CONFIDENTIAL

ROUTING AND RECORD SHEET

SUBJECT: (Optional) Proposed Federal Standard 1023

FROM: [redacted] Chief, Policy and Plans Staff/OS [redacted]

EXTENSION [redacted]

NO. OS 8-1315X

DATE 15 September 1988

TO: (Officer designation, room number, and building)	DATE RECEIVED	DATE FORWARDED	OFFICER'S INITIALS	COMMENTS (Number each comment to show from whom to whom. Draw a line across column after each comment.)
1. DD/PTS ATTN: [redacted]	16 SEP 1988 9/16/88			For review and comment by 22 September, please. Thanks, [redacted]
2.				
3. C/TSG			✓	
4. C/EAG			✓	
5.				
6.				7 to 3 ✓ Request your comments on the att'd. Would appreciate your feedback by COB 21 Sept. Also, please advise if any additional routing is appropriate [redacted]
7. PTS/PPB Attn: [redacted]		9/22	Emb	
8.				
9.				
10. [redacted]				
11. C/APS/OS				
12.				
13.				7-10 PTS components have reviewed the att'd and have no comment. [redacted]
14. [redacted]				
15.				

FORM 1-79 **610** USE PREVIOUS EDITIONS

CONFIDENTIAL

NATIONAL COMMUNICATIONS SYSTEM
OFFICE OF THE MANAGER
WASHINGTON, D.C. 20305 - 2010

IN REPLY
REFERTO:

NCS-TS

AUG 23 1988

STAT

Chief, Management Services Division
Office of Information Technology
CENTRAL INTELLIGENCE AGENCY
Washington, DC 20505

Dear Sir:

Proposed Federal Standard 1023 "Telecommunications: Interoperability Requirements for Encrypted, Digitized Voice Utilized with 25 KHz Channel FM Radios operating above 30 MHz," is enclosed for your review and approval.

This proposed standard was developed by the Land Mobile Radio (LMR) subcommittee of the Federal Telecommunication Standards Committee (FTSC) with broad Government participation.

Proposed Federal Standard 1023 was widely circulated for industry comment in January 1988. Following this comment period, the enclosed report was prepared by the Department of Commerce's Institute for Telecommunication Sciences (ITS). The draft standard has been reviewed by the FTSC, and it was approved by them for formal government coordination at their August 11, 1988, meeting.

Your comments on the enclosed standard should be furnished within 90 days of the date of this letter to the Office of Technology and Standards, National Communications System, Washington, D.C. 20305-2010. Any questions regarding the proposed standard should be directed to Mr. Robert M. Fenichel, telephone (202) 692-2124.

Sincerely,

B. E. MORRISS
Deputy Manager

2 Enclosures
1 Proposed Fed Std 1023
2 ITS Impact Assessment

PROPOSED FEDERAL STANDARD 1023

TELECOMMUNICATIONS: INTEROPERABILITY REQUIREMENTS FOR ENCRYPTED, DIGITIZED VOICE UTILIZED WITH 25 KHZ CHANNEL FM RADIOS OPERATING ABOVE 30 MHZ

First Draft
Revision 1

January 14, 1988

This proposed Federal standard has not yet been approved and is subject to modification.

1. SCOPE

1.1 Description. This standard establishes interoperability requirements regarding the analog to digital conversion, encryption (with related synchronization), and modulation of encrypted voice associated with Frequency Modulation (FM) radio systems employing 25 kHz channels and operating above 30 MHz. In this standard, voice is digitized using 12 kbit/s Continuously Variable Slope Delta-modulation (CVSD) and then encrypted using a National Security Agency (NSA) Commercial COMSEC Endorsement Program (CCEP) Type I encryption algorithm.

1.2 Purpose. This standard is to facilitate interoperability between telecommunication facilities and systems of the Federal Government.

1.3 Application. This standard shall be used by all Federal departments and agencies in the design and procurement of digitized voice encryption equipment for use with nominal 25 kHz channel FM radio systems that operate above 30 MHz and digitize voice at greater than 4.8 kbits/s and less than 16 kbits/s, other than Data Encryption Standard (DES) algorithm-encrypted radios. All such equipment must be capable of digitizing voice using 12 kbit/s Continuously Variable Slope Delta-modulation (CVSD).

