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MAS/234-EL/4380
4 August 1995

To : See MAS Distribution List No. 2

Subject : STANAG 4380 EL (EDITION 1) - TECHNICAL STANDARDS FOR ANALOGUE-DIGITAL CONVERSION OF VOICE SIGNALS USING CONTINUOUSLY VARIABLE SLOPE DELTA MODULATION (CVSD)

Reference : AC/302-D/688 dated 31 January 1994 (Edition 1)(1st Draft)

Enclosure : STANAG 4380 (Edition 1)

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

2. The reference listed above is 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.

G.B. FERRARI
Major-General, ITAF
Chairman, MAS

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STANAG 4380
(Edition 1)

NORTH ATLANTIC TREATY ORGANIZATION
(N A T O)

MILITARY AGENCY FOR STANDARDIZATION
(M A S)

STANDARDIZATION AGREEMENT

SUBJECT : TECHNICAL STANDARDS FOR ANALOGUE-DIGITAL CONVERSION OF VOICE SIGNALS USING CONTINUOUSLY VARIABLE SLOPE DELTA MODULATION (CVSD)

Promulgated on 4 August 1995

G.B. FERRARI
Major-General, ITAF
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 4380
(Edition 1)

NAVY/ARMY/AIR

NATO STANDARDIZATION AGREEMENT (STANAG)

TECHNICAL STANDARDS FOR ANALOGUE-DIGITAL CONVERSION OF VOICE SIGNALS USING CONTINUOUSLY VARIABLE SLOPE DELTA MODULATION (CVSD)

Annexes:

A. Technical Standards of Coder and Decoder
B. NATO Protocol Implementation Conformance Statement (NPICS) Proforma

AIM

1. The aim of this agreement is to define the technical standards required to ensure interoperability of CVSD encoded voice signals.

AGREEMENT

2. Participating nations agree to use the standards defined in this document when exchanging CVSD encoded voice signals.

GENERAL

3. Analogue/Digital conversion of voice signals shall be performed by a coder/decoder based on the CVSD technique. Sampling rates of 16 or 32 kHz leads to coding at 16 or 32 kbits/s, using syllabic companding controlled by a three bit logic. The technical characteristics of the coder and decoder are defined in Annex A. This covers both 16 and 32 kbit/s services. The NPICS Proforma as it applies to the STANAG is at ANNEX B.

IMPLEMENTATION OF THE AGREEMENT

4. This STANAG is implemented by a nation when its voice coder/decoder standards comply with this agreement and are placed in service.

ANNEX A to
STANAG 4380
(Edition 1)

TECHNICAL STANDARDS OF CODER AND DECODER

1 GENERAL CHARACTERISTICS

1.1 Analogue/digital conversion of telephone signals (speech or other voice-band signals) shall be performed by a delta coder/decoder using syllabic companding controlled by a three bit logic. This STANAG describes coding and decoding, at both 16 and 32 kbit/s services.

1.2 Block diagrams of the coder and decoder are shown in Figures 1 and 2, including the various test points as described below.

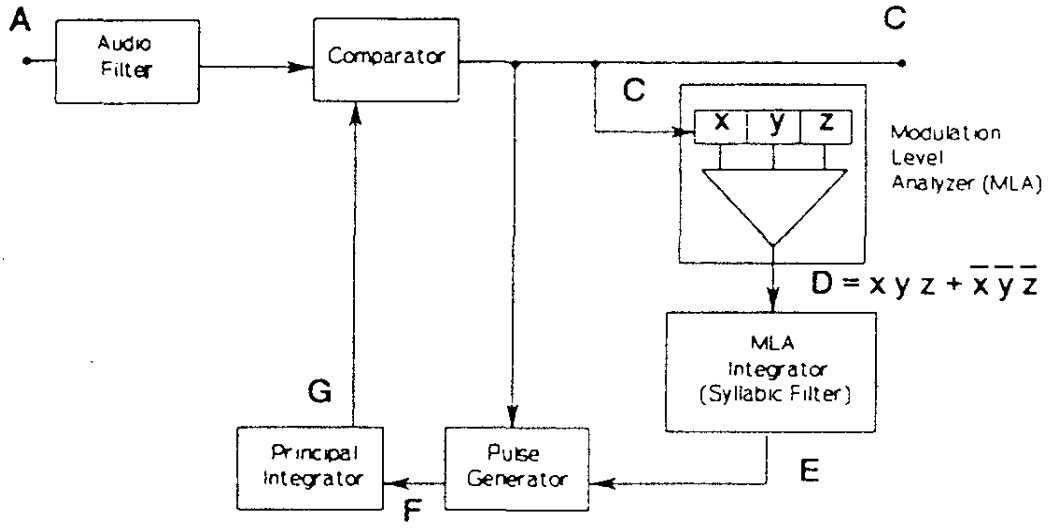

Figure 1 - Block Schematic of the Coder

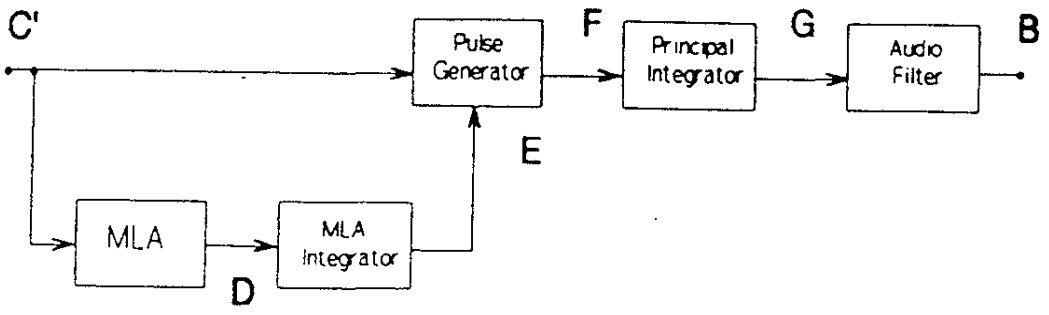

Figure 2 - Block Schematic of the Decoder

2 FOUR-WIRE TO FOUR-WIRE AUDIO FREQUENCY CHARACTERISTICS

2.1 Relative Level at Points A and B of Figures 1 and 2

The relative levels at points A and B shall be -4 dBr.

