

**DRAFT VERSION (Core text, excluding annexes): Version 1.5 of 6<sup>th</sup> April 2021  
DRAFT VERSION (Whole STANAG): Version 1.6 of 27<sup>th</sup> August 2021**

## **NATO STANDARDIZATION AGREEMENT (STANAG)**

### **TECHNICAL STANDARDS FOR HF RADIO LINK LAYER AND APPLICATION SUPPORT PROTOCOLS**

#### **RELATED DOCUMENTS:**

See Section 8 (References).

#### **AIM**

The aim of this agreement is to define the functions and interfaces required for networked, error-free communication over HF radio channels, nominally for beyond-line-of-sight communications. This STANAG makes use of waveforms standardized in other STANAGs and standardized applications. This STANAG defines the necessary intermediate layers to provide a complete solution.

#### **AGREEMENT**

The participating nations agree to implement the protocols and interfaces defined in this STANAG (including mandatory Annexes) to provide communications over HF radio channels.

#### **IMPLEMENTATION OF THE AGREEMENT**

This STANAG is implemented by a nation when data communication on long-haul or short-haul HF radio channels complies with the characteristics detailed in this agreement.

#### **DEFINITIONS**

node	An implementation of the profile described in the main body of and mandatory annexes to this STANAG. The node is generally assumed to include the HF (modem and radio) and cryptographic equipment required for communications.
subnetwork	A collection of nodes. As a whole, a subnetwork provides a reliable networked data-transport service for external users or clients.

### **1. INTRODUCTION**

This STANAG specifies protocols for data communication over HF radio, which will usually be used for beyond-line-of-sight communication. This STANAG describes a set of functions, segregated logically into layers, together with the interfaces, data formats, and procedures required for interoperability. External standards and specifications are referenced and used where appropriate. The technical characteristics that are required to ensure interoperability and reliable system operation are described in the main body of and mandatory annexes to the document. Information-only annexes provide information on possible implementation of interfaces and subnetwork clients. The annexes also contain implementation advice based on experience during the development and deployment of the protocols.

This document is organised so that the main body gives an overview of the structure of the STANAG and the

capabilities that should be realised when it is implemented. The details of the interfaces, data formats, and procedures are described in a number of mandatory and informational annexes.

### 1.1. Changes in This Edition

The primary driver for changes in this edition is to provide support for Wideband HF and ALE. A number of small improvements have been made as well as general clean up of the specification text.

Functional changes to STANAG 5066 are set out in Section 9. The introductory text has been substantially rewritten to improve clarity.

## **2. SERVICES PROVIDED**

This STANAG enables interoperability at the two major classes of interface: first, the “common air interface”, describing how information is exchanged between nodes by radio; and second, the non-HF interfaces which allow external users or clients to interact with the subnetwork and with each other over the subnetwork. While physical interfaces are left up to the system implementer (e.g., Ethernet, FDDI, internal bus, or shared memory), the data formats (primitives) and procedures that make up the interface are specified in detail so that client applications can make use of the subnet.

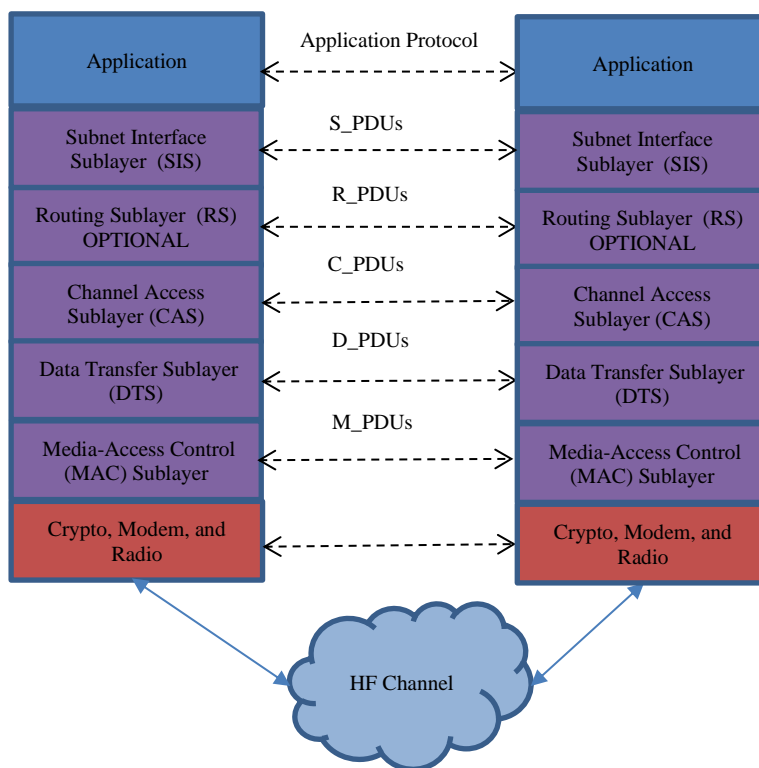
### 2.1. Common Air Interface: Reliable Data Communications over HF Radio

Reliable data communications over HF radio is provided by using an ARQ data link protocol supported by the modern waveforms referenced in this STANAG. The STANAG is suitable for use with other waveforms with similar characteristics.

