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MAS/140-EL/4202
25 May 1988

To : See Distribution Overleaf

Subject : STANAG 4202 EL (EDITION 2) - TRANSMISSION ENVELOPE CHARACTERISTICS FOR HIGH RELIABILITY DATA EXCHANGE BETWEEN LAND TACTICAL DATA PROCESSING EQUIPMENT OVER SINGLE CHANNEL RADIO LINKS

References : a. MAS/29-EL/4202 of 21 January 1983
b. AC/302-D/390 of 23 July 1986

Enclosure : STANAG 4202 (Edition 2)

1 The enclosed NATO Standardization Agreement which has been ratified by nations as reflected in page iii is promulgated herewith.

2 The references listed above are to be destroyed in accordance with local document destruction procedures.

3 AAP-4 should be amended to reflect the latest status of the STANAG.

ACTION BY NATIONAL STAFFS

4. National staffs are requested to examine page iii of the STANAG and if they have not already done so, to advise the Defence Support Division, IS, through their national delegation as appropriate of their intention regarding its ratification and implementation

A.J. MELO CORREIA
Major-General, POAF
Chairman, MAS

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ST4202A

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STANAG 4202
(Edition 2)

NORTH ATLANTIC TREATY ORGANIZATION
(NATO)

MILITARY AGENCY FOR STANDARDIZATION
(MAS)

STANDARDIZATION AGREEMENT

SUBJECT: TRANSMISSION ENVELOPE CHARACTERISTICS FOR HIGH RELIABILITY DATA EXCHANGE BETWEEN LAND TACTICAL DATA PROCESSING EQUIPMENT OVER SINGLE CHANNEL RADIO LINKS

DISTRIBUTION STATEMENT C
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Promulgated on 25 May 1988

A.J. MELO CORREIA
Major-General, POAF
Chairman, MAS

RECORD OF AMENDMENTS

No.	Reference/date of amendment	Date entered	Signature

EXPLANATORY NOTES

AGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Chairman MAS under the authority vested in him by the NATO Military Committee.

2. No departure may be made from the agreement without consultation with the tasking authority. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

DEFINITIONS

4. Ratification is "The declaration by which a nation formally accepts the content of this Standardization Agreement".

5. Implementation is "The fulfilment by a nation of its obligations under this Standardization Agreement".

6. Reservation is "The stated qualification by a nation which describes that part of this Standardization Agreement which it cannot implement or can implement only with limitations".

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

7. Page iii gives the details of ratification and implementation of this agreement. If no details are shown it signifies that the nation has not yet notified the tasking authority of its intentions. Page iv (and subsequent) gives details of reservations and proprietary rights that have been stated.

Agreed English/French Texts

STANAG 4202)
(Edition 2)

NAVY/ARMY/AIR

NATO STANDARDIZATION AGREEMENT (STANAG)

TRANSMISSION ENVELOPE CHARACTERISTICS FOR HIGH RELIABILITY DATA EXCHANGE BETWEEN LAND TACTICAL DATA PROCESSING EQUIPMENT OVER SINGLE CHANNEL RADIO LINKS

Annexes:

A. Transmission Envelope Characteristics for Analogue Voice Bandwidth Channels.

B. Additional Characteristics for Interim Use of 16kbps Digital Channels.

Related Documents:

STANAG 4203: Technical Standards for Single Channel HF Radio Equipment.

STANAG 4204: Technical Standards for Single Channel VHF Radio Equipment.

STANAG 4205: Technical Standards for Single Channel UHF Radio Equipment.

STANAG 5620· Standards for Interooerability of Fire Support Systems.

STANAG 5036: Parameters and Practices for the Use of the NATO 7 Bit Code

AIM

1. The aim of this agreement is to define the transmission envelope characteristics needed for high reliability information exchange between and among Alliance land forces' data processing systems over tactical single channel radio links.

AGREEMENT

2. The participating nations agree to use the characteristics contained in this STANAG for their Data Circuit Terminating Equipment (DCE) providing the interface between their Data Terminal Equipment (DTE) and certain single channel radio links.

GENERAL

3. This STANAG defines the essential technical characteristics permitting DTE (e.g. those described in STANAG 4130) to exchange information with an undetected error rate of one message in a million or better over links established with certain single channel radio equipment (e.g. those described in STANAGs 4203, 4204 and 4205).

4. The transmission envelope defined in this STANAG is considered to be transparent to the DTE in that no restrictions are placed on the message content. Message length and repeat transmission may have to be constrained by operational/ECCM needs.

5. Annex A contains those transmission envelope characteristics needed for data exchange over analogue voice bandwidth links (e.g. those nominal 3 kHz channels defined in STANAGs 4203, 4204 and 4205).

6. Annex B contains those additional transmission envelope characteristics needed for the interim use of Annex A characteristics over wide bandwidth digital links (e.g. the 16 kbps channel defined in STANAG 4204 and 4205). Further, Annex B defines a "Data Flag" needed to identify data transmission over shared voice/data links, such as those provided by the United States VINSON(1) and the United Kingdom LAMBERTON encryption equipments.

7. Whilst it is the intention that this STANAG will be primarily for use by land forces, it is recognised that certain marine forces will also be required to conform to this requirement.

DEFINITIONS

8 For the purposes of this STANAG:

(a) a DTE can be a subscriber equipment which acts as the source or sink for packets of data to or from a communication equipment (e g. host computer, front end processor, intelligent terminal);

(b) the DCE can be any equipment that converts signal to or from the DTE into a form which can provide the specified format data exchange through the communications link

IMPLEMENTATION OF THE AGREEMENT

9. This STANAG is implemented by a nation when the technical characteristics contained in this agreement are being used in that nation's forces for data exchange between land technical data processing equipment over single channel radio links.

