NOTICE OF CHANGE

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MIL-STD-188-105
NOTICE 2
14 May 1999

DEPARTMENT OF DEFENSE
MILITARY STANDARD

INTEROPERABILITY AND PERFORMANCE STANDARD
FOR THE
ALL-DIGITAL TACTICAL-TO-STRATEGIC GATEWAY

TO ALL HOLDERS OF MIL-STD-188-105:
1. THE FOLLOWING PAGES OF MIL-STD-188-105 HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
i	14 May 1999	i	1 Feb 1994
ii	14 May 1999	ii	1 Feb 1994
1	14 May 1999	1	1 Feb 1994
2	14 May 1999	2	1 Feb 1994
5	14 May 1999	5	16 Apr 1996
6	14 May 1999	6	16 Apr 1996
15	14 May 1999	15	1 Feb 1994
16	1 Feb 1994	16	Reprinted w/o change
65	14 May 1999	65	1 Feb 1994
66	14 May 1999	66	1 Feb 1994
71/72	14 May 1999	71/72	1 Feb 1994

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-188-105 will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the standard is completely revised or canceled.

Custodians:
Army - CR
Navy - EC
Air Force - 02
DISA - DC1
NSA - NS

Preparing activity:
DISA (JIEO) DC1

(Project TCSS-0050)

AMSC N/A

AREA TCSS

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FOREWORD

1. This military standard (MIL-STD) is approved and will be used by the Office of the Secretary of Defense, the Military Departments, the Chairman of the Joint Chiefs of Staff (CJCS) and the Joint Staff, the Unified and Specified Commands, Department of Defense (DOD) Agencies, and DOD Field Activities.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this MIL-STD should be addressed to:

Director
Joint Information Engineering Organization
ATTN: JEBBA
Fort Monmouth, New Jersey 07703-5613

by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this MIL-STD or by letter.

3. Originally, MIL-STD-188 covered technical standards for tactical and long-haul communications, but later evolved through revisions (MIL-STD-188A, MIL-STD-188B) into a document applicable to tactical communications only (MIL-STD-188C).

4. The Defense Information Systems Agency (DISA), formerly the Defense Communications Agency (DCA), published DCA circulars (DCACs) promulgating standards and engineering criteria that apply to the long-haul Defense Communications System (DCS) and to technical support of the National Military Command System (NMCS).

5. As a result of a Joint Chiefs of Staff (JCS) action, standards for all military communications are now being published in a MIL-STD-188 series. This series is subdivided into a MIL-STD-188-100 series, covering common standards for tactical and long-haul communications; a MIL-STD-188-200 series, covering standards for tactical communications only; and a MIL-STD-188-300 series, covering standards for long-haul communications only. Emphasis is being placed on developing common standards for tactical and long-haul communications published in the MIL-STD-188-100 series.

6. This MIL-STD defines all technical characteristics essential to achieving interoperability between digital-tactical networks and digital-strategic networks for circuit-switched voice and data subscribers.

SUPERSEDES PAGE i OF MIL-STD-188-105

7. Users of this MIL-STD should be aware that it is based, at least in part, on the following commercial standards

ANSI T1.216	ITU I.460
ANSI T1.217	ITU V.110
ANSI T1.403	
ANSI T1.408	
ANSI T1.607	
ANSI T1.610	
ANSI T1.619	

and that there may be patent rights, copyright claims, or both, by companies or individuals on portions of the standard. Before incorporating this MIL-STD into systems or equipment, the user should contact the American National Standards Institute (ANSI) and the International Telecommunication Union-Telecommunication Standardization (ITU-T) regarding claims on conditions pertaining to the use of any of the above standards. Implementors of this MIL-STD shall be solely responsible for compensating companies or individuals entitled to any royalties.

