels of 2 Pa:
A4.14.1.2.1. The pressure response voltages due to fortuitous coupling from the focal subassemblies must not exceed 30 mV_{rms} at any point inside the telephone. All conductors and components located within 1 cm of the subassembly must be tested.
A4.14.1.2.2. The pressure response voltages must not exceed 1 mV_{rms} on any external wiring. All conductors leaving the telephone must be tested.
A4.14.1.2.3. The open-circuit sound pressure response voltage must not exceed 60 mV_{rms} for any transducer included in the telephone-auxiliary unit composite.
A4.14.1.2.4. The open-circuit sound pressure response voltage must not exceed 1 mV_{rms}, for any component used to implement the positive security measure.

A4.14.1.3. Test Conditions.
A4.14.1.3.1. The sensitivity of the test instrumentation and the environmental noise conditions throughout the specified frequency range must permit the detection and accurate measurement of any signal from a 100,000-ohm (or less) source with an open circuit voltage at least one-tenth the maximum allowed level. The net loading impedance of the test instrumentation must be equal to or greater than 100,000 ohms at the point of connection to the conductors being tested.
A4.14.1.3.2. Both online and offline tests are required for the focal subassemblies. Online tests are performed in the idle state with the telephone connected to the CTS in the normal manner. For the offline tests, the telephone is completely disconnected from the CTS. In both cases, all contacts used for positive security measures are in their normal condition (normal-open are open, normal-closed are closed).

A4.14.1.4. Acoustic Signals.

A4.14.1.4.1. The sound pressure levels of the test signals are not less than 2 Pa for all tests. Tests on internal points are conducted at 1 kHz. All other tests are conducted over the frequency range 100 Hz to 15 kHz; either continuously or at intervals not to exceed one-half octave below 400 Hz and one-third octave above 400 Hz. The test frequency may be modulated to facilitate recognition during recovery but the rms value must not be less than 2 Pa for at least 50 percent of the modulation cycle.

A4.14.1.4.2. Testing of more than one transducer at a time is allowed as long as the sound pressure level at each transducer being considered is at least 2 Pa. In any event every transducer in the telephone-auxiliary unit composite must be tested either in combination with other transducers or in a separate test run.

A4.14.1.5. Signal Recovery.
A4.14.1.5.1. Internal Points. Identify every conductor that either extends to within 1 cm of the focal subassembly or is connected to a component that extends to within 1 cm of the focal subassembly. For all electrical signals produced as the result of coupling from the focal subassembly, measure the ground-referenced voltage at each of these conductors and the differential voltage for all pair-wise combinations of these conductors; the voltages measured must not exceed the limits provided above.
A4.14.1.5.2. External Wiring. The external wiring that must be tested consists of the conductors (wires) in the station mounting cord and in any other external electrical connection to the telephone (not handset, headset, or auxiliary unit cords). Measure the electrical signals produced as the result of pressure response from the 2 Pa sound source. Both ground-referenced voltages and differential pair-wise voltages must be measured for each of these conductors. Every conductor must be tested individually against ground and in pair-wise combination with every other conductor. The pressure response voltages must not exceed the limits stipulated above.

A4.14.2. Contact Capacitance Test. This test need not be performed if the manufacturer of the component in question has specified for it a minimum performance that meets or exceeds these criteria.
A4.14.2.1. All normal-open metallic contact pairs used for positive security measures must be measured (installed or not installed at the manufacturer's option) to confirm compliance with the criteria for maximum capacitance. The test instrumentation must be capable of detecting and accurately measuring capacitances one-tenth the specified maximum value.

A4.14.2.2. Acceptance Criterion. The capacitance across the normal-open contacts must be lower than 7 pF.

A4.14.3. Contact Resistance Tests. These tests need not be performed if the manufacturer of the component in question has specified for it a minimum performance that meets or exceeds these criteria.
A4.14.3.1. All normal-closed metallic contact pairs used for positive security measures must be measured (installed in the telephone) to confirm compliance with the criteria for maximum closed resistance. The test instrumentation must be capable of detecting and accurately measuring resistances one-tenth the specified maximum value.
A4.14.3.2. All normal-open metallic contact pairs used for positive security measures must be measured (installed or not installed in the telephone at the manufacturer's option) to confirm compliance with the criteria for minimum open resistance. The test instrumentation must be capable of detecting and accurately measuring resistances 10 times the specified minimum value.

A4.14.3.3. Acceptance Criteria. The closed resistance of normal-closed contacts must be lower than 150 mW.
A4.14.3.4. The open resistance across normal-open contacts must exceed 100 MW.

PART 3 (ANNEX 1)

SUPPLEMENTARY DESIGN AND CONSTRUCTION SPECIFICATIONS TYPE-ACCEPTANCE CLASS 1

Preliminary Note: This annex to part 3 of TSG Standard 4 describes the specific supplementary requirements for TSG type-acceptance Class 1. The general type-acceptance approach and those requirements that are applicable to all the type-acceptance classes were presented in part 3 itself.

A4.15.1. Operational/Physical Limitations.
A4.15.1.1. There is no voice annunciator capability when the telephone is in the idle state; voice annunciation over a secondary voice path is permitted if the telephone is already in the in-use state.
A4.15.1.1.1. When the telephone is in the idle state:

No audio signals originating outside the telephone can be annunciated directly by any element in the telephone.

Externally generated incoming ring signals or instructions may only activate a ring signal generator located in the telephone itself.

Audible annunciation of an incoming call is accomplished with the internally generated signals that occur when the appropriate incoming ring instruction/signal is received by the telephone.

A4.15.1.1.2. Incoming audio may be routed to the receiver element in the handset or to a speaker in an auxiliary unit or in the main body of the telephone set when, and only when, the telephone is in the in-use state. This audio may be for the existing call, for local intercom, or to annunciate another call.

A4.15.2. Telephone Security and Inspection Support Measures.
A4.15.2.1. Except as specified below, focal subassemblies cannot include any components other than the transducers or microphonic elements themselves and the components used to implement the positive security measures.
A4.15.2.1.1. Wires and printed circuit conductors may be included if they connect directly to a transducer and are operationally necessary. Wires in the cord connecting an external member (e.g., handset, headset, auxiliary unit) to the main body of the telephone must meet this criterion to be included in a focal subassembly.
A4.15.2.1.2. Components connected directly across the terminals of the transducers may be included if the transducers in question are located in a member external to the main body of the telephone, and the positive security measures are located within the main body itself.
A4.15.2.1.3. Some transducers are contained in sealed packages that also contain other components. Electret microphone-based transmitter elements are typically constructed in this way. For purposes of assigning the focal subassembly, sealed packages that do not permit direct access to the actual transducer may be treated as if the entire package were the transducer.
A4.15.2.2. The following positive security measures are applied at the boundaries of each focal subassembly. These protective measures must be in effect whenever the transducers contained within the subassembly are operationally inactive. Unless the proper control signal (manual in-use action or incoming ring signal) is received, the operationally inactive measures remain in effect.
A4.15.2.2.1. Normal-open metallic-contact disconnect devices (switches or relays) completely disconnect all intrinsic connectors of the focal subassembly. The initial breakdown voltage rating for the device must be at least 1.5 kV. The resistance across the open contacts must exceed 100 MW. The capacitance across the open contacts must be less than 7 pF.
A4.15.2.2.2. Normal-closed metallic contacts across the intrinsic connectors of the focal subassembly (on the subassembly side of the disconnected conductor) short all the intrinsic connectors together. The shorted conductors are disconnected from the rest of the telephone by the normal-open contacts cited above. The closed contacts must have a resistance less than 150 mW and be either 5 percent gold alloy or gold clad. The opening and closing of these shorting contacts must occur with no voltages across them.
A4.15.2.3. When the telephone is in the idle state, power is removed from all components operationally used to amplify in-use state transmit signals.
A4.15.2.4. Test points that permit the electrical verification of all security protective conditions are included. At a minimum, these test points must provide electrical access to the following:

A4.15.2.4.1. Every metallic contact used as a protective measure.
A4.15.2.4.2. Every terminal of every transducer.
A4.15.2.4.3. All audio amplifier input signals, output signals, and power feeds.
A4.15.2.4.4. All wires leaving the telephone.
A4.15.2.4.5. A means to synchronize test equipment with the exchange of data to and from the CTS. For many systems, these exchanges occur in discrete blocks with a readily discernible transition from an idle condition (at which time there is no electrical signal on the data line other than, possibly, DC) to the data transfer. In these cases the test points on the data lines, A4.15.2.4.4. above, are sufficient. If synchronization to the start of the basic data block cannot be obtained from the data lines without interpretation of the digital data stream, a specific test point that will provide it must be available inside the telephone.

PART 3 (ANNEX 2)

SUPPLEMENTARY DESIGN AND CONSTRUCTION SPECIFICATIONS TYPE-ACCEPTANCE CLASS 2

Preliminary Note: This annex to part 3 of TSG Standard 4 describes the specific supplementary requirements for TSG type-acceptance Class 2. The general type-acceptance approach and those requirements that are applicable to all the type-acceptance classes were presented in part 3 itself.

A4.16.1. Operational/Physical Limitations. There is no voice annunciator capability when the telephone is in the idle state; voice annunciation over a secondary voice path is permitted if the telephone is already in the in-use state.
A4.16.1.1. When the telephone is in the idle state:
A4.16.1.1.1. No audio signals originating outside the telephone can be annunciated directly by any element in the telephone.
A4.16.1.1.2. Externally generated incoming ring signals or instructions may only activate a ring signal generator located in the telephone itself.
A4.16.1.1.3. Audible annunciation of an incoming call is accomplished with the internally generated signals that occur when the appropriate incoming ring instruction/signal is received by the telephone.
A4.16.1.2. Incoming audio may be routed to the receiver element in the handset or to a speaker in an auxiliary unit or in the main body of the telephone set when, and only when, the telephone is in the in-use state. This audio may be either for the existing call, for local intercom, or to annunciate another call.

A4.16.2. Telephone Security and Inspection Support Measures.
A4.16.2.1. If transducers are contained in a unit that is located outside the main body of the telephone (such as a handset or auxiliary unit), that unit may, in its entirety (together with the cord connecting it to the main body and the positive security measures located within the main body), be used as a focal subassembly. For functions wholly contained within the main body of the telephone, focal subassemblies are limited to the transducers, the components used as positive security measures, and the wires connecting these components to the transducers.
A4.16.2.2. Some transducers are contained in sealed packages that also contain other components. Electret microphone-based transmitter elements are typically constructed in this way. For purposes of assigning the focal subassembly, sealed packages that do not permit direct access to the actual transducer may be treated as if the entire package were the transducer.
A4.16.2.3. The following positive security measures are applied at the boundaries of each focal subassembly. These protective measures must be in effect whenever the transducers contained within the subassembly are operationally inactive. Unless the proper control signal (manual in-use action or incoming ring signal) is received, the operationally inactive measures remain in effect.
A4.16.2.3.1. Normal-open metallic-contact disconnect devices (switches or relays) completely disconnect all intrinsic connectors of the focal subassembly. The initial breakdown voltage rating for the device must be at least 1.5 kV. The resistance across the open contacts must exceed 100 MW. The capacitance across the open contacts must be less than 7 pF.
A4.16.2.3.2. Normal-closed metallic contacts across the intrinsic connectors of the focal subassembly (on the subassembly side of the disconnected conductor) short all the intrinsic connectors together. The shorted conductors are disconnected from the rest of the telephone by the normal-open contacts cited above. The closed contacts must have a resistance less than 150 mW and be either 5 percent gold alloy or gold clad. The opening and closing of these shorting contacts must occur with no voltages across them.
A4.16.2.4. Test points that permit the electrical verification of all security protective conditions are included. At a minimum, these test points must provide electrical access to the following:
A4.16.2.4.1. Every metallic contact used as a protective measure.
A4.16.2.4.2. All wires leaving the telephone.
A4.16.2.4.3. A means to synchronize test equipment with the exchange of data to and from the CTS. For many systems, these exchanges occur in discrete blocks with a readily discernible transition from an idle condition (at which time there is no electrical signal on the data line other than, possibly, DC) to the data transfer. In these cases, the test points on the data lines, a4.16..2.4.2. above, are sufficient. If synchronization to the start of the basic data block cannot be obtained from the data lines without interpretation of the digital data stream, a specific test point that will provide it must be available inside the telephone.

PART 3 (ANNEX 3)

SUPPLEMENTARY DESIGN AND CONSTRUCTION SPECIFICATIONS TYPE-ACCEPTANCE CLASS 3

Preliminary Note: This annex to part 3 of TSG Standard 4 describes the specific supplementary requirements for TSG type-acceptance Class 3. The general type-acceptance approach and those requirements that are applicable to all the type-acceptance classes were presented in part 3 itself.

A4.17.1. Operational/Physical Limitations. [Nothing additional is required for this class. All specifications for this section are provided in part 3 of this standard.]

A4.17.2. Telephone Security and Inspection Support Measures.

A4.17.2.1. If transducers are contained in a unit that is located outside the main body of the telephone (such as a handset or auxiliary unit), that unit may, in its entirety (together with the cord connecting it to the main body and the positive security measures located within the main body), be used as a focal subassembly. For functions wholly contained within the main body of the telephone, focal subassemblies are limited to the transducers, the components used as positive security measures, and the wires connecting these components to the transducers.

A4.17.2.2. Some transducers are contained in sealed packages that also contain other components. Electret microphone-based transmitter elements are typically constructed in this way. For purposes of assigning the focal subassembly, sealed packages that do not permit direct access to the actual transducer may be treated as if the entire package were the transducer.

A4.17.2.3. The following positive security measures must be applied at the boundaries of each non-annunciator focal subassembly and are optional for annunciator focal subassemblies. If the annunciator subassemblies use these measures, the alternative conditions in section 3(3).2.4, below, may be ignored. All protective measures must be in effect whenever the transducers contained within the subassembly are operationally inactive. Unless the proper control signal (manual in-use action or incoming ring signal) is received, the operationally inactive measures remain in effect.

A4.17.2.3.1. Normal-open metallic-contact disconnect devices (switches or relays) completely disconnect all intrinsic connectors of the focal subassembly. The initial breakdown voltage rating for the device must be at least 1.5 kV. The resistance across the open contacts must exceed 100 MW. The capacitance across the open contacts must be less than 7 pF.

A4.17.2.3.2. Normal-closed metallic contacts across the intrinsic connectors of the focal subassembly (on the subassembly side of the disconnected conductor) short all the intrinsic connectors together. The shorted conductors are disconnected from the rest of the telephone by the normal-open contacts cited above. The closed contacts must have a resistance less than 150 mW and be either 5 percent gold alloy or gold clad. The opening and closing of these shorting contacts must occur with no voltages across them.

A4.17.2.4. If the positive security measures stipulated in section 3(3).2.3 are not applied to the annunciator focal subassembly, the annunciator must be a two-terminal ringer that is operated by DC. For any transducer or sealed ringer package used without the protective measures of section 3(3).2.3, the microphonic response to a 2 Pa sound pressure level must be less than 1 mV_{rms} over the frequency range 100 Hz to 15 kHz.

A4.17.2.5. Test points that permit the electrical verification of all security protective conditions are included. At a minimum, these test points must provide electrical access to the following:

A4.17.2.5.1. Every metallic contact used as a protective measure.

A4.17.2.5.2. All terminals on the annunciator transducer or ringer package.

A4.17.2.5.3. All wires leaving the telephone.

A4.17.2.5.4. A means to synchronize test equipment with the exchange of data to and from the CTS. For many systems, these exchanges occur in discrete blocks with a readily discernible transition from an idle condition (at which time there is no electrical signal on the data line other than, possibly, DC) to the data transfer. In these cases the test points on the data lines, A4.17.2.5.3. above, are sufficient. If synchronization to the start of the basic data block cannot be obtained from the data lines without interpretation of the digital data stream, a specific test point that will provide it must be available inside the telephone.

