NATO STANDARD

AComP-5634

IP ACCESS TO HALF-DUPLEX RADIO NETWORKS

Edition A Version 1
DECEMBER 2022

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NATO LETTER OF PROMULGATION

19 December 2022

1. The enclosed Allied Communication Engineering Publication AComP-5634, Edition A, Version 1, IP ACCESS TO HALF-DUPLEX RADIO NETWORKS, which has been approved by the nations in the Consultation, Command, and Control Board (C3B), is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 5634.

2. AComP-5634, Edition A, Version 1, is effective upon receipt.

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4. This publication shall be handled in accordance with C-M(2002)60.

Dimitrios SIGOULAKIS
Major General, GRC (A)
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
FRA	France only uses RTP-HE protocol and does not plan to use VARC protocol described at paragraph 1.7 of AComP-5634

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

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CHAPTER 1 INTRODUCTION

1.1 OVERVIEW

This standard, hereafter referred to as IOP-HD, provides a waveform-agnostic interoperability specification for the interconnection of IP networks of one nation to half-duplex radio networks of another nation.

The document includes the complete specifications for the IOP-HD interface:

- Physical, data link, network layer and transport layer specification
- Service admission control, identification and mapping for voice and data
- Half-duplex radio control for voice (push-to-talk functionality)

The standard describes profiles and parameters to be used for access to radio services from IP based networks. The IOP-HD specifications are based on existing STANAGs and other international standards where applicable, in addition to using Federated Mission Network (FMN Spiral 2) specifications for guidance

Edition 1 of this STANAG provides interoperability specifications for IPv4 only. IPv6 will be included in later editions.

1.2 CONCEPT OF EMPLOYMENT

1.2.1 Background and requirements

STANAG 5634 is a response to requirements identified in the following documents:

- TN1246: “Wireless Communications Architecture (LAND): Scenarios, Requirements and Operatinal View” revision 1, 2012 (NR) [15]
- TN1247: “Wireless Communications Architecture (Land): Systems Views”, Revision 1, 2012 (NR) [16]
- STANAG 4448: “Technical Standards for Non-Secure Voice Interoperability of Very High Frequency (VHF) Combat Net Radios (CNR) by use of Common Interface Adapter Devices”, Edition 1, 2005 [17] (now cancelled)
- STANAG 4449: Voice and Data Interface Between Secure VHF EPM Combat Net Radios”, Edition 1, 2005 [18] (now cancelled)

While the two decommissioned STANAGs met the requirement for back-to-back interoperability, the TN1246/TN1247 develop Requirements and System views based on analysis of NATO operations. These documents have been through NC3 bodies for endorsement as descriptional for the situation in the wireless tactical Land domain.

The need for this interoperabilty point arise when military units of different nations require interoperability that cannot be achieved directly over-the-air. Such situations may be pre-planned for a military mission or solely ad hoc based on immediate requirements between units with adjacent areas of interest, short term cooperation in a Task Forces/Battle Group or otherwise where the need to exchange data is needed, but not possible, other than via a wired interface.

STANAGs 4448 [17] (see Figure 1) and STANAG [18] (see Figure 2) used analogue interface cabling or fibre multiplexing via a separate Radio Adapter to meet the requirement for voice and in the latter case data.

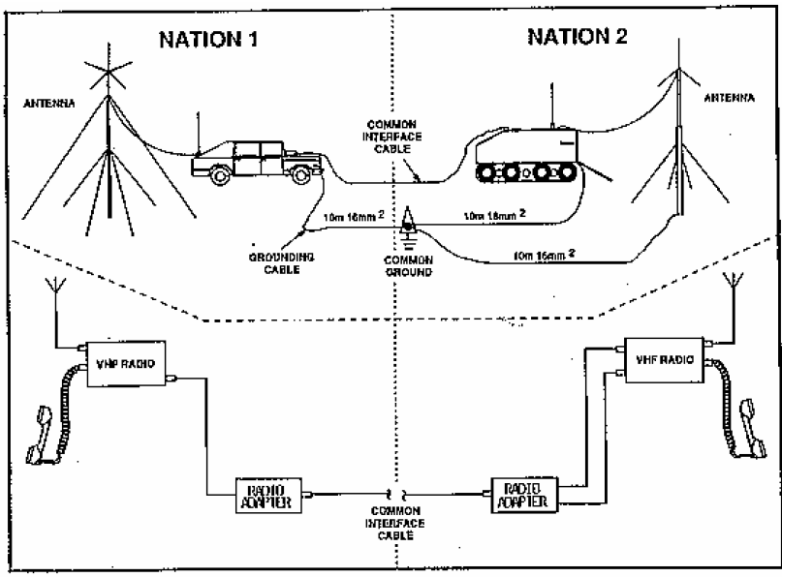

Figure 1: Interoperability use case from STANAG 4448 [17] – using analogue cabling to provide non-secure voice interoperability

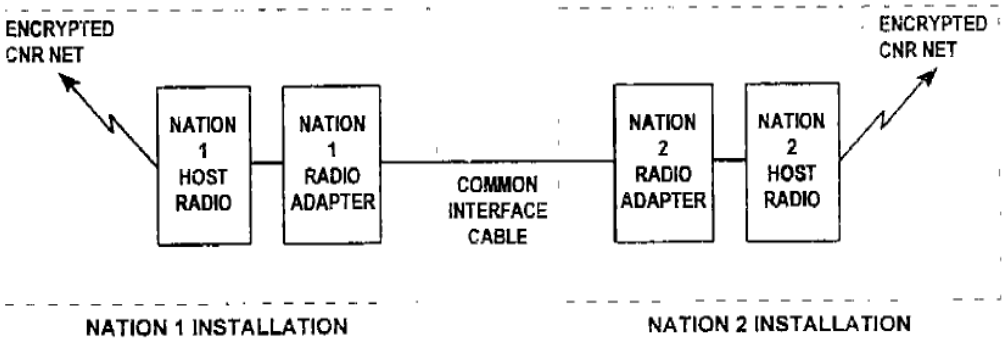

Figure 2: The system drawing for back-to-back secure interoperability in STANAG 4449 [18]

Over the last years back-to-back interoperability has been used to create Command and Control as decribed above. However – each situation required either complex networking equipment or special cables to be made to match the involved radios. Using STANAG 5634, ad hoc or planned operability can be achieved at limited cost and with minium configuration effort.

Technical Note 1246 [15] analyzes a NATO coalition operation at tactical Land level. The document identifies the typical border between wireless and wired systems to be at the Battalion to Brigade level as depicted in Figure 3.

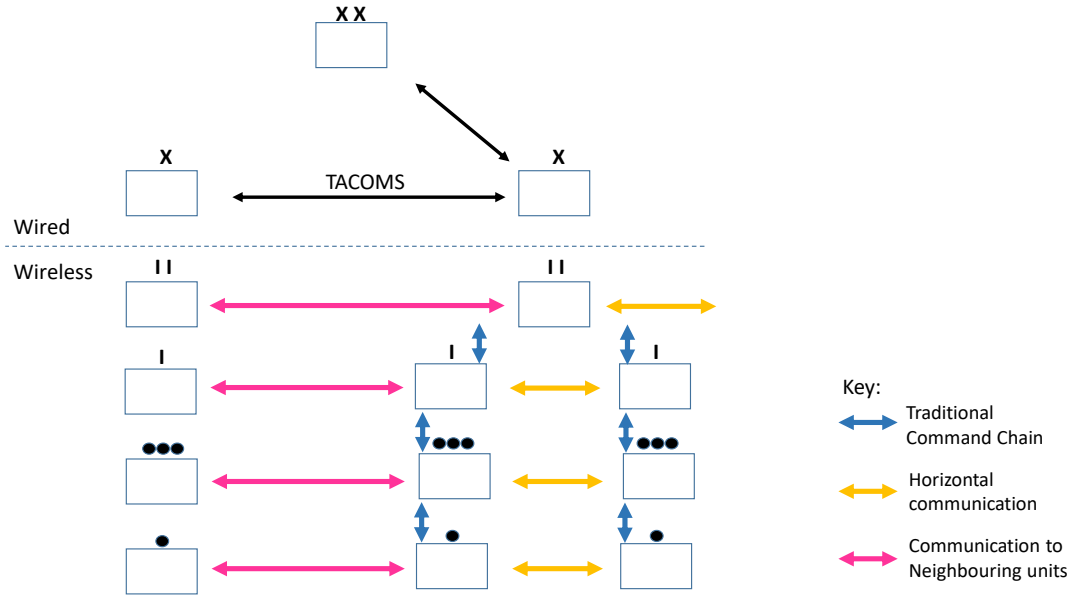

Figure 3: Required operational wireless connectivity

The TN also describes an increased requirement for horizontal communications at this same lower echelon level. Below the Brigade HQ there is a stated operational requirement to support increased communication horizontally and outside the conventional command structure if required.

Multi national forces may have a granularity of national force contributions at the same level of brigade and below. This is further described in TN1247 [16]. The consequence for interoperability between nations is to either use direct wireless interoperability or interoperability via a wired interface. The wired interface may be a tactical wired national or coalition network or a direct back-to-back connection between radios.

Technical Note 1247 [16] defines NATO Wireless tactical communications Maturity Levels as in Table 1. NATO Maturity Level 2 (NML-2) is defined as the ability to connect wireless radios back-to-back using wired standards. While TACOMS identified the interoperability point between wired and wireless systems, the specification was never defined. This STANAG will describe such an interface when IP based protocols are used at the Interoperability Point.

Table 1 NATO Wireless communications maturity levels

NML-1	NML-2	NML-3	NML-4	NML-5
No electronic communicatinos interface. Information is passed manually, swivel chair interface.	Wired interface using TACOMS standards for back to back radio. Implication is that one national radio has to be installed on another's platform and configuration has to be preplanned.	Basic wireless interfaceprovided at selected wireless interoperability points (WIoP). WIoP may be simple point to point link or netted. Use of NBWFs in HF, VHF and/or UHF bands. Includes RBCI	SIOP capable of MANET operation and includes wideband capability. Common waveforms more widespread.	Ubiquitous use of common waveforms. Interaction between nations can be truly ad hoc.

In TN1247 [16] the force structure is depicted using incompatible radios, but still having a need for communications. The NATO Maturity Level -2 (NML-2) interoperability would before this STANAG require specific interface solutions for any pair of radios. If only two nations, A and B, are involved, then only one solution is needed. However, when more nations are involved the number of specific interfaces needed to provide interoperability increases exponentially as the existing A-B solution is no help when communicating with C.

This STANAG 5634 represents a single common solution for the described operational interoperability requirements. It also provides means for routing of data to avoid unnecessary data flows in connected networks, as well as features to optimize the service levels between different radio systems/waveforms.

STANAG 5634 assumes the radio and the wired side to support the Internet Protocol (IP). This approach allows radios to be placed close to each other – or to be seperated by a tactical IP-based network, national or coalition. The approach also allows wired subscribers in a tactical national or coalition network to communicate with users in the connected radio network using a stanadrdized interface. This is a huge improvement especially on the wired networking side, as routers and interfaces can be established in a standardized way – not thinking about the nature of different radios or waveforms.