---

(1) Since the VINSON equipment (i.e. KY-57/58) is designed for tactical secure voice application, all usages of these equipments to secure data (i.e. all non-voice communications traffic whether in analogue or digital form) must be approved by SECAN prior to finalizing plans for such employment.

(With 2 Appendices)

TRANSMISSION ENVELOPE CHARACTERISTICS FOR ANALOGUE VOICE BANDWIDTH CHANNELS

INTRODUCTION

1. This Annex contains the definition for the following:

(a) Transmission Rate.

(b) Frequency Shift Keying (FSK) Modulation.

(c) Key Time Delay.

(d) Envelope Synchronization.

(e) Error Detection and Correction (ED&C) Coding.

(f) Time Dispersal Coding (TDC).

(g) Cyclic Redundancy Check.

(h) Envelope Termination.

2. The elements defined in this Annex are depicted in Figure A1.

TRANSMISSION RATE

3. HF Band

(a) The primary application of this STANAG is for ground wave transmission paths where the preferred rate for establishment of communications is 600 bps with 150,300 and 1200 bps as possibilities, if conditions permit.

(b) If this STANAG is applied to skywave transmission paths, the preferred rate for establishment of communications is 75 bps with the rates cited above as possibilities, if conditions permit.

4. VHF Band

The primary application of this STANAG is for ground wave transmission paths where the preferred rate for establishment of communications is 600 bps with 300 and 1200 bps as possibilities, if conditions permit.

5. UHF Band

The primary application of this STANAG is for ground wave transmission paths where the preferred rate for establishment of communications is 600 bps with 300 and 1200 bps as possibilities if conditions permit.

FREQUENCY SHIFT KEYING (FSK) MODULATION

6. The FSK modulation characteristics are as follows:

(a) Mark or 1: 1575 Hz.

(b) Space or 0: 2425 Hz.

(c) Audio tone frequency accuracy - transmit: ± 5 Hz (± 1 Hz desired).

(d) Receiver capability: ± 20 Hz.

7 The change from a mark to a space or vice versa must be accomplished with a maximum phase discontinuity of 5^{o}. No other waveform discontinuities are permitted.

8. The clock accuracy shall be ± 1 part in 10^5 or better for synchronous data.

KEY TIME DELAY

9 This time is defined as the time from the start of the transmission event (e g operation of a transmit switch or activiation of a PRESSET command) to the start of the first bit of the mandatory envelope synchronization defined in this Annex This period allows for equipment turnaround and start-up times to allow the end-to-end radio link to be established See Figure A1

10. Keytime delays of nominal values between 0 0 and 3.30667 seconds in steps of 0.10667 seconds are to be provided. The exact duration of the keytime delay is specified in terms of bits at the baseband transmission rate, thus keytime delay=

N x 128 bits at 1200 bits per second

N x 64 " " 600 " " "

N x 32 " " 300 " " "

N x 16 " " 150 " " "

N x 8 " " 75 " " "

(a) where N is the Keytime Delay Factor (KDF) expressed as an integer in the range 0-31. A limited number of values for KDF will be permissible and agreed for use. At least a KDF of N=5 (0.53333 secs) and N=19 (2.026676 secs) must be provided.

(b) during the keytime delay period, the modulation applied to the transmitter shall be reversals, ending in a zero, so that the transition to the reversals of the 'bit synchronization' period is continuous.

11. For use with link encryption devices, this key time delay must take note of the needs for synchronization of those equipments over the radio channel.

ENVELOPE SYNCHRONIZATION PREAMBLE

12. The transaction shall commence with a 96 bit sequence of bit and character synchronization at the end of the key time delay period defined in this STANAG. The purpose of the synchronization is to allow reliable message detection and timing in the high noise environment of a tactical radio channel. This sequence is shown in Figure A1

(a) Bit Synchronization. An alternate 1-0 . pattern with a total length of 33 bits commencing and terminating with a '1' element shall be used

(b) Character Synchronization A 63 bit maximal length pseudorandom sequence shall be used as generated by a (6,1)(*) shift register starting with a fill of all '1's This 63 bit sequence follows the bit synchronization without a break

ERROR CONTROL

13. The means to obtain the required performance (i e one message in 10^6 or fewer will contain an undetected error) is a system consisting of three elements, error detection and correction (ED&C) coding, time dispersal coding (TDC) and cyclic redundancy check (CRC). ADP systems requiring a higher standard of performance should include extra coding in the input message text.

14. The (12,7) Hamming Coding was selected to enable the receiving equipment to detect and correct single bit errors within a 7-bit byte. Double bit errors within the 7-bit byte will be detected but not corrected.

(*) In the usual notation (6,1) means a 6-stage shift register with the output of the 1st and 6th stage modulo 2 added and fed back into the 1st stage input as shown in Figure A2

(a) Encoding. Five error detection and correction (ED&C) bits are added to each 7-bit byte of the message text to form a 12-bit Hamming code byte. The first of the five additonal bits is a parity check on the 7-bit byte to form an 8-bit character with odd parity. The remaining checks cause odd parity bits to be entered into the other four check bit positions The encoding details are shown in Table A1.

(b) Decoding. The de-interleaved message will be separated into 7-bit bytes and Hamming code bits calculated as shown in Table A1. The calculated and received parity bits will be exclusive OR to form a 5 bit correction word. The value of the correction word is specified in Table A2 and indicates whether the received 7-bit byte is correct, contains a single correctable error or contains uncorrectable errors. If the Hamming decoding indicates the presence of a 7-bit byte with a detectable but uncorrectable error, the entire message should be rejected and no further processing take place (i.e. no negative acknowledgement (NACK) is sent). Table A2 also provides an example of the action necessary for the correction of a single bit error

15. The error control includes a time dispersal coding (TDC) technique which converts a contiguous sequence of up to 16-bit errors to a uniformly dispersed pattern of single bit errors among 16 characters This technique is needed to permit the selected ED&C to perform properly within the burst error environment of the tactical single channel radio link This is accomplished by dividing a message into blocks of 16 12-bit bytes (i.e a total of 192 bits . Padding, if needed to create a full block is done by insertion of additional EOT characters as described in paragraph 18 a)(vi).