2.2 Absolute Level

The absolute level is calculated by:

dBm = dBr + dBm0 (for dBm0 see Table 1)

2.3 Impedance at Points A and B

The nominal value of the impedance at points A and B shall be 600 ohms.

2.4 Return Loss at Points A and B against 600 Ohms

The return loss at points A and B shall be ≥ 16 dB in the frequency range from 300 Hz to 3400 Hz against a load resistor of 600 ohms with an input level of -20 dBm0.

2.5 Symmetry at Points A and B

Points A and B shall be balanced and not referred to ground, i.e. shall be floating.

3 CODER AND DECODER CIRCUITS

3.1 Input and Output Audio Filters

The input and output audio filters shall have a passband of 300Hz to 2.6 kHz for 16 kbit/s and 300Hz to 3.4 kHz for 32 kbit/s services and an attenuation of at least 25 dB for frequencies above 6 kHz referred to 800 Hz.

3.2 Amplitude Frequency Characteristics of the Principal Integrator

The ideal amplitude frequency characteristics for single and double integration between points F and G are shown in Figure 3.

3.3 Modulation Level

A signal of 800 Hz at 0 dBm0, applied to point A of the coder, shall give a duty cycle (mean proportion of binary '1' digits at point D each one indicating a run of three consecutive bits of the same polarity at point C) of $C_d = 0.5$ at point D of the modulation level analyzer (MLA).

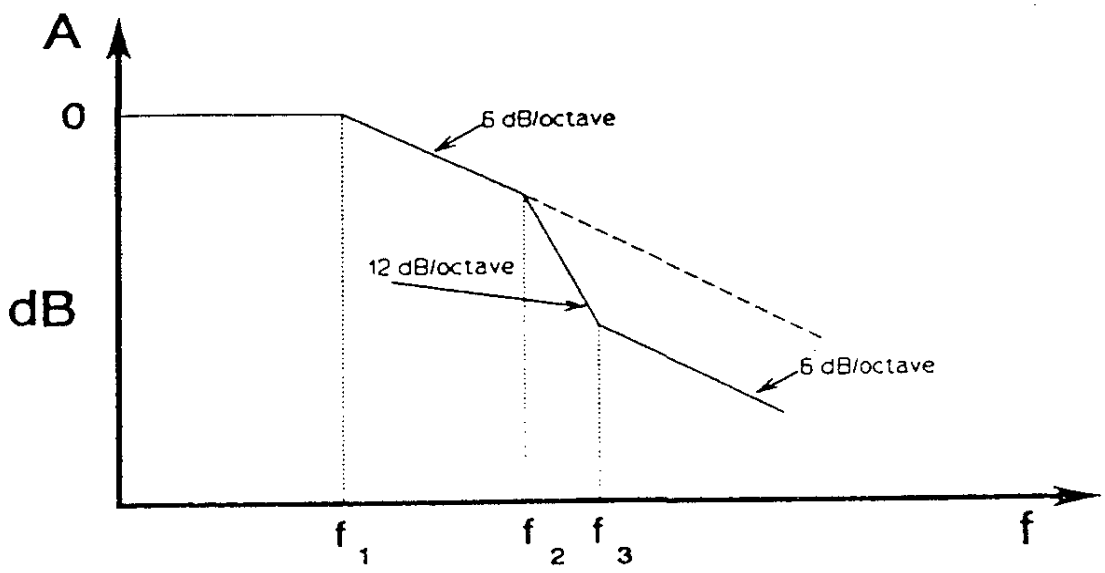

Figure 3 - Ideal Amplitude Frequency Characteristics of the Principal Integrator

Single Integration	Double Integration
f_1 = 100 Hz to 300 Hz	f_1 = 100 Hz to 300 Hz
	f_2 = 2700 Hz
	f_3 = 6400 Hz

3.4 Compression and Expansion

3.4.1 In the coder and decoder the quantizing step size q, which drives the principal integrator at point F, shall have an essentially linear relationship to the duty cycle at point D of the MLA integrator (see Figure 4).

3.4.2 It follows that the ratio of the quantizing step size at point F corresponding to a duty cycle of C_d=0.5 at point D of the MLA integrator to the minimum step size q_0 shall be 34 dB (provisional tolerance ±2 dB).

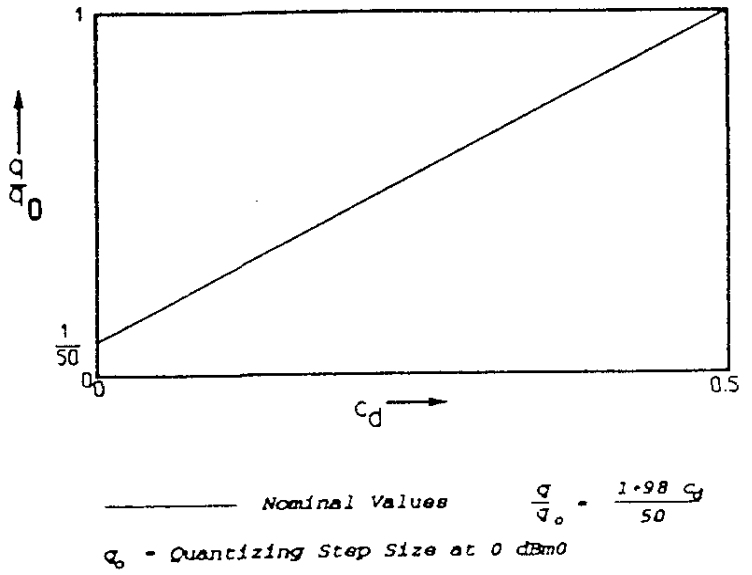

Figure 4 - Relation Between MLA Output Duty Cycle and Size of Quantizing Steps

3.5 Companding Speed

The following is valid for the condition that C is connected to C'. When an 800 Hz sinewave signal at point A is suddenly changed from -42 dBm0 to 0 dBm0, the output signal at point B shall reach 90% of its final value within 2 ms to 4 ms.