The data transfer sublayer defined in the profile supports automatic changes of the user data rate (that is, code rate) of the HF modem in response to changing channel conditions (adaptive data rate). This capability requires remote control of the HF modem and use of auto-baud waveforms such as STANAG 4539 or STANAG 5069. The profile is defined so nodes in which remote control of the modem, and hence adaptive data rate, is not available will interoperate with nodes which do have the capability.

The profile defined here supports frequency selection by use of Automatic Link Establishment (ALE), but does not require that ALE is available.

2.2. The STANAG 5066 Protocol Stack



**Figure 1: STANAG 5066 Layer Architecture**

STANAG 5066 provides an interface between applications and the HF channel communications, comprising Crypto, Modem and Radio. The interface to the HF Channel is described in Section 3. Applications are described in Section 4.

STANAG 5066 has a layered architecture, with peer protocol defined with a set of PDUs and service interfaces specified between each layer. The following sublayers are specified:

1. The **Subnetwork Interface Sublayer (SIS)** provides a service interface to applications using STANAG 5066. Annex A defines the service interface provided by SIS to applications. The primary service function is to transfer blocks of data (UNIDATA). The SIS defines a peer protocol using S\_PDUs.
2. The **Routing Sublayer (RS)** is an optional sublayer that is used in configurations where data needs to traverse an HF channel multiple times. This is needed to support Wireless Token Ring Protocol (WTRP) configurations with partial connectivity. The RS is specified in Annex R.
3. The **Channel Access Sublayer (CAS)** controls communication between peers by managing “physical links” which control ARQ communication between peers. The CAS can provide simultaneous access to multiple peers or constrain operation to one active peer at a time. The CAS is specified in Annex B.
4. The **Data Transfer Sublayer (DTS)** provides data transfer with one or more peers. The DTS provides a reliable (ARQ) data link service, as well as best-effort (non-ARQ) service for broadcast, multicast and communication to peers in EMCON. The DTS supports data rate selection for STANAG 4539

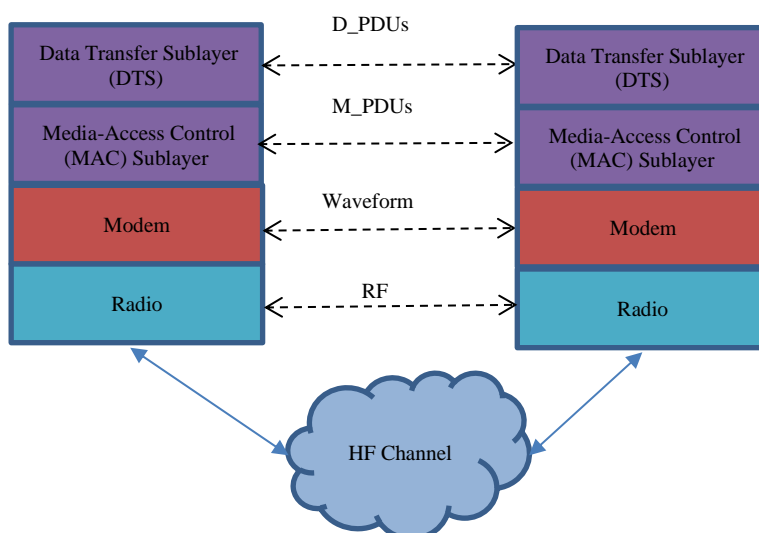
and STANAG 5069 waveforms. The DTS is specified in Annex C.

5. The **Media-Access-Control (MAC) Sublayer** provides mechanisms for enhanced media-access control capability for HF data communication in multi-node networks. Whereas the Channel-Access Sublayer provides pairwise logical link control mechanisms to establish a point-to-point link (or set of multiple, independent point-to-point links) for data communication, the Media-Access- Control Sublayer introduces modes for enhanced media-access control capability for HF data communication in multi-node networks, and the prescribed method in which they may be used with other STANAG 5066 capabilities. These optional channel-access modes extend or modify, but do not replace, the pairwise logical link control mechanisms defined for the Channel Access Sublayer. General requirements for the Media-Access-Control Sublayer are defined in Annex J of this STANAG, with requirements on each of the defined protocols for media-access- control provided in Annex K for Carrier-Sense-Multiple Access and Annex L for Wireless-Token- Ring Protocol (WTRP). Annexes may be added in future versions of this STANAG for other techniques, such as Adaptive Time Division Multiple Access.