1. SCOPE

1.1 Purpose. The purpose of this military standard (MIL-STD) is to provide a baseline for a gateway between tactical networks and strategic networks. The tactical networks are digital networks based on Tri-Service Tactical Communications (TRI-TAC) specifications. The strategic networks are digital networks based on Integrated Services Digital Network (ISDN) standards. This MIL-STD addresses the requirements for transmission of voice and data, through the gateway, between tactical and strategic circuit-switched networks. The requirements are specifically for the gateway and do not address requirements for a gateway switch. These requirements further presume that a call is always set up as a dial-up, circuit-switched call and that it progresses such that an inband, end-to-end, encrypted phase can be established with the New Terminal to support secure voice or secure data transmissions.

1.2 Applicability. This MIL-STD applies to interfaces between digital communications systems only.

1.3 Objectives. This MIL-STD has three objectives:

a. To achieve interoperability between strategic (ISDN) and tactical (TRI-TAC) digital circuit-switched networks for voice and data.

b. To achieve cost-effective interoperability and performance across the interface by referencing specific subsets of military and commercial standards.

c. To provide the following gateway capabilities:

1. Five (5) levels of precedence and preemption.

2. Common-channel-signaling message conversion.

3. Choice of rate adaption or transcoding for voice algorithm conversion.

4. Direct digital interfacing that preserves bit-count integrity (BCI).

5. Support of end-to-end transmission and reception of secure voice and secure data.

1.4 Defense Information System framework. This MIL-STD is based on the Defense Information System (DIS) framework (see 4.1, Figure 1) described below.

a. The DIS concept provides for an evolutionary integration of existing and future Department of Defense (DoD) computer and telephone communications systems. The DIS framework provides efficient, end-to-end, integrated services for information sources, sinks, and processors. Integrated services provide for voice, message, graphic, and imagery transfer across a single network interface. By definition, the DIS framework includes all components necessary to achieve interoperability between and among DoD users.

b. The DIS framework consists of three major sections demarcated by reference points A and B. Users may access the DIS through subscriber network elements, such as source, sink, or processor terminal equipment. These terminal equipment include telephones, facsimile machines, and other data terminal equipment (DTE). For the information source, sink, and processor elements to be interoperable, all seven layers of the International Standards Organization (ISO) Open Systems Interconnection (OSI) Reference Model must be interoperable.

c. DTEs exchange information through information-transfer utilities. Information-transfer utilities are composed of local-network elements, wide-network elements, and their respective interoperability reference points. DOD Services and Agencies provide fixed-plant, local-network elements to support strategic users and base operations. They also provide tactical local-network elements to support garrison operations and access to wide-network elements, as well as tactical-network elements to support deployed combat forces. The Defense Information Systems Agency (DISA) provides wide-network elements to interconnect geographically separated local-network elements. The wide-network elements include the Defense Communications System (DCS) and public switched telephone networks (PSTN). Since the local- and wide-network elements and interoperability reference points in the information-transfer utilities represent the telecommunications portion of DIS, their functionality is limited to the lower three layers of the OSI Reference Model.

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this MIL-STD to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the current issue of the DoD Index of Specifications and Standards (DODISS) and supplements thereto. Only applicable sections of the referenced documents, as identified in sections 4 and 5,are intended to be used.

STANDARDS

Federal

FED-STD-1037	*Glossary of Telecommunication Terms*
FIPS PUB-182	*Integrated Services Digital Network (ISDN)*

Military

MIL-STD-188-113	*Interoperability and Performance Standards for Analog-to-Digital Conversion Techniques*
MIL-STD-188-202	*Interoperability and Performance Standards for Tactical Digital Transmission Groups (Coaxial Cable)*

[Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Commanding Officer, Naval Publications and Forms Center (ATTN: NPODS), 5901 Tabor Avenue, Philadelphia, PA 19120-5099.]

2.1.2 Other government documents, drawings, and publications

ICD-003	*Framing and Synchronization Protocols*
TT-A3-9016-0056	*Digital Common Channel Signaling/Supervision Plan* (U)

(To obtain the above two documents, contact US Army Communications-Electronics Command, Attn: AMSEL-RD-SE-SY-C-EA, Fort Monmouth, NJ 077033-5613.)