NOTE:
A1 The MLA integrator circuits of the coder and decoder shall have the same characteristics and hence the same companding speed.

3.6 Procedure for Testing the Decoder

Testing is performed by means of periodical test bit sequences (listed in Table 1) which result in audio signals at 800 Hz at the decoder output point B.

3.6.1 The test bit sequence generator is connected to the decoder input point C' (see Figure 2).

3.6.2 The 800 Hz levels at point B shall conform to the values given in Table 1.

3.6.3 When the signal at point C' is switched from the periodical test bit sequence 'a' to the periodical test bit sequence 'g', then the output signal at point B shall reach 90% of its final value within 5.5 ms to 11.5 ms (see Figure 5). When the signal at point C' is switched from the periodical test bit sequence 'g' to the periodical test bit sequence 'a', then the output signal at point B shall reach 10% of the value of the periodical test bit sequence 'g' within 4 ms to 8 ms.

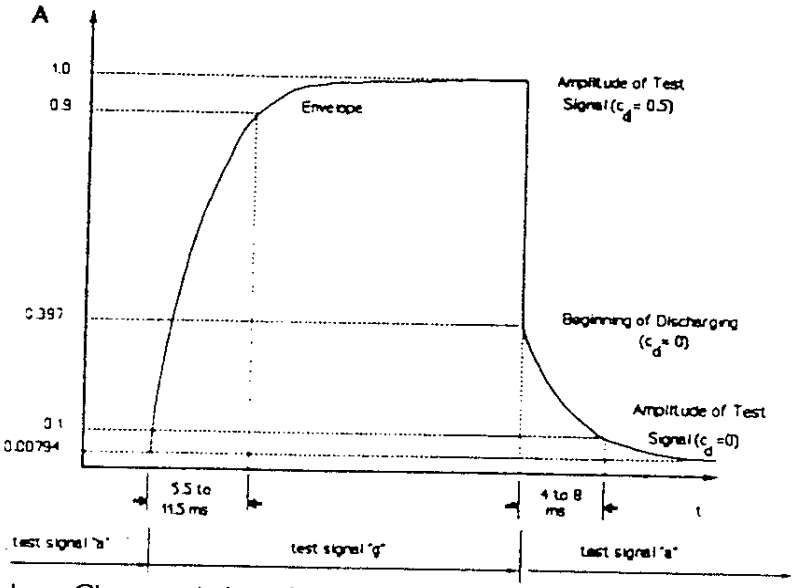

Figure 5 - Envelope Characteristics of the Output Signal at Point B (Half the Envelope)

Note: for clarification

A2 For an RC circuit in the MLA integrator, with time constants of 4 ms for both charging and discharging, the envelope characteristic of the output signal at point B is shown in Figure 5. For the case of switching the signal at point C' from sequence 'a' to sequence 'g', the characteristic of the output signal at point B is self-explanatory. When switching from sequence 'g' to sequence 'a', the amplitude at the beginning of discharging is at the first moment after switching higher - by a factor of 50 - then the final value which is reached asymptotically. The final value equals -42 dBm0 (i.e. 0.00794). The amplitude at the beginning of discharging is hence 0.397 (C_d = 0). The value of 10% is then reached at 5.76 ms.

TEST SIGNALS	BIT SEQUENCE	C_d	LEVEL (dBm0)
a. (1)	10110100100100101101	0	-41.5 ± 3
a. (2)	10110110101010010010010010010101011011011	0	-42 ± 3
b. (1)	11011001001001001101	0.05	-25 ± 2.5
b. (2)	10110110101010010010001001001010110110111	0.05	-25 ± 2.5
c. (1)	10110101000100101011	0.1	-19 ± 2
c. (2)	11011011010100100010001001001010110111011	0.1	-18.5 ± 2
d. (1)	11011001000010011011	0.2	-11 ± 2
d. (2)	11011101100101000100001000100110101110111	0.2	-11.5 ± 2
e. (1)	11011010000010010111	0.3	-6.5 ± 1.5
e. (2)	11101110110010001000000100010011011101111	0.3	-6.5 ± 1.5
f. (1)	11011010000001001111	0.4	-3 ± 1.5
f. (2)	11110111010100010000000010001010111011111	0.4	-3 ± 1.5
g. (1)	11101010000000101111	0.5	0 ± 1
g. (2)	11111011101000100000000001000101110111111	0.5	0 ± 1

TABLE 1 - BIT SEQUENCES FOR TESTING DELTA DECODER

Note:

A3 C_d - Duty cycle at point D of the modulation level analyzer (MLA), (approximate).

(1) - Sequence of 20 bits for a bit rate of 16 kbit/s.

(2) - Sequence of 40 bits for a bit rate of 32 kbit/s.

4 ELECTRICAL PERFORMANCE

4.1 General

4.1.1 The required values under paragraphs 4.2 to 4.7 are valid for the condition that C is connected to C'.

4.1.2 For measurement, the input (point A) and the output (point B) are to be terminated with 600 ohms and signals whose frequencies are sub-multiples of the sampling rate shall be avoided. Accordingly, where a nominal test signal frequency of 800 Hz is indicated, the actual frequency shall be slightly different; a preferred value is 820 Hz but frequencies from 804 Hz to 860 Hz may be used.

4.1.3 The measurements, according to paragraphs 4.2 to 4.4, shall be performed at a specific frequency within the recommended band.

4.2 Insertion Loss between Points A and B

The insertion loss between points A and B at 800 Hz with an input level of 0 dBm0 shall be 0 dB ±2 dB. The insertion loss contributed by the transmit and receive sides shall not exceed one-half of this value.