### 3. STANAG 5066 Interfaces to the HF Channel.

STANAG 5066 defines three ways to interface to the HF channel, which are described in this section. These interfaces can all be used with the waveforms defined in STANAG 4285, STANAG 4529, STANAG 4539 and STANAG 5069. It is anticipated that STANAG 5066 can be used with other waveforms with similar characteristics to these.

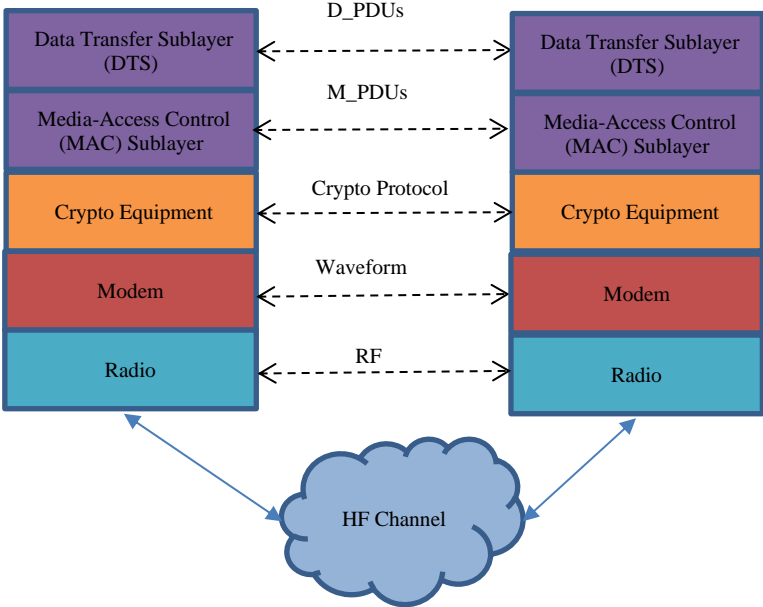
#### 3.1. Direct Interface to Modem



**Figure 2: STANAG 5066 Direct Interface to Modem**

The STANAG 5066 stack **may** interface directly to a modem, with a stack as shown in Figure 2. Data interface between STANAG 5066 stack and Modem **may** use the synchronous serial interface specified in Annex D. This data interface **may** use other communication mechanisms such as the TCP data interface specified in Annex A of MIL-STD-188-110D.

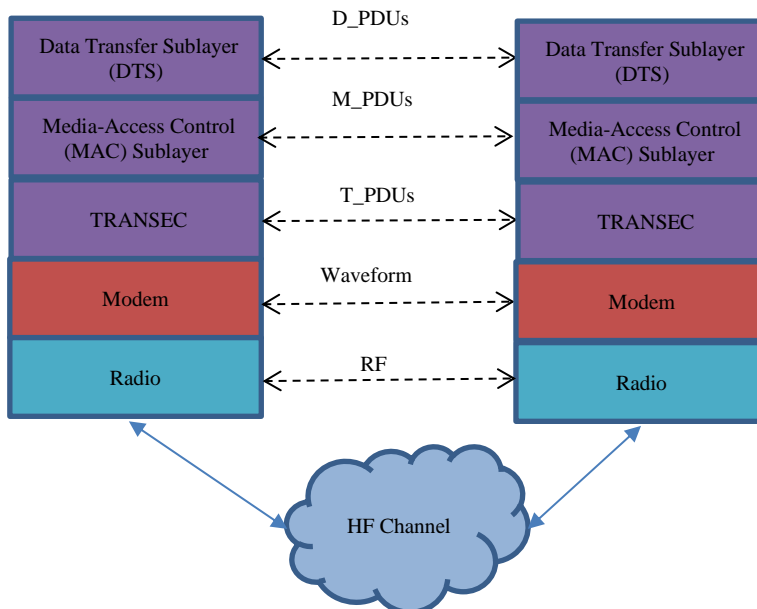
3.2. Interface to Synchronous Serial Crypto Equipment



**Figure 3: STANAG 5066 Interface to Synchronous Serial Crypto Equipment**

The STANAG 5066 stack can be interfaced to Synchronous Serial Crypto Equipment, such as BID-950, KG-84C and KIV-7, as shown in Figure 3. Data interface between STANAG 5066 and Crypto Equipment **shall** conform to Annex D of this specification.