TT-C1-7205-0102 Specification NSA No. 79-20	*Performance and Interface Specification for TSEC/KY-68 Digital Subscriber Voice Terminal, and Ancillaries*

(To obtain the above document, contact the National Security Agency, Attn: V31, 9800 Savage Road, Fort Meade, MD 20755-6000.)

2.2 Non-government documents

2.2.1 ITU-T Recommendations. The United States Government participates in the International Telecommunications Union-Telecommunication Standardization Sector (ITU-T), which is part of the United Nations (a treaty organization), through the Department of State. Although industry representatives may work on its committees, approval of standards (called Recommendations) is by governments.

ITU G.711	*Pulse-Code Modulation of Voice Frequencies*
ITU I.460	*Multiplexing, Rate Adaptation, and Support of Existing Interfaces*
ITU V.110	*Support of Data Terminal Equipment (DTEs) with V-Series Type Interfaces by an Integrated Services Digital Network (ISDN)*

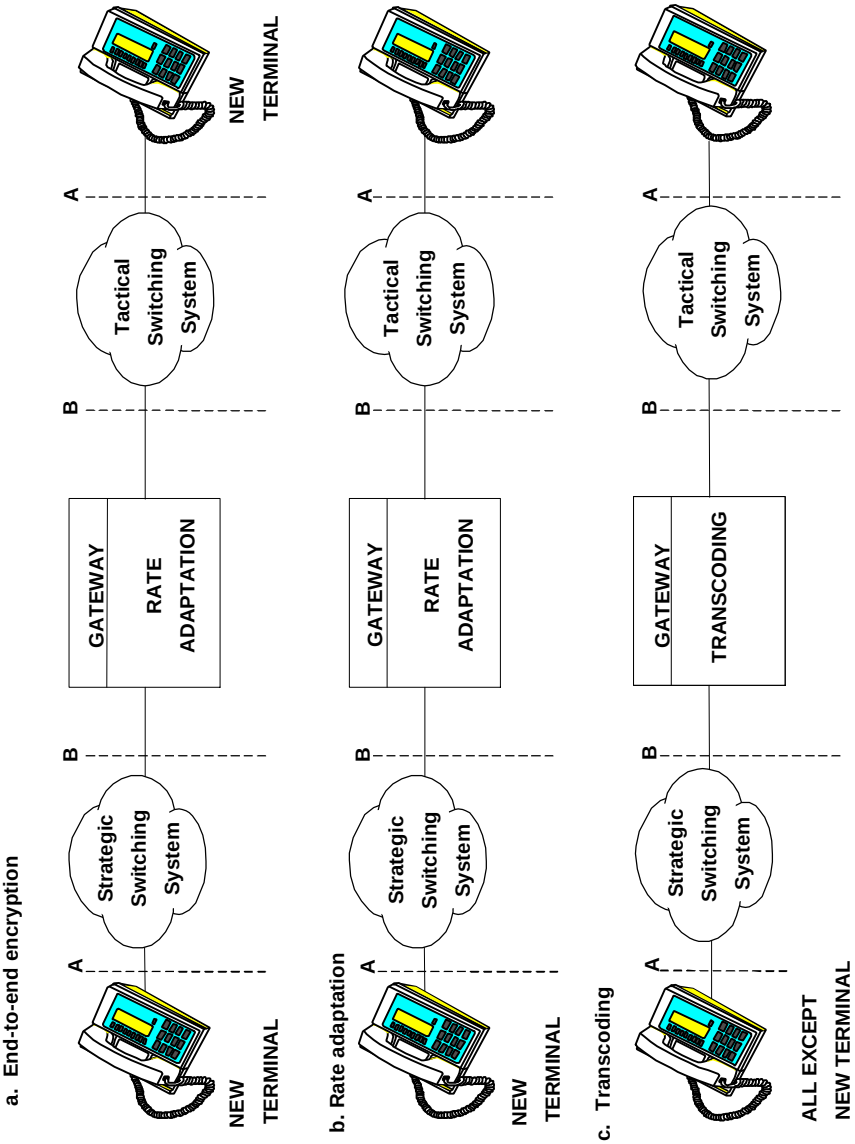
nonsecure voice traffic can be supported. In this case the gateway function shall perform transcoding, as described in 5.5.