GLOSSARY

Preliminary Note: The definitions in this glossary are for use with the TSG standards only. They are provided to ensure a precise, unambiguous meaning for terms used to describe TSG requirements. Many of the terms used have no related meaning in any other context. Where terms are involved that are employed by the telephone industry, the usages given are intended to be consistent with most common industry practices. Usage, however, can vary significantly from company to company, and this glossary is not a definitive study of all the ways in which these terms may be used. It is important in using the TSG standards, that these terms not be given any more or any less meaning than is specified here.

ANNUNCIATOR -- A device for producing an audible signal to announce an incoming call.

AUDIBLE SIGNAL -- A sound that is specifically emitted by the telephone to be audible anywhere in its immediate vicinity.

AUXILIARY UNIT -- A device connected to the telephone by means other than the station mounting cord or the handset cord.

BUILT-IN MICROPHONE -- A microphone located in the body of the telephone rather than in the handset.

CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors, used to provide the electrical connections between two separate, distinct units or component parts.

CRITICAL SUBASSEMBLY -- Any subassembly that is not a focal subassembly, but that contains components essential to the operation of positive security functions.

CTS (COMPUTERIZED TELEPHONE SYSTEM) -- A generic term used to describe any telephone system that uses centralized stored program computer technology to provide switched telephone networking features and services. Referred to commercially by such terms as computerized private branch exchange (CPBX), private branch exchange (PBX), private automatic branch exchange (PABX), electronic private automatic branch exchange (EPABX), computerized branch exchange (CBX), computerized key telephone systems (CKTS), hybrid key systems, business communications systems, and office communications systems.

CTS ELECTRONIC TELEPHONES -- Telephone sets expressly designed to operate with specific CTS to obtain the various features and services offered by those CTS. These telephones are not compatible with normal central office service and cannot be connected directly to standard central office lines.

DISCONNECT -- A device that (1) inserts a break at some point in the normal hardwire conduction path that exists between a telephone and its telecommunications medium, and (2) only when the telephone is in the in-use state, establishes a temporary metallic connection across that break.

FOCAL SUBASSEMBLY -- Any subassembly that contains transducers or other potentially microphonic components.

HANDS-FREE ANSWERING -- A feature available on some telephones and telephone systems that, when certain types of incoming calls occur, either automatically places the telephone in the in-use state or allows the user, without any manual action, to initiate the in-use state by means of a voice-activated switch.

HANDSET -- A combined telephone earpiece (containing a receiver element) and mouthpiece (containing a transmitter element) mounted on a handle.

HANDSET CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors, used to provide the electrical connections between the handset and the main body of the telephone.

HANDSET MOUNTING -- The receptacle, bracket, cradle, or other support specifically provided on the main body of the telephone to hold the handset when it is not in use. The handset mounting is fitted with a means to detect whether or not the handset is in place in (or on) the handset mounting.

HEADSET -- A combined telephone earpiece (containing a receiver element) and mouthpiece (containing a transmitter element) assembly to be worn on the user's head.

HOOKSWITCH -- The device employed to determine if the handset is, or is not, in place in (or on) the handset mounting is termed the hookswitch regardless of how it operates. In some cases the hookswitch will not involve any sort of mechanical switch and/or break any incoming current loop.

HOUSE CABLING -- The wiring and associated frames that provide the electrical connections between the computer-controlled telephone system and the individual blocks or jacks for each telephone's station mounting cord.

IDLE STATE (VOICE TERMINAL) -- A voice terminal is in the idle state whenever it is not in the in-use state (see below).

IN-USE STATE (VOICE TERMINAL) -- A voice terminal is in the in-use state if it is communicating to its network system which a user is either initiating or actively engaged in communications via a temporary switched connection set up by that network system.

ISOLATOR (ISOLATION) -- A device that (1) inserts a break at some point in the normal hardwire conduction path that exists between a telephone and its telecommunications medium, and (2) only when the telephone is in the in-use state, provides a temporary communications channel across that break without establishing an end-to-end metallic connection.

KEY TELEPHONE SYSTEM -- A system of telephones and connections to the public switched telephone network (PSTN) or to a private branch exchange (PBX) that provides the telephones with selective access to the PSTN or PBX connections by means of pickup keys located at or near the telephones.

MANUAL ACTION -- An action that requires that the user touch, move, lift, or otherwise manipulate by hand, some control or part of the telephone. An operation that is actuated by the user's voice does not qualify as a manual action.

MICROPHONE -- Any component among whose intended functions include performing as a transducer to produce an electrical analogue output from an audio-frequency sound pressure waveform input.

MICROPHONIC -- Any component, regardless of its intended functions, that exhibits transducer behavior to produce an electrical analogue output from an audio-frequency sound pressure waveform input is termed microphonic.

NETWORK SYSTEM -- An assembly of member terminals, control facilities, and intercommunication facilities that can establish and maintain a communications link between any two of the member terminals.

OFF-HOOK (TELEPHONE) -- A telephone in the in-use state.

ON-HOOK AUDIO SECURITY/ON-HOOK TELEPHONE AUDIO SECURITY -- The use of positive measures to protect on-hook telephones against passing room audio is known as on-hook audio security or on-hook telephone audio security.

ON-HOOK (TELEPHONE) -- A telephone in the idle state.

OPERATIONALLY INACTIVE TRANSDUCER -- A telephone has many functional states, e.g., in-use, idle, incoming ring, incoming voice announcement, off-hook, speakerphone, programming, etc. When the specific state of the telephone does not require a particular transducer to perform any action, that transducer is referred to as an operationally inactive transducer for the state in question.

PBX (PRIVATE BRANCH EXCHANGE) -- A PBX is a local switched telephone network that is itself a member of the PSTN, and which provides access to the PSTN for its member terminals.

PRESSURE RESPONSE LEVEL -- The pressure response level of a microphone is the ratio of voltage output to sound pressure level input.

PSTN (PUBLIC SWITCHED TELEPHONE NETWORK) -- The ordinary dial-up telephone system.

PUSH-TO-OPERATE HANDSET -- There are three forms of push-to-operate handsets:

1. A telephone handset equipped with separate push-to-activate momentary-contact switches, one for the transmitter element and one for the receiver element. Either switch when not activated shorts the leads to its respective transducer and completely disconnects the transducer from the station mounting cord wires.
2. A telephone handset equipped with a single push-to-activate momentary-contact switch. When the switch is not activated, the leads for both the transmitter element and the receiver element are shorted and are disconnected from the station mounting cord wires.
3. A telephone handset equipped with both a single push-to-activate momentary-contact switch and with an isolation amplifier that allows audio signals to travel from the station mounting cord to the receiver element but not from the receiver element to the station mounting cord. When the switch is not activated, the leads for the transmitter element are shorted together and are disconnected from the station mounting cord wires.

RECEIVER ELEMENT -- The speaker located in the handset or headset earpiece. This transducer converts audio-frequency electrical signals to acoustic signals that are audible when the earpiece is held against the user's ear.

RINGER -- An annunciator that cannot be used for voice calls, announcements, or paging. A ringer can only produce specific audible signals.

SPEAKER -- Any component among whose intended functions include performing as a transducer to produce a sound pressure analogue output from an input audio-frequency electrical waveform.

SPEAKER-MICROPHONE -- Any component whose intended functions include performing both as a microphone and as a speaker.

SPEAKERPHONE -- A feature that permits a telephone to be used without lifting the handset. A speakerphone may be physically incorporated into the telephone set or it may consist of one or more auxiliary units. A usable speakerphone contains a microphone, or microphone-amplifier combination, which is sensitive enough to pick up normal conversational speech levels at a distance of several feet and a speaker, or speaker-amplifier combination, which will transduce normal telephone signal levels to sound pressure levels that can be heard at a distance of several feet.

STATION MOUNTING CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors, used to provide the electrical connections between the main body of the telephone and the blocks or jacks that terminate the house cabling.

TELECOMMUNICATIONS MEDIUM -- A means of transporting electrical information from one communications terminal to another.

TELEPHONE -- A voice terminal that, regardless of whatever other functions it performs, is a member terminal of a telephone network and accomplishes all the incoming and outgoing signaling and voice interfacing necessary for operation in that network.

TELEPHONE NETWORK -- A network system that, regardless of whatever other functions it performs, provides temporary speech communications links between member voice terminals. The essential characteristics of a telephone network are (1) that it recognize when a member terminal is initiating a call (goes off-hook), (2) that it identify the terminal being called (number dialed), (3) that it annunciate the incoming call (rings the called terminal), and (4) that it maintain a voice grade communications channel between the calling and called terminals only for the duration of the call.

TRANSDUCER -- A component of the telephone that either converts electrical signals to acoustic signals or acoustic signals to electrical signals: includes microphones, ringers, speakers, and speaker-microphones.

TRANSMITTER ELEMENT -- The microphone located in the handset or headset mouthpiece. This transducer converts acoustic signals spoken directly into the mouthpiece to analogue audio-frequency electrical signals for transmission to the main body of the telephone.

TSG-APPROVED TELEPHONE -- TSG-approved status is awarded to telephones that have been technically evaluated by the government's Telephone Security Group and determined to meet all applicable on-hook telephone audio security criteria. A TSG-approved telephone provides all necessary security features as intrinsic properties of the telephone itself.

TYPE-ACCEPTED TELEPHONE -- A TSG-approved telephone model that the TSG has evaluated in response to a formal application by its manufacturer, and has been approved and awarded a TSG type-acceptance number. The TSG telephone type-acceptance program is the primary vehicle for evaluating commercial telephones for TSG approval. TSG has issued type-acceptance standards that specify the on-hook security design, construction, and performance characteristics required for various genres of telephones and type-acceptance classes.

UNCONTROLLED/UNPROTECTED LINE
UNCONTROLLED/UNPROTECTED TELECOMMUNICATIONS MEDIUM -- A telecommunications medium, such as a telephone wireline, that is not provided continuous positive physical protection against unauthorized, clandestine intercept of the information it is being used to convey.

VOICE TERMINAL -- A generic term used to describe any device that, regardless of whatever other functions it performs, provides an intentional transmit and/or receive interface between a human talker/listener and an electric or electronic communications system. All voice terminals contain transducers; a microphone is necessary if there is a transmit function and a speaker if there is a receive function. Telephones, speakerphones, and intercom sets are common examples of voice terminals.

ON-HOOK TELEPHONE AUDIO SECURITY PERFORMANCE SPECIFICATIONS

TSG STANDARD 5

March 1990

PREFACE

This standard was prepared by the Telephone Security Group (TSG). The charter members of the TSG are: Department of the Air Force, Department of the Army, Central Intelligence Agency, Defense Intelligence Agency, Department of Energy, Federal Bureau of Investigation, Department of the Navy, National Security Agency, US Secret Service, and Department of State.

The TSG is the primary technical and policy resource in the US Intelligence Community for all aspects of the technical surveillance countermeasures (TSCM) program involving telephone systems. The TSG standards contain guidance for providing on-hook security to telephone systems in areas where sensitive government information is discussed. Implementation of TSG standards neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as TEMPEST, COMSEC, or OPSEC.

TSG Standard 1 is an introduction to telephone security that provides general information about the TSG standards.

ON-HOOK TELEPHONE AUDIO SECURITY PERFORMANCE SPECIFICATIONS

A5.1. Purpose. This standard specifies the minimum required performance for a telephone that can be located in a sensitive discussion area without supplementary on-hook audio security measures. The technical performance requirements expressed in this standard are included as a part of the type-acceptance criteria of TSG Standards 3 and 4.

A5.2. Applicability. The acceptance criteria and tests presented in this standard are for use in manufacturing and procurement of telephone instruments. These criteria are not intended for the testing and examination of installed units.

A5.3. Specifications. The telephone must comply with the performance specifications (intrinsic on-hook microphonics, resistance to modification, and verifiable security) for all the following configurations:

Disconnected from its host system or network with no power applied.

Disconnected from its host system or network, but fully powered and operationally ready.

Connected to its host system or network, fully powered, and operationally ready.

A5.3.1. Intrinsic On-Hook Microphonics.

A5.3.1.1. While on-hook, the telephone must not be able to pick up and transmit audio to the mounting cord. The telephone instrument must not exhibit intrinsic microphonic behavior with respect to any of the wires leaving the body of the instrument. The non-microphonic characteristic must be sustained independent of all environmental stimuli, including acoustic and electromagnetic fields, voltages, or commands that could be impressed on mounting cord or power supply wires. Without a manual action by the user, neither the system nor an incoming call is permitted to alter the telephone's non-microphonic characteristics or cause it to be off-hook.

A5.3.1.2. The purpose for testing microphonic behavior under this standard is not to identify or study individual microphonic components, but to measure the level of microphonic response for the whole instrument. With respect to microphonics, the telephone is considered to be an elemental microphone. The microphonic response is measured at the mounting cord of the instrument. When the instrument is excited by a sound pressure field, the microphonic response presents signal voltages at the mounting cord wires. The ground referenced voltage is to be measured at every conductor leaving the instrument. Also, the differential voltage for all pair-wise combinations of conductors must be measured to fully quantify the microphonic response. This set of voltage measurements is performed while the instrument is subjected to an acoustic excitation at a specified sound pressure level.

A5.3.1.3. The pressure response level of a microphone is the ratio of voltage output to sound pressure level (SPL) input. The voltage measurement is generally specified as an open-circuit measurement. For purposes of this specification, the internal loading on the wires being tested may be taken into consideration in configuring the voltage measuring equipment. The test equipment input resistance must equal or exceed the on-hook terminating impedance inside the telephone. Regardless of the actual internal terminating impedance, a test equipment impedance in excess of 100 kW is neither required nor prohibited. The minimum allowed impedances for various conditions are shown in Table A5.1.

Table A5.1.

TERMINATING IMPEDANCE INSIDE TELEPHONE	MINIMUM ALLOWED IMPEDANCE FOR TEST EQUIPMENT
$Z \leq 100$ kW	Z
$Z \geq 100$ kW	100 kW

A5.3.1.4. A response of 0.5 microvolts/pascal is the maximum sound pressure response that is allowed for a telephone that is to be connected to uncontrolled lines. When the response is measured in volts and the SPL in pascals, the pressure response level is obtained by dividing the input SPL into the output voltage.

$$[\text{microvolts}]/[\text{pascals}] \leq 0.5$$

When decibels are used to express both the SPL and response voltage, the pressure response level may be obtained by subtracting the input SPL (dB) from the output voltage (dB). If the voltage is measured in dB above one microvolt and the SPL in dB above 20 micropascals, the maximum allowed pressure response level becomes -100 dB.

[dBmV]-[dB SPL] ≤ -100 Db

A5.3.1.5. The telephone may be tested at any convenient SPL provided that accurate voltage measurements can be accomplished with the necessary resolution. Compliance with these requirements can normally be accomplished using an input SPL of 100 dB (2 pascals) or greater. Lower sound pressure levels require the ability to perform calibrated audio-frequency voltage measurements of less than one microvolt. Examples of the maximum allowed response voltages for various test SPL values are shown in Table A5.2.

Table A5.2.

TEST SPL		**MAXIMUM ALLOWED RESPONSE**	
dB*	**Pascals**	**Microvolts (mV)**	**dBmV**
60	0.020	0.01	-40
70	0.063	0.03	-30
80	0.20	0.1	-20
90	0.63	0.3	-10
94	1.0	0.5	- 6
100	2.0	1	0
110	6.3	3	+10

*[dB above 20 micropascals]

A5.3.1.6. The specified on-hook microphonic performance is required over the frequency range 200-6000 Hertz (Hz). The actual testing to demonstrate compliance with these specifications may be conducted by measurements taken either at discrete frequencies or with a continuous frequency sweep over the required range. The continuous frequency sweep is preferred. If discrete frequencies are used, below 400 Hz the measurements may be made at intervals not to exceed one-half octave; above 400 Hz the frequency intervals are not to exceed one-third octave. The equivalent impedance (from 200 to 6000 Hz) of all the terminations, devices, and test equipment connected to the particular wire/wire or wire/ground combination being tested must comply with Table A5.1.

A5.3.2. Resistance to Modification. The ideal condition for on-hook audio security is that the telephone cannot by any means be caused to produce audio when it is on-hook. For real telephones, however, there is always a possibility that accidental or deliberate modifications to an otherwise approved instrument could cause it to pass audio. Measures to minimize this possibility must be applied.