While representing a great help to the national and coalition network operators configuring the networks, STANAG 5634 also motivates radio manufacturers to provide one standard interface to the wired infrastructure.

Providing the STANAG5634 interface at the wired side will ensure interoperability as long as services are provided in the radio network. The radio will allow or dismiss services outside its capabilites.

1.2.2 Waveform Agnostic

The AComP-5634 promotes a waveform agnostic interoperability specification for the interconnection of IP networks of one nation to half-duplex radio networks of another nation.

The standard includes a description of functions needed in order to adapt to specific waveforms (and respective characteristics for the radio and associated air-interface).

The mapping of services and information from STANAG5634 to the waveform – and vice versa – is the responsibility of the radio – eventually the standardization body writing and defining the

waveform. The interface assumes the operational procedures and user/network operators to ensure that only systems at the same/allowed security level are connected.

This STANAG facilitate a standard for interconnection of radios using different – or similar – waveforms, via a wired interface using the Internet Protocol, this being a network like the Federated Mission Network (FMN), a national tactical communications network or radios directly connected back-to-back.

1.2.3 Implementation Agnostic

The AComP-5634 does not promote any specific requirements for implementation of the standard, whether to be HW or SW integrated into one physical radio transceiver, or being implemented as an external adapter or interface box as it was defined in STANAG4449 [18].

1.3 IOP-HD INTERFACE DEFINITION

1. This standard defines AComP-5634: IP access to Half Duplex Radio Networks – IOP-HD
2. The AComP-5634 “IP access to Half Duplex Radio networks”, IOP-HD, is the wired interface between a half-duplex radio network of one nation and an IP network of a different nation.
3. The IOP-HD may also be used between back-to-back (IP) connected radio networks of different nations.
4. Applicable interface types are represented in figure Figure 4.

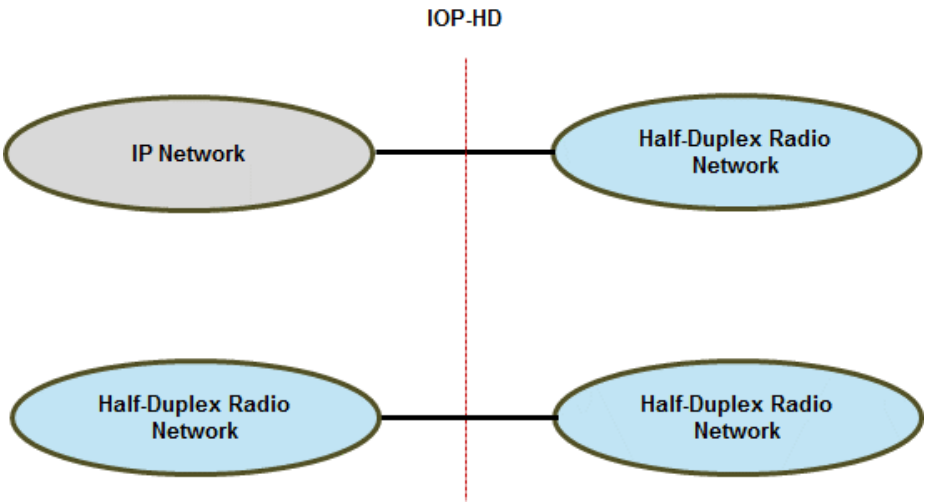

Figure 4: AComP-5634 – IP Access to Half-Duplex Radio Networks – IOP-HD

5. The IOP-HD interface enables efficient use of the half-duplex radio network from an external IP network or another radio network. IOP-HD ensures IP access for any nation to a radio network of another nation with services provided by the specific waveform in use.

1.4 RADIO MODEL

1. The definition of IOP-HD assumes a (layer 3) Radio Model, depicted in Figure 5.

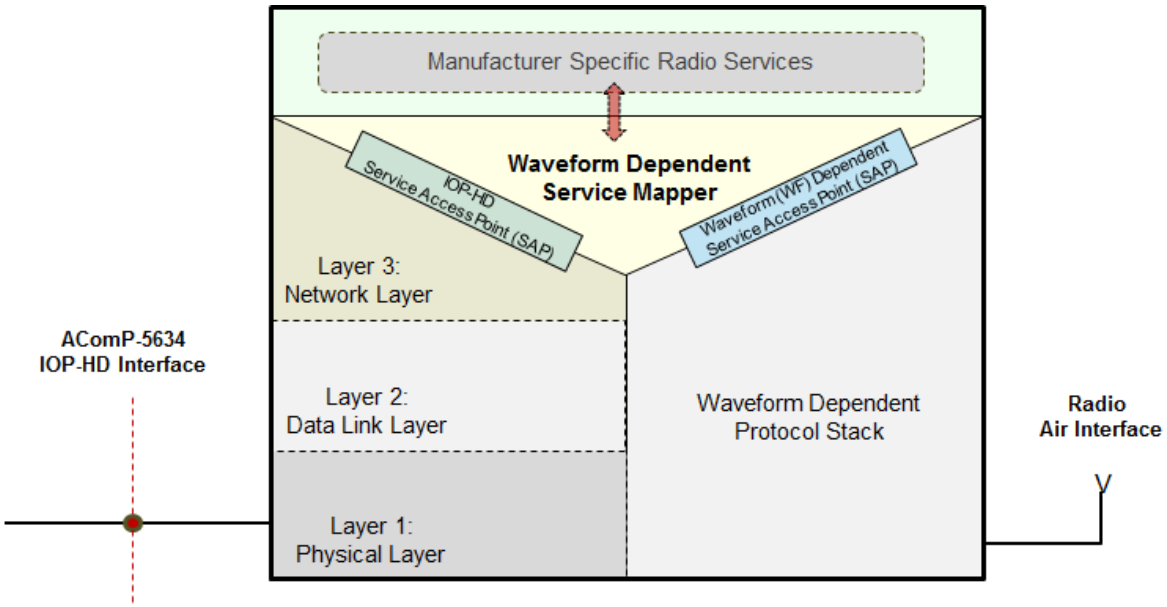

Figure 5: AComP-5634 Radio Model

2. All information received at the IP-HD interface will be processed according a to a specific set of functions that enables service interoperability between an IP network and a radio network:

   - Service admission control
   - Service identification
   - Service mapping between the IOP-HD interface and the radio air interface

   The exact implementation of associated radio functionality – based on the radio model – will be national concern.

3. The functions needed to properly map services from the IOP-HD network interface to a radio network and vice versa is defined in Annex J : “IOP-HD Interface Base Standard –Service Admission Control, Identification and Mapping between the IP Network Interface and Radio Network”

4. The Radio Model does not require all functions to be in one physical entity. The IOP-HD service admission control, identification and service mapper, in whole or parts, may be external to the tranceiver.

1.5 IOP-HD SCENARIOS

1. The IOP-HD interface is applicable to various system scenarios and network connections, including wired IP network interface, transit networking and back-to-back connections between radio networks, as illustrated in the Figure 6 to Figure 11.