(a) Encoding The TDC is implemented in the array shown in Figure A3 The vertical 12-bit byte corresponds to the 7-bit byte plus the 5 Hamming code bits. The first 12-bit byte is stored in character slot No. 1, followed by the 2nd 12-bit byte in character slot No. 2, and so on until all 16 character slots are filled in.

(b) Decoding. At the receiver the array is implemented as shown in Figure A4, thus assembling the 12-bit bytes in the proper order for application of the ED&C coding.

16. Since the selected ED&C coding plus the TDC will fail in certain situations, an overall message validity check is necessary. This overall message check is provided by use of the polynomial cyclic redundancy check (CRC) described in CCITT

recommendation V.41. The implementation details for the CRC are provided in paragraph 18. If the CRC technique indicates the presence of an uncorrectable error (or errors) the message should be rejected.

ENVELOPE TERMINATION

17. In order to provide reliable detection of envelope termination, a minimum of 4 end-of-text (EOT) characters per STANAG 5036 (position 0/4) are appended after the CRC bytes. In addition the TDC technique requires blocks of an integral number of 16 characters, thus the EOT character is used for padding purposes as described in paragraph 18(b)(vi).

ENVELOPE CONSTRUCTION

18. In order to preclude mistakes in the transmission and reception of the envelope, the following details are provided:

(a) Text Limitations and Encryption. The first character of any transmission (after the character synchronization sequence) must be either "SI" or "NUL" (STANAG 5036). SI shall be followed by clear characters, NUL by encrypted character.

(b) Construction for Transmission.

(See also Appendices 1 and 2)

(i) The given data text (e.g. STANAG 5620) is made up into a whole number of 7-bit bytes by the addition of up to 6 1-bits at the end of the input text. This supplemented text is herein referred to as the message text. At the receiver output these extra bits will be output on the 7-bit byte output interface.

(ii) Each 7 bit byte of the message text is formed into a 8-bit byte with the most significant bit 'MSB' always set to "0" (off). Two additional 8-bit bytes of all '0's are then added to the end of the modified message text.

(iii) The modified and extended message text is then divided modulo -2 by the 17-bit V.41 polynomial $X^{16} + X^{12} + X^5 + 1$ aligning the MSB of the polynomial with the first bit of the modified and extended message text to obtain a 16 bit remainder

(iv) To recover the 7-bit byte structure for transmission the original message text is reformed from the modified message text by deleting the MSB (0) of each 8-bit byte excluding the two '0' bytes added in paragraph (ii). These two bytes are replaced by the 16-bit remainder generated by paragraph (iii) The 7-bit byte structure is then restored by adding 5 '1's to the end of the original message text and CRC remainder.

(v) The above message is now terminated by appending 4 EOT characters.

(vi) If required, additional EOT characters (a minimum of 0 up to a maximum of 15) are put in to ensure that a block structure of integral number of 16 7-bit byte characters is provided into the TDC array. Thus a message will end with a minimum of 4, up to a maximum of 19, EOT characters.

(vii) The input message, CRC and EOTs is now Hamming encoded as described in paragraph 14(a).

(viii) The Hamming encoded message is now entered into the TDC array as described in paragraph 15(a)

(ix) The synchronization preamble is now added per paragraph 12 and the entire message now modulated using the FSK described in paragraph 6.

(c) Reconstruction for Receiving.

(i) The receiving message is FSK demodulated per paragraph 6 and synchronization obtained

(ii) The incoming text is now de-interleaved as described in paragraph 15(b).

(iii) The 12-bit byte message text, CRC and EOT's are now Hamming decoded per paragraph 14(b). The actions to be taken are shown in Table A2. It must be noted that if the Hamming decoding indicates the presence of a 7-bit byte with detectable but uncorrectable errors, then the entire message should be rejected (and all further processing be terminated and no NACK is sent)

(iv) The 7-bit bytes of the input message, but not the three 7-bit bytes of the CRC, are formed into 8-bit bytes with the MSB set to '0'. The first 16 bits of the three 7-bit bytes of the transmitted CRC are formed into two 8-bit bytes. The received modified message and CRC is now divided module -2 by the CCITT V.41 polynomial. A non-zero result (i.e. remainder) indicates the presence of uncorrectable (and previously undetected) error or errors and the message text should be ignored. Again a NACK will not be sent.

(v) If the CRC is zero, the message text including any additional 1's (inserted per paragraph 18(a)(i)) should be outputted to the data user (DTE) and an ACK (message received) may now be sent if permitted by the system FCCM and operational rules No ACK is to be sent to ACK messages

Input Message Bits							EDC Bits				
b1	b2	b3	b4	b5	b6	b7	P1	P2	P3	P4	P5
x	x	x	x	x	x	x	x				
x		x		x		x		x			
	x	x			x	x			x		
			x	x	x	x				x	
x	x	x	x	x	x	x	x	x	x	x	x

Table A1 HAMMING CODE GENERATION

P_1 is odd parity on the 7-bit byte

P_2 is odd parity on the 7-bit byte bits 1, 3, 5, 7

P_3 is odd parity on the 7-bit byte bits 2, 3, 6, 7

P_4 is odd parity on the 7-bit byte bits 4, 5, 6, 7.