2. REFERENCED DOCUMENTS

a. NSA Specification 86-33, INDICTOR Interface Control Document (FOUO)

b. NSA Specification 86-32, WINDSTER Interface Control Document (FOUO)

c. Communications Security Equipment System Document 14, TSEC/KY-57/58 (CONFIDENTIAL)

Note: All references to the above document assume the KY-57/58 has been modified to operate at 12 kbits/s (i.e. 75 percent normal clock rate).

The above three documents are published by the National Security Agency (NSA), Fort Meade MD 20755, and can be made available to Government departments and agencies and to manufacturers participating in the NSA Commercial COMSEC Endorsement Program (CCEP).

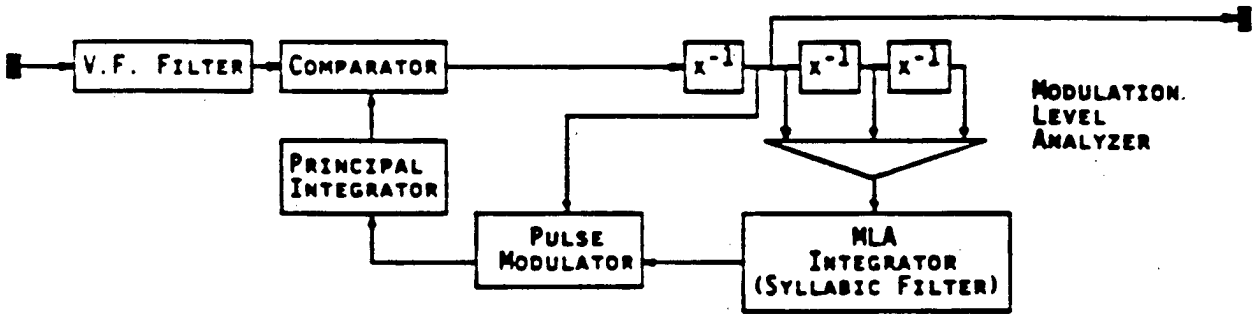
3. REQUIREMENTS

3.1 Overview. This standard describes interoperability-related requirements for the conversion of analog voice to digital form (section 3.2), its encryption and related synchronization (section 3.3), and subsequent frequency modulation (section 3.4).

3.2 Analog to Digital Conversion

3.2.1 Digital Rate. Voice shall be converted, using Continuously Variable Slope Delta-modulation (CVSD), to a 12,000 ±.02 percent digital stream.

3.2.2 Block Diagram and General Description. The following diagram is a typical representation of the CVSD analog-to-digital conversion process.



In the typical CVSD representation above, the incoming analog voice signal is passed through a Voice Frequency (V.F.) Filter and then compared, by a Comparator, with the output of the Principal Integrator. The previous bit output of this Comparator is used: (1) as the digital output of the CVSD encoder, (2) to determine the polarity of the pulse generated by the Pulse Modulator, and (3) as input of the Modulation Level Analyzer. The Modulation Level Analyzer (MLA) provides indication to the MLA Integrator whenever the last and previous two bits from the Comparator are either all ONEs or all ZEROs. (This is referred to as run-of-three coincidence coding). The MLA Integrator determines the step size, which is variable and based upon the MLA output, and provides this pulse amplitude information to the Pulse Modulator. The Pulse Modulator provides pulses to the Principal Integrator as the Principal Integrator attempts to follow the shape of the input voice waveform.

3.2.3 V.F. Filter. The V.F. Filter should have an attenuation at 6 kHz and higher frequencies relative to frequencies between 300 and 3,000 Hz of at least 20 dB. It is recommended that the filter be essentially flat (i.e. ±3 dB) between 300 and 3,000 Hz.

3.2.4 Comparator. The binary digital output of the Comparator shall be either ONE or ZERO, depending upon whether the amplitude of the input voice signal is greater than or less than the output of the Principal Integrator.

3.2.5 Modulation Level Analyzer. The Modulation Level Analyzer (MLA) shall charge the MLA Integrator whenever the last and two immediately preceding bits from the Comparator are either all ONEs or all ZEROs (i.e. there is run-of-three coincidence).

3.2.6 MLA Integrator. The MLA Integrator (often called Syllabic Filter) provides pulse amplitude information to the Pulse Modulator. The change in pulse amplitude from one bit time to the next (i.e. quantizing step size) should vary, in a linear manner, from a run-of-three coincidence rate of 0 percent to a rate of 50 percent by a voltage ratio of approximately 10 to 1 (i.e. 20 dB). The time constant of the MLA Integrator shall be 6±2 ms.