4.3 Attenuation Distortion with Frequency

4.3.1 Attenuation Distortion with Frequency - 16 kbit/s:

The attenuation distortion, between points A and B, relative to 800 Hz measured with an input level of -20 dBm0 applied to point A shall be within the limits of Figure 6a. The distortion contributed by the transmit side alone, measured at point G of the coder, shall not exceed the limits indicated by the broken lines in Figure 6a.

4.3.2 Attenuation Distortion with Frequency - 32 kbit/s:

The attenuation distortion, between points A and B, relative to 800 Hz measured with an input level of -20 dBm0 applied to point A shall be within the limits of Figure 6b. The distortion contributed by the transmit side alone, measured at point G of the coder, shall not exceed the limits indicated by the broken lines in Figure 6b.

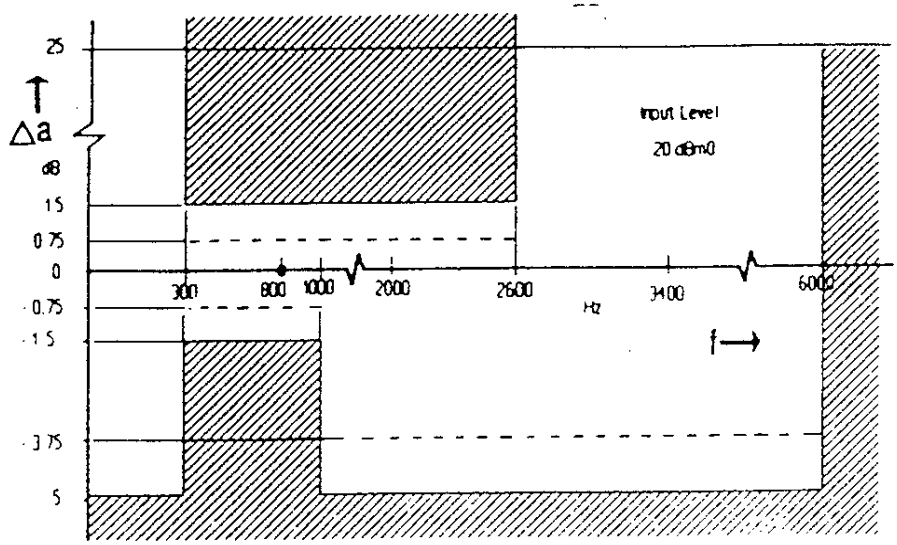

Figure 6a - Attenuation Distortion with Frequency at a Bit Rate of 16 kbit/s

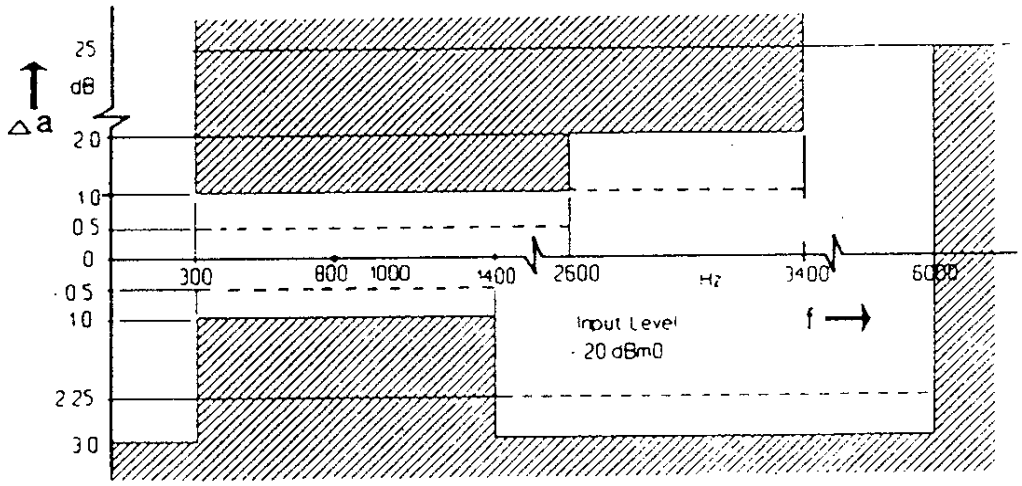

Figure 6b - Attenuation Distortion with Frequency at a Bit Rate of 32 kbit/s

4.4 Variation of Gain with Input Level

4.4.1 Variation of Gain Δg with Input Level - 16 kbit/s:

The variation of gain Δg with input level, n, normalized to the gain at an input level of -20 dBm0, shall not exceed the limits given in Figure 7a for a frequency of 800 Hz.

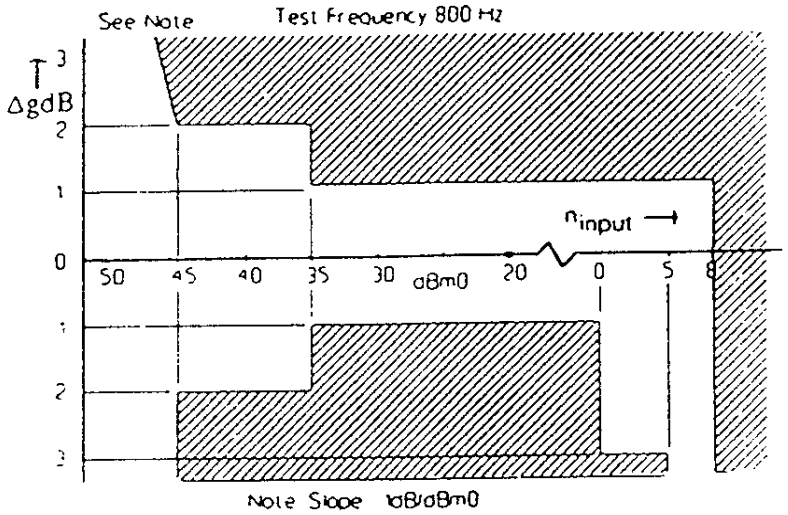

Figure 7a - Variation of Gain with Input Level at a Bit Rate of 16 kbit/s

4.4.2 Variation of Gain Δg with Input Level - 32 kbit/s:

The variation of gain Δg with input level, n, normalized to the gain at an input level of -20 dBm0, shall not exceed the limits given in Figure 7b for a frequency of 800 Hz.