P_5 is odd parity on the 7-bit byte bits 1 through 7, and parity bits 1 through 4

N.B. This code will fail on some 3-bit errors per 12-bit byte

CORRECTION WORD b_8 b_9 b_{10} b_{11} b_{12}	BIT IN ERROR	ACTION
0 0 0 0 0	NONE	ACCEPT CHARCTER, DISCARD PARITY
1 1 0 0 1	b_1	REVERSE BIT IN ERROR, ACCEPT CHARACTER, DISCARD PARITY BITS
1 0 1 0 1	b_2	
1 1 1 0 1	b_3	
1 0 0 1 1	b_4	
1 1 0 1 1	b_5	
1 0 1 1 1	b_6	
1 1 1 1 1	b_7	
1 0 0 0 1	P_1	PARITY BIT IN ERROR, ACCEPT CHARACTER, DISCARD PARITY
0 1 0 0 1	P_2	
0 0 1 0 1	P_3	
0 0 0 1 1	P_4	
0 0 0 0 1	P_5	
OTHER VALUES	UNCORRECTABLE	DISCARD MESSAGE

b_1 2 3 4 5 6 7	P_1 2 3 4 5	
1 0 0 0 1 1 0	1 0 1 1 0	RECEIVED CHARACTER AND PARITY
	0 1 0 1 1*	CALCULATED PARITY
	1 1 1 0 1	CORRECTED WORD
1		CORRECTED BIT-b_3

Table A2. PARITY BIT CORRECTION WORD

N.B. Parity bit P_5(*) is calculated from received bits b_1 b_2 b_3 b_4 b_5 b_6 b_7 P_1 P_2 P_3 P_4

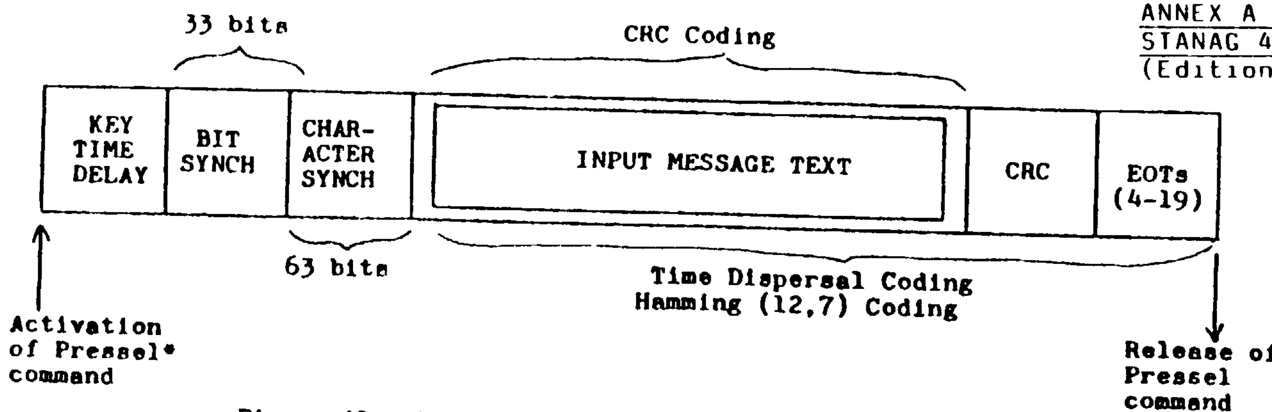


Figure A1. NON-SECURE MESSAGE STRUCTURE

*Pressel is also called "push to talk (PTT)".

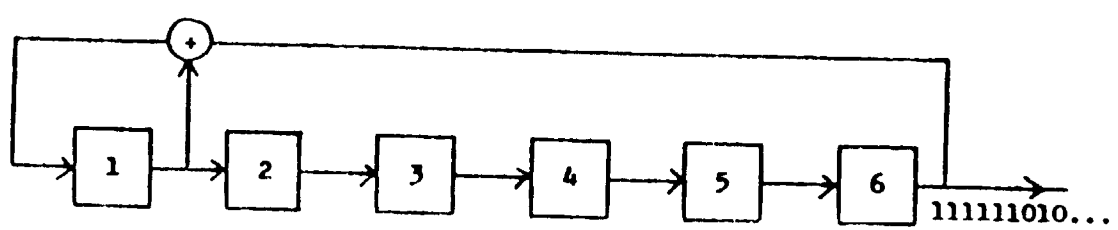
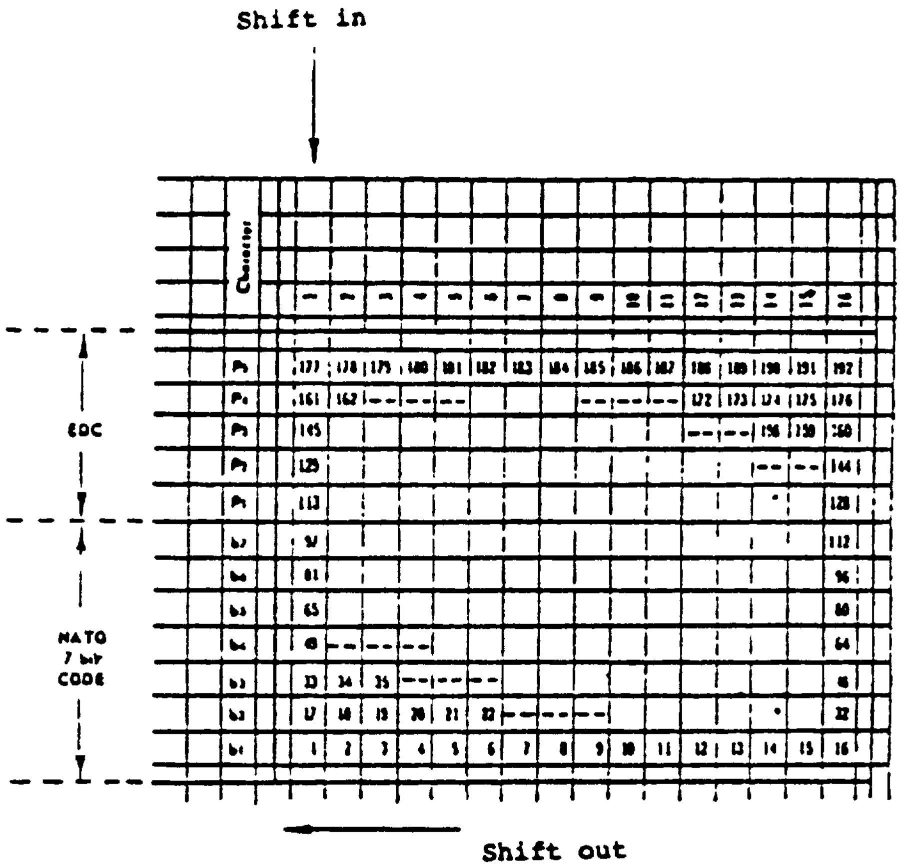