4.1.3.3 Transcoding. The gateway function shall provide a transcoder to convert the tactical voice digitization algorithm from/to 16-kbps continuously variable slope delta (CVSD) (optionally 32-kbps CVSD) modulation to/from the strategic voice digitization algorithm based on 64-kbps pulse-code modulation (PCM), using mu-law companding.

4.1.3.4 Rate adaptation. The gateway shall rate-adapt 16-kbps signals (optionally 32 kbps) from the tactical network into 64-kbps signals for the strategic network and vice versa. The gateway facility shall use standard ITU-T I.460 bit-rate adaptation techniques to rate-adapt 16-kbps signals (optionally 32-kbps signals) into 64-kbps channels. This will allow the gateway to maintain BCI, as required in 4.1.4.2, to maintain cryptographic synchronization between calling and called secure terminals.

4.1.4 End-to-end encrypted telephone service. For end-to-end encrypted calls, it is necessary to use the same voice-encoding and encryption methods at each terminal. Negotiations occur during call setup to determine if a common voice-encoding mode exists. If a common voice-encoding mode exists, the call shall be established using rate adaptation at the gateway function. Nonsecure voice coordination can then be used to initiate an in-band signaling sequence between the end instruments, to determine if they have interoperable encryption algorithms. Figure 2 depicts all the possible combinations of end-to-end telephone services. New Terminals will be needed in both networks to achieve end-to-end encrypted calls across the gateway. All other combinations of terminals listed in Figure 2 will support only nonsecure telephone service. A description of the New Terminal is given in 4.1.4.1. The general requirements applicable to the gateway and end-to-end secure telephone service are given in 4.1.4.2.

4.1.4.1 New Terminal. The New Terminal will have at least 2 voice-encoding modes: 64-kbps PCM with mu-law companding and 16-kbps CVSD. When a New Terminal is used in an ISDN network, the New Terminal will be ISDN-capable with direct 64-kbps digital access to the strategic switch, and it will be able to negotiate with the gateway during call setup. When used in the ISDN network, the New Terminal will negotiate with the gateway, during call setup, to determine which voice-encoding algorithm will be used. The 64-kbps PCM with mu-law companding shall be the default case. When used in the tactical network, the New Terminal will use 16-kbps CVSD (optionally 32-kbps CVSD).



* All analog terminals shall be connected by terminal adapters.

Figure 2. End-to-end telephone service .

a Call-release message, which will be forwarded to the tactical network, and a Release message, which will be returned to the ISDN, in accordance with section 5.4.4.2a for call clearing initiated in the ISDN network. The ISDN will, in turn, return a Release-complete message to the gateway, in accordance with 5.4.4.2b. This indicates the ISDN trunk is available for a new connection.

5.4.10.2 Unsuccessful calls initiated in the strategic network. Call initiation from the ISDN network follows the same process as described in 5.4.3.2a for call initiation in the ISDN network: the gateway receives a Setup message from the ISDN circuit switch and maps this onto a tactical Call-initiate message, which it forwards to the tactical circuit switch. For a variety of reasons, such as "Called party unavailable," "Unassigned loop," "All-trunks busy," or "Invalid route," the tactical switch sends a Call-release message to the gateway. The gateway will then create a Disconnect message, which will be forwarded to the ISDN network, in accordance with section 5.4.3.2b for call-clearing initiated in the tactical network. The ISDN will, in turn, 5.4.4.1b. This indicates the ISDN trunk is available for a new connection. The gateway will then send the ISDN a Release-complete message, in accordance with 5.4.4.1c.