4.5 Idle Channel Noise

4.5.1 Idle Channel Noise - 16 kbit/s:

The noise shall be measured weighted. The idle channel noise at point B shall not exceed -45 dBm0p. The level of any single frequency shall not exceed -50 dBm0 in the frequency range from 0.3 kHz to 8 kHz.

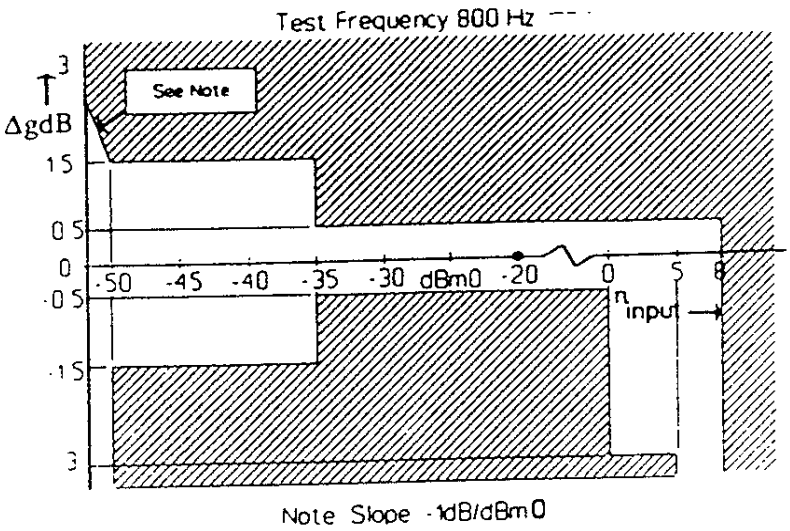

Figure 7b - Variation of Gain with Input Level at a Bit Rate of 32 kbit/s

4.5.2 Idle Channel Noise - 32 kbit/s:

The noise shall be measured weighted. The idle channel noise at point B shall not exceed -60 dBm0p. The level of any single frequency shall not exceed -65 dBm0 in the frequency range from 0.3 kHz to 16 kHz.

4.6. Variation of Noise (Quantizing and Harmonic Distortion) with Input Level

4.6.1 Variation of Noise with Input Level - 16 kbit/s:

The noise shall be measured unweighted with a sinewave test signal at 800 Hz. With such a test signal applied to point A, the ratio of signal to noise power at the output point B shall be above the limits of Figure 8a.

4.6.2 Variation of Noise with Input Level - 32 kbit/s:

The noise shall be measured unweighted with a sinewave test signal at 800 Hz. With such a test signal applied to point A, the ratio of signal to noise power at the output point B shall be above the limits of Figure 8b.

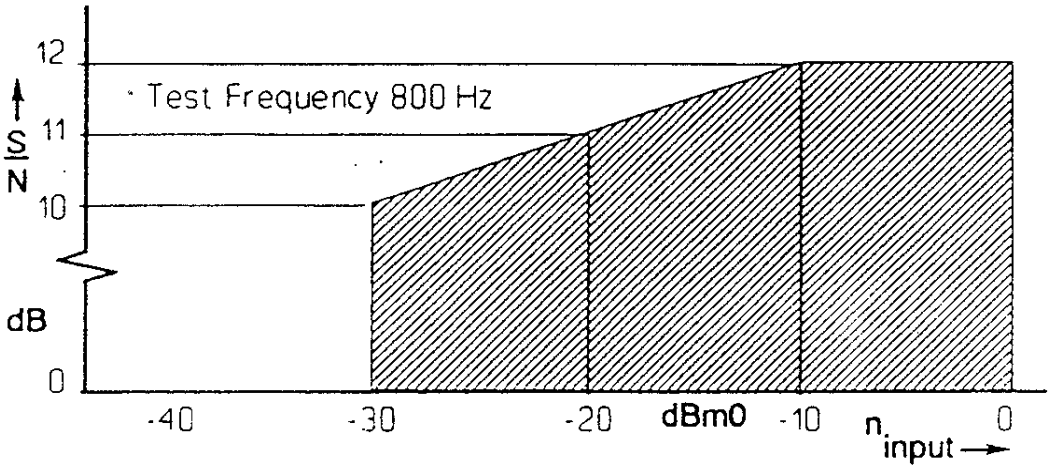

Figure 8a - Signal to Noise (Quantizing and Harmonic Distortion) Ratio with Level at a Bit Rate of 16 kbit/s