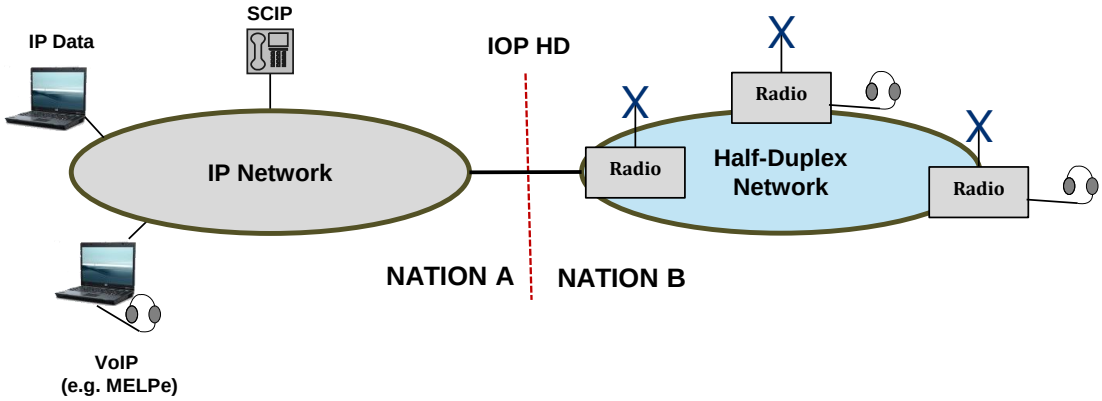

Figure 6: IOP-HD: Wired IP Network Interface

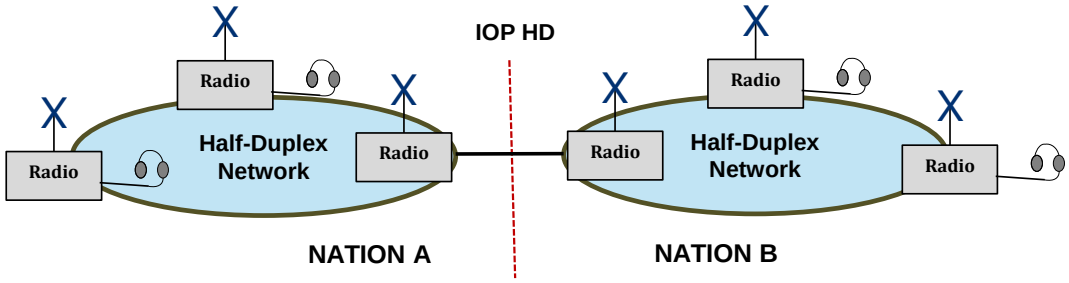

Figure 7: IOP-HD: Back-to-Back (IP) Connected Radio Networks

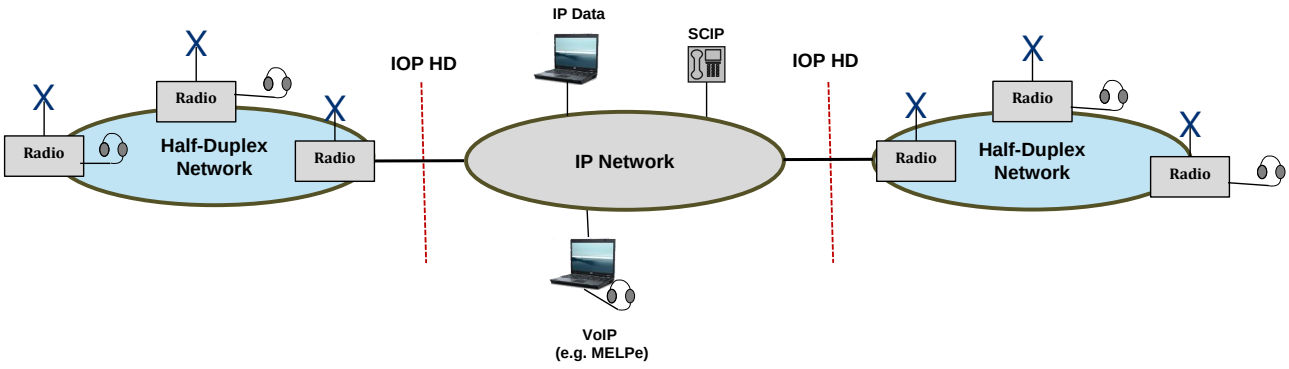

Figure 8: IOP-HD: IP Network as Transit Network Between Radio Networks

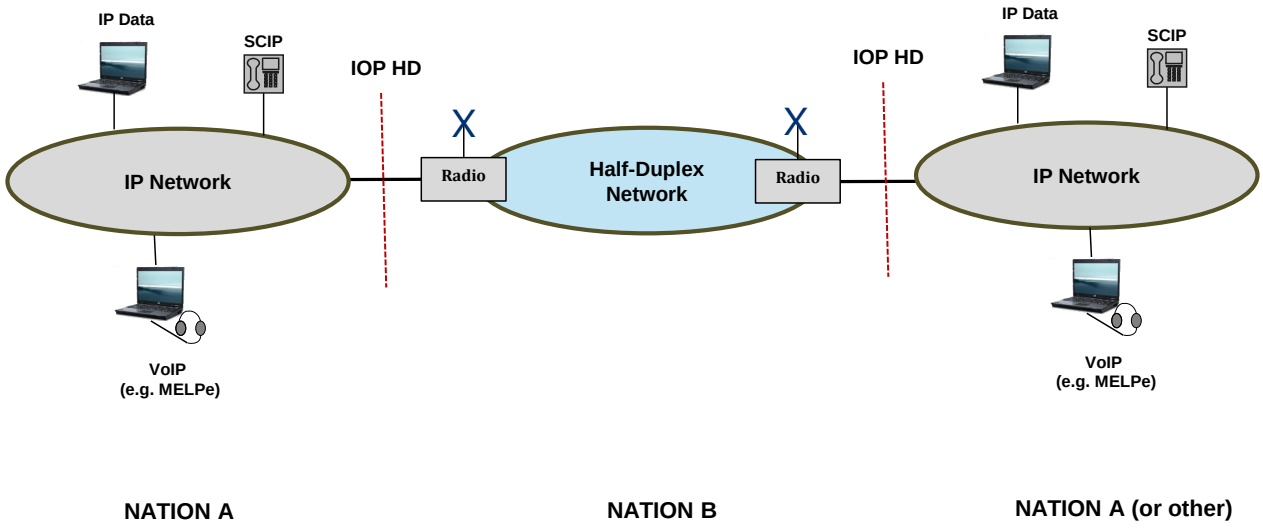

Figure 9: IOP-HD: Radio Network as Transit Network Between IP Networks

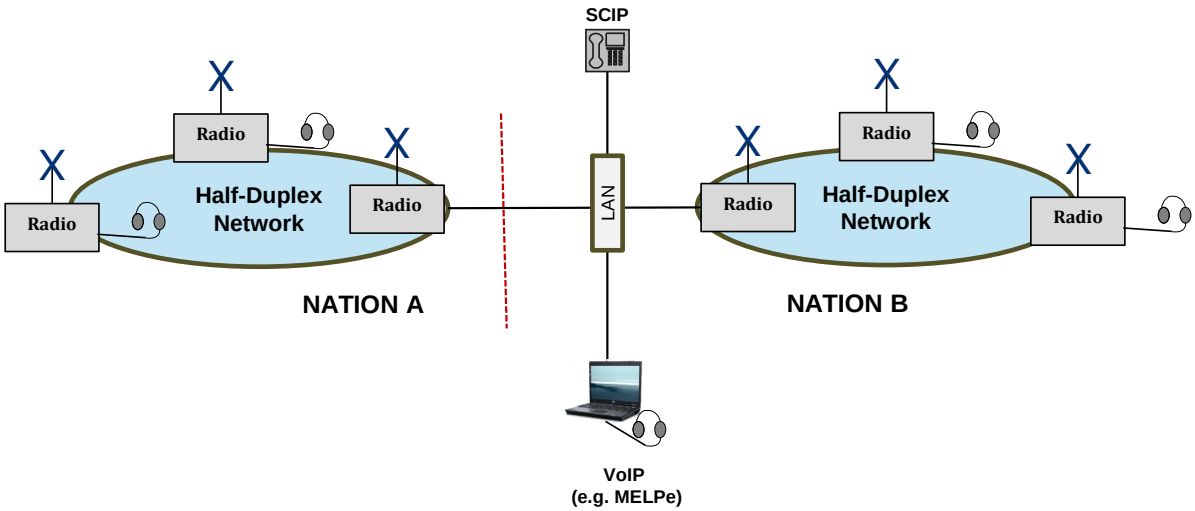

Figure 10: IOP-HD: Radio Network LAN Network Connection

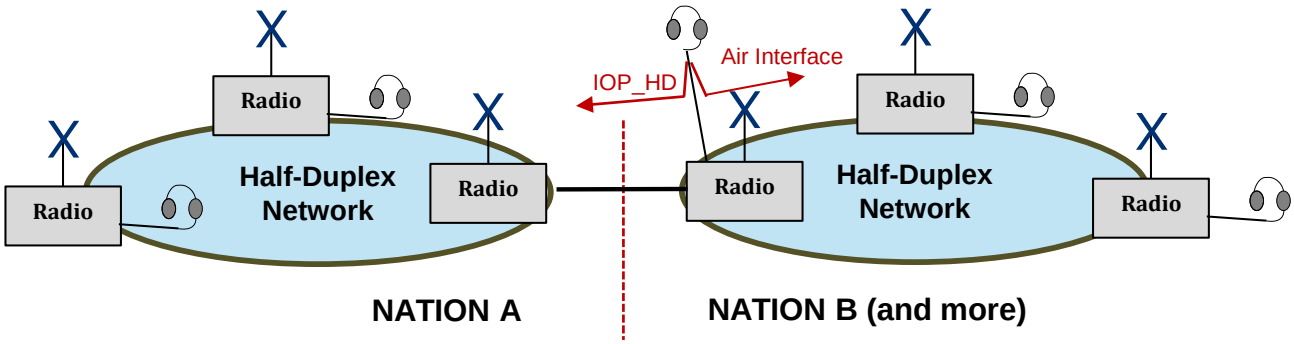

Figure 11: IOP-HD: Local Radio Operator

Note Figure 11: Scenario may affect Service Mapper functionality, not the IOP-HD interface, as traffic generated locally on the radio.

1.6 SERVICES PROVIDED

1. The IOP-HD interface enables IP hosts and routers in the wired network to access the half-duplex radio network.

2. The available services over the radio network are determined by the waveform in use.

3. The radio side of IOP-HD performs admission control, identification and service mapping in accordance with the specific waveform services. The details are described in Annex I.

4. Edition 1 of this AComP specifies the following services:

    a. Real-Time Voice Push-To-Talk (PTT) Services between an IP network and a half-duplex radio network
    b. IP-data forwarding services between
        i. an IP network and a half-duplex radio network
        ii. between two radio networks connected back-to-back on their wired side

1.7 PROTOCOL MODEL

1. The IOP-HD protocol stack (Edition 1) is shown in Figure 12:

Characteristics / Protocols			Base Standards
Upper Layers (4+)		RTP RTP-HE	RTP: STANAG 4644 / AComP-5634 RTP-HE: RFC 3550 / AComP-5634
Layer 4 Protocols			
Transport Layer		UDP, TCP	UDP: STANAG 4644 TCP: STANAG 4644
Layer 3 Protocols			
Network Layer	Forwarding	IPv4, IGMP, ICMP, ARP	IPv4: STANAG 4644 IP QoS: STANAG 4711 ICMP: STANAG 4644 IGMP: RFC 3376 ARP: STANAG 4644
	Routing	Static, Dynamic OSPFv2, BGP-4 RIPv2	STANAG 4647 STANAG 4644 RFC 2453
Layer 2 Protocols			
Data Link Layer	Ethernet	LLC	STANAG 4640
		MAC	STANAG 4640
	Serial	PPP	RFC 1661 (RFC 1662)
Layer 1 Protocols			
Physical Layer	Ethernet	Twisted Pair	STANAG 4640
	Serial	-	STANAG 5066 (EIA-232D/423 or EIA-422)

Figure 12: Protocol Model for the IOP-HD Interface

2. Selection of reference standards are based on the following:
    a. Existing STANAGs: TACOMS series 4639-4647 (TACOMS Phase 1)
    b. Emerging STANAGs: STANAG 4711
    c. Federated Mission Networking: FMN Spiral 3
    d. Applicable RFC series of standards

3. The physical layers for the Ethernet based interface is defined in STANAG 4640, Annex A, ref. [1].

4. The physical layer for the serial (V.11 synchronous serial) interface is defined in the standard ITU-T, V.11, ref [4], with the added system prerequisites given in STANAG 5067, Annex A (A-3), ref [6]: “If the interconnection is via a synchronous serial link interconnection then the pair of DCEs and the interconnection between them are a national responsibility.” (The serial interface is a national concern and the physical layer must be agreed between nation if used)

5. Protocols for the data link layers are defined in STANAG 4640, Annex B, ref [1].

6. For the network layer, protocols for routing are defined herein. For the IOP-HD Edition 1 static routing shall be supported. Dynamic routing may also be supported. Specifications for routing are based on STANAG 4644 Annex A, ref [2].

7. AComp-5634 will facilitate for the use of dynamic routing protocols.

    a. The following dynamic routing protocols are specified in STANAG 4644, Annex C, ref [2]:
        i. The OSPFv2 and BGP-4 routing protocol
    b. In addition, the following candidate dynamic routing protocol is specified in RFC 2453, ref [13]:
        i. The RIP Version 2 protocol

8. The IP protocol suite is as specified in STANAG 4644, Annexes D, E and F, ref [2], with the addition of:

    a. Other protocols that are needed:
        i. ICMP and ARP

9. The IGMP protocol is specified in RFC3376, ref [11]
    a. Protocol: IGMPv3

10. The IP QoS standard shall be STANAG 4711, ref [7]), with an additional option specified in STANAG 4644, ref [7]: RFC2474

11. The IOP-HD transport layer protocols (UDP and TCP) are defined in STANAG 4644 Annex F, ref [2].

12. Upper layer protocols for (voice) services are defined as follows:

a. The RTP protocol: STANAG 4644 Annex F, ref [2] and AComP-5634 Annex E (this document)
b. The RTP-HE protocol: AComP-5634 Annex G (this document)

13. Upper layer protocols for control of a half-duplex transmission environment across an IP network are defined as follows:
    a. Voice Activated Radio Control (VARC) based PTT function: AComP-5634, Annex F (this document)
    b. RTP-HE based PTT signaling: AComP-5634, Annex G (this document)

14. A half-duplex radio network conforming to this standard should be able to simultaneously handle both defined options for half-duplex control across the IOP-HD interface:
    a. RTP-HE based half-duplex control
    b. VARC based half-duplex control

15. In the event that the radio is the initiating party for voice streaming (Squelch state), the radio shall use the half-duplex control as specified for the particular profile (VARC/RTP-HE Protocol) for streaming voice to the IP network connection.