A5.3.2.1. The design and construction of a telephone must not facilitate any modification that could cause it to pass audio or become microphonic while on-hook.

A5.3.2.2. The telephone's internal components must be situated so that the instrument's on-hook isolation cannot be easily or covertly bypassed.

A5.3.2.3. The internal component layout of the telephone must facilitate countermeasures inspection to find potentially compromising modifications. With the cover removed, a desirable internal layout would present critical components and connections in clear view. The layout would facilitate inspection to such a degree that any added conductors or implanted components would be found immediately. A compromising modification could be readily identified because all connections critical to on-hook security would be visible. On-hook audio security is compromised when a microphonic element becomes connected to, or transfers audio to, the external wires. Therefore, components and circuit traces that are connected to any transducer or microphonic element must not be located adjacent to components or circuit traces that connect to external wires.

A5.3.2.4. To support the above inspection requirement, there should be no unnecessary enclosed spaces that prevent inspection.

A5.3.2.5. There must be no unnecessary or spare wires leaving the telephone.

A5.3.2.6. If a telephone set is computerized, or is a part of a computerized telephone system, it is not permissible for any software change to cause the telephone to pass audio or become microphonic.

A5.3.3. Verifiable Security.

A5.3.3.1. The construction of the telephone set must provide a means for the physical and electrical inspection at any time; before, during, or after installation. All components that provide on-hook audio isolation must function properly. All security functions must be verifiable by either physical inspection or electrical measurement, or both.
A5.3.3.2. The telephone must be capable of sustaining repeated disassembly without physical damage or deterioration occurring.
A5.3.3.3. If electrical test points are required to test the components that provide isolation, these test points must be placed so that they can be safely accessed in all normal operating configurations.
A5.3.3.4. Production changes and modifications, or repairs to existing telephone instruments, must not diminish compliance with these specifications.

GLOSSARY

Preliminary Note: The definitions in this glossary are for use with the TSG standards only. They are provided to ensure a precise, unambiguous meaning for terms used to describe TSG requirements. Many of the terms used have no related meaning in any other context. Where terms are involved that are employed by the telephone industry, the usages given are intended to be consistent with most common industry practices. Usage, however, can vary significantly from company to company, and this glossary is not a definitive study of all the ways in which these terms may be used. It is important in using the TSG standards, that these terms not be given any more or any less meaning than is specified here.

CTS (COMPUTERIZED TELEPHONE SYSTEM) -- A generic term used to describe any telephone system that uses centralized stored program computer technology to provide switched telephone networking features and services. CTSs are referred to commercially by such terms as computerized private branch exchange (CPBX), private branch exchange (PBX), private automatic branch exchange (PABX), electronic private automatic branch exchange (EPABX), computerized branch exchange (CBX), computerized key telephone systems (CKTS), hybrid key systems, business communications systems, and office communications systems.

MANUAL ACTION -- An action that requires that the user touch, move, lift, or otherwise manipulate by hand, some control or part of the telephone. An operation that is actuated by the user's voice does not qualify as a manual action.

MICROPHONE -- Any component among whose intended functions include performing as a transducer to produce an electrical analogue output from an audio-frequency sound pressure waveform input.

MICROPHONIC -- Any component, regardless of its intended functions, that exhibits transducer behavior to produce an electrical analogue output from an audio-frequency sound pressure waveform input is termed microphonic.

NETWORK SYSTEM -- An assembly of member terminals, control facilities, and intercommunication facilities that can establish and maintain a communications link between any two of the member terminals.

OFF-HOOK (TELEPHONE) -- A telephone in the in-use state.

ON-HOOK AUDIO SECURITY/ON-HOOK TELEPHONE AUDIO SECURITY -- The use of positive measures to protect on-hook telephones against passing room audio is known as on-hook audio security or on-hook telephone audio security.

ON-HOOK (TELEPHONE) -- A telephone in the idle state.

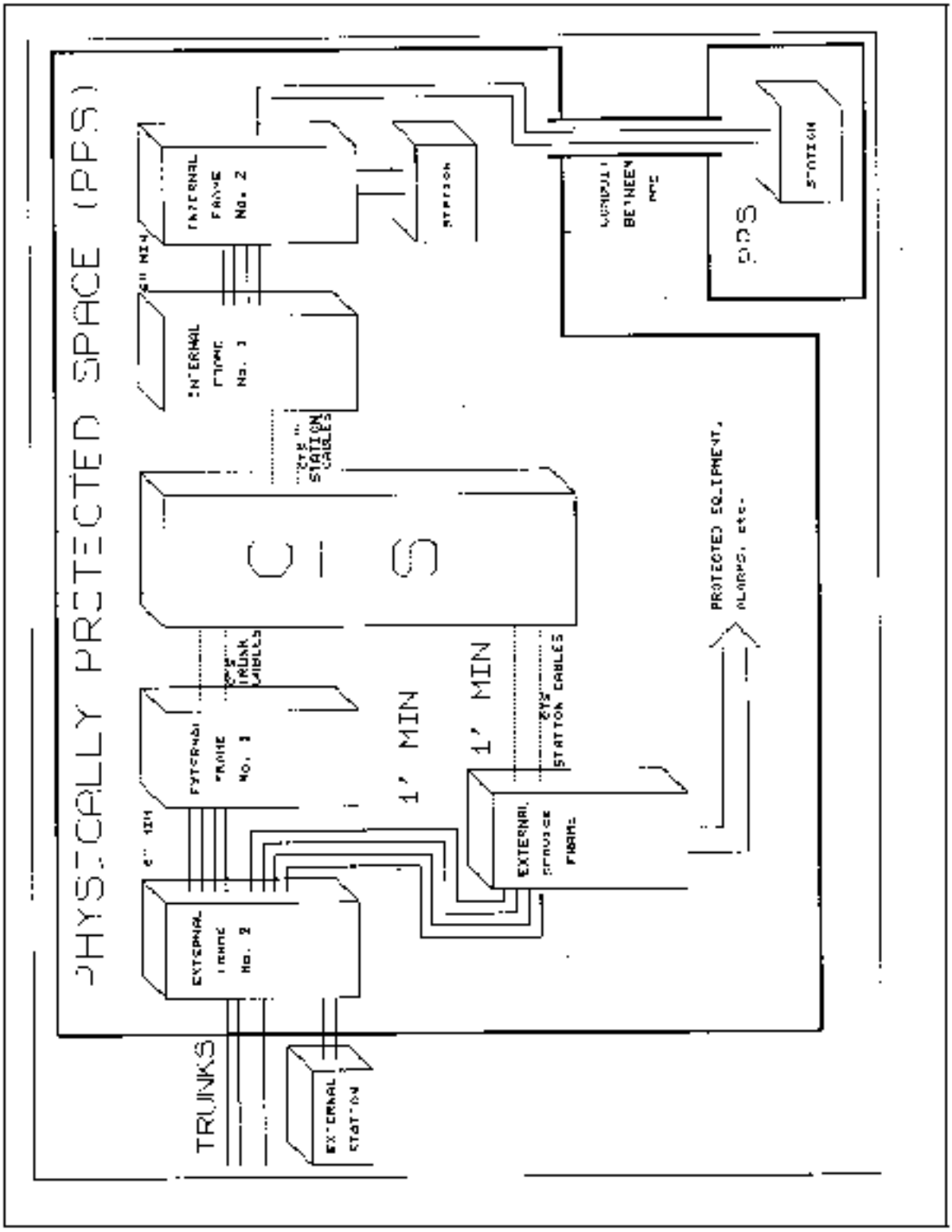
PRESSURE RESPONSE LEVEL -- The pressure response level of a microphone is the ratio of voltage output to sound pressure level input.

STATION MOUNTING CORD -- A flexible assembly of individually insulated electrical wires enclosed in a common insulating jacket and fitted with terminating connectors, used to provide the electrical connections between the main body of the telephone and the blocks or jacks that terminate the house cabling.

TELEPHONE -- A voice terminal that, regardless of whatever other functions it performs, is a member terminal of a telephone network and accomplishes all the incoming and outgoing signaling and voice interfacing necessary for operation in that network.

TRANSDUCER -- A component of the telephone that either converts electrical signals to acoustic signals or acoustic signals to electrical signals; includes microphones, ringers, speakers, and speaker-microphones.

UNCONTROLLED LINE --A telephone wireline that is not provided continuous positive physical protection against unauthorized, clandestine intercept of the information it is being used to convey.


PHYSICALLY PROTECTED SPACE (PPS)
TRUNKS
EXTERNAL STATION
EXTERNAL FRAME No. 2
EXTERNAL FRAME No. 1
STATION
CBS
STATION
PROTECTED EQUIPMENT, ALARMS, etc.
1' MIN
1' MIN
STATION CABLES
TRUNK CABLES

TELEPHONE SECURITY GROUP APPROVED EQUIPMENT

TSG STANDARD 6

March 1990

PREFACE

This standard was prepared by the Telephone Security Group (TSG). The charter members of the TSG are: Department of the Air Force, Department of the Army, Central Intelligence Agency, Defense Intelligence Agency, Department of Energy, Federal Bureau of Investigation, Department of the Navy, National Security Agency, US Secret Service, and Department of State.

The TSG is the primary technical and policy resource in the US Intelligence Community for all aspects of the technical surveillance countermeasures (TSCM) program involving telephone systems. The TSG standards contain guidance for providing on-hook security to telephone systems in areas where sensitive government information is discussed. Implementation of TSG standards neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as TEMPEST, COMSEC, or OPSEC.

TSG Standard 1 is an introduction to telephone security that provides general information about the TSG standards.

TELEPHONE SECURITY GROUP-APPROVED EQUIPMENT

A6.1. Purpose. TSG Standard 6 is a compilation of TSG-approved telephone security equipment. These items have been specifically evaluated by the TSG for security effectiveness.

A6.2. Applicability. This standard applies to all telephone installations that must be provided with on-hook audio security.

A6.3. Submission Procedure. TSG will consider for approval any telephone security equipment submitted by a member agency.

A6.4. Approved Equipment. Approved equipment is listed on the following pages. TSG will issue updates as needed.

TELEPHONES TYPE-ACCEPTED IN ACCORDANCE WITH TSG STANDARD 3:

TSG TYPE-ACCEPTANCE PROGRAM FOR TELEPHONES USED WITH THE CONVENTIONAL CENTRAL OFFICE INTERFACE

June 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: Eagle Telephonics, Long Island, NY

MODEL: Safe Set

TRADE NAME: None

DESCRIPTION & USE: This is a single-line analog telephone for use with the conventional loop-start interface of the Public Switched Telephone Network.

ORDER CODE: 600-152-1

POINT OF CONTACT: Eagle Telephonics: (516) 244-9600

Supplier: Bell Atlantic Systems Inc, Washington, DC (202) 484-9657.

TSG NUMBER: TSG-XlBlOO90134

PRICE: Eagle Telephonics: $250.00 each

2,000+ units	5% discount
5,000+ units	20% discount
10,000+ units	25% discount

Bell Atlantic Systems, Inc: $187.50 each
Wall mount kit: $18.20

AS OF: April 1991

COMMENTS: Has hold and hookswitch flash features

October 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: AT&T

MODEL: Modified Type 710

TRADE NAME: None

DESCRIPTION & USE: This is a single-line analog telephone for use with the conventional loop-start interface of the Public Switched Telephone Network.

ORDER CODE: Not available

POINT OF CONTACT: Paul McQuillan
AT&T Federal Systems,
1600 Pennsylvania Ave. NW,
Washington, DC 20500,
(202) 456-6400
FAX (202) 842-0316

TSG NUMBER: TSG-X310191268

PRICE: Not applicable

AS OF: Not applicable

COMMENTS:

1. Tone or pulse dialing.

2. Speed dials up to 16 sets of numbers.

3. Provides line hold. This feature is activated by placing the handset in the cradle while depressing the hold button.

4. This instrument is manufactured in China for AT&T and modified in the United States for TSG.

TELEPHONES TYPE-ACCEPTED IN ACCORDANCE WITH TSG STANDARD 4:

TSG TYPE-ACCEPTANCE PROGRAM FOR ELECTRONIC TELEPHONES

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: AT&T

MODEL: Modified 7302H
Manufacturer Discontinued

TRADE NAME: MERLIN, voice terminal

DESCRIPTION & USE: Modified model 7302H, 5-button voice terminal for use with all models of MERLIN control units and AT&T systems 25, 75, and 85.

ORDER CODE: PEC 9400-078

POINT OF CONTACT: David Jones (301) 982-2626

TSG NUMBER: TSG-3B10187128

PRICE: $365.00

AS OF: February 1988

COMMENTS:

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: AT&T

MODEL: Modified 7303H

TRADE NAME: MERLIN, voice terminal

DESCRIPTION & USE: Modified model 7303H, 10-button voice terminal for use with all models of MERLIN control units and AT&T systems 25, 75, and 85.

ORDER CODE: PEC 9400-079

POINT OF CONTACT: David Jones (301) 982-2626

TSG NUMBER: TSG-3BlOl87128

PRICE: $475.00

AS OF: February 1988

COMMENTS: Replaced by the 7303S.

The PEC code will remain the same.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: AT&T

MODEL: Modified 7305HO1
Manufacturer Discontinued

TRADE NAME: MERLIN, voice terminal

DESCRIPTION & USE: Modified model 7305H, 34-button voice terminal for use with all models of MERLIN control units and AT&T systems 25, 75, and 85.

ORDER CODE: PEC 9400-080

POINT OF CONTACT: David Jones (301) 982-2626

TSG NUMBER: TSG-3B10187128

PRICE: $575.00

AS OF: January 1988

COMMENTS: Replaced by 7305HO2.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: AT&T

MODEL: Modified 7305HO2

TRADE NAME: MERLIN, voice terminal

DESCRIPTION & USE: Modified model 7305H, 34-button voice terminal for use with all models of MERLIN control units and AT&T systems 25, 75, and 85.

ORDER CODE: PEC 9400-097

POINT OF CONTACT: David Jones (301) 982-2626

TSG NUMBER: TSG-3B10187128

PRICE: $550.00

AS OF: February 1988

COMMENTS: Replaces PEC 9400-080.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: AT&T

MODEL: Modified 7308H

TRADE NAME: MERLIN, voice terminal

DESCRIPTION & USE: Modified model 7308H, 34-button voice terminal for use with all models of MERLIN control units and AT&T systems 25, 75, and 85.

ORDER CODE: PEC 9400-098

POINT OF CONTACT: David Jones (301) 982-2626

TSG NUMBER: TSG-3BlOl87128

PRICE: $910.00

AS OF: February 1988

COMMENTS: Deluxe attendant console with direct station select capability.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	AT&T
MODEL:	Modified 7405D
TRADE NAME:	Digital voice terminal
DESCRIPTION & USE:	34-button telephone for use with AT&T systems 75 and 85.
ORDER CODE:	PEC 9400-150
POINT OF CONTACT:	David Jones (301) 982-2626
TSG NUMBER:	TSG-lB10188035
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	AT&T
MODEL:	Modified 7406D
TRADE NAME:	Digital voice terminal
DESCRIPTION & USE:	For use with AT&T systems 75 and 85.
ORDER CODE:	See comments
POINT OF CONTACT:	David Jones (301) 982-2626
TSG NUMBER:	TSG-1B10188035
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	PEC 9400-148: with liquid crystal display.
	PEC 9400-149: without liquid crystal display.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	AT&T
MODEL:	7505
TRADE NAME:	Digital voice terminal
DESCRIPTION & USE:	For use with integrated services digital network (ISDN) central office service.
ORDER CODE:	Not applicable
POINT OF CONTACT:	David Jones (301) 982-2626
TSG NUMBER:	TSG-210189012
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	

June 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	AT&T
MODEL:	Modified 7506
TRADE NAME:	Digital voice terminal
DESCRIPTION & USE:	For use with integrated services digital network (ISDN) central office service.
ORDER CODE:	Not applicable
POINT OF CONTACT:	David Jones (301) 982-2626
TSG NUMBER:	TSG-210189012
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	

June 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	AT&T
MODEL:	Modified SPIRIT telephone **Discontinued by manufacturer**
TRADE NAME:	Digital voice terminal
DESCRIPTION & USE:	For use with AT&T SPIRIT system.
ORDER CODE:	Not applicable
POINT OF CONTACT:	David Jones (301) 982-2626
TSG NUMBER:	TSG-210189011
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	

June 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	AT&T
MODEL:	7507
TRADE NAME:	Digital voice terminal
DESCRIPTION & USE:	For use with ISDN protocol.
ORDER CODE:	Not applicable
POINT OF CONTACT:	David Jones (301) 982-2626
TSG NUMBER:	TSG-210191177
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	The mute button and microphone for the speakerphone feature were disabled.