3.3. Interface using AES and other Encryption Algorithms

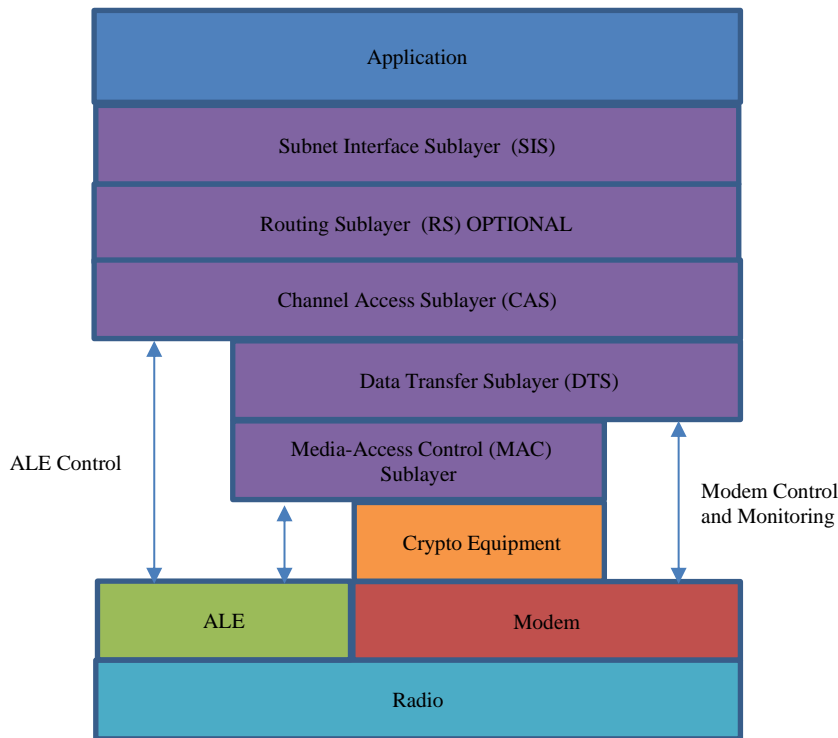


**Figure 4: STANAG 5066 Interface using AES and other Encryption Algorithms**

The STANAG 5066 stack can be extended downwards to include encryption in a TRANSEC sublayer following the specification of Annex T of this specification. Annex T specifies use of the Advanced Encryption Standard (AES) and provides a general framework for use of alternative encryption algorithms.

Data interface between the TRANSEC layer and Modem **may** use the synchronous serial interface specified in Annex D. This data interface **may** use other communication mechanisms such as the TCP data interface specified in Annex A of MIL-STD-188-110D.

### 3.4. Modem Control and Monitoring



**Figure 5: STANAG 5066 Modem and ALE Control**

STANAG 5066 allows for, but does not require control communication with the modem. Monitoring and control of the modem is performed by the DTS, as shown in Figure 5. The following requirements are identified:

1. To achieve Data Rate Selection, as described in Annex C, the sender needs to control the modems sending speed and associated parameters such as interleaver.
2. To provide optimum recommendations on transmission parameters, the receiver needs to be able to monitor SNR and other receive characteristics.
3. To determine switching time when no EOT is received, performance of Annex K and Annex L can be optimized by monitoring end of transmission at modem level.

In addition to these requirements and implementation may use additional modem control, configuration and monitoring capabilities to improve system performance and management.

#### 3.1. Use of Automatic Link Establishment (ALE)

Automatic Link Establishment (ALE) enables selection of best frequency. For STANAG 5069, 4G ALE also allows selection of transmit and receive bandwidth. ALE mechanisms are specified in MIL-STD-188-141D, providing 2G (synchronous), 3G (asynchronous) and 4G mechanisms. STANAG 4538 defines 3G mechanisms.

ALE sits at the same level as the modem in the protocol architecture. ALE and Modem share use of the radio, with only one of them having access at any moment. ALE and Modem will co-ordinate sharing of the modem.

STANAG 5066 specifies two uses of ALE, as shown in Figure 5:

1. ALE used by MAC Sublayer, as specified in Annex J. In this mode, the MAC layer negotiates a frequency for use by all nodes on the subnetwork.
2. ALE used by the CAS, as specified in Annex B. In this mode, ALE is used to connect to one peer node or to a subset of nodes on the network. This will lead to the SIS queueing traffic for other nodes, as specified in Annex A.

ALE **may** be used in a third implicit mode on a two-node network. In this configuration, ALE can be used to set up a link without interaction with STANAG 5066, as there is only one destination.

### 3.2. Crypto Bypass

It can be seen in Figure 5 that all user data is passed through the Crypto. In order to achieve use of ALE and variable data rate, STANAG 5066 needs to communicate with components on the other side of the Crypto. This communication is called Crypto Bypass.

When Crypto Bypass is used, additional controls and checks **may** be needed on the information flow. Mechanisms to achieve this are outside of the scope of this STANAG.

## 4. APPLICATION SUPPORT

The SIS service provides a simple service interface to support applications, as defined in Annex A.

### 4.1. Applications Supported

Each application supported by STANAG 5066 will use a SAP (Subnet Access Point). STANAG 5066 can support up to 16 applications sharing a channel, each with a different SAP ID (0-15).