3.2.7 Pulse Modulator. The pulse modulator shall create pulses using amplitude information from the MLA Integrator and polarity information from the Comparator.

3.2.8 Principal Integrator. The Principal Integrator shall have a time constant of 1±.25 ms.

3.3 Encryption

3.3.1 Encryption Algorithm. Encryption of the digitized voice shall be accomplished with the encryption algorithm used in the INDICTOR and WINDSTER COMSEC Modules (see references a and b) using the cryptographic mode that has cryptographic compatibility with the KY-57/58. (Other compatible implementations may be substituted.)

3.3.2 Encryption Operating Mode. The encryption process shall use the cryptographic operating mode of the INDICTOR and WINDSTER COMSEC Modules designated for compatibility with the KY-57/58. (Other compatible implementations may be substituted.)

3.3.3 Cryptographic Synchronization.

3.3.3.1 Synchronization Check Bits. Transmitting radios shall predictably force synchronization check bits in the unencrypted digitized voice, prior to encryption, as is done by the KY-57/58 (see reference a (section 5.3, paragraph 2) and reference c). Receiving radios shall utilize these predictable synchronization check bits to determine whether cryptographic synchronization has been lost (see reference a, section 5.3.3, paragraph 3).

3.3.3.2 Alternating ONE/ZERO Pattern. Continously Variable Slope Delta-modulation (CVSD) should inherently produce an alternating binary ONE/ZERO pattern during the idle condition (i.e. pauses in speech). In order to promote rapid initial synchronization and resynchronization, transmitting radios shall ensure that a segment of alternating ONE/ZERO pattern at least 95 percent the length of the segment produced by the KY-57/58 (see reference c) is produced in the unencrypted bit stream, prior to encryption, at least once every two seconds. All receiving radios shall be capable of initial synchronization and subsequent resynchronization (after detecting absence of synchronization check bits) utilizing segments of alternating ONE/ZERO pattern in the decrypted bit stream.

3.3.4 End-of-Message Sequence. Radios shall transmit the same encrypted End-of-Message sequence used by the KY-57/58, with a duration between 60 and 120 percent of that transmitted by the KY-57/58, at the end of each half-duplex transmission, followed by 160±10 ms of unencrypted alternating ONE/ZERO pattern, to mark the end of a transmission. (Note: this is to assist encryption equipment and repeaters in distinguishing between a fade condition and an actual end of transmission.)

3.3.5 Additional Non-voice Sequences. Radios may employ additional, unspecified, non-voice sequences at the start of transmissions (e.g. KY-57/58 initial synchronization). However, use of these additional sequences shall not impair interoperation with radios not utilizing such additional sequences.

3.4 Modulation

3.4.1 Deviation and Coding. Transmitter deviation shall be ±4 kHz (±10 percent) from the carrier frequency. Receiving radios shall operate satisfactorily regardless of whether transmitted binary ONEs (or ZEROs) were coded as positive or negative 4 kHz shifts in carrier frequency.

3.4.2 Spectral Shaping. For the following values of frequency offset in kHz (f) from the carrier frequency, spectral power in dB shall be reduced from the unmodulated carrier power by more than:

a. 5 to 10 kHz — $83 \log_{10}(f/5)$

b. 10 to 50 kHz — $116 \log_{10}(f/6.1)$ or $50+10 \log_{10}$ (transmit power in watts), whichever is the lesser attenuation

c. above 50 kHz — $43+10 \log_{10}$ (transmit power in watts)

4. EFFECTIVE DATE. The use of this standard by U.S. Government departments and agencies is mandatory effective 180 days following the date of this standard.

5. CHANGES. When a Government department or agency considers that this standard does not provide for its essential needs, a statement citing specific requirements shall be sent in duplicate to the General Services Administration (K), Washington, DC 20405, in accordance with the provisions of Federal Property Management Regulation 41 CFR 101-29.403-1. The General Services Administration will determine the appropriate action to be taken and will notify the agency.