October 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: AT&T

MODEL: Modified 8510

TRADE NAME: Not Applicable

DESCRIPTION & USE: The 8510 is a TSG Class 2 ISDN terminal for the BRI T-Interface environment. It features 10 call appearances, a display, message waiting, mute, hold, call log, alarm clocks, and a host of other features controlled by 40 buttons and 25 LEDs.

This terminal is a voice-only terminal with the capability of data and/or call appearance expansion via a modular connector. Using the same modular connector, a removable ROM board is used rather than the traditional socket to provide easier firmware upgradability. The phone is compatible with a standard RS-232 data connection.

ORDER CODE: Not applicable

POINT OF CONTACT: David Jones (301) 982-2626

TSG NUMBER: TSG-210193300

PRICE: Not available

AS OF: Not applicable

COMMENTS: The microphone for the speakerphone feature were disabled.

Dialing out or answering calls cannot be accomplished while the handset is in the cradle.

A standard model K2S1 handset is used (300 Hz-3.4 kHz) but can be upgraded to a wideband (100 Hz-3.4 kHz) handset for enhanced acoustics.

April 1994

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: AT&T

MODEL: Modified 8520

TRADE NAME: Not Applicable

DESCRIPTION & USE: The 8520 is a TSG Class 2, ISDN terminal for the BRI T-Interface environment. It features a display, 20 call appearances, message waiting, mute, hold, drop, transfer, call log, conferencing, and a host of other features.

The 8520 is a voice terminal with data capability via an RS-232 connector.

ORDER CODE: PEC 9817-002

POINT OF CONTACT: Jim Shattles, AT&T Denver, CO
303-538-1837

TSG NUMBER: TSG-210194119

PRICE: Not available

AS OF: Not applicable

COMMENTS: The speakerphone feature is not TSG approved. The speakerphone can operate only when the handset is off the cradle.

Dialing out or answering calls cannot be accomplished while the handset is in the cradle.

A standard model K2S1 is used (300 Hz-3.4 Khz), but can be upgraded to a wide-band (100 Hz-3.4 Khz) handset for enhanced acoustics.

March 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	Eagle Telephonics
MODEL:	Modified 600100
TRADE NAME:	EAGLE electronic telephone instrument
DESCRIPTION & USE:	10-button telephone for use with EAGLET and EAGLE ONE systems.
ORDER CODE:	600130
POINT OF CONTACT:	Alex Wenger (516) 273-6700
TSG NUMBER:	TSG-2B10086294
PRICE:	$440.00
AS OF:	February 1988
COMMENTS:	

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	Eagle Telephonics
MODEL:	Modified 600103
TRADE NAME:	EAGLE electronic telephone instrument
DESCRIPTION & USE:	20-button telephone for use with EAGLET and EAGLE ONE systems.
ORDER CODE:	600133
POINT OF CONTACT:	Alex Wenger (516) 273-6700
TSG NUMBER:	TSG-2B10086294
PRICE:	$480.00
AS OF:	February 1988
COMMENTS:	

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	Mitel, Inc.
MODEL:	SUPERSET 4-TS
TRADE NAME:	SUPERSET 4-TS
DESCRIPTION & USE:	For use with Mitel PBX systems.
ORDER CODE:	Not applicable
POINT OF CONTACT:	Scott Sullivan (703) 591-0880
TSG NUMBER:	TSG-2B10388035
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: Northern Telecom

MODEL: Modified 5009S

TRADE NAME: P phone

DESCRIPTION & USE: Electronic telephone for use with Northern Telecom SL-100 and DMS-100 switches.

ORDER CODE: Not applicable

POINT OF CONTACT: Edward F. Carroll (703) 847-7520, (800) 336-3774

TSG NUMBER: TSG-2AlO287302

PRICE: Not available

AS OF: Not applicable

COMMENTS: The handset used with the type-accepted version is equipped with specially configured mercury switches. The mercury switches are essential for the on-hook security of the telephone and also provide unattended off-hook security. This handset is considered to be equivalent to a push-to-operate handset. The on-hook security is derived from the position sensitivity of the mercury switches, and the handset must be horizontally positioned when on-hook. The telephone cannot be wall-mounted.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: Northern Telecom

MODEL: Modified MERIDIAN 2018

TRADE NAME: Modified MERIDIAN

DESCRIPTION & USE: Electronic telephone for use with Northern Telecom SL-1, SL-100, and DMS-100 switches.

ORDER CODE: Not applicable

POINT OF CONTACT: Edward F. Carroll (703) 847-7520, (800) 336-3774

TSG NUMBER: TSG-2AlO288014

PRICE: Not available

AS OF: Not applicable

COMMENTS: The handset used with the type-accepted version is equipped with specially configured mercury switches. The mercury switches are essential for the on-hook security of the telephone and also provide unattended off-hook security. This handset is considered to be equivalent to a push-to-operate handset. The on-hook security is derived from the position sensitivity of the mercury switches, and the handset must be horizontally positioned when on-hook. The telephone cannot be wall-mounted.

February 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Type-accepted telephone
MANUFACTURER:	Northern Telecom Inc.
MODEL:	2016-S
TRADE NAME	Telephone
DESCRIPTION & USE:	Electronic telephone for use with Northern Telecom SL-1, SL-100, and DMS-100.
ORDER CODE:	Not applicable.
POINT OF CONTACT:	Supplier: Bell Atlantic Systems Inc., Washington, DC (202) 484-9657
TSG NUMBER:	TSG-210291030
PRICE:	$545.10
AS OF:	February 1991
COMMENTS:	Options are available for this telephone, but are not yet approved.

August 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone

MANUFACTURER: Northern Telecom Inc.

MODEL: M5009S

TRADE NAME: None

DESCRIPTION & USE: Electronic telephone for use with Northern Telecom Sl-1, Sl-100, and DMS-100. Has newly designed handset with extended service mercury switches.

ORDER CODE: Not applicable

POINT OF CONTACT: Supplier: Bell Atlantic Systems Inc., Washington, DC (202) 484-9657

TSG NUMBER: TSG-2A10293237

PRICE: Not available

AS OF: Not applicable

COMMENTS: The handset used with the type-accepted version is equipped with specially configured mercury switches. These switches are essential for the on-hook security of the telephone and also provide unattended off-hook security. This handset is considered equivalent to a push-to-operate handset. The on-hook security is derived from the position sensitivity of the switches, and the handset must be horizontally positioned when on-hook. The telephone cannot be wall mounted.

TELEPHONES AND EQUIPMENT APPROVED IN ACCORDANCE WITH TSG STANDARD 5:

ON-HOOK TELEPHONE AUDIO PERFORMANCE SPECIFICATIONS

February 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone interface

MANUFACTURER: Eagle Telephonics, Long Island, NY

MODEL: STU-III Interface

TRADE NAME: None

DESCRIPTION & USE: The STU-III Interface allows a single-line STU-III terminal to perform all the sophisticated functions of an EAGLE ONE 20-button key telephone while only requiring 3-pair for connection to the KSU (Key Service Unit).

ORDER CODE: 600-162

POINT OF CONTACT: Rick Riccoboni (516) 273-6700

TSG NUMBER: TSG-210091058

PRICE: $316.25

AS OF: September 1991

COMMENTS:

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure telephone unit III (STU-III) Type 1 terminal

MANUFACTURER: AT&T

MODEL: Single-line

TRADE NAME: Single-line STU-III

DESCRIPTION & USE: Dual-purpose telephone capable of transmitting voice and data in both secure and nonsecure (unencrypted) modes.

ORDER CODE: Not applicable

POINT OF CONTACT: None

TSG NUMBER: None

PRICE: $2900.00

AS OF: September 1988

COMMENTS: Meets TSG on-hook audio security performance specifications.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure telephone unit III (STU-III) Type I terminal

MANUFACTURER: Motorola

MODEL: Single-line with Mod 2

TRADE NAME: Single-line STU-III

DESCRIPTION & USE: Dual-purpose telephone capable of transmitting voice and data in both secure and nonsecure (unencrypted) modes.

ORDER CODE: Not applicable

POINT OF CONTACT: None

TSG NUMBER: None

PRICE: $2145.00

AS OF: September 1988

COMMENTS: Mod 2 models meet TSG on-hook audio security performance specifications.

Contact NSA for details of their replacement program for non-Mod 2 models.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure telephone unit III (STU-III) Type 1 terminal

MANUFACTURER: RCA

MODEL: Single-line with Mod 4

TRADE NAME: Single-line STU-III

DESCRIPTION & USE: Dual-purpose telephone capable of transmitting voice and data in both secure and nonsecure (unencrypted) modes.

ORDER CODE: Not applicable

POINT OF CONTACT: None

TSG NUMBER: None

PRICE: $2200.00

AS OF: September 1988

COMMENTS: Must be equipped with Mod 4 to meet TSG on-hook audio security performance specifications. Unmodified single-line STU-III models require a disconnect device.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure telephone unit III (STU-III) Type 1 terminal

MANUFACTURER: Motorola

MODEL: Multiline with Mod 4

TRADE NAME: Multiline STU-III

DESCRIPTION & USE: Dual-purpose telephone capable of transmitting voice and data in both secure and nonsecure (unencrypted) modes.

ORDER CODE: Not applicable

POINT OF CONTACT: None

TSG NUMBER: None

PRICE: Not available

AS OF: Not applicable

COMMENTS: Must be equipped with Mod 4 to meet TSG on-hook audio security performance specifications. Unmodified multiline STU-III models require a disconnect device.

May 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure Telephone Unit (STU-III)

MANUFACTURER: Motorola

MODEL: SECTEL 1500 Single Line

TRADE NAME: None

DESCRIPTION & USE: A Type 1 terminal compatible with all STU-III terminals in either data or voice modes. This terminal is capable of transmitting voice or data in secure or nonsecure (unencrypted) modes.

ORDER CODE: GSN STUN20

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7072

Motorola, Scottsdale, Arizona: (602) 441-8367

TSG NUMBER: None

PRICE: $2,845.00

AS OF: September 1991

COMMENTS:

April 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure Telephone Unit (STU-III)

MANUFACTURER: Motorola

MODEL: SECTEL 2500

TRADE NAME: None

DESCRIPTION & USE: A single-line, Type 2 terminal approved for sensitive but unclassified voice and data. The terminal is interoperable with all Type 1 STU-III products. This terminal incorporates on-hook security measures required under TSG Standard 5, and as such is approved as a stand-alone terminal without need for an external line disconnect or isolator.

ORDER CODE: 5DGT2506X

POINT OF CONTACT: Motorola, Scottsdale, Arizona:
(602) 441-8367

TSG NUMBER: Not applicable

PRICE: $3,395.00

AS OF: June 1991

COMMENTS:

May 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure Telephone Unit (STU-III)

MANUFACTURER: Motorola

MODEL: STU-III/A

TRADE NAME: None

DESCRIPTION & USE: A single-line telephone compatible with all STU-III and STU-II terminals. The STU-III/A is capable of transmitting voice and data in both secure and nonsecure (unencrypted) modes.

ORDER CODE: GSN STUB26

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7072;

Motorola, Scottsdale, Arizona: (602) 441-8367

TSG NUMBER: Not applicable

PRICE: $3,885.00

AS OF: September 1991

COMMENTS:

May 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure Telephone Unit (STU-II)

MANUFACTURER: Motorola

MODEL: SECTEL STU-II/B

TRADE NAME: None

DESCRIPTION & USE: A single-line telephone compatible with all STU-II terminals. The STU-II/B is similar in appearance to the STU-III.

ORDER CODE: GSN STUN29

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7072

Motorola, Scottsdale, Arizona: (602) 441-8367

TSG NUMBER: Not applicable

PRICE: $4,225.00

AS OF: September 1991

COMMENTS:

August 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure Telephone Unit (STU-III)

MANUFACTURER: General Electric

MODEL: GE 9600

TRADE NAME: None

DESCRIPTION & USE: A Type 1 terminal compatible with all STU-III terminals in either data or voice modes. This terminal is capable of transmitting voice or data in secure or nonsecure (unencrypted) modes. The weight is 23 lbs.

ORDER CODE: GSN STUN30

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7072

TSG NUMBER: None

PRICE: Single-line: $2,299.00

With multi-line adapter: $2,369.00

AS OF:

COMMENTS:

August 1992

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Secure Telephone Unit (STU-III)
MANUFACTURER:	AT&T
MODEL:	1100
TRADE NAME:	None
DESCRIPTION & USE:	A Type 1, single-line terminal compatible with all STU-III terminals in either data or voice modes.
ORDER CODE:	5810-01-360-3895
POINT OF CONTACT:	NSA: (800) 328-7883 or (301) 684-7071/7072
TSG NUMBER:	None
PRICE:	$1,660.00
AS OF:	August 1992
COMMENTS:	

August 1992

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Secure Telephone Unit (STU-III)
MANUFACTURER:	AT&T
MODEL:	2100
TRADE NAME:	None
DESCRIPTION & USE:	A Type 2, single-line terminal compatible with all STU-III terminals in either data or voice modes.
ORDER CODE:	5810-01-362-0608
POINT OF CONTACT:	NSA: (800) 328-7883 or (301) 684-7071/7072
TSG NUMBER:	None
PRICE:	$1,745.00
AS OF:	August 1992
COMMENTS:	

September 1992

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Secure Telephone Unit (STU-III)
MANUFACTURER:	AT&T
MODEL:	1150
TRADE NAME:	None
DESCRIPTION & USE:	A Type 1, multi-line terminal compatible with all STU-III terminals in either data or voice modes.
ORDER CODE:	5810-01-360-3895
POINT OF CONTACT:	NSA: (800) 328-7883 or (301) 684-7071/7072
TSG NUMBER:	None
PRICE:	$1,785.00
AS OF:	November 1992
COMMENTS:	

September 1992

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Secure Telephone Unit (STU-III)
MANUFACTURER:	AT&T
MODEL:	2150
TRADE NAME:	None
DESCRIPTION & USE:	A Type 2, multi-line terminal compatible with all STU-III terminals in either data or voice modes.
ORDER CODE:	5810-01-362-0608
POINT OF CONTACT:	NSA: (800) 328-7883 or (301) 684-7071/7072
TSG NUMBER:	None
PRICE:	$1,845.00
AS OF:	November 1992

COMMENTS:

April 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Cellular STU-III

MANUFACTURER: Motorola

MODEL:

TRADE NAME: Enhanced Cellular STU-III

DESCRIPTION & USE: A cellular STU-III that can interface with the PSTN either through free space or wirelines. It has a standard RJ-11 modular plug. It transmits a maximum of 3 watts and weighs 41 lbs. It supports voice in the non-secure and secure modes, and data in the secure mode using an RS-232C connector.

ORDER CODE: 5810-01-256-1097

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7072

Motorola, Scottsdale, Arizona:
(602) 441-8367

TSG NUMBER: Not applicable

PRICE: About $4,000

AS OF: July 93

COMMENTS:

May 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure Telephone Unit (STU-III)

MANUFACTURER: AT&T

MODEL: 1100M

TRADE NAME: Merlin STU-III

DESCRIPTION & USE: A Type 1 terminal compatible with the Merlin PABX switches. It provides all features commonly available on Merlin supported telephones. Like all STU-IIIs it supports voice and data in secure and nonsecure modes, and data in only the secure mode.