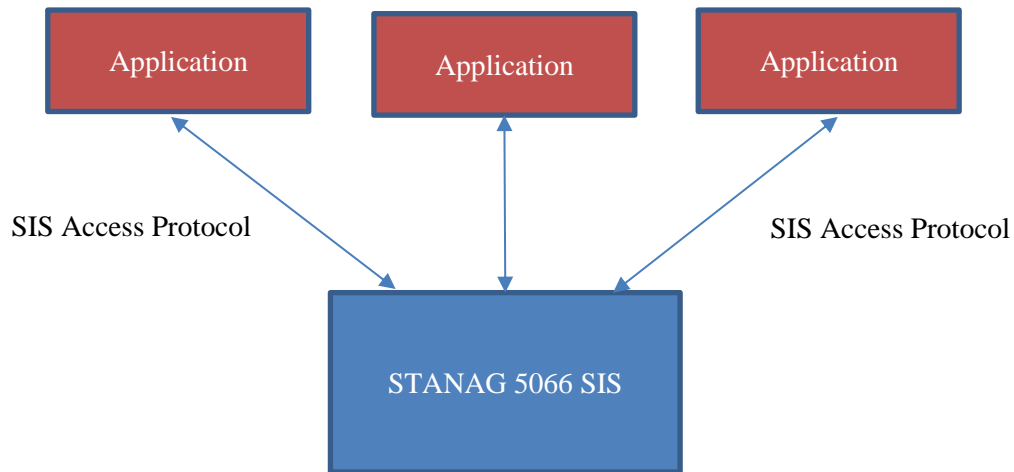
Annex F specifies SAP ID assignment for a number of applications. Where one of these applications is used, the assigned SAP ID **shall** be used. If an application listed in Annex F is not being used, a deployment **may** use its assigned SAP ID for a different application.

STANAG 5066 fully specifies one application, specifies supporting protocol for other applications, and references external applications. This includes:

1. HF Operator Chat. A simple operator chat protocol specified in Annex O.
2. Support for ACP 127 legacy formal military messaging using the Character Oriented Stream Service (COSS), specified in Annex P.
3. Support for Multicast Transfer using ACP 142, specified in Annex Q. This enables two services over ACP 142:
  - a. STANAG 4406 Annex E, to provide formal military messaging.
  - b. Multicast Email (MULE) specified in RFC 8494, to provide email or formal military messaging using RFC 6477.
4. Compressed File Transfer Protocol (CFTP) which can be used to provide basic email services, specified in Annex V.
5. Chat and Presence using XMPP, specified in XEP-0365.

6. IP Client, that enables an IP subnet to be operated over STANAG 5066. This provides support for some IP services, such as ICMP Ping. IP Client is specified in Annex U.

#### 4.2. Enabling Applications to Share a STANAG 5066 Stack



**Figure 6: SIS Access Protocol Model**

It is desirable to have multiple applications share a single STANAG 5066 Stack, so that a common stack implementation can be used and that data from the different applications can be multiplexed over STANAG 5066 communication. This is achieved by use of the SIS Access Protocol, illustrated in Figure 6 and specified in Annex S. The SIS Access Protocol operates locally to a node and has no end to end implications.

## **5. List of Annexes**

Annex A:	Subnetwork Interface Sublayer (mandatory)
Annex B:	Channel Access Sublayer (mandatory)
Annex C:	Data Transfer Sublayer (mandatory)
Annex D:	Interface between Data Transfer Sublayer and Communications Equipment (mandatory)
Annex E:	Absent
Annex F:	SAP Assignment (mandatory)
Annex G:	Absent
Annex H:	Absent
Annex I:	Absent
Annex J:	General Requirements for Enhanced Media-Access-Control (MAC) Capabilities in Multi-Node STANAG 5066 Networks
Annex K:	High-Frequency Carrier-Sense Multiple-Access (CSMA) Protocols
Annex L:	High-Frequency Wireless Token-Ring-Protocol (WTRP) Requirements
Annex M:	Reserved
Annex N:	Guidance on Address Management in STANAG 5066 Networks
Annex O:	HF Operator Chat
Annex P:	ACP 127 & Character-Oriented Serial Stream
Annex Q:	ACP 142
Annex R:	Routing Sublayer
Annex S:	SIS Access Protocol (mandatory)
Annex T:	STANAG 5066 TRANSEC Crypto Sublayer using AES and other Protocols
Annex U:	IP Client
Annex V:	Compressed File Transfer Protocol

Annexes not marked as “mandatory” are “information only”.

Annexes marked “Absent” were present in previous editions of STANAG 5066. Annex M is marked “reserved” as a provisional allocation has been made.