Figure A2. IMPLEMENTATION OF CHARACTER SYNCH. SEQUENCE

A-9-



The numbers 1-192 show the order in which the bits are issued to the communication network the character numbers indicate the input sequence.

Figure A3. TDC BIT INTERLEAVING (TRANSMIT)

CYCLIC REDUNDANCY CHECK (CRC)

1 A CRC Checkword is generated and added to the message according to the rules set out below. As an aid to understanding the process, a message consisting of the two characters A2 is used as an example.

2. Each 7 bit character in the message is converted to an 8 bit byte by adding a zero in the b_8 position:

	b_7	b_6	b_5	b_4	b_3	b_2	b_1
A	1	0	0	0	0	0	1
2	0	1	1	0	0	1	0

→

b_8	b_7	b_6	b_5	b_4	b_3	b_2	b_1
0	1	0	0	0	0	0	1
0	0	1	1	0	0	1	0

3. A Message Polynomial is generated by combining the bytes in order and multiplying by 2^{16}:- i.e. the addition of two 8 bit bytes of all '0's to the end of the modified message text.

A	2	
0 1 0 0 0 0 0 1	0 0 1 1 0 0 1 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

↑ MSB of polynomial ↑ LSB

4. The message polynomial is then divided, modulo 2, by a generator polynomial to obtain the remainder which is the CRC Checkword. The generator polynomial is represented mathematically by the 17 bit polynomial $x^{16} + x^{12} + x^5 + 1$ which is equal to the 17 bit binary number:

b_{17} b_1

1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1

↑ MSB ↑ LSB

5. Modulo 2 division is implemented by iterative use of the 'Exclusive Or' function, shown in full at Figure 1-1, to produce the 16 bit remainder, for the example, of:

0 0 1 0 1 0 0 0 1 1 1 0 1 1 0 0

↑ MSB ↑ LSB

6. The remainder is converted into a 21 bit number by multiplying the remainder by 2^5 and adding 31 to the result. (This is equivalent to appending 5 "ones" to the less significant end of the remainder.)

0 0 1 0 1 0 0 0 1 1 1 0 1 1 0 0 1 1 1 1 1

MSB ... LSB

7. This 21 bit number is divided into three 7 bit characters.

1st char. CRC	2nd char. CRC	3rd char. CRC
0 0 1 0 1 0 0	0 1 1 1 0 1 1	0 0 1 1 1 1 1
b_7 ... b_1	b_7 ... b_1	b_7 ... b_1

Which are appended to the original message, thus:

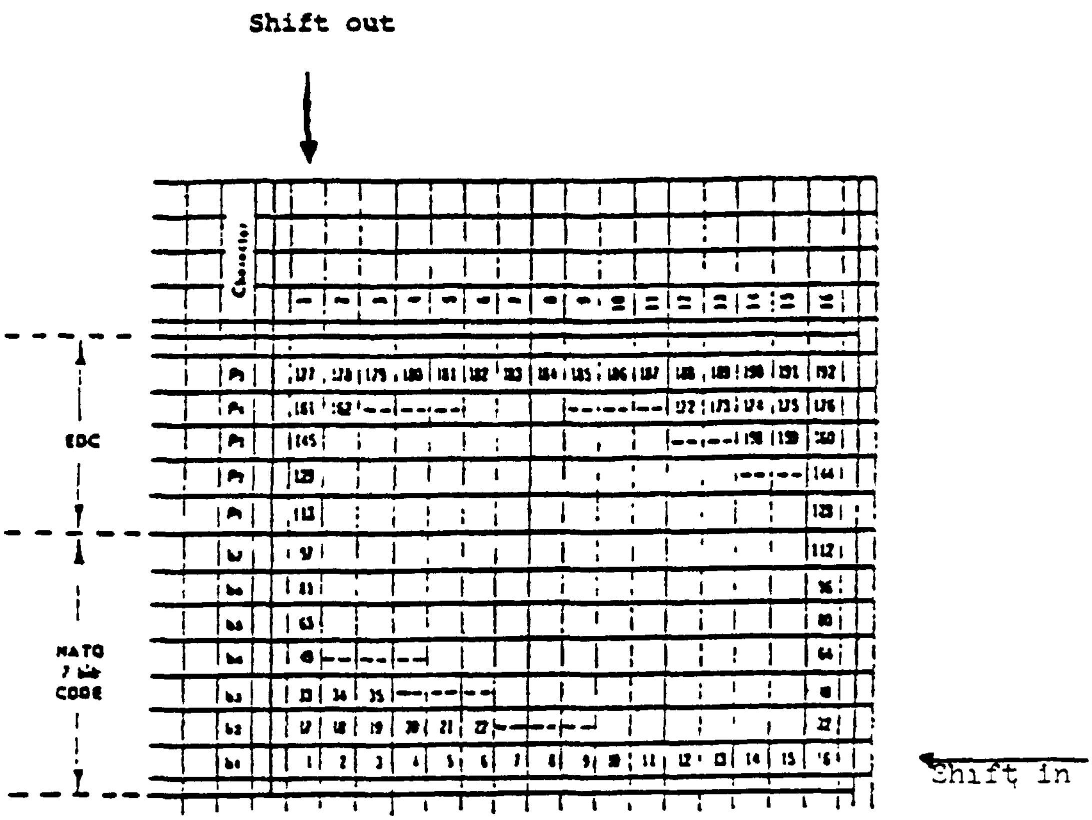
	b_7	b_6	b_5	b_4	b_3	b_2	b_1
A	1	0	0	0	0	0	1
2	0	1	1	0	0	1	0
1st CRC	0	0	1	0	1	0	0
2nd CRC	0	1	1	1	0	1	1
3rd CRC	0	0	1	1	1	1	1