NOTE! *Edition 1 does not comprise session initiation protocol (SIP) or similar to create and terminate communications sessions between multiple endpoints on IP networks, including determination of for instance type of codec used for the voice service.*

1.8 AComP-5634 DOCUMENT STRUCTURE

1. AComP-5634 is separated into annexes that specifies the requirements for interoperability over the IOP-HD. The specifications can be divided into three main categories:

    a. IOP-HD interface characteristics: Interface protocol stack and layered IP/Ethernet or synchronous serial-based protocols; and

    b. Dedicated protocols for half-duplex control across IP/Ethernet or IP/serial-based networks

    c. Radio functions for service admission control, identification and mapping between the IP network and the radio network

2. The different AComP-5634 annexes are:
    a. Interface Characteristics:
        i. ANNEX C: NSPICS IOP-HD Interface
        ii. ANNEX D: NPICS IOP-HD Interface: General Characteristics
    b. Dedicated Protocols
        i. ANNEX E: Base Standard (BS) for IOP-HD: VARC (Voice Activated Radio Control)
        ii. ANNEX F: NPICS for IOP-HD: VARC
        iii. ANNEX G: Base Standard (BS) for IOP-HD: RTP-HE Based Half-Duplex Protocol
        iv. ANNEX H: NPICS for IOP-HD: RTP-HE Based Half-Duplex Protocol
    c. Radio Functions (Service Support)

   i. ANNEX I: Base Standard for IOP-HD: Service Admission control, Identification and Mapping
   ii. ANNEX J: NPICS for IOP-HD: Service Admission control, Identification and Mapping
d. Example Base Profile
   i. ANNEX K: Example Base Profile for an AComP-5634 Compliant Half-Duplex Radio

5. In addition, the standard contains guidance and informative annexes to navigation towards standard compliance and understanding:
   a. ANNEX A: Abbreviations and Definitions
   b. ANNEX B: Guidance for NSPICS/NPICS Completion

1.9 RELATED DOCUMENTS AND REFERENCES

1. AComP-5634 is complemented by the following documents (references) to provide the full IOP-HD protocol suite:

[1] STANAG 4640: TACOMS Lower Layer Specifications
[2] STANAG 4644: TACOMS Connectionless Network Protocols
[3] STANAG 4647: TACOMS Gateway Protocols
[4] ITU-T Recommendation V.11: Electrical Characteristics for Balanced Double-Current Interchange Circuits Operating at Data Signalling Rates up to 10 Mbit/s, 10/96
[5] RFC 1661: The Point-to-Point Protocol (PPP)
[6] STANAG 5067: “Interconnection of IPv4 Networks at Mission Secret and Unclassified Security Levels”, Edition 2
[7] STANAG 4711: “Interoperability Point Quality of Service (IOP QoS)”
[8] ISO/IEC 9646-1: “Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 1: General concepts”, 1994
[9] EUROCAE ED-137B: “Interoperaibility Standards for VoIP ATM Components, Volume 1: Radio”, July 2012
[10] RFC3376: “Internet Group Management Protocol, Version 3”
[11] SCIP-233.501: “Reference Module 501 – MELP(e) Voice Specification”
[12] RFC 2453: “RIP – Version 2”
[13] FMN Spiral 3 Specification (Proposed): “FMN Spiral 3 Service Instructions for Protected Core Commications”, 27 March 2018
[14] FMN Spiral 3 Specification (Proposed): “FMN Spiral 3 Service Instructions for Audio and Video-Based Colaboration”, 27 March 2018
[15] TN1246: “Wireless Communications Architecture (Land): Scenarios, Requirements and Operational View”, Revision 1, June 2012
[16] TN1247; “Wireless Communications Architecture (Land): Systems Views”, Revision 1, 2012
[17] STANAG 4448: “Technical Standards for Non-Secure Voice Interoperability of Very High Frequency (VHF) Combat Net Radios (CNR) by use of Common Interface Adapter Devices”, Edition 1, 2005 (now cancelled)
[18] STANAG 4449: “Voice and Data Interface Between Secure VHF EPM Combat Net Radios” (now cancelled)
[19] STANAG 5630: “Narrowband Waveform for VHF/UHF Radios”

2. Additional applicable civilian and military standards are listed in the Protocols Overview table of the NSPICS to which they apply.

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ANNEX A ABBREVIATIONS AND DEFINITIONS

A-1 ABBREVIATIONS

Abbreviation	Description
A/G	Air/Ground [EUROCAE]
ACOMP	Allied Communications Publication
ARP	Address Resolution Protocol
ATC	Air Traffic Control [EUROCAE]
BGP	Border Gateway Protocol
BS	Base Standard
CRSC	Contributing Source Identifier
CSVD	Continuous Variable Slope Delta modulation
DS	Differentiated Services
DSCP	Differentiated Services Code Point
DTX	Discontinuous Transmission
ENAP	External Network Access point [TACOMS]
FCT	Forced Continuous Transmission
GPS	Global Positioning System
GRS	Ground Radio Station [EUROCAE]
ICMP	Internet Control Message Protocol
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IETF	Internet Engineering Task Force
IGMP	Internet Group Management Protocol
IOP	International Interoperability Point
IOP-HD	International Interoperability Point – Half-Duplex
IP	Internet Protocol

IPv4	IP version 4
ISO	International Orgaization for Standardization
ITU	International Telecommunication Union
ITU-R	International Telecommunication Union – Radiocommunication Sector
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
LAN	Local Area Network
LLC	Link Layer Control
MC	Multicast
NNEC	NATO Network Enabled Capability
NPICS	NATO Protocol Implementation Conformance Specification
NPRL	NSPICS Requirement List
NSP	Network Service Provider
NSPICS	NATO ISO Standardised Profile Implementation Conformance Statement
OSI	Open System Interconnected
OSPF	Open Shortest Path First
PHY	Physical layer
PICS	Protocol Implementation Conformance Statement
PPP	Point-to-Point Protocol
PT	Payload Type
PTT	Push-to-Talk
QoS	Quality of Service
R2S	RTP Supervision Session (Keep Alive Message) [EUROCAE]
RFC	Request for Comment
RTP	Real-time Transport Protocol
RTP-HE	Real-time Transport Protocol Header Extension
R2S	Realtime Session Supervision Protocol [EUROCAE]
SCIP	Secure Communications Interoperability Protocol

SDP	Session Description Protocol
SIP	Session Initiation Protocol
STANAG	NATO Standardization Agreement
TACOMS	Tactical Area Communications (set of STANAGs)
TCP	Transmission Control Protocol
ToS	Type of Service
TSVCIS	Tactical Secure Voice Cryptographic Interoperability Specification
UDP	User Datagram Protocol
UHF	Ultra High Frequency
VARC	Voice Activated Radio Control protocol
VCS	Voice Communication System [EUROCAE]
VHF	Very High Frequency
WAN	Wide Area Network

A-2 DEFINITIONS

NPICS	For a NATO standard, the NPICS corresponds to the Protocol Implementation Conformance Statement (PICS) defined in ISO/IEC 9646-1 for an International Standard.
NPICS Proforma	NATO Protocol Implementation Conformance Statement. NPICS proforma is used to issue a statement of conformance to high-level requirements in the AComP. Compliance with a particular requirement in this NPICS indicates compliance with all associated mandatory detailed AComP requirements.
NPRL	NSPICS Requirement List - The NPRL sections in the NSPICS present only those items that differ in status from the base standard or those items that are not included in a NPICS or base standard.
NSPICS	NATO ISO Standardised Profile Implementation Conformance Statement. NSPICS proforma is used to issue a statement of conformance to base standards used in the AComP. Compliance to a particular base standard in the NSPICS indicates compliance with the listed base standard. The AComP may list specific requirements or deviations from the listed base standard (separate NPRL - NATO Profile Requirement List for each base standard).
SQUELCH	Function to mute audio when signal levels are low/noise

ANNEX B GUIDANCE FOR NSPICS/NPICS COMPLETION

B-1 INTRODUCTION

1. For an implementation claimed to conform to AComPs, the NATO Protocol Implementation Conformance Statement (NPICS) and NATO Standardised Profile Implementation Conformance Statement (NSPICS) proformas shall be completed.
2. Definitions of NPICS and NSPICS are given in Annex A of this document.
3. For a NATO standard, the NPICS corresponds to the Protocol Implementation Conformance Statement (PICS) defined in ISO/IEC 9646-1, ref [8] for an International Standard. The term NPICS is used to avoid confusion where the requirements for NPICS and PICS differ.
4. A completed NPICS proforma is the NPICS for the implementation in question.
5. The implementation of the NSPICS proforma shall follow the same rules as for the NPICS.
6. 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:
   a. by a protocol tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation;
   b. by the protocol implementer, as a check-list to reduce the risk of failure to conform to the standard through oversight;
   c. 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; and
   d. by the user - or potential user - of the implementation, as a basis for initially checking the possibility of interworking with another implementation (while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible NPICSs).
7. All material in the base standard is considered mandatory unless another status is specifically indicated in this NPICS Proforma.

B-2 ABBREVIATIONS AND SPECIAL SYMBOLS

B.2.1 Status Symbols

1. M mandatory
2. O optional
3. <n> optional; required to choose one (or more then one) of the group of options labelled by the same numeral <n> (1, 2, etc.); an example is shown in Table B-1;
4. X prohibited
5. <pred>: conditional-item symbol, including predicate identification, see B.3.4

6. ¬ logical negation, applied to a conditional item's predicate see B.3.4.2

7. Table B-1 reports a dummy example. The optional fields marked as “O.1” represent the list of possible values that the quantity “Information transfer rate” can assume: the implementer must choose one of them to support the requirement.

Table B-1: Example Optional Field

Item	Protocol Feature	Reference	Status	Support
	Are the system’s bearer service attributes and values defined for information transfer mode:			
EITM.1	Circuit?	C.3.1.2.	M	Yes [ ]
	Are the system’s bearer service attributes and values defined for information transfer rate:			
EITR16	16 kb/s?	C.3.1.2.	O.1	Yes [ ] No [ ]
EITR32.1	32 kb/s?	C.3.1.2.	O.1	Yes [ ] No [ ]
EITR32.2	32kb/s with 2 time slots?	C.3.1.2.	O.1	Yes [ ] No [ ]
EITR48	48 kb/s with 3 time slots?	C.3.1.2.	O.1	Yes [ ] No [ ]
EITR64.1	64 kb/s with 2 time slots?	C.3.1.2.	O.1	Yes [ ] No [ ]

O.1: Support for at least one of these options is required

B.2.2 Item References

1. 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 sequence (in capitals).

B.2.3 Base Standard References

1. The AComP standard is partly based on existing civilian or military standards. However, these standards are described for use in generic systems. When an existing standard is adopted, the base standard includes only a reference to the existing standard.
2. The standards include a number of options and parameters to be selected. For each standard, a table describing which parameter is optional or mandatory is provided. This table is defined as the PICS proforma.
3. When an existing standard is adopted, including a PICS proforma fully applicable to an already existing standard, a specific AComP PICS proforma is not defined and only the link to the existing PICS is given. Otherwise, a specific AComP PICS proforma is defined.

B.3 INSTRUCTIONS FOR COMPLETING THE NPICS PROFORMA

B.3.1 General Structure of the NPICS Proforma

1. In general, the PICS proformas are organised as follows:

a. Identification;

b. Protocol Summary;

c. Implementation; and

d. References.

2. 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.

3. 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. In this case, all relevant choices are to be marked.