## **6. Interoperability with Edition 3**

Edition 4 of STANAG 5066 introduces a number of new protocol elements to improve the CAS and DTS services. It is a key goal of Edition 4 to ensure that there is robust interoperability with implementations following STANAG 5066 Edition 3 and earlier.

To achieve this an implementation shall determine if a peer implementation supports Edition 4 (or subsequent). If a peer only supports edition 3 or the status cannot be determined, an implementation shall not use any of the Edition 4 capabilities set out in this annex. This will ensure interoperability with Edition 3.

Peer Capability can be determined in three ways.

1. A priori knowledge. The edition supported by a specific peer or by the whole network may be known.
2. Use of CAS-1 capability negotiation, as specified in the CAS-1 sub-layer. This is always used for ARQ data when ALE is not used. It may be used for ARQ data with ALE and shall be used if the peer capability is not known. This means that peer capability will always be known if ARQ data is being transferred.
3. Use of the Capability EOW defined in Section C.6.4 of Annex C. This enables Edition 4 peer capability to be explicitly determined with no ARQ data is being exchanged. It also facilitates capability update when a node is upgraded to Edition 4.

## 7. Profiles

STANAG 5066 is a complex standard with many options. This section sets out profiles of the layer services and applications provided using STANAG 5066. This enables a deployment or a procurement to clearly specify what is needed from STANAG 5066.

In addition to the layer services and applications, a broader profile might include Waveforms and ALE protocols used along with other interoperability choices of layers below STANAG 5066. Such a profile is outside the scope of this STANAG.

### 7.1. Layer Services Profile Options

STANAG 5066 contains a number of options in the core protocols and functions set out in Annexes A, B, C and J contain some optional elements, listed in Table 1 as profile options. This table provides an identifier for each option which are referenced in the Layer Services Profile. The table references where in the STANAG each of these options are specified.

Profile Option	Annexes	Notes
HARD LINKS	A, B	DEPRECATED. Retained for Edition 3 compatibility. Not expected to be used.
EXPEDITED DATA	A, C	DEPRECATED. Retained for Edition 3 compatibility. Not expected to be used.
NON-ARQ WITH ERRORS	A, C	Service defined in Annex A, with implementation in Annex C. Not used by any current applications, but may be used in the future.
DUPLEX FIXED	B, C	Duplex operation with a fixed frequency two node network
MULTIPLE ACCESS	B	Operation with Multiple Simultaneous Peer Access model, necessary to support multicast with non-ALE networks with three or more nodes using CSMA or WTRP
ALE 1:1	B	Use Single Peer Access Model in conjunction with ALE. This is the ALE mode that is expected to be most commonly used. This option has two modes "EXPLICIT CAS-1" and "IMPLICIT CAS-1". One of these modes needs to be selected.
MULTICAST ALE	B	Use of Multicast ALE to enable support of multicast with ALE. This might help improve performance for multicast applications over network not using CSMA or WTRP
DUPLEX WITH ALE	B, C	Use of ALE with Duplex, to enable Single Peer Access Model in a multi-node network. This would be used to support a network where multiple nodes have duplex capability.
HDRCR	C	DEPRECATED. Retained for Edition 3 compatibility. Use of the High Data Rate Change Request PDU. Not expected to be used.
MAC ALE	J	Use of ALE with MAC ALE

**Table 1: Layer Services Profile Options**

## 7.2. Layer Services Profile

This section specifies a set of Layer Service Profile for STANAG 5066. The following Annexes are mandatory in all of the profile options.

Annex A:	Subnetwork Interface Sublayer
Annex B:	Channel Access Sublayer
Annex C:	Data Transfer Sublayer
Annex D:	Interface between Data Transfer Sublayer and Communications Equipment
Annex S:	SIS Access Protocol

The following Annexes are required in some of the profile options:

Annex J:	General Requirements for Enhanced Media-Access-Control (MAC) Capabilities in Multi-Node STANAG 5066 Networks
Annex K:	High-Frequency Carrier-Sense Multiple-Access (CSMA) Protocols
Annex L:	High-Frequency Wireless Token-Ring-Protocol (WTRP) Requirements

The following Annexes are optional, and if their use is required it **shall** be specified in conjunction with profile:

Annex R:	Routing Sublayer
Annex T:	STANAG 5066 TRANSEC Crypto Sublayer using AES and other Protocols

Both of these annexes can be used in conjunction with any profile. Annex T is an alternative to Annex D, and this **may** become a choice in future versions of this standard. Annex R is important to support some WTRP configurations, and so is explicitly noted with these profile options. Annex R **may** be used with any profile option.

Table 2 defines a list of profiles. For a given deployment, every node needs to follow the same profile, as this STANAG does not provide a dynamic mechanism to distinguish between these profiles. When procuring systems, it can be sensible to specify multiple profiles, to enable deployment with different profiles.