PREPARING ACTIVITY:

National Communications System
Office of Technology and Standards
Washington, DC 20305-2010

IMPACT ASSESSMENT OF PROPOSED FEDERAL STANDARD 1023

L. T. Jones

Submitted to:

National Communications System
Office of Technology and Standards
Washington, DC 20305

July, 1988

Declassified in Part - Sanitized Copy Approved for Release 2013/08/05 : CIA-RDP91B00390R000100100007-1

TABLE OF CONTENTS

IMPACT ASSESSMENT OF PROPOSED FEDERAL STANDARD 1023

L. T. Jones*

This report records a study which was aimed at assessing the economic and technological ramifications associated with the adoption of proposed Federal Standard 1023, entitled "Telecommunications: Interoperability Requirements for Encrypted, Digitized Voice Utilized with 25 kHz Channel FM Radios Operating Above 30 MHz." Written comments were submitted by the public, industry, and several U.S. Government agencies. Verbal survey remarks were gathered, by the Institute for Telecommunication Sciences, from several manufacturers of land mobile radio equipment. These have been used to assess the perceived impact of the proposed standard and to derive the conclusions. It is shown that the proposed standard provides an acceptable means of satisfying established Government requirements.

1. INTRODUCTION

In a July 5, 1978 letter from R. F. Carroll, Jr., Assistant Commissioner of the General Services Administration (GSA), to Marshall Cain, Assistant Manager of the National Communications System (NCS), Mr. Carroll stated that it is essential that Federal telecommunication standards be promulgated with due consideration of product availability and economic and technological impact. He specifically requested that future standards proposed for approval and issuance as Federal Standards include the following:

- Justification for inclusion of detailed design requirements (if any) in lieu of functional/performance requirements
- Summary of significant agency and industry comments that were considered in the formulation of the standard
- Assessment of product availability and whether commercially available off-the-shelf; including number of potential suppliers

The information presented in the following sections of this report is intended to address the concerns of GSA (and other Government agencies) relative to proposed Federal Standard 1023 (FED-STD-1023).

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*The author is with the Institute for Telecommunication Sciences, National Telecommunications and Information Administration, U.S. Department of Commerce, Boulder, CO 80303.

The design requirements of proposed FED-STD-1023 are discussed in Section 2. Comments from both industry and U.S. Government agencies are then presented. These comments are divided into two classes, those that are primarily written and those that are primarily verbal. Section 3 summarizes the written comments. Section 4 summarizes the verbal comments gathered by the Institute for Telecommunication Sciences (ITS). The availability of transceivers complying with the proposed standard is addressed in Section 5. The perceived impact of proposed FED-STD-1023 is presented in Sections 6 and 7, and conclusions are given in Section 8.

During the course of this study, contact was made with several industry sources. Questions, formulated prior to those contacts, were administered in the same manner to all sources to avoid leading or biasing the respondents. Because of the sensitive and competitive nature of product information among manufacturers, the names of the companies represented in the interviews are not stated in this report. However, a detailed cross reference is available at the Institute for Telecommunication Sciences for inspection by Government agencies. Identification of companies will be considered "For Official Use Only."

2. DETAILED DESIGN REQUIREMENTS OF PROPOSED FED-STD-1023

FED-STD-1023 establishes analog-to-digital (A to D) techniques, encryption (with related synchronization), and modulation to be used for radio transmission of encrypted voice employing 25 kHz channels operating on carrier frequencies above 30 MHz. The A to D technique specified is Continuously Variable Slope Delta-modulation (CVSD). An overwhelming majority of digitally encrypted radios used by the Government today use this A to D technique. The specified bit rate is 12 kbit/s. FED-STD-1023 specifies the use of Type I encryption. Type I encryption may be used to send classified information (if a classified key is used). Type I encryption or a lesser level of encryption may be used to send sensitive but unclassified information. Encryption is accomplished in FED-STD-1023 using the encryption algorithm of the National Security Agency developed INDICTOR and WINDSTER COMSEC Modules using the cryptographic mode that has cryptographic compatibility with the KY-57/58 (other compatible implementations may be substituted).

Proposed Federal Standard 1023 contains the necessary detailed information to ensure interoperability between digitally encrypted radios (operating with

the same key) regardless of the manufacturer. It does not, however, contain any detailed design information that would restrict a manufacturer in the methods used to implement the operational requirements, or give one manufacturer an unfair advantage over another.

3. WRITTEN COMMENTS

Following the request for comments on proposed FED-STD-1023, listed in the Federal Register, in addition to comments by the public and industry, three U.S. Government agencies provided written responses: Defense Communications Agency (JTC3A), Department of Energy, and Department of Transportation.