8. On message reception, the CRC characters are identified and separated from the message characters. A message polynomial is generated from the received message characters as defined in paragraphs 2 and 3 above. The 16 bit remainder is extracted from the three CRC characters and is added to the message polynomial:

A	2	$x\ 2^{16}$
0 1 0 0 0 0 0 1	0 0 1 1 0 0 1 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

0 0 1 0 1 0 0 0 1 1 1 0 1 1 0 0 1 1 1 1 1

0 1 0 0 0 0 0 1 0 0 1 1 0 0 1 0 0 0 1 0 1 0 0 0 1 1 1 0 1 1 0 0



The numbers 1-192 show the order in which the bits are received from the communication network, the character numbers indicate the input sequence.

Figure A4. TDC BIT INTERLEAVING (RECEIVE)

END OF TRANSMISSION (EOT) INDICATOR

1. The end of the message is identified by adding four EOT characters to the message, immediately following the CRC characters.

2. If the resultant message length is not an integral multiple of 16 characters, additional EOT characters are added to roundup the message length to an integral multiple of 16 characters as follows:

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	
A	1	0	0	0	0	0	1	
2	0	1	1	0	0	1	0	
1st CRC	0	0	1	0	1	0	0	
2nd CRC	0	1	1	1	0	1	1	
3rd CRC	0	0	1	1	1	1	1	
1st EOT	0	0	0	0	1	0	0	End of Message Indicator
2nd EOT	0	0	0	0	1	0	0	
3rd EOT	0	0	0	0	1	0	0	
4th EOT	0	0	0	0	1	0	0	
EOT	0	0	0	0	1	0	0	Padding EOT to roundup message to 1 x 16 characters
EOT	0	0	0	0	1	0	0	
EOT	0	0	0	0	1	0	0	
EOT	0	0	0	0	1	0	0	
EOT	0	0	0	0	1	0	0	
EOT	0	0	0	0	1	0	0	
EOT	0	0	0	0	1	0	0	

```
                         |    A    |    2    |      Received CRC checkword      |

Message Polynomial       0 1 0 0 0 0 0 1 0 0 1 1 0 0 1 0 0 0 1 0 1 0 0 0 1 1 1 0 1 1 0 0
incl. CRC Remainder        1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                           ---------------------------------
Generator Polynomial       0 0 0 0 1 0 1 0 0 1 1 1 0 1 0 0 1 1 0 1 0
                                   1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                   ---------------------------------
                                   0 0 1 0 1 1 1 1 0 1 0 1 1 1 0 1 1 0 0
                                       1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                       ---------------------------------
                                       0 0 1 1 1 0 1 0 1 0 1 1 0 0 1 1 0 1 1 1
                                           1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                           ---------------------------------
                                           0 1 0 1 1 1 0 1 1 0 0 0 1 0 1 1 0 1
                                             1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                             ---------------------------------
                                             0 0 1 1 0 0 1 1 0 0 0 0 0 1 1 0 0 0 1
                                                 1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                                 ---------------------------------
                                                 0 1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                                   1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                                   ---------------------------------
                                                   0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
                                                         |                             |
                                                         v                             v
Final Remainder ≡ zero = No Errors                       0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
                                                         ===============================
```

FIG. 2-2 MODULO 2 DIVISION OF RECEIVED MESSAGE + CHECKWORD POLYNOMIAL

9. The resultant polynomial is divided, modulo 2, by the generator polynomial. If there are no transmission errors, the remainder from this process will be zero. A non-zero remainder indicates the presence of a transmission error.

10. The division process is shown in full at Fig. 1-2.

```
                                  A          2            x 2^16
Message Polynomial         0 1 0 0 0 0 0 1 0 0 1 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Generator Polynomial         1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
First Partial Remainder      0 0 0 0 1 0 1 0 0 1 1 1 0 1 0 0 1 0 0 0 0
                                     1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                     0 0 1 0 1 1 1 1 0 1 0 1 1 0 0 0 1 0 0
                                         1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                         0 0 1 1 0 1 0 1 0 1 1 1 0 0 1 0 1 0 0
                                             1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                             0 1 0 1 1 1 0 1 1 1 0 1 1 0 1 0 1 0
                                               1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                               0 0 1 1 0 0 1 1 1 0 1 0 0 1 0 1 1 0 0
                                                   1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                                   0 1 0 0 0 1 1 0 1 0 0 0 0 1 1 0 1 0
                                                     1 0 0 0 1 0 0 0 0 0 0 1 0 0 0 0 1
                                                     0 0 0 0 0 1 0 1 0 0 0 1 1 1 0 1 1 0 0

Final Remainder = CRC Checkword                              0 0 1 0 1 0 0 0 1 1 1 0 1 1 0 0
```

FIG 1-1 MODULO 2 DIVISION OF MESSAGE POLYNOMIAL TO GENERATE CRC CHECKWORD

A-1-4-

(With 1 Appendix)

ADDITIONAL CHARACTERISTICS FOR INTERIM USE OF 16 kbps DIGITAL CHANNELS

INTRODUCTION

1. This Annex describes those additonal characteristics needed to adapt the envelope prescribed in Annex A for interim use of wide bandwidth (i.e. 16kbps) digital channels such as that described in STANAG 4204.