Note that the Non-ARQ with Errors profile option is not used in any profile, as there are no standardized or open protocols using this option. If future applications are defined that need this service, use of the “Non-ARQ Applications” profile option will be added to profile options in a future version of this standard.

Profile	Mandatory Profile Options and Annexes	Notes
ALE Basic (IMPLICIT CAS-1)	ALE 1:1 (mode IMPLICIT CAS-1)	Profile suitable for Skywave operation where ALE is always used.  This mode optimizes for short lived ALE connections/soft links.
ALE Basic (EXPLICIT CAS-1)	ALE 1:1 (mode EXPLICIT CAS-1)	Profile suitable for Skywave operation where ALE is always used.  This mode optimizes for long lived soft links where multiple ALE links are used support one soft link.
Duplex Pair	DUPLEX FIXED	A profile for use between a pair of nodes using duplex and fixed frequency.
Duplex Network	DUPLEX WITH ALE; ALE 1:1	A profiled for use to support a network with multiple nodes where some or all nodes are capable of duplex operation  ALE 1:1 Mode needs to be specified in conjunction with this mode.
Multicast ALE Network	MULTICAST ALE; ALE 1:1	A profile to support an ALE network which can optimize for multicast applications, which has potential to improve performance.  ALE 1:1 Mode needs to be specified in conjunction with this mode, to support ARQ and Unicast applications.
Non-ARQ Applications	NON-ARQ WITH ERRORS; MULTIPLE ACCESS;	A profile suitable to support (non-standard or future) applications using the Non-ARQ with errors service
CSMA Fixed Frequency	MULTIPLE ACCESS, Annex J, Annex K	Multi-node using Annex K  Useful for Surface Wave with light load or Skywave deployment without ALE
CSMA with ALE	MULTIPLE ACCESS, Annex J, Annex K, MAC ALE	Multi-node using Annex K with ALE  Useful to support Surface Wave deployment with light load where fixed frequency is not appropriate
WTRP Fixed Frequency	MULTIPLE ACCESS, Annex J, Annex L	Multi-node using Annex L  Useful for Surface Wave with high load
WTRP with ALE	MULTIPLE ACCESS, Annex J, Annex L, MAC ALE	Multi-node using Annex L with ALE  Useful to support Surface Wave deployment with high load where fixed frequency is not appropriate

**Table 2: Layer Services Profiles**

### 7.3. Application Profile

When deploying STANAG 5066 systems, it is important that all nodes offer the same set of applications to ensure interoperability. All of the applications standardized by STANAG 5066 or referenced in Annex F, can be used with any STANAG 5066 Layer Services Profile. For this reason, the STANAG Application Profile is specified separately. A full STANAG 5066 profiles comprises both Layer Services Profile and Application Profile.

The Application Profile is simply a list of applications to be used. This list **shall** contain at least one application, which **may** be applications listed in this section or **may** be others applications or a mix. STANAG 5066 has five annexes which specify use of applications operating over STANAG 5066. Most of these annexes reference external standards and only define operation over STANAG 5066:

Annex O:	HF Operator Chat
Annex P:	ACP 127 & Character-Oriented Serial Stream
Annex Q:	ACP 142
Annex U:	IP Client
Annex V:	Compressed File Transfer Protocol

For two of these annexes, the following additional information **shall** be supplied:

1. Annex Q. Whether STANAG 4406 Annex E, RFC 8494 (MULE) or both are supported
2. Annex U. Whether IPv4, IPv6 or both are supported/

The list of applications supported **may** include any application that runs over STANAG 5066. This includes the following applications which are referenced in Annex F:

- HMTF (STANAG 5066 Edition 3 Annex F.5)
- HFPOP (STANAG 5066 Edition 3 Annex F.6)
- XMPP (XEP-0365 “Server to Server communication over STANAG 5066 ARQ”)

## 8. References

1. NATO STANDARDIZATION AGREEMENT 4203 — Technical Standards for Single Channel HF Radio Equipment
2. NATO STANDARDIZATION AGREEMENT 4285— Characteristics of 1200/ 2400/ 3600 bps single tone modulators/demodulators for HF radio links
3. NATO STANDARDIZATION AGREEMENT 4406 Annex E — Military Message Handling System, Annexe E: Tactical MMHS Protocol and Profile Solution, March 2005
4. NATO STANDARDIZATION AGREEMENT 4529 — Characteristics of Single-Tone Modulators/Demodulators for Maritime HF Radio Links with 1240 Hz bandwidth
5. NATO STANDARDIZATION AGREEMENT 4538 — Technical Standards for an Automatic Radio Control System (ARCS) for HF Communications Links
6. NATO STANDARDIZATION AGREEMENT 4539 — Technical Standards for Non-Hopping HF Communications Waveforms