3.1 Defense Communications Agency

The Defense Communications Agency (JTC3A) suggested that:

- "an option using the Data Encryption Standard (DES) should also be included" in FED-STD-1023 "so that tactical radios can interface directly with compatible DoD base radios"
- "the standard specifically rules out digitizing voice at 16 kbit/s."

Regarding the first point, it does not seem wise to require all radios to have a DES option in order for them to comply with FED-STD-1023. Most users may not even need this option. If it is a requirement for enough users, then the manufacturers (with necessary concurrence from NSA) will probably attempt to provide such a radio. At this writing, NSA would not endorse any more DES radios. FED-STD-1023 will not prevent production of such a radio. Regarding the second point, Section 1.3 of FED-STD-1023 states that it applies to radios that "digitize voice at greater than 4.8 kbit/s and less than 16 kbit/s." Therefore 16 kbit/s equipment is not covered by FED-STD-1023 and is not excluded by it.

3.2 Department of Energy

The Department of Energy (DOE) expressed concerns about some aspects of FED-STD-1023:

1. DOE felt it was unclear whether the standard was designed for transmission of classified as opposed to sensitive (but unclassified) information.

2. DOE was also concerned about the capability of 12 kbit/s CVSD to be used for simulcast and complications of using commercial modems and multiplex equipment.

3. DOE believed 12 kbit/s CVSD was proprietary and was concerned about possible range reduction.

4. DOE was concerned about a possible requirement for existing equipment (particularly DES equipment) to be replaced rather than grandfathered out.

5. DOE felt that the FCC's Public Safety National Plan led to the conclusion that the requirement for interoperability as specified by FED-STD-1023 was questionable.

Regarding item 1: Section 1.1 of FED-STD-1023 states that the standard employs Type I encryption. Classified information may be sent using Type I encryption if a classified key is used. Type I encryption is also suitable for sending sensitive but unclassified information (a classified key is not required in this case). In addition, a level of encryption below Type I may be used for transmitting sensitive but unclassified information. Regarding item 2: (1) simulcast systems have been built and operate satisfactorily using 12 kbit/s CVSD; (2) V.33 modems can be utilized to send 12 kbit/s CVSD; (3) multiplexing 12 kbit/s CVSD is not as straightforward (using standard equipment) as is multiplexing 4.8 or 9.6 kbit/s data rates (however, few radio users have this requirement). Regarding item 3: (1) 12 kbit/s CVSD is not proprietary; (2) Range reduction problems of early DES encrypted CVSD radios were primarily the result of the error extension inherent in the cryptographic mode used (cipher feedback) and not a function of CVSD itself. The encryption mode specified in FED-STD-1023 does not have this problem. Regarding item 4: Section 1.3 of FED-STD-1023 specifically prevents the standard from placing any restrictions on the purchase of DES equipment. Regarding item 5: it is unclear what the relevance of the FCC's Public Safety National Plan (which addresses trunked systems) is to the requirement for FED-STD-1023. Perhaps DOE was thinking of the five common channels that the FCC plan established for accessing a trunked system with a conventional radio or a trunked system that is not interoperable with the trunked system of the organization being called. However, even if two people are on the same radio channel, without some external conversion they will not be able to communicate by voice in the encrypted mode unless their radios use the same A to D technique, same

encryption, same synchronization, same key, and same (or compatible) modulation.

3.3 Department of Transportation

The Department of Transportation suggested that FED-STD-1023 should use either 4.8 or 9.6 kbit/s data rates and pointed to studies using an "APC-NS algorithm" at 9.6 kbit/s, which had intelligibility superior to that of 12 kbit/s CVSD. These tests were apparently made with various types of background noise. However, it did not appear that these tests were made on a radio channel experiencing Rayleigh fading (as one might expect in a land mobile radio channel). It is generally agreed that advances in voice coding technology will allow narrowband digital radio. The Land Mobile Radio Subcommittee of the Federal Telecommunications Standards Committee (FTSC) is following developments in voice coding technology as well as advances in transceiver and modulation technology for possible application to FED-STD-1024 (narrowband, digital, encrypted voice radios). However, developments are not far enough along to support standardization at this point in time.

