STANDARDS CHANGES CATALOG (SCC)

SCC NUMBER: SCC #135

CHANGE PROPOSAL TITLE: Robust ~~s~~Scrambler ~~c~~Clarification

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ORIGINATOR'S INTERNAL NUMBER:

AFFECTED DOCUMENT: ~~Appendix J, rev C of~~ MIL~~il~~-STD~~td~~-188-220C, paragraph 5.3.15, Appendix B and J.

PRECEDENCE: Routine

RECOMMENDATIONS:

RECORD OF PROCESSING

DATE:	ACTION:
16 Oct 02	Proposal / R0
26 Nov 02	R1
15 Jan 03	Work Item
4 Mar 03	R2
19 June 03	R3
15 Oct 03	R4; Approved for MIL-STD-188-220C

1. STATEMENT OF THE PROBLEM:
The Robust scrambler described in figure 89 of paragraph J.3.3 is not the V.33 scrambler referenced by CCITT V.33 Annex A.

2. PROBLEM ANALYSIS:
If V.33 scrambler is used as described in CCITT V.33, then the result will be different than if it is calculated as shown in Figure 89 of appendix J.

3. PROPOSED SOLUTION:

a. Remove references to the V.33 scrambler in paragraph J.3.3. by changing the entire paragraph to read:

Physical layer data scrambling shall use the scrambler and descrambler described in Figure 89. Physical layer data scrambling shall use the pseudo-noise (PN) generator specified in CCITT V.33 Annex A. Although the generating polynomial used is as specified in CCITT V.33 Annex A, the process is different. The generating polynomial is $1 + X^{-18} + X^{-23}$.

Figure 89 shows the structure of the data scrambler and de-scrambler. The data sequence to be transmitted, D_{out} is formed as follows:

$$D_{out} = (D_{in}) \text{ Å } \overline{((D_s X^{-18}) \text{ Å } (D_s X^{-23}))}$$

|<---- pseudo noise (PN)----->|

Where D_{in} is the input data. The shift register D_s shall be initialized to zero before the first bit of data is scrambled on transmission. On data reception, the de-scrambler shift register D_s shall be initialized to zero before the first received data bit is de-scrambled."

Note: symbol ⊕ is XOR operand.

A ⊕ B is A **XOR** B.

$\overline{A \oplus B}$ is A **XNOR** B.

b. Change Appendix B as shown below.

409.2.1	Forward Routing	I.4.1	409:M	Yes__ No__	
409.2.1.a	The source shall calculate the path through the intranet network to reach each destination	I.4.1	409:M	Yes__ No__	
409.2.1.b	The specific source directed route for each destination shall be encoded into the intranet header	I.4.1	409:M	Yes__ No__	
409.2.2	End-to-end Acknowledgements	I.4.2	409:M	Yes__ No__	
409.3	Examples	I.5	X	---	
409.3.1	Example 1	I.5.1	X	---	
409.3.2	Example 2	I.5.2	X	---	
409.3.3	Example 3	I.5.3	X	---	
409.3.4	Relay Processing	I.5.4	X	---	
409.3.4.1	Relay Processing at Node C	I.5.4.1	X	---	
409.3.4.2	Relay Processing at Node F	I.5.4.2	X	---	

A.7.9 Robust Communications Protocol

Item	Protocol Feature	Reference	Status	Support	Notes
410	Robust Communications Protocol	Appendix J	102.1.3.4:M	Yes__ No__	
410.1	Introduction	J.3	102.1.3.4:M	Yes__ No__	
410.1.1	Physical Protocol Components	J.3.1	102.1.3.4:M	Yes__ No__	
410.1.2	Optional Rate 1/3 Convolutional Coding	J.3.2	102.1.3.4:M	Yes__ No__	
410.1.2.a	The G2 output shall be inverted to provide some data scrambling capability	J.3.2	102.1.3.4:M	Yes__ No__	
410.1.3	Optional Data Scrambling	J.3.3	102.1.3.4:M	Yes__ No__	
410.1.3.a	Physical layer data scrambling shall use the ~~pseudo random bit generator specified in CCITT V.33 Annex A~~ scrambler and descrambler described in Figure 89	J.3.3	102.1.3.4:M	Yes__ No__	