2. The first additional characteristic needed is the conversion or bypassing of the FSK modulation to a suitable baseband digital (i.e. polar non-return to zero (NRZ)).

3 The second additional characteristic is the standard for the "data flag" capability needed to automatically identify data transmission over shared voice/data lines (i.e. to enable the automatic bypass of the receiver's analogue to digital converter for voice signal and any periodic resynchronization technique (if selected) (such as those contained in the United States VINSON(1) and the United Kingdom LAMBERTON encryption equipment).

SIGNAL CONVERSION

4 The 1200 bps and other rates/FSK modulated signal described in Annex A must be converted or bypassed, via a suitable nationally selectable means, into a digital baseband (e.g. Polar NRZ such as CCITT recommendation V.10/V.11) which can then be asynchronously sampled by the DCE to obtain the signal at the standard (i e. STANAG 4204) 16 kbps rate presented to the radio for transmission. At the receiver, a suitable nationally chosen means would be used to obtain the baseband signal and its conversion back into the 1200 bps or other VHF rates/FSK modulated signal (if necessary)

DATA AND VOICE FLAG

5. In order to insure proper line alignment, the data or voice flag is inserted into the transmitted preamble to identify the type of signal being passed. The definition and details of transmission and reception of the data and voice flags is contained in Appendix 1. The transmission envelope is shown in Figure B1.

---

(1) Since the VINSON equipments (i.e. KY-57/58) are designed for tactical secure voice application, all usages of these equipments to secure data (i.e. all non-voice communications traffic whether in analogue or digital form) must be approved by SECAN prior to finalizing plans for such employment.

6. These flags do not provide authentication of the signal of any sense.

7. At the end of the data message the receiving system shall place the equipment into the voice mode.

TRANSMISSION AND RECEPTION OF DATA AND VOICE FLAGS

A. DEFINITIONS

1. COMMON PATTERN: OCTAL 7-5-3-1-0 (15 bits) (i.e., 111 101 011 001 000).

2. INVERTED COMMON PATTERN: OCTAL 0-2-4-6-7 (15 bits) (i.e., 000 010 100 110 111)

3. UNIQUE VOICE PATTERN: Fifteen (15) bits of all logical 1s. (i.e., 111 111 111 111 111).

4. COMMON FRAME: Thirty (30) repetitions of "COMMON PATTERN" followed by one (1) inverted "COMMON PATTERN".

5 UNIQUE VOICE FRAME: 31 repetitions of "UNIQUE VOICE PATTERN".

6. DATA FLAG: Two (2) repetitions of "COMMON FRAME".

7 VOICE FLAG: One (1) "COMMON FRAME" followed by one (1) "UNIQUE VOICE FRAME".

B. TRANSMIT

1 Initial $PTT_{(A)}$ upon receipt of "Request to Send" from DTE.

2 Ignore any DDCO if it appears during aperiod of 100 msec of $PTT_{(A)}$.

3 If DDCO appears during the next 300 msec, then insert either data or voice flag after appearance of DDCO

4. If DDCO does not appear during the next 300 msec, $PTT_{(A)}$ is released and then $PTT_{(B)}$ reapplied followed by insertion of data or voice flag.

C. RECEIVE

1. Flag search commences after detection of DDCO.

2. Data flag detection:

   (a) detection of one (1) perfect "COMMON PATTERN" followed by detection of next three (3) consecutive patterns with six (6) or fewer errors.

   (b) after detection of one (1) "INVERTED COMMON PATTERN" repeat above.

(c) data mode (DDCO provided a DTE) is declared if two (2) successful detections of both "COMMON PATTERN" and "INVERTED COMMON PATTERN" is made.

Note: If flag search indicates that an inversion of the signal's sense has taken place then complete procedure but provide inverted output to DTE.

3. Voice Flag Detection

(a) detection of "COMMON PATTERN" and "INVERTED COMMON PATTERN" as in "DATA" case.

(b) detection of one (1) perfect "UNIQUE VOICE PATTERN".

4. If DDCO is detected but neither flag is successfully detected, then voice mode is enabled for 500 msec followed by the start of the flag search procedures.