ORDER CODE: GSN STUA15

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7072

TSG NUMBER: None

PRICE: $2,295

AS OF: July 1993

COMMENTS:

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Multiline adapter

MANUFACTURER: AT&T

MODEL: 105197735 Mod I

TRADE NAME: STU-III multiline adapter

DESCRIPTION & USE: Provides keystrip and ringer to adapt a single-line STU-III telephone set for use with a lA2-type key telephone system.

ORDER CODE: National stock number 5810012629604

POINT OF CONTACT: Not applicable

TSG NUMBER: None

PRICE: Not available

AS OF: Not applicable

COMMENTS: Must be equipped with Mod I to meet TSG on-hook audio security performance specifications. Unmodified multiline adapters require a disconnect device and/or ringer protection.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Multiline adapter
MANUFACTURER:	GE/RCA
MODEL:	Part number 8689417-501
TRADE NAME:	STU-III multiline adapter
DESCRIPTION & USE:	Provides keystrip and ringer to adapt a single-line STU-III for use with a IA2-type key telephone system.
ORDER CODE:	National stock number 5810012509865
	Part number 8689417-501
POINT OF CONTACT:	Not applicable
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Meets TSG on-hook audio security performance specifications.

February 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Secure Telephone Unit (STU-III) Interface

MANUFACTURER: Motorola

MODEL: STU-III/R

TRADE NAME: None

DESCRIPTION & USE: An interface that provides compatibility between a secure telephone unit (STU-III) network and the public switched telephone network. The interface is remotely controlled by the telephones it supports.

ORDER CODE: LDGR1004A

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7071

Motorola, Scottsdale, Arizona: (602) 441-8367

TSG NUMBER: Not applicable

PRICE: $8,227.00

AS OF: June 1991

COMMENTS:

May 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: STU-III Secure Data Device

MANUFACTURER: AT&T

MODEL: 1900

TRADE NAME: None

DESCRIPTION & USE: The Secure Data Device (SDD) is a data-only STU-III compatible with all STU-III terminals in the data mode at 9.6 KBS.

ORDER CODE: GSN STUA12

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7072

TSG NUMBER: Not applicable

PRICE: $1,995.00

AS OF: August 1991

COMMENTS:

October 1992

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: STU-III Secure Data Device

MANUFACTURER: AT&T

MODEL: 1910

TRADE NAME: None

DESCRIPTION & USE: The Secure Data Device (SDD) is a data-only STU-III compatible with all STU-III terminals in the data mode at 14.4 KBS.

ORDER CODE: GSN STUA12

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7072

TSG NUMBER: None

PRICE: $1,995.00

AS OF: November 1992

COMMENTS: Any telephone used with the SDD to coordinate its operation must be TSG approved when used in a sensitive discussion area.

February 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Type-accepted telephone interface

MANUFACTURER: Eagle Telephonics, Long Island, NY

MODEL: STU-III Interface

TRADE NAME: None

DESCRIPTION & USE: The STU-III Interface allows a single-line STU-III terminal to perform all the sophisticated functions of an EAGLE ONE 20-button key telephone while only requiring 3-pair for connection to the KSU (Key Service Unit).

ORDER CODE: 600-162

POINT OF CONTACT: Rick Riccoboni (516) 273-6700

TSG NUMBER: TSG-210091058

PRICE: $316.25

AS OF: September 1991

COMMENTS:

October 1992

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: STU-III Interface

MANUFACTURER: Motorola, Scottsdale, Arizona

MODEL: STI-377 Module

TRADE NAME: None

DESCRIPTION & USE: The STI-377 Module interfaces a Motorola SECTEL 1500, 2500, or STU-IIIA with a Northern Telecom DMS-100 or SL-100 switch. The Module has 9 user programmable keys which can provide the same features as NTI telephone models 5009S or "P" Phone.

ORDER CODE: 5810-00-U90-3225

POINT OF CONTACT: NSA: (800) 328-7883, (301) 684-7071/7072

TSG NUMBER: None

PRICE: $450.00

AS OF: November 1992

COMMENTS:

November 1992

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: STU-III Facsimile

MANUFACTURER: Motorola

MODEL: SECTEL MFAX 5000T

TRADE NAME: None

DESCRIPTION & USE: The SECTEL MFAX 5000T is an MFAX 5000T fax unit combined with a Motorola SECTEL 1500 STU-III to provide the world's first phone/fax/data in either secure or clear modes. The SECTEL MFAX 5000T weighs 20 lbs.

ORDER CODE: MFAX 5000T: NSN 5810-01-357-4948

Order Motorola SECTEL 1500 separately.

POINT OF CONTACT: NSA: (800) 328-7883 or (301) 684-7071/7072

TSG NUMBER: None

PRICE: MFAX 5000T: $3,079

W/SECTEL 1500: $4,975

AS OF: November 1992

COMMENTS: Connects with all Motorola SECTEL terminals.

Authenticates caller and recipient.

- × Send and receive secure or clear faxes.
- × Talk while you fax.
- × Fax uses thermal paper.
- × Clear fax prints in 16 shades of gray.
- × Unattended 24 hour fax reception.
- × Routes fax to computer for later retrieval.
- × Programmable for disabling of clear fax.
- × Secure: 9600, 4800, 2400 bps.
- × Clear: 9600, 7200, 4800, 2400, 1200 bps.
- × Memory dialing for up to 16 sets of numbers.

January 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: STU-III Two Line Adapter

MANUFACTURER: AT&T

MODEL: FWA-1

TRADE NAME: None

DESCRIPTION & USE: The FWA-1 interfaces between two 2-wire, or one 2-wire and one 4-wire incoming telephone lines, and a STU-III telephone. It is compatible with a 4-wire Autovon line. Simultaneous operation on two lines is possible, e.g., talking on one line while receiving an incoming call on the second line.

ORDER CODE: NSN 5810-00-U90-3266

POINT-OF-CONTACT: NSA: (800) 328-7883, (301) 684-7071/7072

Paul McQuillan
AT&T Federal Systems,
1600 Pennsylvania Ave. NW,
Washington, DC 20500,
(202) 456-6400
FAX (202) 842-0316

TSG NUMBER: None

PRICE: $250.00

AS OF: February 1993

COMMENTS: The FWA-1 is approved for use without the need for an external disconnect or isolator.

OTHER TSG-APPROVED TELEPHONES

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	500ABM **Manufacturer Discontinued**
TRADE NAME:	Telephone
DESCRIPTION & USE:	Rotary dial, single-line telephone.
ORDER CODE:	PEC 9400-012
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required. Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	502BMW **Manufacturer Discontinued**
TRADE NAME:	Telephone
DESCRIPTION & USE:	Rotary dial, single-line telephone.
ORDER CODE:	PEC 9400-042
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required. Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	2501AB/BMW
TRADE NAME:	Telephone
DESCRIPTION & USE:	Touchtone, single-line telephone.
ORDER CODE:	Not available
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required.
	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	568HSM **Manufacturer Discontinued**
TRADE NAME:	Telephone
DESCRIPTION & USE:	Rotary dial, 6-key telephone.
ORDER CODE:	PEC 9400-086
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required. Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	2504BMW
TRADE NAME:	Telephone
DESCRIPTION & USE:	Touchtone, single-line telephone.
ORDER CODE:	PEC 9400-008
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required.
	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	2568HUM
TRADE NAME:	Telephone
DESCRIPTION & USE:	Touchtone, 6-key telephone.
ORDER CODE:	PEC 9400-045
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required.
	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	3568HHM
TRADE NAME:	Telephone
DESCRIPTION & USE:	16-button touchtone dial, 2-wire- or 4-wire-(AUTOVON)-compatible, 6-key telephone.
ORDER CODE:	PEC 9400-004
POINT OF **CONTACT:**	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required.
	Formerly manufactured by WECO.
	Replaced model 3568HTM.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	3504B/C
TRADE NAME:	Telephone
DESCRIPTION & USE:	16-button touchtone dial, 2-wire- or 4-wire-(AUTOVON)-compatible, single-line telephone.
ORDER CODE:	PEC 9400-003
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required.
	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	2714A **Manufacturer Discontinued**
TRADE NAME:	Telephone
DESCRIPTION & USE:	PRINCESS
ORDER CODE:	Not available
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required. Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	680A **Manufacturer Discontinued**
TRADE NAME:	Telephone
DESCRIPTION & USE:	Rotary dial, 18-key CALL DIRECTOR.
ORDER CODE:	Not available
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required. Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	2851CM-60
TRADE NAME:	Telephone
DESCRIPTION & USE:	Touchtone, wall-mount, 6-key telephone.
ORDER CODE:	PEC 9400-052
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required.
	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	3641AMW1A R/B, and 3641AM1A
TRADE NAME:	Telephone
DESCRIPTION & USE:	16-button touchtone dial, 2-wire- or 4-wire-(AUTOVON)-compatible, 30-key CALL DIRECTOR.
ORDER CODE:	PEC 9400-006
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	not applicable
COMMENTS:	Ringer protection is required.
	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	3640AMW1A R/B, and 3640AM1B
TRADE NAME:	Telephone
DESCRIPTION & USE:	16-button touchtone dial, 2-wire- or 4-wire-(AUTOVON)-compatible, 18-key CALL DIRECTOR.
ORDER CODE:	PEC 9400-005
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required. Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	2685AM1
TRADE NAME:	Telephone
DESCRIPTION & USE:	Touchtone dial, 30-button CALL DIRECTOR.
ORDER CODE:	PEC 9400-073
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required.
	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	2684AM1
TRADE NAME:	Telephone
DESCRIPTION & USE:	Touchtone dial, 18-button CALL DIRECTOR.
ORDER CODE:	PEC 9400-072
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required.
	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	TSG-approved telephone
MANUFACTURER:	AT&T
MODEL:	681A **Manufacturer discontinued**
TRADE NAME:	Telephone
DESCRIPTION & USE:	Rotary dial, 30-button CALL DIRECTOR.
ORDER CODE:	Not available
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Ringer protection is required. Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: TSG-approved telephone

MANUFACTURER: Electrospace Systems, Inc.

MODEL: MLP-2

TRADE NAME: Multi-Line Phone-2

DESCRIPTION & USE: Telephone approved for both red and black applications (must be wired to supporting telephone switch[es]).

ORDER CODE: Not applicable

POINT OF CONTACT: Richard Fenwick, Jr. (214) 470-2000

TSG NUMBER: None

PRICE: Not available

AS OF: Not applicable

COMMENTS:

TSG-APPROVED DISCONNECT/ISOLATION DEVICES

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Telephone line disconnect
MANUFACTURER:	AT&T
MODEL:	270A **Manufacturer Discontinued**
TRADE NAME:	Automatic disconnect
DESCRIPTION & USE:	Automatically disconnects a 2-wire or 4-wire instrument from the outgoing telephone lines.
ORDER CODE:	Not available
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Telephone line disconnect
MANUFACTURER:	AT&T
MODEL:	270B or 27OBW
TRADE NAME:	Automatic disconnect
DESCRIPTION & USE:	Automatically disconnects a 2-wire or 4-wire instrument from the outgoing telephone lines.
ORDER CODE:	PEC 94007
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	$933.00
AS OF:	January 1990
COMMENTS:	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Key system telephone line disconnect
MANUFACTURER:	SanBar
MODEL:	4001A
TRADE NAME:	SanBar disconnect line card
DESCRIPTION & USE:	Automatically disconnects the speech path of a multiline instrument from the outgoing telephone lines.
ORDER CODE:	Not applicable
POINT OF CONTACT:	SanBar (714) 727-1911
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Replaces the standard telephone line card in 1A2-type electromechanical key systems.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Line disconnect

MANUFACTURER: SanBar Corp.

MODEL: 4001B, also known as 4001-201

TRADE NAME: None

DESCRIPTION & USE: This line card replaces the standard telephone line card in lA2-type Key Service Units. It automatically disconnects the speech path of a multiline telephone from the outgoing telephone line.

ORDER CODE: Not applicable

POINT OF CONTACT: SanBar Corp., Santa Ana, California
(800) 527-4837, (714) 755-5555

TSG NUMBER: Not applicable

PRICE: $126.00

AS OF: May 1992

COMMENTS:

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Automatic disconnect/optical isolator
MANUFACTURER:	Mid-Atlantic Electronic Technologies
MODEL:	87030
TRADE NAME:	OPSYS
DESCRIPTION & USE:	Fiber-optic isolation system for use with telephone systems.
ORDER CODE:	Not applicable
POINT OF CONTACT:	Ross Bates (301) 948-3377
TSG NUMBER:	None
PRICE:	Varies depending on configuration.
AS OF:	Not applicable
COMMENTS:	Can be used to provide isolation for fire and intrusion alarms.
	Compatible with 2-wire or 4-wire voice or data circuits, key system telephones, or RS422 data circuits.
	Provides isolation between the subscriber’s telephone system and destination.

December 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Isolator

MANUFACTURER: Fiberplex, Inc.

MODEL: FOI-2971 & FOI-2972T

TRADE NAME: None

DESCRIPTION & USE: The FOI-2971 and FOI-2972T are automatic fiber-optic isolators compatible with 2-wire telephones, STU-III's, data modems, and facsimile equipment. Both FOI units are linked together with up to two kilometers of fiber-optic cable. The FOI-2971 is connected to the outside exchange side while the FOI-2972T is located on the inside subscriber side.

ORDER CODE: FOI-2971 & FOI-2972T

POINT OF CONTACT: Fiberplex Inc,
9005-8 Junction Drive,
Annapolis Junction, Maryland 20701
(301) 604-0100

TSG NUMBER: Not Applicable

PRICE: FOI-2971 (outside): $415
FOI-2972T (inside): $615
All 4 connectors: $ 60
Fiber-optic cable: $ 1.25/foot

AS OF: March 1991

COMMENTS:

May 1992

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Line disconnect

MANUFACTURER: Northern Telecom Inc.

MODEL: UKS-IOS

TRADE NAME: None

DESCRIPTION & USE: This line card replaces the standard telephone line card in lA2-type Key Service Units. It automatically disconnects the speech path of a multiline telephone from the outgoing telephone line.

ORDER CODE: Stock No. X9955343, NSN 5998 01180 1275

POINT OF CONTACT: Northern Telecom Inc.
105 Laurentien Blvd.
St. Laurent, Quebec, H4N2M3, Canada
Attn: John Gruszynski
(800) 361-5999 Ext 8557

TSG NUMBER: Not applicable

PRICE: About US $100 depending on quantity

AS OF: May 1992

COMMENTS:

January 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Isolator

MANUFACTURER: Novacom Inc., 9401 Mathy Drive, Fairfax, Virginia 22031 (NOVACOM no longer exists)

MODEL: TISD (Telephone Interface Security Device)

TRADE NAME: None

DESCRIPTION & USE: The TISD provides automatic fiber-optic isolation for up to six lines. It includes a self-test feature to detect faulty interface circuit boards. It is compatible with analog, 2-wire loop, ground, or direct inward dial (DID) start for telephone systems worldwide.

ORDER CODE: The TISD System includes the equipment shelf and P/N 5840 power supply with self test circuitry; P/N 9401 2-wire loop or ground start interface; P/N 9403 loop, ground or DID start interface; Auxiliary panel with 2 mounted 66 blocks; manual and power cord.

POINT OF CONTACT: None, Novacom terminated as of June 1991

TSG NUMBER: Not Applicable

PRICE: $21,000.00

AS OF: January 1988

COMMENTS:

September 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Isolator

MANUFACTURER: Versitron, Inc.

MODEL: R701

TRADE NAME: None

DESCRIPTION & USE: This system consists of two electrically and physically isolated modules. It includes the R701 telephone line isolator, a 12502 outside exchange card connected by fiber-optic cables to a 12503 inside subscriber card, a G702 (P/N 12504) ring generator, a front cover assembly with fan (P/N 14067), and a power supply. These cards are located in the E99OZ enclosure (P/N 13090).

ORDER CODE: Not applicable

POINT OF CONTACT: Versitron, Inc.,
9005-8 Junction Drive,
Annapolis Junction, Maryland 20701
(301) 497-8600

TSG NUMBER: Not applicable

PRICE: Not available

AS OF: Not applicable

COMMENTS: This automatic isolator system has been in use since the 1970's.