4. 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 the AComP, according to B.2.3 above. The remaining columns record the status of the item, i.e., whether support is mandatory, optional, prohibited, or conditional. In the conditional case, space is provided for the answers (see Section B.3.4).

5. A supplier may provide, or be required to provide, further information, categorised as either Additional Information or Exception Information. In this case, the 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 unambiguous identification for the item (e.g., a numeral); there are no other restrictions on its format and presentation.

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

7. 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, for presentation clarity, the supplier may provide more than one NPICS, each covering some subset of the implementation's configuration capabilities.

B.3.2 Additional Information

1. Items of Additional Information allow a supplier to provide additional information intended to assist in 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. An example is an outline of the ways in which a single implementation can be set up to operate in a variety of environments and configurations. Another example is a brief rationale (based perhaps upon specific application needs) for the exclusion of features, which, although optional, are nonetheless present in typical implementations of this protocol.

2. 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.

B.3.3 Exception Information

1. 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 case. Instead, the supplier shall write the answer in 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.

2. An implementation for which an Exception item is required does not conform to the AComP.

3. The situation described above may arise when a defect in the standard has been reported and the correction is expected to change the requirement not met by the implementation.

B.3.4 Conditional Status

B.3.4.1 Conditional Items

1. 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.

2. 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.

3. 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.

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

5. If the value of the predicate in any line of a conditional item is true (see B.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.

B.3.4.2 Predicates

1. A predicate is one of the following:

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

   b. predicate name for a predicate defined elsewhere in the NPICS proforma item. The definition for a predicate name is a Boolean expression constructed by combining simple predicates, 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; 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.

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

3. A dummy example is given in the following Table B-2.

Table B-2: Example of Use of "predicate"

Item	Protocol Feature	Reference	Status	Support
*DSTI4	Does the implementation provide one or more PRA interfaces?	B.2.4	O	Yes [ ] No [ ]
DSTI5	Is the PRA implementation compliant with ETS 300011?	B.2.4	DSTI4:M	N/A [ ] Yes[ ]

B.4 IDENTIFICATION

1. The AComP NPICS reference and its corresponding protocol are identified in table form as shown in the following two sections.

B.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: Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.

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

B.4.2 Protocol Identification

Identification of protocol, specification	AComP on INTERFACES
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 implementations does not confirm to the AComP	No [ ] Yes [ ]

Date of Statement	

ANNEX C NSPICS FOR THE IOP-HD INTERFACE

C.1 INTRODUCTION

1. Guidance, notations and instructions for the completing of NSPICS proforma can be found in Annex B of the AComP-5634 (this AComP).

C.2 NSPICS

1. The Protocols Overview section of this NSPICS lists the applicable base standards.
2. The NATO Profile Requirements List (NPRL) tables in this NSPICS present only those items that differ in status from the base standard or those items that are not included in a NPICS or base standard.
    a. See NSPICS definition in Annex A of this document

C.2.1 Identification of the Implementation and General Statement of Conformance

Implementation Details	
Nation/Supplier	
Implementation name/version	
System name (if different)	
Are all mandatory features implemented	Yes [ ] No [ ] (The answer No means that the Implementation does not conform to the AComP)
Date of statement	

C.2.2 Protocols Overview

Base Standard Features				Profile Features	
Item	**Protocol**	**Clause of Base Standard**	**Status**	**Status**	**Support**
IOP-HD-Phy1	Physical layer for metallic Ethernet	TACOMS standard for 10BASE-T and 100BASE-TX according to STANAG 4640 Annex A	-	M	Yes [ ]
IOP-HD-LL1	Link Layer Ethernet (LAN) Protocols	TACOMS standard for Ethernet (LAN) Protocols STANAG 4640 Annex B	-	M	Yes [ ]
IOP-HD-NL1	IP Static Routing	TACOMS standard for gateway protocols STANAG 4647 Annex A-1	-	M	Yes [ ]

Base Standard Features				Profile Features	
IOP-HD-NL2	Dynamic Routing	TACOMS standard for gateway protocols STANAG 4647 Annex A-1	-	O	Yes [ ] No [ ]
IOP-HD-NL3	Dynamic Routing – OSPFv2	TACOMS standard for connectionless network protocols STANAG 4644 Annex C-4	-	IOP-HD-NL2: M	N/A Yes [ ]
IOP-HD-NL4	Dynamic Routing – BGP4	TACOMS standard for connectionless network protocols STANAG 4644 Annex C-3	-	IOP-HD-NL2: O	N/A Yes [ ] No [ ]
IOP-HD-NL5	Dynamic Routing – RIPv2	RFC2453	-	IOP-HD-NL2: O	N/A Yes [ ] No [ ]
IOP-HD-NL6	IP Protocol Suite – IPv4, ICMP, ARP	TACOMS standard for connectionless network protocols STANAG 4644 Annex E-1 and E-2	-	M	Yes [ ]
IOP-HD-NL7	IP Protocol Suite – IGMP	RFC3376	-	M	Yes [ ]
IOP-HD-NL8	IP QoS	STANAG 4711 IP QoS	-	M	Yes [ ]
IOP-HD-NL9	IP QoS	Federated Mission Networking (FMN Spiral 3) standard for service instructions for protected core communications, IP QoS Profile	-	O	Yes [ ] No [ ]
IOP-HD-NL10	IP QoS	RFC2474	-	IOP-HD-NL9: M	N/A Yes [ ]
IOP-HD-TL1	IP Access Protocols – UDP	TACOMS standards for IP real-time data protocols STANAG 4644 Annex F-1	-	M	Yes [ ]
IOP-HD-TL2	IP Access Protocols – TCP	TACOMS standards for IP real-time data protocols STANAG 4644 Annex F-1	-	M	Yes [ ]
IOP-HD-UL1	IP Access Protocols – RTP	TACOMS standards for IP real-time data protocols STANAG 4644 Annex F-1	-	M	Yes [ ]
IOP-HD-HD1	IP Access Protocols – RTP-HE	EUROCAE Interoperability Standards for VOIP ATM Components, Volume 1: Radio	-	O	Yes [ ] No [ ]
IOP-HD-HD2	IP Network Half-Duplex Control Protocol	EUROCAE Interoperability Standards for VOIP ATM Components, Volume 1: Radio	-	IOP-HD-HD1: M	N/A Yes [ ]
IOP-HD-HD3	IP Network Half-Duplex Control Protocol	AComP-5634 – IOP-HD Interface, VARC	-	M	Yes [ ]

Base Standard Features					Profile Features	
IOP-HD-HD4	IOP-HD interface Service Admission control, Identification, and Mapping	AComP-5634 – IOP-HD Interface, Service Admission control, Identification and Mapping	-		M	Yes [ ]

C.2.3 NPRL for the Physical Layer of the IOP-HD Interface

The IOP-HD Physical Layer is as specified in STANAG 4640 Annex A, ref [1].

The IOP-HD Physical Layer use the following profile defined in STANAG 4640 Annex A-1 as basis for own profile:.

- The NSPICS for TACOMS Interface Ex12 metallic Ethernet

The NPRL for the Physical Layer shall be as specified in STANAG 4640, Annex A-1, paragraph 2.6 (no deviations).

C.2.4 NPRL for the Data Link Layer of the IOP-HD Interface

The IOP-HD Data Link Layer is as specified in STANAG 4640 Annex B, ref [1].

The IOP-HD Data Link Layer use the following profile defined in STANAG 4640 Annex B-1 as basis for own profile:

- The NSPICS for applicable link layer protocols to TACOMS CSMA/CD Local Area Network (LAN)

The NPRL for the IOP-HD Data Link layer shall be based on STANAG 4640 Annex B-1 paragraph 2.2 “Protocols Overview”

1. Item refers to STANAG 4640 Annex B-1 paragraph 2.2 “Protocols Overview”

Base Standard Features				Profile Features	
Item	**Protocol**	**References**	**Status**	**Status**	**Support**
MAC	Medium Access Method	IEEE 802.3-2005 Clause 4 STANAG 4640-B-2	-	M	Yes [ ]
FRAtyp	Ethernet II Frame (type encoded)	IEEE 802.3-2005Clause 3.1.1, 3.2, 3.3 and 3.4. STANAG 4640-B-2	O.1	M	Yes [ ]
*FRAlen	Ethernet 802.3 (Length encoded)	IEEE 802.3-2005Clause 3.1.1, 3.2, 3.3 and 3.4. STANAG 4640-B-2	O.1	O	No [ ]
FRAs	MAC Frame Structure (SNAP format)	IEEE 802.3-2005 Clause 10	-	X	No [ ]
OUI	Universal addresses and protocol identifiers	IEEE 802.3-2005 Clause 9	-	M	No [ ]

Base Standard Features				Profile Features	
FLC	Flow Control at CSMA/CD networks	IEEE 802.3-2005 Annex 31A, 31B STANAG 4640-B-2	-	X	No [ ]
CAP	Capability Autosetting at CSMA/CD networks on twisted pair	IEEE 802.3-2005 Clause 28 STANAG 4640-B-2	-	X	No [ ]
*AUG	Autonegotiation for type 1000Base-X	IEEE 802.3-2005 Clause 37 STANAG 4640-B-2	-	X	No [ ]
*LAG	Link aggregation at CSMA/CD networks	IEEE 802.3-2005 Clause 43 STANAG 4640-B-2	-	X	No [ ]
LLC	Logical Link Control	IEEE 802.2-1998 Clauses 6 to 8 STANAG 4640-B-3	-	M	Yes [ ]
*BRG	Media Access Control Bridging	IEEE 802.1D-1998 Clauses 6, 7, 8, 10, and 12 STANAG 4640-B-4	-	X	No [ ]
*QoS	Quality of Service at CSMA/CD Networks	IEEE 802.1D-1998 Clauses 6 and 7 STANAG 4640-B-4	-	X	No [ ]
*V2B	Media Access Control Bridging of Ethernet V2.0 in LAN	IEEE 802.1H-1997 Clause 4.3 STANAG 4640-B-7	-	X	No [ ]
*VLAN	Virtual LAN at CSMA/CD networks	IEEE 802.1Q-1998 STANAG 4640-B-6	-	X	No [ ]
PAC	Port Based Access Control at CSMA/CD networks	IEEE 802.1X-2001 STANAG 4640-B-8	-	X	No [ ]

O.1 : One or more of the options must be supported

NPRLs as listed for each base standard in STANAG 4640 Annex B-1 shall apply for each Mandatory element in the IOP-HD profile.

C.2.5 NPRL for the Network Layer – Routing - of the IOP-HD Interface

The IOP-HD Network Layer – Routing - is as specified in STANAG 4647 Annex A, ref [3] – as part of TACOMS requirements for Ex12 Gateway Protocols.

In the event that Dynamic Routing will be supported, this is as specified in STANAG 4644 Annex C, ref [2].