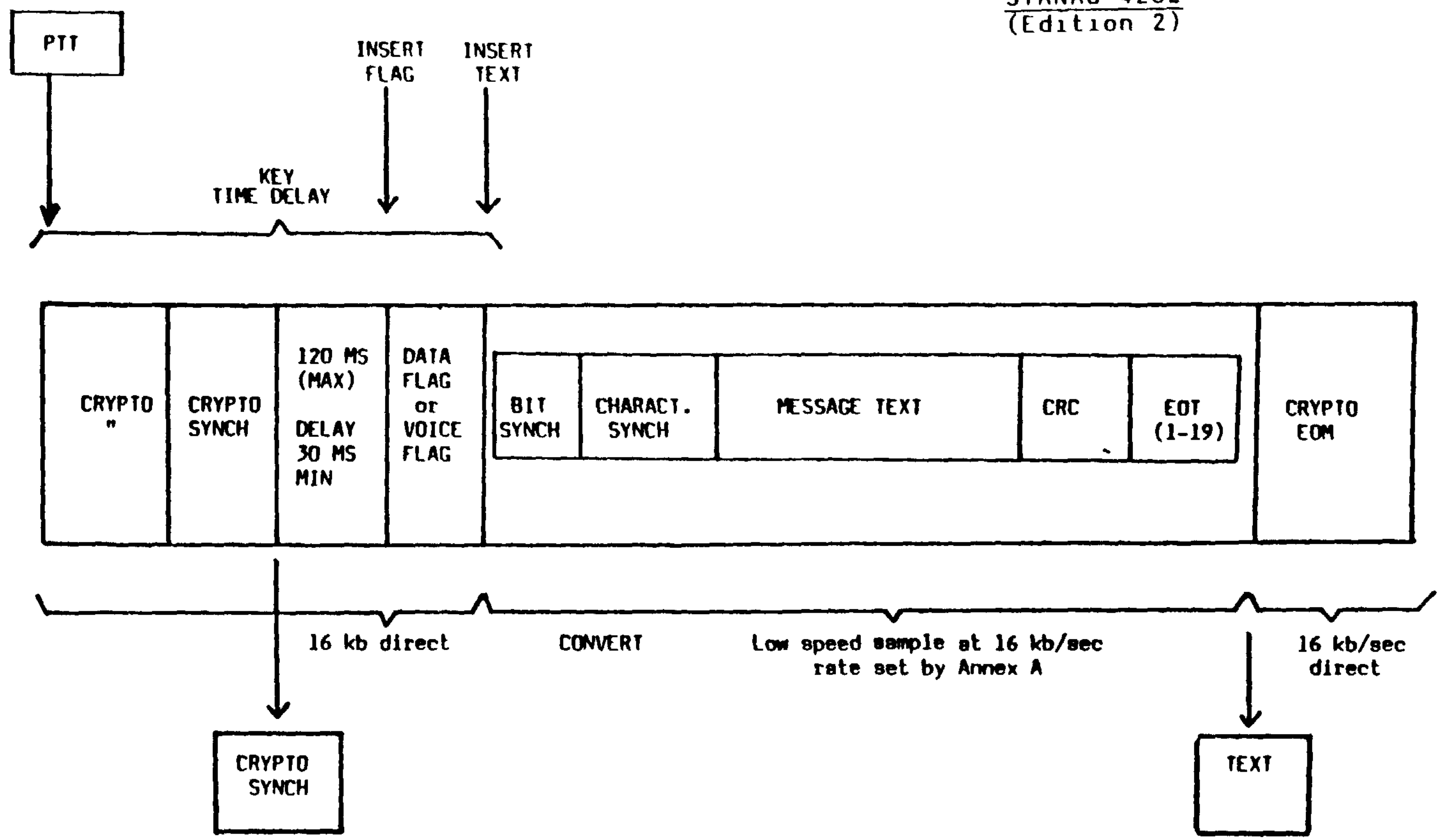


FIGURE B1: MESSAGE CONSTRUCTION: 16 kb/sec ENCRYPTED LINKS

RATIFICATION AND IMPLEMENTATION DETAILS
STADE DE RATIFICATION ET DE MISE EN APPLICATION

NATION	NATIONAL RATIFICATION REFERENCE DE LA RATIFICATION NATIONALE	NATIONAL IMPLEMENTING DOCUMENT NATIONAL DE MISE EN APPLICATION	IMPLEMENTATION/MISE EN APPLICATION FORECAST DATE DATE PREVUE NAVY MER	FORECAST DATE ARMY TERRE	FORECAST DATE AIR	ACTUAL DATE DATE REELLE NAVY MER	ACTUAL DATE ARMY TERRE	ACTUAL DATE AIR
BE*	JSTel 060525 of/du 27.10.86							
CA*	2441-4202 (DLAEEM 5-3) of/du 23.1.87	D-01-060-001/ AX-004		95				
DA	M.204.69.S 4202/MAS-03663 of/du 13.2.87							
FR								
GE	Will not ratify/ ne ratifie pas							
GR								
IT								
LU								
NL*	M87/0198/5405 of/du 2.7.87							
NO								
PO								
SP								
TU*	Gn P.P:2307-892-86/AND.D. MAS.S(4202)4032 of/du 2.12.86		12.90	12.90	12.90			
UK	D/D Stan/341/8/4202 of/du 13.8.86	Defence Standard	11.88	11.88	11.88			
US	J-4202 of/du 7.10.87	USA-ACCS-AC-400-011A MIL STD-188-200			12.89		11.86	

*See reservation overleaf/
Voir réserve au verso

RESERVATIONS/RESERVES

BELGIUM
BELGIQUE

Belgium would prefer to standardize on ONE set of modulation characteristics and ONE error control system. Therefore the status of draft STANAG 4285 should be reconsidered as soon as STANAG 4202 is ratified. Belgium does not envisage to implement two different STANAGs for data transmission over radio links.

La Belgique préférerait normaliser UN ensemble de caractéristiques de modulation et UN système de contrôle des erreurs. Il faudra donc réexaminer l'état d'avancement du projet de STANAG 4285 dès que le STANAG 4202 aura été ratifié. La Belgique n'envisage pas de mettre en application deux STANAG différents en ce qui concerne la transmission de données par l'intermédiaire de liaisons radioélectriques.

CANADA

The Canadian Navy and Air Force do not plan to implement this STANAG. The Army will implement it in conjunction with the TCCCS Project.

Les Forces aériennes et les Forces navales du Canada ne prévoient pas de mettre le présent STANAG en application. Les Forces terrestres le mettront en application dans le cadre des projets TCCCS.

NETHERLANDS
PAYS-BAS

This STANAG is not applicable to the R.NL. Navy and the R.NL. Air Force does not implement this STANAG. Implementation of this STANAG by the Army cannot be stated yet.

Le présent STANAG n'est pas applicable au sein des Forces navales royales des Pays-Bas et les Forces aériennes royales des Pays-Bas ne l'ont pas mis en application Rien ne peut encore être annoncé quant à la mise en application du STANAG au sein des Forces terrestres.

TURKEY
TURQUIE

Turkish Navy and Air Force will not implement this STANAG but Army will take into consideration of the STANAG in the future procurement.

Les Forces navales et aériennes de la Turquie ne mettront pas ce STANAG en application, mais ses Forces terrestres en tiendront compte pour leurs acquisitions futures.