October 1992

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: CTS with Automatic Optical Isolator

MANUFACTURER: AT&T & Mid-Atlantic Electronic Technologies

MODEL: None

TRADE NAME: Merlin Legend Secure Communications System

DESCRIPTION & USE: The Computerized Telephone Switch (CTS) includes an automatic Optical Isolation System (OIS). It provides out-of-building service, intercom, ring-down, and paging. It is compatible with trunks that are 2-wire loop and 4-wire E&M, and 2-wire drop lines.

In order to qualify for TSG approval, the CTS must be installed, controlled, and maintained according to TSG Standard 2. The control of the CTS by cleared US personnel protects the security features of the OIS.

ORDER CODE:

5-card cabinet with power supply:	6139-SFS
Fiber interface and ring generator:	61393
Eight port, 2-wire loop/drop card:	61394
Eight port, 2-or-4-wire card:	61395

POINT OF CONTACT: SALES: AT&T Greg Gilbert, (301) 608-4257
Ed Rainsberger, (301) 608-4235

TSG NUMBER: Not applicable

PRICE: Depends on configuration

AS OF: Not applicable

COMMENTS: The OIS is a newer version of the Mid-Atlantic OPSYS optical isolation system.

March 1995

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Disconnect

MANUFACTURER: Fiberplex

MODEL: TDU-3000, TDU-3000R

TRADE NAME: None

DESCRIPTION & USE: The TDU-3000 is small and designed to mount on a wall or floor. It accepts one analog telephone line in and provides two lines out. The power supply is a separate, replaceable unit that mounts directly onto the disconnect. It is 50/60 Hz and is switchable between 115 and 230 VAC. A power failure results in the disconnect providing isolation with no telephone service. The TDU-3000R is for TEMPEST applications.

ORDER CODE: Not applicable

POINT OF CONTACT: Fiberplex Inc.
9005-8 Junction Drive
Annapolis Junction, MD 20701
Tel: (301) 604-0100

TSG NUMBER: Not applicable

PRICE:

TDU-3000:	$1,115
TDU-3000R:	$1,192

AS OF: March 1995

COMMENTS: This disconnect must be plugged into a power receptacle that is properly grounded.

RINGER PROTECTION

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Protective ringer
MANUFACTURER:	AT&T
MODEL:	RlA
TRADE NAME:	Not available
DESCRIPTION & USE:	Self-contained, externally mounted, nonresonant ringer assembly.
ORDER CODE:	PEC 94084
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Protective ringer

MANUFACTURER: AT&T

MODEL: D-180414 kit of parts

TRADE NAME: R2 ringer isolator

DESCRIPTION & USE: Kit of electronic parts used to isolate a factory-installed telephone ringer.

ORDER CODE: PEC 94007

POINT OF CONTACT: Not available

TSG NUMBER: None

PRICE: Not available

AS OF: Not applicable

COMMENTS: Formerly manufactured by WECO.

May be used in conjunction with some microphonic ringers to create nonmicrophonic ringer assemblies.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Ringer protection

MANUFACTURER: Several available

MODEL: Varies with manufacturer

TRADE NAME: Local ring generator (also called common ringing).

DESCRIPTION & USE: Telephone system component that regenerates ring signal. The locally generated ring signal is provided to the telephone instead of the ring signal coming directly from the telephone company.

A local ring generator provides ringer protection if the telephone system is located within the protected area.

ORDER CODE: Varies with manufacturer

POINT OF CONTACT: Varies with manufacturer

TSG NUMBER: None

PRICE: Varies with manufacturer and product line

AS OF: Not applicable

COMMENTS: May use any American-built local ring generator that may be installed within the same physically controlled space as the telephones to be protected.

TSG-APPROVED HANDSETS

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Push-to-operate handset
MANUFACTURER:	AT&T
MODEL:	G10A
TRADE NAME:	Not available
DESCRIPTION & USE:	Push-to-operate handset installed in lieu of factory handset.
ORDER CODE:	PEC 94269
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Push-to-operate handset
MANUFACTURER:	AT&T
MODEL:	G10B
TRADE NAME:	Not available
DESCRIPTION & USE:	Push-to-operate handset installed in lieu of factory handset.
ORDER CODE:	COMCODE 101-320-620 (BLACK)
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Push-to-operate handset
MANUFACTURER:	AT&T
MODEL:	G10F
TRADE NAME:	Not available
DESCRIPTION & USE:	Push-to-operate handset installed in lieu of factory handset.
ORDER CODE:	PEC 94003
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Not available
AS OF:	Not applicable
COMMENTS:	Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Push-to-operate handset

MANUFACTURER: Plantronics

MODEL: WG10

TRADE NAME: Not available

DESCRIPTION & USE: Push-to-operate handset installed in lieu of factory handset.

ORDER CODE: Not applicable

POINT OF CONTACT: Not available

TSG NUMBER: None

PRICE: Not available

AS OF: Not applicable

COMMENTS:

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Push-to-operate handset
MANUFACTURER:	AT&T
MODEL:	Type R, with security modification
TRADE NAME:	Not available
DESCRIPTION & USE:	Push-to-operate handset installed in lieu of factory handset.
ORDER CODE:	PEC 94036
POINT OF CONTACT:	David Jones (301) 982-2626
TSG NUMBER:	None
PRICE:	$150.00
AS OF:	1987
COMMENTS:	

TSG-APPROVED TELEPHONE FILTERS

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Filter

MANUFACTURER: AT&T

MODEL: KS20161

TRADE NAME: Not available

DESCRIPTION & USE: Low-pass, single-wire, radio frequency filter used to prevent signals above 10 kHz from passing via telephone lines.

ORDER CODE: PEC 94013

POINT OF CONTACT: Not available

TSG NUMBER: None

PRICE: Not available

AS OF: Not applicable

COMMENTS: Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Filter

MANUFACTURER: AT&T

MODEL: KS20162

TRADE NAME: Not available

DESCRIPTION & USE: Low-pass, balanced, 2-wire, radio frequency filter used to prevent signals above 10 kHz from passing via telephone lines.

ORDER CODE: PEC 94014

POINT OF CONTACT: Not available

TSG NUMBER: None

PRICE: Not available

AS OF: Not applicable

COMMENTS: Formerly manufactured by WECO.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Filter cabinet	
MANUFACTURER:	Filtron Manufacturing Co. All-Tronics, Inc. RF Interonics Cornell Dubilier Electronics LectroMagnetics, Inc. Genisco Technology Corp.	
MODEL:	Various types are available from several manufacturers.	
TRADE NAME:	Not available	
DESCRIPTION & USE:	Radio frequency-tight cabinet for mounting filters.	
ORDER CODE:	Varies with manufacturer and product line.	
POINT OF CONTACT:	Filtron Manufacturing Co. All-Tronics, Inc. RF Interonics Corp. Cornell Dubilier Electronics LectroMagnetics, Inc. Genisco Technology Corp.	(516) 433-5311 (516) 333-3090 (516) 231-6400 (213) 829-6701 (213) 870-9383 (213) 537-4750
TSG NUMBER:	None	
PRICE:	Varies with manufacturer and product line.	
AS OF:	Not applicable	
COMMENTS:	A large variety of sizes and styles of cabinets are available from the various manufacturers listed.	

MISCELLANEOUS TSG-APPROVED EQUIPMENT

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Keystrip

MANUFACTURER: WECO

MODEL: 6050

TRADE NAME: Not available

DESCRIPTION & USE: Externally mounted keystrip to provide multiline service in areas with single-line telephones, equipped with plug and jack or single-line automatic disconnects.

ORDER CODE: PEC 94440

POINT OF CONTACT: Not available

TSG NUMBER: None

PRICE: Not available

AS OF: Not applicable

COMMENTS: Provides five lines and hold.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Keystrip

MANUFACTURER: WECO

MODEL: 6051

TRADE NAME: Not available

DESCRIPTION & USE: Externally mounted keystrip to provide multiline service in areas with single-line telephones, equipped with plug and jack or single-line automatic disconnects.

ORDER CODE: PEC 94441

POINT OF CONTACT: Not available

TSG NUMBER: None

PRICE: Not available

AS OF: Not applicable

COMMENTS: Provides 11 lines and hold.

March 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE:	Manual disconnect
MANUFACTURER:	There are many manufacturers and suppliers for telephone plugs and jacks.
MODEL:	225A
TRADE NAME:	Plug and jack
DESCRIPTION & USE:	Manually disconnects the protected telephone instrument from the outgoing telephone lines.
ORDER CODE:	Not applicable
POINT OF CONTACT:	Not available
TSG NUMBER:	None
PRICE:	Varies for different manufacturers and product lines. Can be as little as $2 to $5 per telephone.
AS OF:	Not applicable
COMMENTS:	Available through a variety of vendors and local telephone stores. Should be wired with buzzer to alert user when not unplugged and telephone is on-hook.

May 1990

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Intercom

MANUFACTURER: Optelecom, Gaithersburg, Maryland

MODEL: AOM (Analog Optical Micromodem)

TRADE NAME: None

DESCRIPTION & USE: A system that provides either a ring-down circuit for intercom service, or single-line telephone service, using a fiber optic link and battery backup. The system was designed for use in shielded enclosures. It is compatible only with pulse dial telephones.

ORDER CODE: AOM

POINT OF CONTACT: Optelecom, Gaithersburg, Maryland
(301) 840-2121, Fax (301) 948-6357

TSG NUMBER: Not Applicable

PRICE: $750.00-$1200.00

AS OF: June 1990

COMMENTS:

August 1991

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Isolator

MANUFACTURER: Fiberplex, Inc

MODEL: FOI-2973 & FOI-2974T

TRADE NAME: None

DESCRIPTION & USE: The FOI-2973 and FOI-2974T are automatic fiber-optic isolators compatible with Northern Telecom Meridian series 5000 telephones only. The FOI-2973 unit connects to the outside Northern Telecom exchange, while the FOI-2974T unit connects to the inside subscriber Meridian 5000 telephone.

ORDER CODE: Not applicable.

POINT OF CONTACT: Fiberplex Inc,
9005-8 Junction Drive,
Annapolis Junction, Maryland 20701
(301) 604-0100

TSG NUMBER: Not Applicable

PRICE:

FOI-2973 (outside)	$390
FOI-2974T (Inside)	$625
All 4 connectors:	$ 60
Fiber-optic cable:	$ 1.25 per foot

AS OF: October 1991

COMMENTS: Does not provide on-hook audio security and does not provide a disconnect.

February 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Telephone Answering Machine

MANUFACTURER: Radio Shack Duophone

MODEL: TAD-410

TRADE NAME: None

DESCRIPTION & USE: The TAD-410 uses one cassette to hold the user's prerecorded announcement and a second cassette for incoming messages. The TAD-410 does not have a remote message retrieval feature. A duplex adapter is required if the machine is to be used on the same jack as a telephone.

ORDER CODE: Not applicable

POINT OF CONTACT: Radio Shack, USA

TSG NUMBER: Not applicable

PRICE: About $80.00

AS OF: February 1993

COMMENTS: Telephone Answering Devices (TADs), unlike telephones, automatically answer incoming calls. This characteristic provides a direct path from the TAD to the outside world at the calling party's initiative. For this reason, TADs should be restricted from sensitive discussion areas. If absolutely required, TADs should be connected to the telephone and power lines only in the absence of sensitive discussions.

February 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Telephone Answering Machine

MANUFACTURER: Phonemate, Inc.
20665 Manhattan Place
Torrance, CA

MODEL: 3900

TRADE NAME: None

DESCRIPTION & USE: The 3900 has a remote message retrieval feature. Simultaneous telephone usage is possible without a duplex adapter. It has a toll saver feature, e.g., if messages are recorded, it answers after the second ring; if none are recorded, it answers after the fourth ring.

ORDER CODE: Not applicable

POINT OF CONTACT: Phonemate, Inc., (310) 328-7453/320-9810; Evans; Circuit City

TSG NUMBER: Not applicable

PRICE: About $40.00

AS OF: February 1993

COMMENTS: Telephone Answering Devices (TADs), unlike telephones, automatically answer incoming calls. This provides a direct path from the TAD to the outside world at the calling party's initiative.

TADs with remote message retrieval provide another vulnerability of possible message retrieval by outsiders. Individual messages may be innocuous, but sensitive when combined. Additionally, sensitive messages may be left erroneously by callers.

The 3900 should be restricted from sensitive discussion areas, but if absolutely necessary, it should be connected to the telephone and power lines only in the absence of sensitive discussions.

TADs are prohibited in sensitive discussion areas administered under TSG Standard 2.

May 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Handset Disconnect

MANUFACTURER: Dynametric, Inc.

MODEL: COM-205R

TRADE NAME: None

DESCRIPTION & USE: The COM-205R is designed for the AT&T Merlin type "R" handset with a rectangular mouthpiece. It consists of a module of gravity switches that connects between the handset and the handset cord. It includes a metal clamp to ensure a snug, secure fit against the handset. It is designed to disconnect the handset elements from the telephone while in the horizontal plane up to 30 degrees. The COM-205R is intended for use as an unattended off-hook device to provide an automatic hold feature.

ORDER CODE: Not applicable

POINT OF CONTACT: DynaMetric
820 Duarte Rd
Monrovia, CA 91016
Attn: R.H. Perley (818) 358-2559
Orders (213) 684-1630

TSG NUMBER: Not applicable

PRICE: 01-09: $79.95; 10-24: $71.95;
25-99: $63.95; 100-200: $59.95

AS OF: May 1993

COMMENTS: Other than providing a hold feature, the COM-205R also disconnects the handset while the handset is in the cradle. Although this module is TSG-approved, connecting it to an unapproved telephone does not imply that the telephone then becomes approved. Telephones may have other internal components, such as the annunciator, that are microphonic.

May 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Fiber Optic Transmission Link Interface

MANUFACTURER: Mid-Atlantic Electronic Technologies, Inc.

MODEL: OPSYS ISDN BRI Card

TRADE NAME: Optical Signal Isolation System

DESCRIPTION & USE: **NOT APPROVED FOR ON-HOOK AUDIO ISOLATION**

The ISDN Basic Rate Interface card is housed in the model OPSYS and supports a short range fiber-optic transmission link and ISDN telephone.

ORDER CODE: Not applicable

POINT OF CONTACT: Boss Rates
9420 Key West Ave., Suite 104
Rockville, MD 20850
(301) 762-0500

TSG NUMBER: Not applicable

PRICE: Not available

AS OF: Not applicable

COMMENTS: The ISDN BRI card does not meet TSG requirements for on-hook telephone audio isolation. However, it does not introduce any additional audio surveillance hazard into the area in which it is installed. It is TSG-approved for TEMPEST isolation applications.

The model OPSYS will also support an interface card that provides on-hook audio isolation for analog telephones.

May 1993

TSG STANDARD 6
TSG-APPROVED EQUIPMENT

DEVICE TYPE: Voice Privacy Device

MANUFACTURER: AT&T

MODEL: TSD 3600

TRADE NAME: None

DESCRIPTION & USE: The TSD, which is small, comes with a 110 VAC to DC power supply, three handset compatibility modules, an interface cord, and instruction manual, and a carrying case. Clear or privacy modes are selected and indicated on a liquid crystal display.

The TSD is not approved for National Security information, nor does it make a telephone TSG-approved. The TSD is intended for use with TSG approved, non-secure telephones. The TSD, located between the handset and telephone base, provides voice privacy with another telephone equipped with a similar device.

ORDER CODE: Not applicable

POINT OF CONTACT: AT&T, 8403 Colesville Road
Silver Spring, MD 20910-3311

Ed Rainsberger	301-608-4235
Greg Gilbert	301-608-4257

TSG NUMBER: Not applicable

PRICE: Not available

AS OF: Not applicable

COMMENTS: The TSD typically delays voice by one or two syllables.