3.4 Survey Forms

Over 200 check list survey forms in opposition to FED-STD-1023 were submitted in response to a campaign by one manufacturer opposed to FED-STD-1023. A few respondents included letters along with the check lists and a few wrote letters in lieu of the check list, but most merely submitted the check list. Most who submitted these responses had apparently been led to believe that FED-STD-1023 proposed a proprietary A to D technique and would therefore guarantee one manufacturer a monopoly. Others were concerned that the standard did not make use of the latest voice coding and modulation technology. The A to D technique proposed by FED-STD-1023 (CVSD at 12 kbit/s) is not proprietary. A standard that will likely be issued sometime in the 1990's, FED-STD-1024, will make use of later technologies for a narrowband, encrypted digital voice radio. FED-STD-1023 is designed for Federal radio users who have an immediate need for encrypted, digital voice radios. Other issues included on this checklist are addressed in other parts of this report.

4. RESULTS OF VERBAL SURVEY

Several companies who are manufacturers of land mobile radio equipment were telephoned initially and the rationale behind the economic and technological impact assessment of proposed FED-STD-1023 was explained. In several cases, the company representatives did not have a copy of proposed FED-STD-1023 or were not familiar with it. In those cases, a copy of the proposed standard was sent to them. Follow-up telephone calls were made to those companies. Five company representatives ultimately provided their opinions. The summary of verbal and voluminous written comments from Company "C" is covered in Section 4.3.

4.1 Company "A"

Company "A" indicated that it is actively investigating the manufacture of radios that will comply with FED-STD-1023. This is somewhat complicated by the fact that its radios are manufactured overseas. The representative from Company "A" does not feel that FED-STD-1023 provides an unfair advantage to any one manufacturer, nor did he feel that the standard would be deleterious to the industry. It is probable that Company "A" will attempt to provide a radio complying with FED-STD-1023.

4.2 Company "B"

Company "B" is actively working on radios that will comply with FED-STD-1023. Company "B" does not believe that FED-STD-1023 provides an unfair advantage to any one manufacturer, nor does it feel that the standard will be deleterious to the industry. However, Company "B" was concerned that the standard might prevent the manufacture of radios that will operate on both FED-STD-1023 and DES (a concern similar to that expressed by DCA above). The response given above to DCA's concerns covers this issue.

4.3 Company "C"

Representatives from Company "C" believe that 9.6 kbit/s sub band coding (SBC) should be the A to D technique specified by FED-STD-1023. Points not previously addressed in this document that were raised by representatives from Company "C":

1. The 12 kbit/s data rate proposed by FED-STD-1023 will force "specialized RF design" of land mobile equipment.

2. FED-STD-1023 will "effectively preclude all other suppliers from entering the market."

3. Trunking and encryption should be linked.

With regard to item 1, the only aspect of standard analog FM radio design that should be changed to implement 12 kbit/s CVSD (that is not required for 9.6 kbit/s SBC) is a widening of the IF bandwidth (16 kHz to 20 kHz). Even this change may not be essential: the Bureau of Alcohol Tobacco and Firearms (ATF) has obtained satisfactory performance from standard analog FM radios adapted to operate on 12 kbit/s CVSD without modifying the IF bandwidth. With regard to item 2, there are already transceivers (made by two different suppliers) that use CVSD that are proceeding through NSA's Commercial COMSEC Endorsement Program (CCEP) at this time. However, only one of these companies is proposing radios complying with FED-STD-1023 in every respect. The other company is proposing radios that operate with 16 kbit/s CVSD (not covered by FED-STD-1023) as opposed to 12 kbit/s CVSD. However, this company and other suppliers have expressed an interest in providing FED-STD-1023 radios. Integrated circuits which perform the A to D conversion are already available from more than one supplier. Based on manufacturers' estimates, the encryption modules will be available from more than one supplier in early 1989. With regard to item 3, manufacturer "C" gave no particular reason why trunking and encryption should be tied together, except that manufacturer "C" uses the same data rate (9.6 kbit/s) on its trunking channel as it does for digitally encrypted voice. An advantage of this approach is that it allows the use of the same modem for both digital voice and signaling channel data. Such a high data rate (9.6 kbit/s) for the signaling channel may not be acceptable for use on narrowband digital systems anticipated by FED-STD-1024. In fact, a representative from Company "C" indicated that on 900 MHz trunked systems (which use narrowband analog FM on 12.5 kHz channels) Company "C" will use a 4800 kbit/s rate on its signaling channel. Company "C" has indicated it will not build radios to the present draft of FED-STD-1023. However, if the standard should be adopted this decision may change.