7. NATO STANDARDIZATION AGREEMENT 5069 — Technical Standards for Wideband Waveforms for Single Non-Hopping, Flexible-Bandwidth HF Channels
8. DEPARTMENT OF DEFENSE INTERFACE STANDARD 188-110D — Interoperability and Performance Standards for Data Modems, MIL-STD-188-110D, 29 December 2017
9. DEPARTMENT OF DEFENSE INTERFACE STANDARD 188-141D — Interoperability and Performance Standards for Medium and High Frequency Radio Systems, MIL-STD-188-141D, 29 December 2017
10. Combined Communications-Electronics Board ACP127(G), “Tape Relay Procedures”, November 1988
11. Combined Communications-Electronics Board ACP142A, “P\_MUL - A Protocol for Reliable Multicast Messaging in Bandwidth Constrained and Delayed Acknowledgement (EMCON) Environments”, October 2008
12. CCITT V41 - Code-independent error-control system, November 1988
13. CCITT V.42 - Error-correcting procedures for DCEs using asynchronous-to-synchronous conversion, March 2002
14. National Institute of Standards and Technology (NIST), “Advanced Encryption Standard (AES)”, 1988
15. REQUEST FOR COMMENTS 791 — Postel, J., “Internet Protocol”, September 1981.
16. REQUEST FOR COMMENTS 6477 — Melnikov, A; Lunt, G., “Registration of Military Message Handling System (MMHS) Header Fields for Use in Internet Mail”, January 2012
17. REQUEST FOR COMMENTS 8200 — Dering, S.; Hinden, R., “Internet Protocol, Version 6 (IPv6) Specification”. July 2017
18. REQUEST FOR COMMENTS 8494 — Wilson, D.; Melnikov, A., “Multicast Email (MULE) over Allied Communications Publication (ACP) 142”, November 2018
19. XMPP Standards Foundation XEP-0365, “Server to Server communication over STANAG 5066 ARQ”, Kille, S., July 2018

## **9. Changes in Edition 4**

Most changes since Edition 3 are in the annexes. Each annex has a section at the end listing changes in Edition 4. The following changes are made in the main document:

1. New Title that better reflects purpose.
2. Updated overall architecture to reflect new annexes.
3. General update of the text to improve clarity.

4. Added section to summarize use of ALE.
5. Added Profiles section.

Table 3 lists the annexes and summarizes the major changes since Edition 3.

<b>Annex</b>	<b>Edition 4 Title</b>	<b>Key Changes</b>
A	Subnetwork Interface Sublayer	Change Hard Links, and Expedited Data to deprecated services, with the expectation of removing these services in future editions.,  Removal of Rank, which is not used or needed. Moved local service encoding and services without end to end significant to Annex S, which now specifies the SIS protocol.
B	Channel Access Sublayer	Added Edition 4 negotiation and support for ALE.
C	Data Transfer Sublayer	Extended frame sequence number to support higher speeds. Provided D_PDU extensibility.
D	Interface between Data Transfer Sublayer and Communications Equipment	No significant change.
E	Absent	Modem control interface that was out of date and not useful.
F	SAP Assignment	Most content moved to annexes O-Q, S, U and V. Renamed to reflect SAP assignment core content. Some new assignments made.
G	Absent	Requirements on 2400 bps modems, now handled in Annex D.
H	Absent	Implementation notes. Information still valid folded into Annex D and other places as appropriate.
I	Absent	Frequency change procedure that is no longer needed due to integrated ALE support in Annex C. Ed3 Annex I is referenced in Annex C for backwards compatibility.
J	General Requirements for Enhanced Media-Access-Control (MAC) Capabilities in Multi-Node STANAG 5066 Networks	No significant change.
K	High-Frequency Carrier-Sense Multiple-Access (CSMA) Protocols	Added “slotted” support to optimize performance on small

		networks.
L	High-Frequency Wireless Token-Ring-Protocol (WTRP) Requirements	Model unchanged. Significant update of protocol.
M	Reserved	
N	Guidance on Address Management in STANAG 5066 Networks	Updated to reflect country address assignment and policy change.
O	HF Operator Chat	Extracted from Annex F. No significant change.
P	ACP 127 & Character-Oriented Serial Stream	Extracted from Annex F. No significant change.
Q	ACP 142	Extracted from Annex F. Description changed (no protocol change) to support MULE as well as STANAG 4406 Annex E.
R	Routing Sublayer	New optional sublayer
S	SIS Access Protocol	Extracted from Annexes A and F. No significant change.
T	STANAG 5066 TRANSEC Crypto Sublayer using AES and other Protocols	New optional layer to provide alternate TRANSEC to Annex D.
U	IP Client	Extracted from Annex F. Added IPv6 support.
V	Compressed File Transfer Protocol	Extracted from Annex F. No significant change.

**Table 3: Changes to Annexes**