- **IOP-HD: Routing**

The IOP-HD Network Layer - Routing - use the profile defined in STANAG 4647 Annex A-1, ref [3], as basis for own profile:

- The NSPICS for IP External Network Ethernet-Based Gateway Protocols

1. Item refers to STANAG 4647 Annex A-1 paragraph 2.2 “Protocols Overview”

Base Standard Features				Profile Features	
Item	**Protocol**	**References**	**Status**	**Status**	**Support**
Ex12-IPv4	IP Protocol Suite	STANAG 4644 E-1	-	M	Yes [ ]
Ex12-IP QoS	IP QoS	STANAG 4644 D-1	-	M	Yes [ ]
Ex12-IPRout	Dynamic Routing	STANAG 4644 C-1	-	O	Yes [ ] No [ ]
Ex12-Ether	Ethernet Protocols	STANAG 4640 B-1	-	M	Yes [ ]

Note:

For Routing it is only the following item that is applicable:

- Ex12-IPRout

The other listed items will be covered in requirements for the IP Protocol Suite:

- IP Protocol Suite
- IP QoS
- Ethernet Protocols

The NPRL for the IOP-HD Network Layer - Routing - shall be based on STANAG 4647 Annex A-1 paragraph 2.5 “NPRL for Routing”. Features related to dynamic routing assume that the profile feature Dynamic Routing is selected as part of protocol support.

1. Item refers to STANAG 4647 Annex A-1 paragraph 2.5

Base Standard Features				Profile Features	
Item	**Protocol**	**References**	**Status**	**Status**	**Support**
Ex12-IPRout-St	Support for static routing	Section 2, para 4	O	M	Yes [ ]
Ex12-IPRout-01	Border Gateway Protocol, interdomain routing (BGP-4)	Section 2, para 4.a	O	O	Yes [ ] No [ ]
Ex12-IPRout-02	Open Shortest Path First, intradomain routing (OSPFv2)	Section 2, para 4.b	O	Ex12-IPRout: M	N/A Yes [ ]

- **IOP-HD: Dynamic Routing**

The IOP-HD Network Layer – Dynamic Routing – use the profile defined in STANAG 4644 Annex C-1, ref [2], "Protocols Overview" as basis for own profile:

- The NSPICS for Routing

1. Item refers to STANAG 4644 Annex C-1 paragraph 2.2

Base Standard Features				Profile Features	
Item	**Protocol**	**Clause of Base Standard**	**Status**	**Status**	**Support**
*BGP4	Border Gateway Protocol, inter domain routing	IETF-RFC 4271	-	O	Yes [ ] No [ ]
*OSPF2	Open Shortest Path First, intradomain routing	IETF-RFC 2328	-	Ex12-IPRout: M	N/A Yes [ ]

The NPRL for the IOP-HD Network Layer – Dynamic Routing (OSPFv2 and BGP-4) shall be based on STANAG 4644 Annex C-1, paragraphs 2.4 (BGP-4) and 2.5 (OSPFv2).

There are no refinements of the base standard features contained in the NPICS and there are no additional requirements to specify.

2. Items refers to IETF RFC 2253

Base Standard Features				Profile Features	
Item	**Protocol**	**Clause of Base Standard**	**Status**	**Status**	**Support**
*RIPv2	RIPv2	IETF-RFC 2253	-	O	Yes [ ] No [ ]

C.2.6 NPRL for the Network Layer – IP Protocol Suite (IPv4, ICMP, ARP) - of the IOP-HD Interface

The IOP-HD Network Layer – IP Protocol Suite (IPv4, ICMP, ARP) – is as specified in STANAG 4644 Annexes E-1 and E-2, ref [2].

The IOP-HD IP protocol suite uses the following as basis for profile definition:

- NSPICS for IP Protocol Suite – Protocols Overview – as defined in STANAG 4644 Annex E-1
- NPRL for IPv4 General Characteristics as defined in STANAG 4644 Annex E-1
- NPICS for IPv4 Base Standard as defined in STANAG 4644 Annex E-2
- NPICS for Internet Control Message Protocol (ICMP) as defined in STANAG 4644 Annex E-2
- NPICS for Address Resolution Protocol (ARP) as defined in STANAG 4644 Annex E-2

1. Item refers to apply to STANAG 4644 Annex E-1 for IPv4 Protocol Suite - Protocols Overview

There are no refinements of the base standard features contained in the NSPICS and there are no additional requirements to specify

2. Item refers to STANAG 4644 Annex E-1 for IPv4 General Characteristics

Base Standard Features				Profile Features	
Item	**Protocol Feature**	**References**	**Status**	**Status**	**Support**
Ipv4 ToS	Type of Service Encoding	IETF-RFC 791	-	X	No [ ]
IPv4DSCP	Differentiated Services Code Point encoding	IETF-RFC 2474	-	O	Yes [ ] No [ ]

3. Item refers to STANAG 4644 Annex E-2 for IPv4 General Characteristics

Base Standard Features				Profile Features	
Item	**Protocol Feature**	**References**	**Status**	**Status**	**Support**
Ipv4Hdr	Internet Header Format	IETF-RFC 791	-	M	Yes [ ]
IPv4Adr	Addressing	IETF-RFC 791	-	M	Yes [ ]
IPv4Frg	Fragmentation and Reassembly	IETF-RFC 791	-	O	Yes [ ] No [ ]
IPv4Tro	Order of Transmission	IETF-RFC 791	-	M	Yes [ ]
IPv4ToS	Type of Service Encoding	IETF-RFC 791	-	X	No [ ]
IPv4DSCP	Differentiated Services Code Point encoding	IETF-RFC 2474	-	M	Yes [ ]

4. Item refers to STANAG 4644 Annex E-2 for Internet Control Message Protocol (ICMP)

5. Base Standard Features				**Profile Features**	
Item	**Protocol Feature**	**References**	**Status**	**Status**	**Support**
ICMP-Header	Standard format ICMP of data header (IP Protocol no=1)	IETF-RFC 792	M	M	Yes [ ]
ECMP-ER	Echo Reply Message (Code no=0)	IETF-RFC 792	O	M	Yes [ ]
ICMP-DU	Destination Unreachable Message (Code no=3)	IETF-RFC 792	O	M	Yes [ ]
ICMP-SQ	Source Quench Message (Code no=4)	IETF-RFC 792	O	X	No [ ]
ICMP-R	Redirect Message (Code no =5)	IETF-RFC 792	X	X	No [ ]
ICMP-E	Echo Message (Code no=8)	IETF-RFC 792	O	M	Yes [ ]
ICMP-TE	Time Exceeded Message (Code no=11)	IETF-RFC 792	M	O	Yes [ ] No [ ]
ICMP-PP	Parameter Problem Message Code (Code no = 12)	IETF-RFC 792	O	X	No [ ]
ICMP-TS	Timestamp Message (Code no=13)	IETF-RFC 792	X	X	No [ ]
ICMP-TSR	Timestamp Reply Message (Code no=14)	IETF-RFC 792	X	X	No [ ]
ICMP-IRq	Information Request Message (Code no=15)	IETF-RFC 792	O	X	No [ ]
ICMP-Irp	Information Reply Message (Code no=16)	IETF-RFC 792	O	X	No [ ]

5. Item refers toreferences refers to STANAG 4644 Annex E-2 for Address Resolution Protocol (ARP)

There are no refinements of the base standard features contained in the NPICS and there are no additional requirements to specify.

C.2.7 NPRL for the Network Layer – IP Protocol Suite (IGMP) - of the IOP-HD Interface

The Network Layer – IP Protocol Suite (IGMP) – is as specified in RFC3376, ref [10].

For the IGMP protocol, there are no refinements of the base standard features and there are no additional requirements to specify.

C.2.8 NPRL for the Network Layer – IP QoS - of the IOP-HD Interface

The IOP-HD network Layer – IP QoS – is as specified in STANAG 4711, ref [7].

There will be no refinements to the base standard definitions and no additional definitions to specify.

In the event of conformance to FMN support, and selection of QoS according to RFC2474, the following shall be adhered to:

The IOP-HD Network Layer – IP QoS– is as specified in STANAG 4644, Annex D, ref [2].

1. Item refers to the NSPICS Protocols Overview as defined in STANAG 4644 Annex D-2 for for IP QoS (section 2.2.):

Base Standard Features				Profile Features	
Item	**Protocol**	**References**	**Status**	**Status**	**Support**
IPQoS-01	TACOMS Standard for IP QoS	STANAG 4644-D3	M	O	Yes [ ] No [ ]
IPQoS-02	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers	RFC 2474	O	M	Yes [ ]
IPQoS-03	An Architecture for Differentiated Service	RFC2475	M	M	Yes [ ]
IPQoS-04	Assured Forwarding PHB Group	RFC2597	M	X	No [ ]
IPQoS-05	An Expedited Forwarding PHB	RFC 3246	M	O	Yes [ ] No [ ]
IPQoS-06	New Terminology and Clarifications for Diffserv	RFC 3260	M	M	Yes [ ]
IPQoS-07	An Informal Management Model for Diffserv Routers	RFC 3290	M	M	Yes [ ]

RFC 2475, RFC 3260 and RFC 3290 are informative with respect to the IOP-HD standard, and there will be no refinements to the base standard definitions and no additional definitions to specify.

Handling of IPQoS and the requirement of (potential) expedited forwarding will be handled by the radio Service Admission Control, Identification and Mapper function.

C.2.9 NPRL for the Transport Layer – IP Access Protocol (UDP) - of the IOP-HD Interface

The IOP-HD Transport Layer – UDP packet transmission– is as specified in STANAG 4644, Annex F-1, ref [2].

The IOP-HD IP protocol – UDP - use the following as basis for profile definition:

- NSPICS for NSP Real Time Data Protocols – Protocols Overview - as defined in STANAG 4644 Annex F-1

2. Item refers to the NSPICS Protocols Overview as defined in STANAG 4644 Annex F-1 for Real-Time Data Protocols (section 2.2.):

Base Standard Features				Profile Features	
Item	**Protocol**	**References**	**Status**	**Status**	**Support**
IPv4	Internet Protocol	STANAG 4644-E	M	M	Yes [ ]
IP QoS	TACOMS Connectionless Network Protocols – IP QoS	STANAG 4644-D	M	X	No [ ]
COTHC	TACOMS Connection Oriented Network Protocols – Connection Oriented Call Processing	STANAG 4643-B	M	O	Yes [ ] No [ ]
UDP	User Datagram Protocol	RFC768	M	M	Yes [ ]
RTP	Real Time Protocol	RFC1889	M	M	Yes [ ]
RTCP	Real Time Control Protocol	RFC 3605	M	O	Yes [ ] No [ ]
RTSP	Real Time Streaming Protocol	RFC 2326	O	O	Yes [ ] No [ ]
TCP	Transport Control Protocol (for LLDP)	RFC 793	M	O	Yes [ ] No [ ]

For the UDP protocol there are no refinements of the base standard features contained in the NSPICS and there are no additional requirements to specify.

C.2.10 NPRL for the Upper Layer – IP Protocol (RTP) - of the IOP-HD Interface

The IOP-HD Upper Layer – RTP packet transmission – is as specified in STANAG 4644, Annex F-1, ref [2].

The IOP-HD IP protocol – RTP - use the following as basis for profile definition:

- NSPICS for NSP Real Time Data Protocols – Protocols Overview – as defined in STANAG 4644 Annex F-1 (see previous table for UDP protocol)

For the RTP protocol there are no refinements of the base standard features contained in the NSPICS and there are no additional requirements to specify.