410.1.3.b	~~The shift register shall be initialized to all zeros before the first bit of data is scrambled on transmission~~ Physical layer data scrambling shall use the pseudo-noise (PN) generator specified in CCITT V.33 Annex A	J.3.3	102.1.3.4:M	Yes__ No__	
410.1.3.c	~~On data reception, the descrambler shift register shall be initialized to zero before the first received data bit is descrambled~~ The shift register D_s shall be initialized to zero before the first bit of data is scrambled on transmission	J.3.3	102.1.3.4:M	Yes__ No__	
410.1.3.d	On data reception, the de-scrambler shift register D_s shall be initialized to zero before the first received data bit is de-scrambled	J.3.3	102.1.3.4:M	Yes No	
410.1.4	Optional Robust Multi-Dwell	J.3.4	102.1.3.4:M	Yes__ No__	
410.1.4.1	Multi-Dwell Packet Format	J.3.4.1	102.1.3.4:M	Yes__ No__	
410.1.4.1.a	When the HAVEQUICK II compatible radio is in active mode, multi-dwell packetizing shall be enabled	J.3.4.1	102.1.3.4:M	Yes__ No__	
410.1.4.2	Multi-Dwell SOP Field	J.3.4.2	102.1.3.4:M	Yes__ No__	
410.1.4.2.a	The length of the SOP pattern shall be determined by bits two, three and four of the robust frame format	J.3.4.2	102.1.3.4:M	Yes__ No__	
410.1.4.3	Multi-Dwell Segment Count Field	J.3.4.3	102.1.3.4:M	Yes__ No__	
410.1.4.3.a	The six required bits shall be encoded as 1, 3, or 5 BCH (15, 7) codewords depending on bits 2, 3, and 4 of the robust frame format	J.3.4.3	102.1.3.4:M	Yes__ No__	
410.1.4.3.b	The six-bit segment counter shall occupy the 6 LSBs of the seven-bit BCH data field	J.3.4.3	102.1.3.4:M	Yes__ No__	
410.1.4.3.c	The MSB of the data field shall be used as an end-of-frame flag which, when set, indicates that data transmission is complete	J.3.4.3	102.1.3.4:M	Yes__ No__	
410.1.4.3.d	A multi-dwell packet marked with an end-of-frame flag shall contain only the SOP pattern and the segment count field used to make the segment number of the first fill data segment transmitted in the previous packet	J.3.4.3	102.1.3.4:M	Yes__ No__	

c. Change Paragraph 5.3.15 as shown below.

5.3.15 Data scrambling. Data scrambling shall be performed if the transmission medium does not have a DC response and there is the possibility that “long” strings of NRZ ones or zeros are transmitted. Long is a relative term that is dependent on the data rate, the low frequency channel cutoff frequency, and the channel S/N, since at low S/N there is less margin for DC drift.

a. At the Data Link layer, the Transmission Header selects a CCITT V.36 scrambler, which includes a randomizer function as well as a pseudo-noise (PN) generator. It is applied inside the FEC (that is, before FEC is applied).

b. CCITT V.36 scrambling shall not be applied outside the FEC because bit errors at the receiver will be extended. ~~In addition, a CCITT V.33 scrambler, which uses a PN generator but not a randomizer, is specified for use at the PL.~~ In a high BER environment this extension will become catastrophic. For that reason a modified CCITT V.33 scrambler defined in section J.3.3, which uses a PN generator but not a randomizer, is specified for use at the PL (as part of the multi-dwell protocol; see J.3.3). In both cases, there is a very small probability that the interleaving for the Data Link layer scrambler ~~or~~and the fixed PN sequence for the PL scrambler may do more harm than good. Therefore, they are individually selectable. Both scramblers should not be used at the same time. If CCITT V.36 scrambling/descrambling is used, the contents of the 20-state shift register shall be initialized to all ones prior to scrambling or descrambling data link frames in each interior transmission unit. The adverse state detector (ASD) counter shall be initialized such that at least 32-bits will have been counted, starting from the first bit input to the 20-state shift register, when the first adverse state is detected. The operation of the scrambling/descrambling shall be as shown in Figure 26. Figure 27 illustrates an example implementation for the CCITT V.36 scrambling/descrambling.

4. ALTERNATIVE SOLUTIONS: None.

5. SYSTEM CHANGES REQUIRED: None.

6. CONFIGURATION ITEM DOCUMENTATION CHANGES: MIL~~il~~-STD~~td~~-188-220C, paragraph 5.3.15, Appendix B and J.~~, paragraph J.3.3.~~

7. IMPACT ON INTEROPERABILITY: None.

8. IMPACT ON RELATED DOCUMENTS: None.

9. IMPLEMENTATION DATES: TBD

10. OTHER CONSIDERATIONS: ~~None.~~This SCC is associated with SCC #134 and SCC #136.

11. REFERENCES: None.

12. Trouble Reports (TRs) ADDRESSED IN THIS SCC: None.