5.5 Transcoding. The gateway shall perform transcoding for voice calls that do not have common voice-encoding techniques. Transcoding shall provide digital translation of 16-kbps (optionally 32-kbps) CVSD to and from 64-kbps mu-law PCM. Transcoding includes two processes: translation of the digital encoding methods, and conversion of the sampling rates. The translation of the digital encoding methods shall be digital, that is, no intermediate analog stage shall be used. This approach eliminates the accumulation of quantization noise generated by analog-to-digital conversion. The sampling rates of 16-kbps (optionally 32-kbps) shall be converted to and from the 8-kbps samples used with 64-kbps mu-law PCM. The complete translation process shall occur in real-time, with the only inherent measurable delay attributable to the hysteresis effect of CVSD, which uses three previous bits to determine the current state. The effectiveness of the transcoding process shall be quantified by using standard TRI-TAC and PCM-encoded test-tone patterns, and measuring the distortion incurred through the translation process. TRI-TAC CVSD test-tone patterns are described in TT-C1-7205-0102 Specification NSA No. 79-20. Mu-law PCM test-tone patterns are described in ITU-T G.711 and Table 6/G.711. The gateway shall be designed to minimize the amount of distortion.

5.6 Rate adaptation. For those calls between terminals using common voice-encoding, the gateway function shall provide

bit-rate adaptation. 16-kbps and the optional 32-kbps tactical bit streams shall be rate-adapted in accordance with the following procedure, as documented in ITU-T I.460 and ITU-T V.110, the section titled *Rate adaptation of 8-, 16-, and 32-kbps streams*.

a. The 16-kbps stream received on incoming tactical trunks shall be mapped to bit positions 1 and 2 of the corresponding outgoing 64-kbps ISDN trunks. (Figure 3.)

b. The optional 32-kbps stream shall be mapped to bit positions 1, 2, 3, and 4.

c. Unused bit positions shall be set to "1."

d. The order of bit transmission of the subrate stream shall be identical before and after rate adaptation.

e. Bit positions 1 and 2 of the incoming ISDN trunk shall be mapped to the corresponding outgoing 16-kbps tactical trunk. (Bit 1 shall precede bit 2 in the 16-kbps stream.)

5.7 Voice encoding. This section defines the types of voice-encoding signals generated by subscriber terminal equipment (or terminal adapters) connected at reference point A in ISDN and tactical networks.

5.7.1 Pulse-code modulation. ISDN terminals use 64-kbps PCM voice encoding with mu-law companding, as described in MIL-STD-188-113, paragraph 5.1, titled *Eight-bit pulse-code modulation (PCM)*.

5.7.2 Continuously variable slope delta. Tactical terminals use CVSD voice encoding as described in MIL-STD-188-113, paragraph 5.2, titled *Continuously variable slope delta (CVSD) modulation*.

5.8 Satellite link count. The purpose of the satellite-link-count (SLC) information element is to indicate the number of satellite links traversed between Defense Information Systems Network (DISN) users. SLC will be used in the DISN, in conjunction with MLPP, to preempt low-priority calls on congested satellite links when alternate satellite link routing would result in transmitting calls with an unacceptable grade-of-service.

An SLC information element is present in Signaling System 7 (SS7) but is absent in DSS1. Since DSS1 is used in DISN subnetworks to interface with other DISN subnetworks that use SS7, it is necessary to introduce an SLC information into

CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - EC
Air Force - 02
DISA - DC
NSA - NS

Preparing Activity:
DISA (JIEO) - DC1

(Project TCSS-0050)

Review Activities:
Army - CR, SC
Navy - EC, MC
Air Force - 02, 13, 17, 18, 19, 90, 93
NSA - NS
DISA - DC1

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