4.4 Company "D"

Company "D" objected to FED-STD-1023 because it believes it gives an unfair advantage to the manufacturer which, for several years, has built radios that use the A to D technique specified in FED-STD-1023. When it was explained to this manufacturer that integrated circuits which perform this A to D conversion are available from more than one manufacturer and that encryption modules will be available from more than one manufacturer, the opposition was greatly reduced. Company "D" will seriously consider building radios complying with FED-STD-1023.

4.5 Company "E"

Company "E" does not believe that FED-STD-1023 will give one mobile radio manufacturer an unfair advantage over the others, nor does it believe the standard will adversely affect the land mobile industry. Company "E" has a radio progressing through NSA's Commercial COMSEC program that is FED-STD-1023 compatible except for the data rate. Company "E" indicates that it probably will build a radio complying with FED-STD-1023.

5. PRODUCT AVAILABILITY

No radios complying with FED-STD-1023 are currently available. One company now has FED-STD-1023 compatible radios progressing through NSA's Commercial COMSEC Endorsement Program. Another company has radios progressing through NSA's Commercial COMSEC Program that are FED-STD-1023 compatible except for their data rate. This company has indicated that it will probably build a radio complying with FED-STD-1023 as well.

A review of industry comments for this document indicates that other companies are also considering building equipment that will comply with proposed FED-STD-1023.

6. TECHNICAL IMPACT

The technical impact of proposed FED-STD-1023 is perceived to be minimal. This is further evidenced by some manufacturers' apparent willingness to build (or expressed plans to build) mobile radio equipment that complies with proposed FED-STD-1023. Integrated circuits which perform the A to D conversion are currently available off-the-shelf from more than one manufacturer. Modules

which perform the encryption function will probably be available off-the-shelf in early 1989 from more than one manufacturer.

The standard contains no technical requirements that would give one manufacturer an unfair competitive advantage over another.

7. ECONOMIC IMPACT

The economic impact of this standard is perceived by most sources to be minimal, but generally positive. The existence of a Federal Standard in this area will undoubtedly encourage some manufacturers that had not marketed products of this type up until this time to build encrypted digital voice radios. If enacted at the date of this report, the standard would lead to a short-term monopoly by one manufacturer for land mobile radios employing Type I encryption. In comparison, a Government user purchasing DES encrypted land mobile radio equipment (where the A to D technique has not been standardized) has a choice between only two manufacturers, one offers 12 kbit/s CVSD and the other offers 9.6 kbit/s SBC. However, once that choice is made, he is locked into one manufacturer's equipment (effectively a monopoly to that user). This standard will not effect this situation for DES users; however, it should help avoid this same situation in the future for users of Type I encrypted land mobile radio equipment, because it will encourage a number of suppliers to produce interoperable Type I encrypted land mobile equipment. This will undoubtedly lead to reduced prices and eliminate the need for sole source procurement by Government users purchasing Type I encrypted digital voice land mobile radios. The existence of a standard will hurt the market for other techniques such as 9.6 kbit/s SBC. Naturally, this is perceived by the manufacturer of these radios as a negative impact. However, it appears that these radios have not made much of a dent in the Federal market. This is evidenced by the fact that 12 kbit/s CVSD already has approximately 80 to 90 percent or more of the Federal market for encrypted digital voice radios.

Most manufacturers and Government users support standardization in this area. Most manufacturers feel that such standards help stimulate the market and increase competition, which should result in eventual lower costs to Government users.

8. CONCLUSIONS

Review of the previous sections of this report leads to the conclusion that proposed FED-STD-1023 provides a reasonable approach to providing compatibility and interoperability between Government-procured land mobile radio transceivers which use encrypted, digitized voice. As noted earlier, the technological impact of this standard upon both industry and Government users is minimal. The economic impact to the industry as a whole should be minimal. If enacted on the date of this report, the standard would lead to a short-term monopoly by one manufacturer; however, the standard should lead to increased competition and lower prices than would result if no standard were implemented. This will lead to a positive economic impact to the Government.

Equipment that meets the standard will be available off-the-shelf in the near future. Adoption of FED-STD-1023 will create an added demand for compatible equipment, encouraging more manufacturers to build this equipment, resulting in increased competition among manufacturers. This should result in considerably lower costs to Government users.

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