TSG GUIDELINES FOR CELLULAR TELEPHONES

TSG STANDARD 7

September 1994

PREFACE

This standard was prepared by the Telephone Security Group (TSG). The charter members of the TSG are: Department of the Air Force, Department of the Army, Central Intelligence Agency, Defense Intelligence Agency, Department of Energy, Federal Bureau of Investigation, Department of the Navy, National Security Agency, US Secret Service, and Department of State.

The TSG is the primary technical and policy resource in the US Intelligence Community for all aspects of the technical surveillance countermeasures (TSCM) program involving telephone systems. The TSG standards contain guidance for providing on-hook security to telephone systems in areas where sensitive government information is discussed. Implementation of TSG standards neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as TEMPEST, COMSEC, or OPSEC.

TSG Standard 1 is an introduction to telephone security that provides general information about the TSG standards.

A7.1. Purpose.
A7.1.1. TSG Standard 7 provides guidelines required for the manufacture and use of both secure and nonsecure cellular telephones in classified or sensitive discussion areas.
A7.1.2. Section I identifies secure and nonsecure cellular telephone security hazards and recommends countermeasures to minimize these vulnerabilities. It also provides a basic understanding of the principle of operation for cellular telephones, which enhances the comprehension of the associated hazards.
A7.1.3. Section II identifies the TSG approval program outlining requirements for designing and manufacturing cellular telephones. The program requirements include the design and construction criteria, the application procedures, the manufacturer's testing requirements, and the necessary documentation.

A7.2. Background Information. TSG Standard 1 provides background information on telephone security and explains some of the principles underlying the requirements set forth in this standard. However, because of the wireless operation of cellular telephones, some of the information in Standard 1 may not apply.
A7.2.1. All secure and nonsecure cellular telephones verified by the TSG as conforming to the requirements of Standard 7 are TSG-approved. The point of isolation is the transmitter section of the cellular telephone. These telephones when unused and on-hook will completely prevent any discussions and digital information in the vicinity of the telephone from unintentional radio frequency transmission. Disconnects are neither used nor required.

A7.3. Applicability. Section I applies to all secure (including STU-III Type I and Type II terminals) and nonsecure cellular telephones operated anywhere. Locations include physically protected spaces (PPS) of US Government (or US Government contractor) sensitive discussion areas. Standard 7 is concerned with on-hook and unattended off-hook audio security. It does not apply to the common, though illegal, practice of interception of cellular telephone conversations or data information.
A7.3.1. Section II is provided for personnel involved in writing contracts, manufacturing, and inspecting all cellular telephones intended for or derived from the TSG-approval program.

A7.4. Definitions. A glossary of terms is provided for this standard. The precise meaning of a technical term may occasionally be at variance with its general use in industry. In those instances, the term will appear in the glossary with an exact definition of its intended use in this standard. It is important that the technical terms included in the glossary be understood to have only the specific meanings shown for them.

SECTION I--FOR ALL CONCERNED

TELEPHONE SECURITY PROGRAM

A7.5. The Problem. Secure and nonsecure cellular telephones create unique challenges for protecting sensitive information. These high-technology telephones will operate almost anywhere due to their portability. Secure cellular telephones will operate in most areas not approved for sensitive information. Likewise, nonsecure cellular telephones will operate in sensitive discussion areas where dial tone can be obtained. Security risks exist in both scenarios. Cognizant security authorities (CSAs) will determine where and under what circumstances cellular telephones are allowed to be used.

A7.5.1. Vulnerabilities of cellular telephones include unauthorized interception of audio during intentional transmission that was declared illegal by Congress in 1986, transmission of nearby audio when the telephone is in use but unattended, and unintended transmission of nearby audio when the user believes the unit is not in operation.

A7.5.2. As newer cellular telephones are developed for an ever-increasing competitive market, newer features and capabilities will create additional risks.

A7.5.3. The procedures for establishing and terminating a cellular telephone call are accomplished by a digital bit stream transmitted through free space by radio frequency energy. This transmission differs considerably from the operation of a fixed telephone connected to wirelines. Cellular telephone technology must be thoroughly analyzed to determine any associated vulnerabilities.

A7.5.4. Safety is an important concern while using a cellular telephone in an automobile. The use of speakerphones and headsets enhances safety by allowing hands-free operation. However, security is another concern. The use of speakerphones increases security risks because of the possibility of hidden monitoring devices. Therefore, the speakerphone feature is not allowed while in the secure mode. Instead, If the cellular telephone user is the driver, he/she may consider pulling off the highway during cellular usage. The automobile AM/FM radio should be played at a volume level just below the level required to carry on a cellular call conversation.

A7.6. Operation. Mobile cellular telephone systems operate on an entirely different principle than standard telephones. A standard telephone has a fixed path to a switch of some sort, either a central office or a private branch exchange. A mobile cellular telephone depends on radio channels for operation. There were initially 666 two-way channels set aside for mobile cellular telephone systems. These were divided into two sets of 333 channels each to allow for two competing suppliers of service in any given area. Transmit and receive frequencies for any given channel are separated by 45 MHz. For any given system 21 of the 333 channels assigned are designated to be control channels (CC). The remainder of the channels are voice channels (VC). Each cell in a system has one CC and about 40 VCs assigned. Signals from the cell site to the mobile travel in the forward direction while signals from the mobile to the cell site are in the reverse direction. This gives rise to the terms forward control channel (FOCC), reverse control channel (RECC), forward voice channel (FVC) and reverse voice channel (RVC).

A7.6.1. No activity other than the handshake occurs between the mobile unit and the cell repeater until a call is to be initiated.

A7.6.2. Countermeasures. Appropriate precautions must be taken to minimize all potential vulnerabilities and maximize the protection of classified or sensitive information. With this goal in mind the following suggestions are provided.

A7.6.2.1. Separation requirements for all cellular telephones, both secure and nonsecure:

A7.6.2.1.1. A 3-foot separation is required between any part of the cellular telephone system and any classified processing equipment, system, wiring, distribution facility, and other miscellaneous conductors. The cellular telephone must be positioned at least 6 feet from any receiver, including other mobile radios, portable computers, or similar devices, and at least 10 feet from any other cellular telephones or transmitters.

A7.6.2.1.2. Any user-operated electronic equipment not able to meet separation requirements because of physical limitations, such as those that exist in an automobile, will be powered off while the cellular telephone is operated. This restriction does not apply to electronic equipment intended for use with the cellular telephone.

A7.6.2.2. Users of all cellular telephones who wish to operate in a classified area will warn personnel within listening range that a cellular telephone is about to be used, and classified discussions should cease. The same precaution should be taken when fixed-path telephones, whether secure or not, are used in a classified area.

A7.6.2.3. The speakerphone feature is allowed only in the nonsecure mode and only after all personnel within hearing range of the telephone have been notified this feature is in use.

SECTION II--FOR MANUFACTURERS

A7.7. Requirements for Secure Cellular Telephones.

A7.7.1. Secure cellular telephone equipment must use shielded wires on all electrical paths interconnecting the cellular telephone system, to include the handset or headset, control unit, and remote control unit. The shield will be grounded to the cellular telephone equipment as a minimum. The shielding protects classified information from point of origination to point of isolation located in the transmitter section.

A7.7.2. As an alternative, fiber optics may be used to interconnect the cellular telephone system components. However, all components must still be grounded to each other.

A7.7.3. Secure cellular telephones must be compatible with a headset comprised of one earphone and low impedance microphone(s). The single earphone will allow the driver to hear sirens and comply with motor vehicle laws. The low impedance microphone(s) must be designed within an acoustic shield or cup that will attenuate normal-level audio-frequency signals. Signals exiting the cup must not be intelligible to personnel in the vicinity of the cellular telephone user.

A7.7.4. An alternative to the headset is a handset equipped with an acoustic cup that fits over the handset mouthpiece. The purpose of the cup is to attenuate normal-level audio-frequency signals. Signals exiting the cup must not be intelligible to personnel in the vicinity of the cellular telephone user. The headset is preferred over the handset for safety reasons while operating an automobile.

A7.7.5. Secure cellular telephones having a speakerphone or external microphone feature must be designed to automatically disable these features in the secure mode of operation.

A7.7.6. The cryptology used in secure cellular telephones will be approved and administered by NSA.

A7.8. Requirements for All Cellular Telephones.

A7.8.1. The operational status of both secure and nonsecure cellular telephone equipment must be exclusively controlled by the user through a manual action. The cellular telephone equipment cannot be remotely made to transmit user-generated information from the vicinity of the equipment.

A7.8.2. The point of isolation for all cellular telephones for TSG approval is the transmitter section. No radio frequency energy will be transmitted unless the user provides a physical motion activating the transmitter. The exception is the routine handshake performed automatically between the cellular telephone and supporting cell.

A7.8.3. All cellular telephones must have a send (transmit) switch design that does not readily lend itself to accidental activation through a physical motion. A recessed switch or key pad could serve this purpose.

A7.8.4. All cellular telephones must provide a continuous, clearly visible, illuminated device indicating radio frequency energy being transmitted at any time, whether on-hook or off-hook. The threshold of this indicator will be set at one milliwatt, plus or minus 10 percent, by a nonvariable component until refined further by active testing. This indicator must be located where it is clearly visible to the user during periods of use.

A7.8.5. All cellular telephones must provide a periodic, clearly audible beep signal that will indicate radio frequency energy being transmitted at any time, whether on-hook or off-hook. The beep will initially sound the instant radio frequency energy is first transmitted, and thereafter at 30-second intervals, plus or minus 5 percent. The beep duration will be approximately one-fourth of a second. The threshold of the beep will be set by a nonvariable component at 1.0 milliwatt until refined further by active testing.

A7.8.6. The above visual and audible indicators will not be activated by software. These indicators will be activated solely by a circuit located between the final stage of the transmitter and the antenna.

A7.8.7. The handshake circuitry must incorporate a nonerasable comparator that verifies only valid handshake data are transmitted.

A7.8.8. A manufacturer is free to change all components not related to the above security features without affecting its TSG approval status. Changes of this sort may be made at the discretion of the manufacturer without involvement of the government.

A7.9. Test Procedures.

A7.9.1. Testing requirements will be defined by the Interagency Telephone Laboratory (ITL) on a time-available basis. Once the test procedure and requirements are developed and made available to the TSG, they will be included in this standard.

A7.9.2. A manufacturer desiring to receive TSG approval for a cellular telephone must submit the following to a Telephone Security Group member who will sponsor the manufacturer.

A7.9.2.1. A cellular telephone to be tested. The telephone must be registered with the cellular and telephone companies to receive an identification number. Registration will allow a cellular telephone to be tested under live conditions. Registration timing should be coordinated with the ITL to accommodate their work schedule.
A7.9.2.2. Documentation to include:
A7.9.2.2.1. A schematic diagram.
A7.9.2.2.2. Block diagram, including complete descriptions of signals between functional blocks.
A7.9.2.2.3. Assembly drawings.
A7.9.2.2.4. Component layout diagrams.
A7.9.2.2.5. Circuit description.
A7.9.2.2.6. A service manual.
A7.9.3. A method to verify that the transmitter can only be activated through a physical motion by the user. This verification may involve review of the manufacturer's source code, as determined by the ITL. A nondisclosure agreement from the ITL may be required by the manufacturer.

GLOSSARY

CELLULAR TELEPHONE -- A mobile telephone system implemented by the use of cells whereby more than one subscriber may use the same frequencies simultaneously in different cells throughout the system.

HANDSHAKE -- Automatically generated computer updates exchanged between a cellular telephone and its supporting repeater cell. These updates are required by the cellular system to provide locator and billing information for the subscriber's cellular telephone. Handshakes are performed at power-up, incoming or outgoing call initiation, signal fades, and relocation to another cell.

OFF-HOOK -- A cellular telephone with an active transmitter.

ON-HOOK -- A cellular telephone with an inactive transmitter.

TYPE I TERMINAL -- A STU-III terminal endorsed by the National Security Agency (NSA) for securing classified or sensitive unclassified US Government information when appropriately keyed.

TYPE II TERMINAL -- A STU-III terminal endorsed by NSA for protecting sensitive unclassified US Government information.

MICROPHONIC RESPONSE CRITERIA FOR NONCOMMUNICATIONS DEVICES

TSG STANDARD 8 (DRAFT)

October 1994

PREFACE

This standard was prepared by the Telephone Security Group (TSG). The charter members of the TSG are: Department of the Air Force, Department of the Army, Central Intelligence Agency, Defense Intelligence Agency, Department of Energy, Federal Bureau of Investigation, Department of the Navy, National Security Agency, US Secret Service, and Department of State.

The TSG is the primary technical and policy resource in the US Intelligence Community for all aspects of the technical surveillance countermeasures (TSCM) program involving telephone systems. The TSG standards contain guidance for providing on-hook security to telephone systems in areas where sensitive government information is discussed. Implementation of TSG standards neither prevents the application of more stringent requirements nor satisfies the requirements of other security programs such as TEMPEST, COMSEC, or OPSEC.

TSG Standard 1 is an introduction to telephone security that provides general information about the TSG standards.

A8.1. Purpose. TSG Standard 8 specifies the procedures and minimum audio security performance required to obtain TSG approval for installation in sensitive discussion areas, of devices other than communications equipment, that cannot initiate off-hook connectivity service.

A8.2. Applicability. This standard applies only to devices intended for connection to a telephone network that cannot originate an off-hook request for connectivity service. Such devices include, but are not limited to, disconnects, isolators, interfaces, and Caller ID. See the Glossary for additional requirements for disconnects and isolators.

A8.3. Definitions. A glossary of terms is provided in this standard.

A8.4. Documentation and Certification Requirements.
A8.4.1. The manufacturer must submit a letter of application for TSG approval, signed by an authorized company official, that identifies the proposed product and certifies it to comply with all the requirements of this standard. Documentation of all claims relating to the requirements is mandatory. Each requirement must be specifically addressed and an explanation of how the device has been determined to comply with that requirement must be provided.
A8.4.2. The manufacturer must provide an electrical description of the device containing the following:
A8.4.2.1. Complete theory of operation including descriptions of the interface connection.
A8.4.2.2. Block diagrams including complete descriptions of signals between functional blocks.
A8.4.2.3. Schematic diagrams and circuit descriptions.
A8.4.2.4. Component listing.
A8.4.2.5. Installation and maintenance manual.
A8.4.2.6. Any supplementary information requested by the government in order to complete the evaluation of the application.
A8.4.2.7. Documents identified as containing proprietary information will be used to evaluate and confirm the necessary conditions only. All proprietary information will be treated with strict confidentiality.
A8.4.3. The below listed documentation is necessary to support field tests and inspections and must be provided by the manufacturer. These documents will be distributed to field inspection teams for use during on-site testing. The information provided for this purpose should be non-proprietary.
A8.4.3.1. Component layout diagrams; include location and function of test points.
A8.4.3.2. Instructions for assembly and disassembly of the device.
A8.4.3.3. Photographs showing all circuit boards and assemblies.
A8.4.3.4. Complete theory of operation including descriptions of the interface connection.

A8.5. Specifications.
A8.5.1. The proposed device must be certified by the manufacturer to comply with all the requirements of this standard. Documentation of all claims relating to the requirements is required. Each requirement must be specifically addressed and an explanation of how the device has been determined to comply with that requirement must be provided.
A8.5.2. Some of the requirements specified below are annotated **"TEST REPORT REQUIRED."** For these requirements, at least one production specimen of the device must be tested and shown to be in full compliance. All delivered items must be exactly identical to the specimen(s) used for these tests. Paragraph A8.5.3 (following) provides a listing of information that must be included in these test reports. The various required tests may be documented in a single consolidated test report or as separate individual reports.

A8.5.3. Format for Required Test Reports.
A8.5.3.1. Abstract.
A8.5.3.2. Objectives of tests.
A8.5.3.3. List of test equipment used.
A8.5.3.4. Test equipment configuration used for each test.

A8.5.4. Test data and conclusions.
A8.5.4.1. If requested, the loan of a production specimen, and whatever ancillary equipment is required for it to be operational, must be provided to allow independent testing and technical evaluation to verify the asserted compliance with the specifications.
A8.5.4.2. Technical supplements numbers 1 and 2 are included to provide background information and guidance for performing the tests required to document compliance with these specifications.