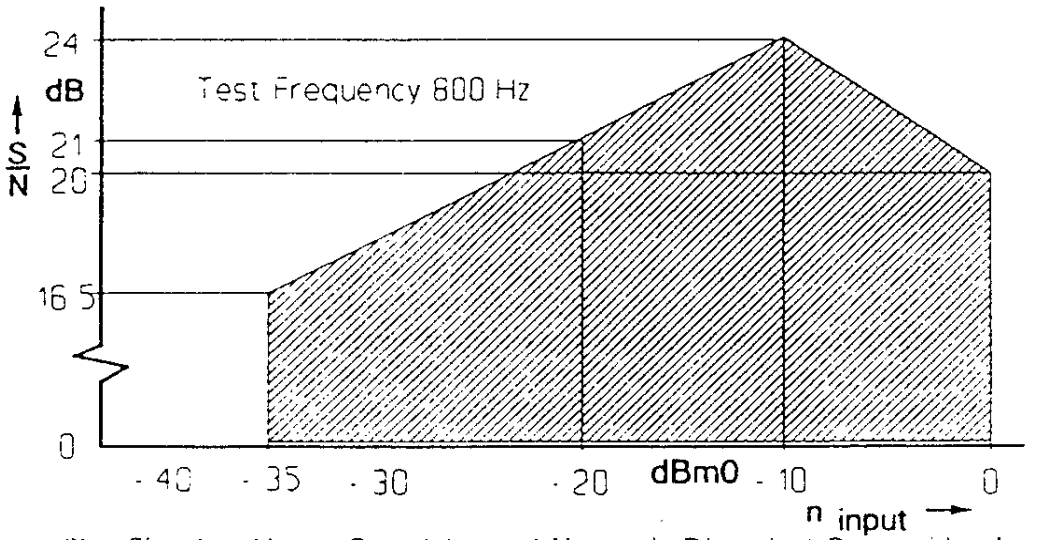

Figure 8b - Signal to Noise (Quantizing and Harmonic Distortion) Ratio with a Level at a Bit Rate of 32 kbit/s

4.7 Variation of Noise (Quantizing and Harmonic Distortion) with Frequency

4.7.1 Variation of Noise with Frequency - 16 kbit/s:

The noise shall be measured unweighted with a sinewave test signal of -20 dBm0. With such a test signal applied to point A, the ratio of signal to noise power at the output point B shall be above the limits of Figure 9a.

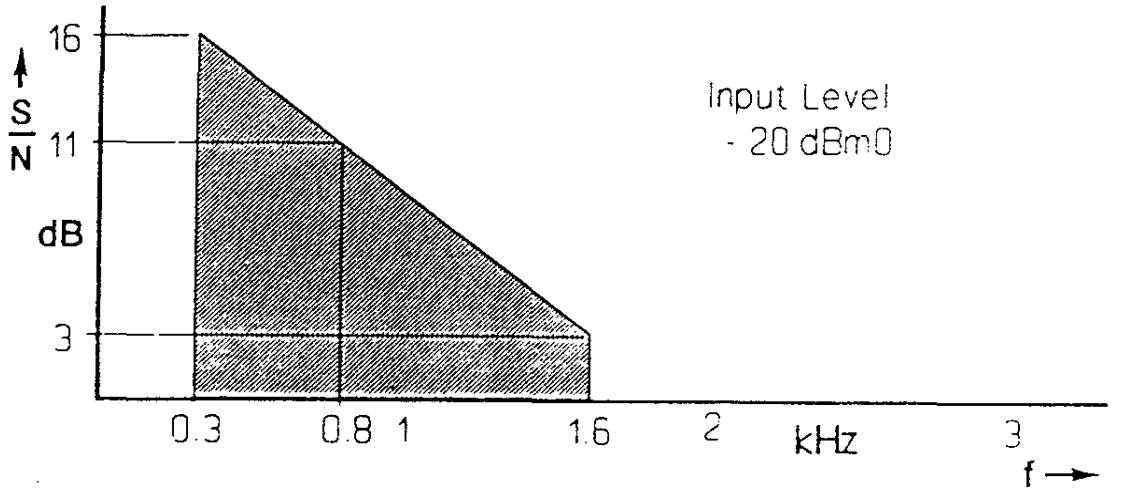

Figure 9a - Signal to Noise (Quantizing and Harmonic Distortion) Ratio with Frequency at a Bit Rate of 16 kbit/s

4.7.2 Variation of Noise with Frequency - 32 kbit/s:

The noise shall be measured unweighted with a sinewave test signal of -20 dBm0. With such a test signal applied to point A, the ratio of signal to noise power at the output point B shall be above the limits of Figure 9b.

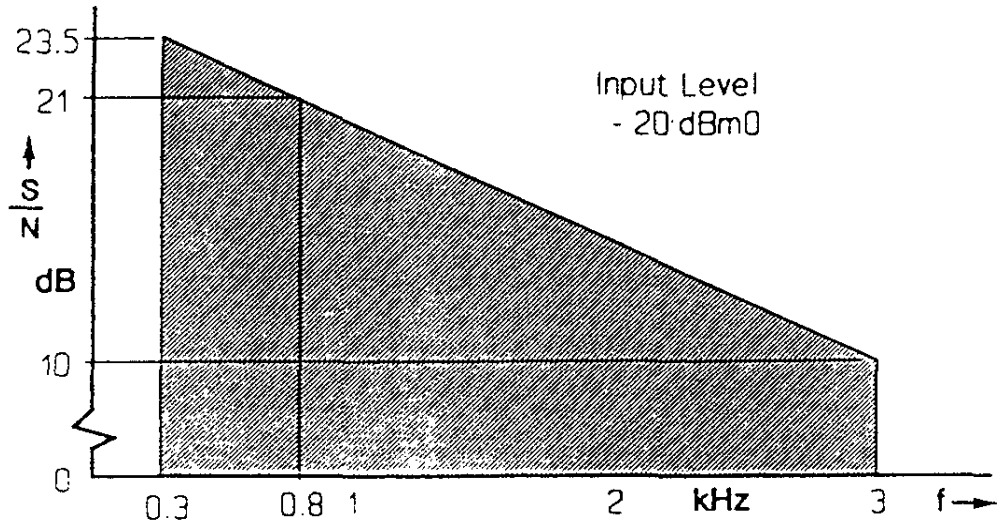

Figure 9b - Signal to Noise (Quantizing and Harmonic Distortion) Ratio with Frequency at a Bit Rate of 32 kbit/s

ANNEX B to
STANAG 4380
(Edition 1)

NATO PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (NPICS) PROFORMA

1 Introduction

For a protocol implementation which is claimed to conform to STANAG 4380 the following NATO Protocol Implementation Conformance Statement (NPICS) proforma shall be completed.

For a NATO standard, the NPICS corresponds to the Protocol Implementation Conformance Statement (PICS) defined in ISO/IEC 9646-1 for an International Standard. The term NPICS is used to avoid confusion where the requirements for NPICS and PICS differ.