C.2.11 NPRL for the Half-Duplex Control – use of VARC - of the IOP-HD Interface

The IOP-HD Half-Duplex Control based on VARC is specified as a Base Standard (BS) in this AComP, Annex F.

The NPICS for VARC is defined in Annex G of this document.

C.2.12 NPRL for the Half-Duplex Protocol – use of RTP-HE and specific PTT signalling - of the IOP-HD Interface

The IOP-HD RTP-HE based Half-Duplex Protocol, including need for support of RTP-HE specific PTT signalling, is based on the concept forwarded in the EUROCAE ED-137B standard, ref [9], and specified as a Base Standard (BS) in this AComP, Annex H.

This EUROCAE ED-137B base standard does not contain an NPICS relevant to the IOP-HD usage of the RTP-HE protocol. The NPICS for IOP-HD use of RTP-HE and specific PTT signalling is therefore defined in Annex I of this document.

C.2.13 NPRL for IOP-HD Interface: Service Admission control, Identification and Mapping

The IOP-HD specifications for Service Admission Control, Identification and Mapping are specified as a Base Standard (BS) in this AComP, Annex J.

The NPICS for IOP-HD specifications for Service Admission Control, Identification and Mapping are defined in Annex K of this document
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ANNEX D NPICS FOR THE IOP-HD INTERFACE – GENERAL CHARACTERISTICS

D.1 INTRODUCTION

1. Guidance, notations and instructions for completing the NPICS proforma can be found in Annex B of the AComP-5634 (this document).

D.2 NPICS

1. Section D.2.1 applies to any implementation of the IOP-HD interface. All IOP-HD characteristics must be in accordance with the NPICS in order to be compliant to the IOP-HD interface.
2. Non-supported mandatory capabilities are to be identified in the NPICS, with an explanation of why the implementation is non-conformant. Such information shall be provided as exception information.

D.2.1 Identification of the Implementation and General Statement of Conformance

D.2.1.1Implementation Identification

Nation/Supplier	AComP-5634 Annex D IOP-HD Interface – General Characteristics
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:

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

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

D.2.1.2General Statement of Conformance

Identification of protocol specification	AComP-5634 Annex D IOP-HD Interface – General Characteristics
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? (The answer Yes means that the implementation does not conform to the AComP)	No [ ] Yes [ ]

Date of Statement	

D.2.2 IOP-HD Interface – General Characteristics

Base Standard Features				
Item	**Protocol**	**Reference**	**Status**	**Support**
IOP-HD-Phy1	Physical layer for IOP-HD metallic Ethernet	TACOMS standard for 10BASE-T and 100BASE-TX according to STANAG 4640 Annex A-9	M	Yes [ ]
IOP-HD-LL1	Link Layer Ethernet (LAN) Protocols	TACOMS standard for Ethernet (LAN) Protocols STANAG 4640 Annex B-1	M	Yes [ ]
IOP-HD-NL1	Routing – Static Routing	TACOMS standard for gateway protocols STANAG 4647 Annex A-1	M	Yes [ ]
IOP-HD-NL2	Routing – Dynamic Routing	TACOMS standard for gateway protocols STANAG 4647 Annex A-1	O	Yes [ ] No [ ]
IOP-HD-NL3	Dynamic Routing – OSPFv2	TACOMS standard for connectionless network protocols STANAG 4644 Annex C-1	IOP-HD-NL2: M	N/A Yes [ ]
IOP-HD-NL4	IP Protocol Suite – IPv4, ICMP, ARP	TACOMS standard for connectionless network protocols STANAG 4644 Annex E-1, E-2	M	Yes [ ]
IOP-HD-NL5	IP Protocol Suite – IGMP	RFC3376	M	Yes [ ]
IOP-HD-NL6	IP QoS	STANAG 4644	M	Yes [ ]

ANNEX E BS FOR THE IOP-HD INTERFACE – VARC BASED HALF-DUPLEX CONTROL

RATIONALE: Voice Activated Radio Control (VARC)

VARC is defined in order to provide a default version for half-duplex control of a radio network according to the following:

a. The IP network host has not implemented the defined IOP-HD RTP-HE protocol (including current SCIP terminals)

b. The radio has not implemented the IOP-HD EUROCAE ED-137B protocol.

There are certain advantages and disadvantages with a VARC solution compared to use of dedicated PTT signals, as defined by the primary IOP-HD RTP-HE protocol:

a. Advantages

    i. No requirements on end-equipment or other standards

    ii. “Any” end-equipment can be used without compatibility problems

b. Disadvantages

    i. Less bandwidth efficient

    ii. Delay in transmission start

    iii. “Wait for next RTP packet for time Δt before release” slows down the system and efficiency on the air

VARC is seen as a necessary complement to the RTP-HE based solution to obtain interoperability also in the cases where the parties have not implemented the RTP-HE solution.

VARC is also defined as a default requirement to be implemented to be compliant to AComP-5634.

E.1 INTRODUCTION

1. This base standard describes the Voice Activated Radio Control (VARC) based half-duplex control for a half-duplex radio network over the IOP-HD interface.
2. The aim of this document is to specify an IOP-HD half-duplex signaling protocol for real-time voice applications for which specific or proprietary half-duplex network and/or terminal signaling protocols are not available or implemented (e.g. SIP INFO or RTP-HE based PTT signalling)
3. VARC half-duplex control shall adhere to the following characteristics:
    a. Real-time (time critical) voice applications
    b. Based on current characteristics for VoIP clients or subscriber equipment, i.e. based on standard RTP header formats
    c. Solution readily adaptable into an all-IP communications infrastructure, including NATO NNEC and TACOMS infrastructure elements
    d. Support point-to-multipoint voice services
    e. End-to-end signaling or traffic streaming capability between IP network subscriber (host) and the radio network without requirement for intermediate (routed) network capabilities (SIP or PTT server)

E.2 IOP-HD INTERFACE VARC HALF-DUPLEX CONTROL

E.2.1 Network Performance Requirements

1. VARC shall enable real-time voice communications over the IOP-HD inteface.
    a. VARC supports the radio and network connections depicted in Figure E-1 to Figure E-4.
    b. IP network to half-duplex radio connections:
        a. Half-duplex radio network connected to an IP network as shown in Figure E-1
    c. Half-duplex radio networks connected back-to-back
        a. Over an IP LAN with other hosts as illustrated in Figure E-2
        b. Directly, i.e., over an IP LAN without other hotsts as shown in Figure E-3
        c. Over a routed (transit) IP network with other hosts as depicted in Figure E-4.

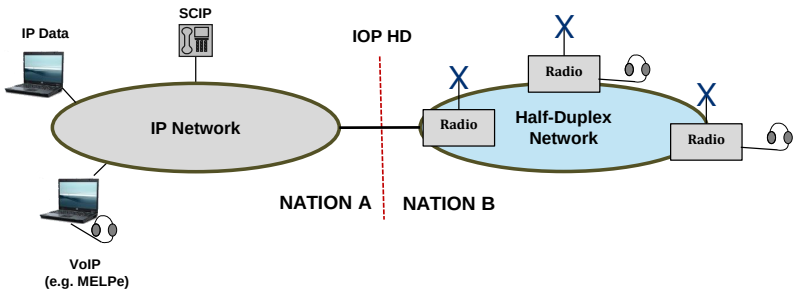

Figure E-1: IP network to a half-duplex radio network

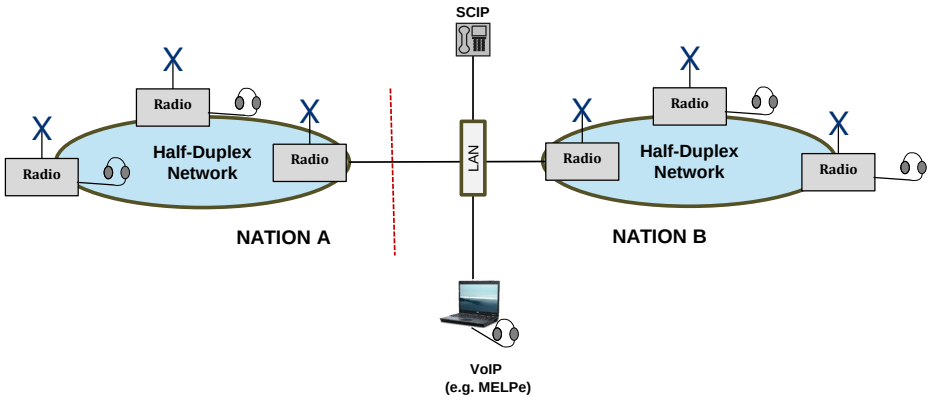

Figure E-2: Half-Duplex Radio Networks connected via a LAN Network Connection

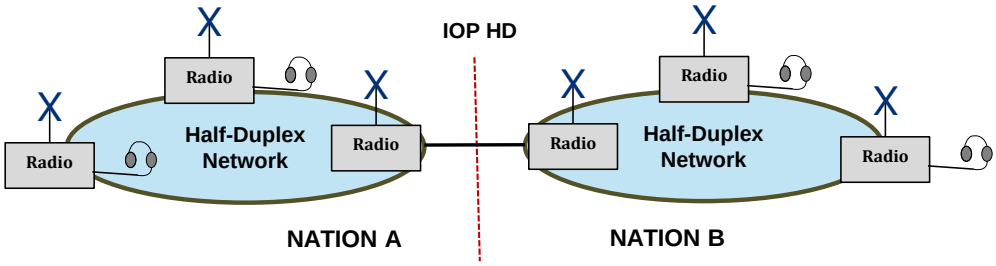

Figure E-3: Half-Duplex Radio Networks directly connected back-to back

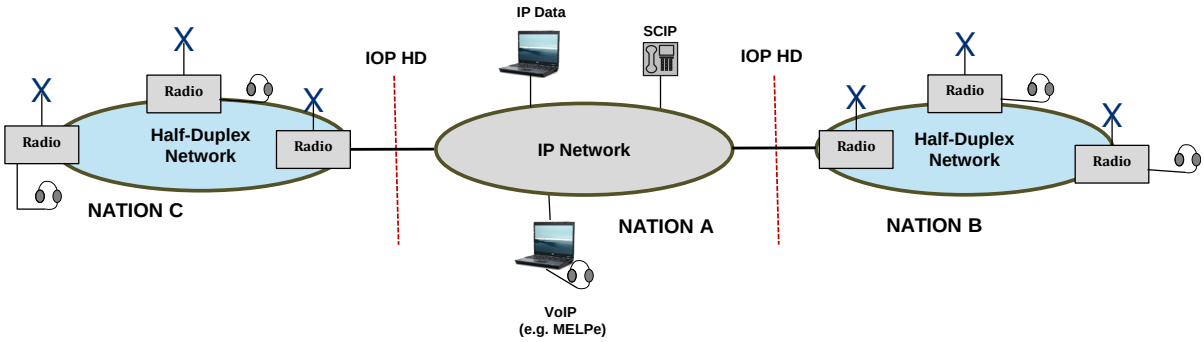

Figure E-4: Half-Duplex Radio Networks connected back-to-back over a routed (transit) IP network

3. VARC does not perform call setup.
4. VARC supports both unicast and multicast voice.
5. VARC is intended for real-time voice services in a half duplex radio network:
    a. MELPe (2.4 kbps unencrypted voice service)
    b. SCIP (2.4 kbps encrypted voice service)
    c. Other voice services may be supported for future editions of the IOP-HD interface