A8.6. Required Performance.

A8.6.1. Intrinsic On-hook Microphonics. The microphonic sound-pressure-response criteria specified in this section applies to all acoustic signals in the frequency range 100 Hz - 15 kHz.

A8.6.2. The RMS voltage limits in Table A8.1. below placed on the microphonic sound-pressure-response levels (MSPRL), at the terminating impedance indicated, in response to a two pascal tone, apply to all the wires and connections that can be used to connect the device to any entity that is not a part of the device. Their ground-referenced and pair-wise differential sound-pressure-response voltages must all conform to the specifications.

Table A8.1.

Terminating Impedance (Z)	MSPRL Allowed to a 2 Pa Tone (V_m)
Z < 50W	V_m = 30nv
50 W $\leq$ Z < 1KW	V_m = 75nv
1KW $\leq$ Z < 10KW	V_m = 150nv
10KW $\leq$ Z < 100KW	V_m = 500nv
100KW $\leq$ Z < 1MW	V_m = 1mv
1MW $\leq$ Z	V_m = 3mv

A8.6.3. All required nonmicrophonic characteristics must be sustained independent of all environmental stimuli; including acoustic and electromagnetic fields, voltages, or commands that could be impressed upon the mounting cord or power supply wires.

A8.6.4. The device must comply with the limits placed on microphonic sound-pressure-response levels and microphonic sound-pressure-response carrier modulation for all of the following configurations:

A8.6.4.1. Disconnected from the telephone lines with no power applied.

A8.6.4.2. Disconnected from the telephone lines but fully powered and operationally ready.

A8.6.4.3. Connected to the telephone lines, fully powered, and operationally ready.

A8.6.5. The open-circuit, unterminated, microphonic sound-pressure-response levels on any of the devices' external wires and metallic connections must not exceed 0.5 microvolts RMS per pascal. **TEST REPORT REQUIRED.**

A8.6.6. The microphonic sound-pressure-response levels on the telephone lines at their point of attachment to the device must not exceed 0.5 microvolts RMS per pascal. **TEST REPORT REQUIRED.**

A8.6.7. The sound-pressure response on all telecommunications-medium that either leave the device or are used to convey information between modules of the device must conform to the requirement and applies both to the intentional telecommunications channels and to any fortuitous vectors that might exist.

A8.6.7.1. When the telecommunications medium are measurable in volts, the modulations of carrier and subcarrier levels due to microphonic sound-pressure response must not exceed 0.5 microvolts rms per pascal. **TEST REPORT REQUIRED.**

A8.6.7.2. The following requirements apply to all telecommunications medium that are not measurable in volts.

A8.6.7.2.1. The microphonic sound-pressure-response levels at these points must not exceed 0.5 microvolts rms per pascal. The voltage levels will be measured at the transmission-medium drive point of the final-stage electrical drivers for the carriers and subcarriers. **TEST REPORT REQUIRED.**

A8.6.7.3. The following specifications apply to every carrier and subcarrier frequency and to its final-stage electrical driver current:

A8.6.7.3.1. The sum of the upward and downward modulation factors for any amplitude-modulations due to microphonic sound-pressure responses of the carriers and subcarriers must not exceed -180dB per pascal. **TEST REPORT REQUIRED.**

A8.6.7.3.2. For carrier and subcarrier frequencies that are less than 100 MHz:

If fa represents the frequency of an acoustic test signal that is incident on the device, fc,d represents the frequency produced by the deviation to a carrier (or subcarrier) frequency caused by a microphonic sound-pressure response to that acoustic test signal, fc,o represents the carrier frequency when no sound is present, and fc.d/fc,d - fd,o/. Then the

amplitude level of fc,d must not exceed -180dB per pascal with respect to fc,o for all fc,d such that fcd $\leq$ 3fa/4. **TEST REPORT REQUIRED.**

A8.6.7.3.3. For carrier-phase-shifts due to microphonic sound-pressure-response effects on a telecommunications-medium's transmission properties:

The total angular deviation over the entire transmission path, relative to transmission of the carrier with no sound present, must not exceed 0/09 radians per pascal. **TEST REPORT REQUIRED.**

A8.6.8. If the device is computerized, or is a part of a computerized telephone system, it is not permissible for any software or firmware change to cause the device to become microphonic.

A8.6.8.1. The required nonmicrophonic characteristics must be achieved independently of all software and firmware contained within the device.

A8.6.8.2. No change in the device's software or firmware can have any effect on its performance in the microphonic sound-pressure level tests.

A8.6.9. Resistance to Modification.

A8.6.9.1. The ideal condition for on-line audio security is when the device in question cannot by any means be caused to produce microphonic audio. For any real equipment, however, there is always the possibility that accidental or deliberate modifications to an otherwise approved device could cause it to become microphonic. The following measures must be applied to reduce this possibility to an acceptable level.

A8.6.9.2. The design and construction of the device must not facilitate any modification which could cause it to pass audio or become microphonic while on-hook.

A8.6.9.3. The device's internal components must be situated so that the normal isolation of intrinsic microphonic transducers cannot be easily or inconspicuously bypassed.

A8.6.9.4. There must be no unnecessary or spare wires leaving the device.

A8.7. **Verifiable Security.**

A8.7.1. With the cover removed, the internal layout must present critical components and connections in clear view. The layout must facilitate inspection to such a degree that any added conductors or implanted components would be found immediately.

A8.7.2. On-hook audio security is compromised when a microphonic element becomes connected to or transfers audio to the external wires. Therefore, components and circuit traces which are connected to electro-acoustic transducers or microphonic elements must not be located adjacent to components or circuit traces which connect to external wires or telecommunications media.

A8.7.3. To support the above inspection requirement, there must be no unnecessarily enclosed spaces that prevent inspection.

A8.7.4. The internal component layout of the device must facilitate countermeasures inspection to find potentially compromising modifications.

A8.7.5. The construction of the device must provide a means for the physical, electrical, and software/firmware (if present) inspection at any time: before, during, or after installation. All security related characteristics must be verifiable by either physical inspection, electrical measurement, and/or software/firmware (if present) verification.

A8.7.6. The device must be capable of sustaining repeated disassembly without physical damage or deterioration occurring.

A8.7.7. Production changes and modifications or repairs to existing telephone instruments must not diminish compliance with these specifications.

TECHNICAL SUPPLEMENT NO. 1

A8.8. Sound-Pressure-Response Level Measurement Requirements.

A8.8.1. The purpose for testing microphonic behavior is not to identify or study individual microphonic components, but to measure the level of microphonic response for the whole device. With respect to microphonics, the device is considered as if it were an elemental microphone. When it is excited by a sound-pressure field, its microphonic response produces signal voltages at its external wires that are a function of the sound-pressure level.

A8.8.2. The pressure-response level of a microphone is the ratio of voltage output to sound-pressure level (SPL) input. The voltage measurement is generally specified as an open-circuit measurement. For purposes of this specification, the internal loading on the wires being tested may be taken into consideration in configuring the voltage measuring equipment. The test equipment input resistance must equal or exceed the on-hook terminating impedance inside the telephone. Regardless of the actual internal terminating impedance, a test equipment impedance in excess of 100,000 ohms is neither required nor prohibited. The minimum allowed impedances for various conditions are:

Table A8.2.

TERMINATING IMPEDANCE INSIDE TELEPHONE	MINIMUM ALLOWED IMPEDANCE FOR TEST EQUIPMENT
Z 100,000	Z
Z 100,000	100,000

A8.8.3. The specified on-hook microphonic performance is required over the frequency range 100Hz - 15 kHz. The actual testing to demonstrate compliance with these specifications may be conducted by measurements taken either at discrete frequencies or with a continuous frequency sweep over the required range. The continuous frequency sweep is preferred.

A8.8.4. If discrete frequencies are used, below 400 Hz the measurements may be made at intervals not to exceed one-half octave; above 400 Hz the frequency intervals are not to exceed one-third octave.

A8.8.5. A response of 0.5 microvolts/pascal is the maximum sound pressure response that is allowed for any device for which this specification is applicable.

A8.8.6. When the response is measured in microvolts and the SPL in pascals, the pressure-response level is obtained by dividing the output voltage by the input SPL and the allowed limit is:

$$\text{microvolts - pascals} \leq 0.5$$

A8.8.7. When decibels are used to express both the SPL and response voltage, the pressure-response level may be obtained by subtracting the input SPL [dB] from the output voltage [dB]. If the voltage is measured in dB above one microvolt and the SPL in dB above 20 micropascals, the maximum allowed pressure-response level becomes -100 dB.

$$\text{dB(V) - dB (SPL])} \leq -100 \text{ dB.}$$

A8.8.8. The device may be tested at any convenient SPL provided that accurate voltage measurements can be accomplished with the necessary resolution. Compliance with these requirements can normally be accomplished using an input SPL of 100 dB or greater, at two pascals. Lower sound-pressure levels require the ability to perform calibrated audio frequency voltage measurements of less than one microvolt. Examples of the maximum allowed response voltages for various test SPL values are shown in Table A8.3.

Table A8.3.

TEST SPL		MAXIMUM ALLOWED RESPONSE	
DB (SPL)*	Pascals	(mV)	db V
60	0.02	0.01	-40
70	0.063	0.03	-30
80	0.2	0.1	-20
90	0.63	0.3	-10
94	1	0.5	-6
100	2	1	0
110	6.3	3	10

*[dB(SPL) = dB above 20 micropascals]

A8.8.9. The ground referenced voltage must be measured at every wire and terminal whose purpose is to provide an external connection to the device.

A8.8.10. All differential voltage for all pair-wise combinations of the device's external wires and terminals must be measured.

A8.8.11. The equivalent impedance (from 100 Hz -15 kHz) combining all the terminations, devices, and test equipment connected to the particular wire/wire or wire/ground combination being tested must comply with Table A8.1.

TECHNICAL SUPPLEMENT NO. 2

A8.9. Sound-Pressure-Response Modulation Measurements Requirements.

A8.9.1. These sound-pressure-response measurements are to assure that the subject device will not be unduly susceptible to unintentional modulation of its proper communications processes by normal conversational speech that takes place in its vicinity. The normal operation of many devices requires that they transmit information between physically separated locations by means of electrical or optical waveforms. Under certain conditions of design, construction, or use, these waveforms may also become modulated by the sound-pressure variations caused by human speech. Depending upon the types of carriers employed, and the types of fortuitous mechanisms that produce the sound-pressure responses, any of several modulation to which a device might be susceptible are amplitude-modulation, frequency-modulation, phase-modulation, pulse-position-modulation, and pulse-width-modulation. The carrier may receive the inadvertent modulation in the driver electronics or in the transmission medium through which it is propagated.

A8.9.1.1. The device may be tested at any convenient SPL provided that accurate measurements can be accomplished with the necessary resolution. Compliance with these requirements can normally be accomplished using an input SPL of 100 dB (2 pascals) or greater. Lower sound-pressure levels require the ability to perform calibrated audio frequency measurements at very low levels.

A8.9.2. All telecommunications media that use wireline conductors are measurable in volts.

A8.9.3. Antenna radiated RF carriers (including those propagated through waveguides) are measurable in volts at the output port of the transmitter (the final-stage electric driver), prior to their conversion to radiated electromagnetic fields by the antenna.

A8.9.4. The electric voltage and/or current of a fiber-optic light source is measurable at the input terminal of the optical transducer.

A8.9.5. An amplitude-modulated signal has an upward modulation factor given by:

$$m_u = \frac{E_{max} - E}{E}$$

and/or a downward modulation factor given by:

$$m_d = \frac{E - E_{min}}{E}$$

Where E is the peak-amplitude of the unmodulated carrier, E_{max} is the maximum peak-amplitude of the modulated carrier, and E_{min} is the minimum peak-amplitude of the modulated carrier. The specification applies to sum of m_u and m_d and requires that:

$$M = m_u + m_d = \frac{E_{max} - E_{min}}{E} \leq 180 \text{ dB /pascal}$$

For an incident sound-pressure level of 100 dB (ref 20 pa) the maximum permissible value for M is -90dB.

A8.9.6. For fiber-optic systems, interferometry may be used to observe the microphonic sound-pressure-response phase shift.

If, the time-invariant zero modulation (no sound) phase difference between the transmission path under test and the reference path used to produce the interference effect is 2n where n may be any integer ≥ 0.

Then, the interference effect of the maximum allowed carrier-phase-shift on the light intensity will be a downward modulation factor of 0.002.

GLOSSARY

ANNUNCIATOR -- A device for producing an audible or visual signal to announce an incoming call.

DISCONNECT -- A noncommunications device which prevents or allows audio or data, from reaching a telephone network or STE, through the use of a temporary, switchable metallic path. To qualify as a disconnect for purposes of this standard, the device must possess all of the following properties:

1. The device must insert a break within the telecommunications medium that exists between the STE and the telephone network.

2. The device must prevent all communications from the STE except when the STE is off-hook.

3. The device must prevent all communications to the STE except when the STE is either off-hook or audibly annunciating an incoming call.

4. The device must provide a temporary link, only when the STE is off-hook, across the break that has been interposed in the normal conduction path. This temporary link must be entirely under the control of the on-hook/off-hook state of the STE.

5. The device may generate, or may require another device to generate, the audible or visual annunciation of an incoming call.

ELECTRO-ACOUSTIC TRANSDUCER -- A component or element which either converts electrical signals to acoustic signals or acoustic signals to electrical signals.

ISOLATOR -- A noncommunications device which prevents or allows audio or data, from reaching a telephone network, or from reaching STE, through the use of a temporary, switchable path. This path must be either a light-conductor, such as fiber optics, or semi-conductor(s).

1. An isolator must meet the same requirements as a disconnect above.

2. If an isolator is intended to meet EMI or TEMPEST requirements, it must have at least a four inch optically coupled path.

MICROPHONE -- A component among whose intended functions include performing as an electro-acoustic transducer to produce an electrical analog output from an audio-frequency sound pressure waveform input.

MICROPHONIC -- A term used to identify any component, regardless of its intended functions, that exhibits electro-acoustic transducer behavior to produce an electrical analog output from an audio-frequency sound pressure waveform input. Capacitors and transformers, if physically large enough, can be microphonic.

MODEM -- A noncommunications interface device that *mod*ulates and *dem*odulates information.

NONCOMMUNICATIONS DEVICE -- Any equipment that cannot request off-hook connectivity service from a telephone network. These devices include, but are not limited to: Caller ID, disconnect, isolator, and interfaces such as modems. Modems integrated into other equipment, such as faxes and computers, are still considered noncommunications devices because they are still an interface.

OFF-HOOK -- An active or in-use state of STE connected to a telephone network, that is either actively initiating a request for connectivity service to other STE, or that is already connected to other STE.

ON-HOOK -- An inactive state of STE connected to a telephone network in which connectivity service is not being requested. STE cannot be on-hook while it is off-hook.

SOUND-PRESSURE-RESPONSE LEVEL -- The SOUND-PRESSURE-RESPONSE LEVEL of a microphone is the ratio of voltage output to sound-pressure level input.

SOUND-PRESSURE-RESPONSE MODULATION -- The degree of change in a measurable property of a telecommunications medium, or carrier signal on that medium, that is produced in response to a unit-value sound-pressure level.

STE (SUBSCRIBER TERMINAL EQUIPMENT) -- The communications equipment connected to a telephone network that has the capability of going off-hook, for which a subscriber normally pays a service charge to provide connectivity to other STE. The equipment may be comprised of, but not limited to: A telephone, fax, computer, or teleconferencing system.

SWITCHED NETWORK -- An assembly of member subscriber terminals, control facilities, and intercommunication facilities which can establish and maintain a communications link between any two of the member terminals.

TELECOMMUNICATIONS MEDIUM -- Any medium by which information is conveyed from one STE to another without transporting physical matter. The medium may be comprised of, but not limited to wire, fiber optics, light, or radio frequencies.

TELEPHONE NETWORK -- A network system of voice grade channels that provides off-hook links between the calling and called STE, only for the duration of the call. It recognizes when connectivity service is requested, identifies the number dialed, and annunciates the incoming call.