A completed NPICS proforma is the NPICS for the implementation in question. The NPICS is a statement of which capabilities and options of the protocol have been implemented. The NPICS can have a number of uses, including use:

- by the protocol implementor, as a check-list to reduce the risk of failure to conform to the standard through oversight;
- by the supplier and acquirer - or potential acquirer - of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the standard NPICS proforma;
- by the user - or potential user - of the implementation, as a basis for initially checking the possibility of interworking with another implementation (note that, while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible NPICSs);
- by a protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

Note:

B.1. All material in the base standard, i.e. STANAG 4380, is considered mandatory unless another status is specifically indicated in this NPICS Proforma.

2 Abbreviations and special symbols

2.1 Status symbols

M	mandatory
O	optional
O.<n>	optional, but support of at least one, or exactly one, of the group of options labelled by the same numeral <n> is required
X	prohibited
<pred>:	conditional-item symbol, including predicate identification, see 3.4 logical negation,
¬	applied to a conditional item's predicate

2.2 General abbreviations

CVSD	Continuously Variable Slope Delta Modulation
MLA	Modulation Level Analyzer
RC	Resistance Capacitance
N/A	Not Applicable

2.3 Item references

Items in the NPICS proforma are identified by mnemonic item references. NPICS items dealing with related functions are identified by item references sharing the same initial letter or letter-pair (in capitals). There follows a list of those initials, in the order in which the groups of items occur in the NPICS proforma.

GC	General Characteristics
FA	Four-wire to Four-wire Audio Frequency Characteristics
CD	Coder and Decoder Circuits
ER	Electrical Characteristics, Remarks
EP	Electrical Performance

2.4 Base Standard References

The generic format of a reference of the NPICS proforma is:

<Paragraph>

for a reference to main STANAG part, and

[<Part>]<Annex>[<Appendix>]/<Paragraph>

for all other STANAG references.

<Part>	= A capital Roman number	(I, II, etc.)
<Annex>	= An uppercase letter	(A, B, etc.)
<Appendix>	= A number or uppercase letter	(A, B, etc., 1, 2, etc.)
<Paragraph>	= <n>.[<n>] or <n>.[<x>] as appropriate	
[ ]	enclose an optional entry	
< >	denote a generic identifier	
<n>	A numeral (1, 2, 3 etc.)	
<x>	A lowercase letter (a, b, c etc.)	

In the case when there are references to one or more CCITT or ISO base standards in addition to STANAG references, the STANAG references shall be prefixed by "STxxxx", while the CCITT or ISO references are direct to chapters, paragraphs etc. Such CCITT or ISO base standards shall be listed in the "Related Documents"-sections of this STANAG or STANAG Annex, to which this PICS Proforma is attached. If more than one CCITT or ISO standard is referenced in the NPICS Proforma, only one reference should be used in each table, with the reference stated above the table.

3 Instructions for completing the NPICS proforma

3.1 General Structure of the NPICS Proforma

The first part of the NPICS proforma - Implementation Identification and Protocol Summary - is to be completed as indicated with the information necessary to identify fully both the supplier and the implementation.

The main part of the NPICS proforma is a fixed-format questionnaire, divided into a number of major subclauses; these can be divided into further subclauses each containing a group of individual items. Answers to the questionnaire items are to be provided in the rightmost column, either by simply marking an answer to indicate a restricted choice (usually Yes or No), or by entering a value or a set or range of values. There are some items where two or more choices from a set of possible answers can apply: all relevent choices are to be marked.

Each item is identified by an item reference in the first column; the second column contains the question to be answered; the third column contains the reference or references to STANAG 4380 according to 2.4 above. The remaining columns record the status of the item - whether support is mandatory, optional, prohibited or conditional - and provide the space for the answers: see also 3.4 below.

A supplier may also provide - or be required to provide - further information, categorized as either Additional Information or Exception Information. When present, each kind of further information is to be provided in a further subclause of items labelled A<i> or X<i> respectively for cross-referencing purposes, where <i> is any unambigious identification for the item (e.g. simply a numeral): there are no other restrictions on its format and presentation.

A completed NPICS proforma, including any Additional Information and Exception Information, is the NATO Protocol Implementation Conformance Statement for the implementation in question.

Note:

B.2. Where an implementation is capable of being configured in more than one way, a single NPICS may be able to describe all such configurations. However, the supplier has the choice of providing more than one NPICS, each covering some subset of the implementation's configuration capabilities, in case that makes for easier and clearer presentation of the information.

3.2 Additional Information

Items of Additional Information allow a supplier to provide additional information intended to assist the interpretation of the NPICS. It is not intended or expected that a large quantity will be supplied, and an NPICS can be considered complete without any such information. Examples might be an outline of the ways in which a (single) implementation can be set up to operate in a variety of environments and configurations; or a brief rationale - based perhaps upon specific application needs - for the exclusion of features which, although optional, are nonetheless commonly present in implementations of this protocol.

References to items of Additional Information may be entered next to any answer in the questionnaire, and may be included in items of Exception Information.

3.3 Exception Information

It may occasionally happen that a supplier will wish to answer an item with mandatory or prohibited status (after any conditions have been applied) in a way that conflicts with the indicated requirement. No pre-printed answer will be found in the Support column for this: instead, the supplier shall write the missing answer into the Support column, together with an X<i> reference to an item of Exception Information, and shall provide the appropriate rationale in the Exception item itself.

An implementation for which an Exception item is required in this way does not conform to STANAG 4380.

Note:

B.3. A possible reason for the situation described above is that a defect in the standard has been reported, a correction for which is expected to change the requirement not met by the implementation.

3.4 Conditional status

3.4.1 Conditional items

The NPICS proforma contains a number of conditional items. These are items for which the status - mandatory, optional or prohibited - that applies is dependent upon whether or not certain other items are supported, or upon the values supported for other items.

In many cases, whether or not the item applies at all is conditional in this way, as well as the status when the item does apply.

Where a group of items is subject to the same condition for applicability, a separate preliminary question about the condition appears at the head of the group, with an instruction to skip to a later point in the questionnaire if the "Not Applicable" answer is selected. Otherwise, individual conditional items are indicated by one or more conditional symbols (on separate lines) in the status column.

A conditional symbol is of the form "<pred>:<x>" where "<pred>" is a predicate as described in 3.4.2 below, and "<x>" is one of the status symbols M, O, O.<n> or X.

If the value of the predicate in any line of a conditional item is true (see 3.4.2), the conditional item is applicable, and its status is that indicated by the status symbol following the predicate; the answer column is to be marked in the usual way. If the value of a predicate is false, the Not Applicable (N/A) answer is to be marked in the relevant line. Each line in a multi-line conditional item should be marked.

3.4.2 Predicates

A predicate is one of the following:

a) an item-reference for an item in the NPICS proforma: the value of the predicate is true if the item is marked as supported, and is false otherwise; or

b) a predicate name, for a predicate defined elsewhere in the NPICS proforma item: see below; or

c) the logical negation symbol " ¬ " prefixed to an item-reference or predicate name; the value of the predicate is true if the value of the predicate formed by omitting the " ¬ " is false, and vice versa.

The definition for a predicate name is a boolean expression constructed by combining simple predicates, as at a) or b) above, using the boolean operators AND, OR and NOT, and parentheses, in the usual way. The value of such a predicate is true if the boolean expression evaluates to true when the item-references are interpreted as at a) above.

Each item whose reference is used in a predicate or predicate definition is indicated by an asterisk in the Item column.

4 Identification

4.1 Implementation identification

Nation/Supplier	
Contact point for queries about the NPICS	
Implementation Name(s) and Version(s)	
Other information necessary for full identification e.g name(s) and version(s) of machines and/or operating systems; system names	

Notes

1 Only the first three items are required for all implementations, other information may be completed as appropriate in meeting the requirement for full identification

2 The terms Name and Version should be interpreted appropriately to correspond with a nation/supplier's terminology (e.g. Type, Series, Model)

4.2 Protocol identification

Identification of protocol specification	STANAG 4380	
Identification of amendments and corrigenda to this NPICS proforma which have been completed as part of this NPICS	Am : Corr. : Am. : Corr. : Am. : Corr. : Am. : Corr :	
Have any Exception items been required (see 3.3)? (The answer Yes means that the implementation does not conform to STANAG 4380)		No[] Yes[]

Date of Statement	

5 Implementation

5.1 General Characteristics

Item	Protocol feature	References	Status	Support
GC1	16 kbit/s bit rate	A/1.1	O.1	Y[]N[]
GC2	32 kbit/s bit rate	A/1.1	O.1	Y[]N[]
GC3	Single Integration	A/3.2	O.2	Y[]N[]
GC4	Double Integration	A/3.2	O.2	Y[]N[]
GC5	Block Schematic	Fig.1 & Fig.2	M	Y[]

5.2 Four Wire to Four Wire Audio Frequency Characteristics

Item	Protocol feature	References	Status	Support
FA1	Relative Level at Points A & B of Figures 1 & 2	A/2.1	M	Y[]
FA2	Impedance at Points A & B	A/2.3	M	Y[]
FA3	Return Loss at Points A & B against 600 ohms	A/2.4	M	Y[]
FA4	Symmetry at Points A & B	A/2.5	M	Y[]

5.3 Coder and Decoder Circuits

Item	Protocol feature	References	Status	Support
CD1	Input and Output Audio Filters	A/3.1	M	Y[]
CD2	Frequency of the Principal Integrator, f1	A/3.2, Fig. 3	M	Y[]
CD3	Frequency of the Principal Integrator, f2, f3	A/3.2, Fig. 3	GC4·M	N/A[]Y[]
CD4	Modulation Level	A/3.3	M	Y[]
CD5	Compression and Expansion	A/3.4	M	Y[]
CD6	Companding Speed	A/3.5	M	Y[]
CD7	Procedure for Testing the Decoder	A/3.6	M	Y[]

5.4 Electrical Performance

5.4.1 Remarks

Item	Protocol feature	References	Status	Support
ER1	Connection	A/4.1.1	M	Y[]
ER2	Termination	A/4.1.2	M	Y[]
ER3	Measurements	A/4.1.3	M	Y[]

5.4.2 16 kbit/s operation

If 16 kbit/s operation is not supported, item GC1, mark N/A and continue at subclause 5.4.3 N/A[]

Item	Protocol feature	References	Status	Support
EP1	Insertion Loss Between Points A & B	A/4.2	M	Y[]
EP2	Attenuation Distortion with Frequency	A/4.3.1	M	Y[]
EP3	Variantion of Gain with Input Level	A/4.4.1	M	Y[]
EP4	Idle Channel Noise	A/4.5.1	M	Y[]
EP5	Variation of Quantizing and Harmonic Distortion with Input Level	A/4.6.1	M	Y[]
EP6	Variation of Quantizing and Harmonic Distortion with Frequency	A/4.7.1	M	Y[]

5.4.3 32 kbit/s operation

If 32 kbit/s operation is not supported, item GC2 mark N/A and skip the rest of the table. N/A[]

Item	Protocol feature	References	Status	Support
EP7	Insertion Loss Between Points A & B	A/4.2	M	Y[]
EP8	Attenuation Distortion with Frequency	A/4.3.2	M	Y[]
EP9	Variation of Gain with Input Level	A/4.4.2	M	Y[]
EP10	Idle Channel Noise	A/4.5.2	M	Y[]
EP11	Variation of Quantizing and Harmonic Distortion with Input Level	A/4.6.2	M	Y[]
EP12	Variation of Quantizing and Harmonic Distortion with Frequency	A/4.7.2	M	Y[]