6. Protocols defined for the IOP-HD interface to be used with VARC include RTP over UDP over IPv4.

E.2.3 VARC Detailed Requirements

1. In order to support VARC the half-duplex radio terminal must be able to detect voice packets:
   a. RTP audio (voice) packets
2. Only detection (or absence) of voice packets shall trigger the radio Push-to-Talk (PTT) function:
   a. Presence of RTP audio packets: PTT active
   b. Absence of RTP audio packets: PTT inactive
3. RTP audio packets (valid voice packets) are as follows:
   a. RTP audio packets: Actual voice content
      i. RTP Payload Type: 96-127
   c. RTP-HE audio packets
      i. As RTP audio packet, with RTP header extension included*
   b. RTP keep alive packets
   c. SCIP Sync Management (SM) frames (ref: SCIP-233.501, ref [12])
      a. Service: 2400 bps MELP Voice – Blank and Burst for Multipoint Operation

** In the event that the radio has not implemented the option of the ED-137B based half-duplex protocol, incoming RTP-HE packets shall be handled as "normal" RTP audio packets*

4. Non-valid RTP packets shall not result in voice activity detections
5. For the radio terminal voice or audio packet detection on the IOP-HD interface shall result in:
   a. Reception of audio (RTP) packets:
      i. Push-to-Talk (PTT) active: Request for network connected radio to enable/maintain transmission across the radio network
         i. Reception of Valid RTP packet
         ii. Number of valid RTP packets received = 1: PTT received
      ii. The radio terminal shall activate transmitter (if idle) and maintain TX ON for duration of RTP packet reception according to the following criteria:
         i. Timer T1 not expired
         ii. T1= Voice inactivity timer
         iii. T1 default value: 2 seconds

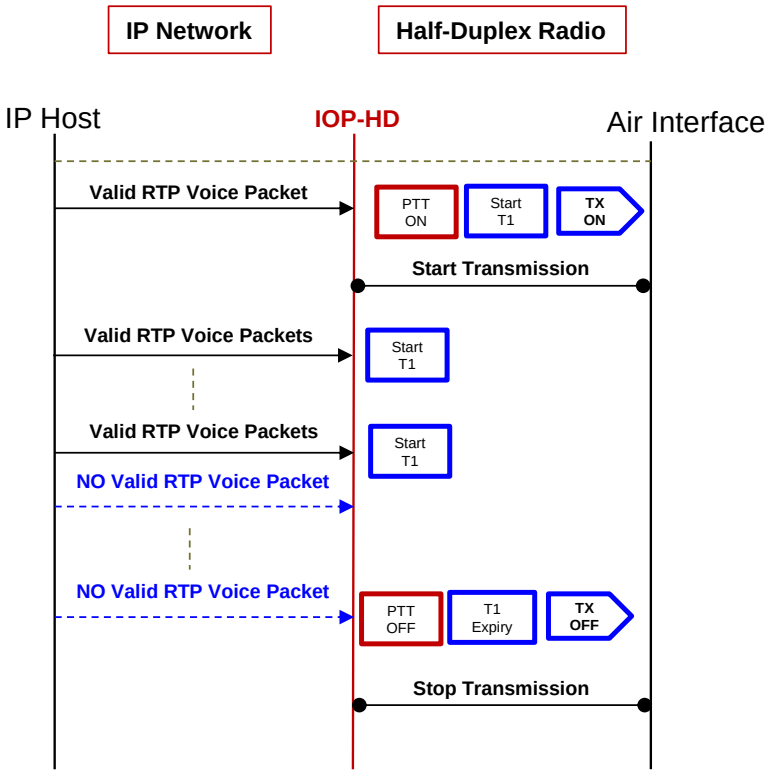

Figure E-5: VARC PTT Sequence Diagram

6. For the radio terminal absence of voice or audio (RTP) packets shall result in:
    a. Push-to-Talk (PTT) inactive: Request for network connected radio to disable transmission across the radio network
        i. Absence of valid RTP packets for time t > T1
        ii. T1= Voice inactivity timer
        iii. T1 default value: 2 seconds
    b. The radio terminal shall deactivate transmitter (if active) to TX OFF
7. For security measures, it is recommended that the radio terminal (and radio network) implement a maximum timer for allowable transmission in one direction to avoid potential Denial-of-Service (DoS) attacks from the IP network
    a. Tx = Voice maximum timer
    b. Tx default value: 30 seconds
    c. Activation / de-activation of Tx supervision should be configurable
8. As the IOP-HD interface is a full duplex interface towards the IP network, the radio terminal (via VARC) shall be prepared to handle multiple incoming voice streams according to the following principles:
    a. Access to the network connected radio transmission shall be on “first come” basis
    b. Audio packets received from a different IP host (source address) during an on-going transmission shall be discarded

9. An on-going transmission shall be pre-empted in the event that an audio stream is received from a source with higher priority than the current source[1]
10. The radio terminal shall handle cross-calling events (i.e. simultaneous voice traffic received on the radio network air interface and IOP-HD) according to the following principles:
    a. It shall be the responsibility of the radio terminal service mapper function (or equivalent) to determine whether an incoming voice stream on the IOP-HD interface shall pre-empt an ongoing (active) radio RX (Squelch) session, and initiate the radio TX
    b. It shall be the responsibility of the radio to determine whether an on-going TX session shall be pre-empted and initiate the radio RX (Squelch) – if possible
11. **NOTE!** With VARC the radio network will not inform a host connected to the IP network or a back-to-back connected radio:
    a. Whether a PTT ON request is successful or not (host transmission of voice packets actually resulting in transmission on the radio)
    b. Whether the IP host is pre-empted from an on-going radio TX session (e.g. by another multicast group of higher priority)
    c. When the active audio session is terminated (time-out or pre-emption)
12. It shall be the responsibility of the radio terminal to (potentially) buffer incoming voice data to ensure proper transmission of all data from the IP network to the radio network (and vice versa) after detection of PTT/Squelch ON to end of transmission (PTT/Squelch OFF).
13. It shall be the responsibility of the radio terminal to handle timer supervision of on-going voice transmissions relative to service (if services have different timer criteria).

E.2.4 VARC Voice Activity Detection Diagrams

E.2.4.1 Multicast Voice Service: MELPe

1. The radio diagram in Figure E-6 illustrate the use of the VARC protocol for support for the following service:
    a. MELPe (low-rate vocoder support)

These services are identified network services between an IP network and a half-duplex radio network for which VARC may be applied.

[1] This functionality requires that the radio is able to distinguish between different sources

2. Figure E-6 depicts the radio terminal half-duplex implementation of VARC, including critical timing issues for implementation of the following service:

   a. 2400 bps MELPe

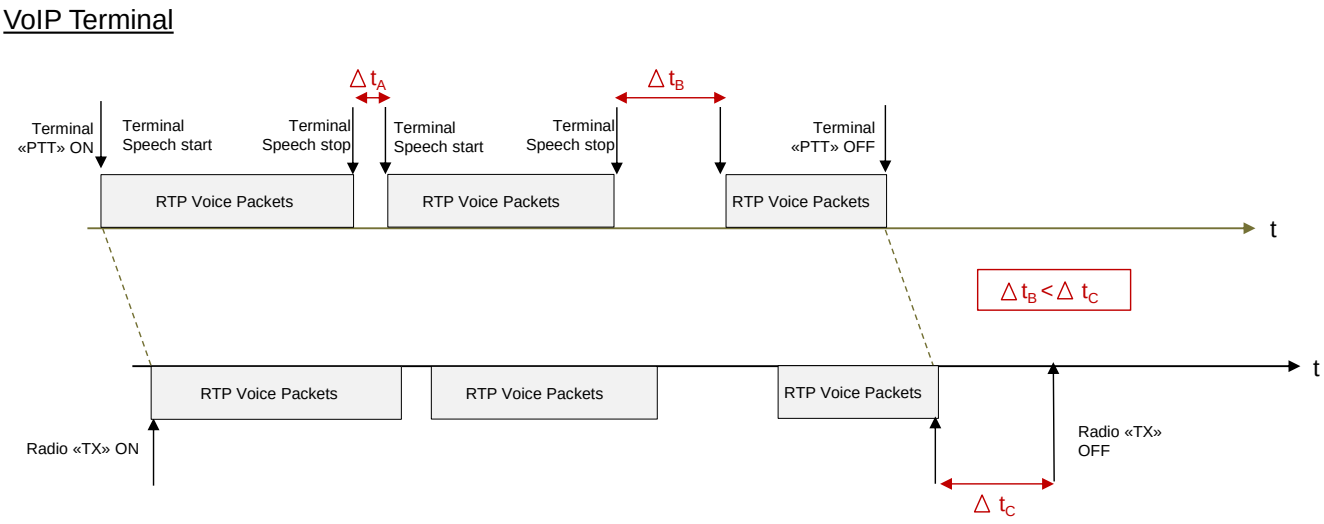

Figure E-6: Half-Duplex Radio Network – MELPe Voice Activity / Radio Transmitter Diagram

3. For the 2400 bps MELPe voice service, the following critical timing issues must be maintained:

   a. The time-out for the radio terminal before assuming PTT off (based on absence of RTP packets) is defined to be:

      i. $\Delta t_C = 2s$

      ii. The value of Δt_A and Δt_B timers included for illustrative purposes

      iii. If the pause between valid RTP voice packets > $\Delta t_C = 2s$ the radio shall cease transmission

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ANNEX F NPICS FOR IOP-HD INTERFACE – VARC HALF-DUPLEX CONTROL

F.1 INTRODUCTION

1. Guidance, notations and instructions for completing the NPICS proforma can be found in Annex B of the AComP-5634 (this AComP).

F.2 NPICS

1. Section F.2.1 applies to implementation of the IOP-HD VARC half-duplex control, defined in Annex E in this document.
2. Network terminals must implement VARC with option to implement the IOP-HD RTP-HE protocol (Annex G in this document) to be fully compliant with AComP-5634.
3. The half-duplex radio terminal needs to implement support for terminals (network) having implemented VARC with option for RTP-HE protocol in order to be compliant with AComP-5634.
4. Non-supported mandatory capabilities are to be identified in the NPICS, with an explanation of why the implementation is non-conformant. Such information shall be provided as exception information.

F.2.1 Identification of the Implementation and General Statement of Conformance

F.2.1.1 Implementation Identification

Nation/Supplier	AComP-5634 Annex H IOP-HD Interface – VARC Half-Duplex Control
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:

Only the first three items are required for all implementations; other information may be completed as appropriate in meeting the requirement for full identification.
The terms Name and Version should be interpreted appropriately to correspond with a supplier's terminology (e.g., Type, Series, and Model).

F.2.1.2 General Statement of Conformance

Identification of protocol specification	AComP-5634 Annex H IOP-HD Interface – VARC Half-Duplex Control
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? (The answer Yes means that the implementation does not conform to the AComP)	No [ ] Yes [ ]

Date of Statement	

F.2.1.3 NPICS for IOP-HD VARC

Base Standard Features				
Item	**Protocol**	**Reference**	**Status**	**Support**
IOP-HD-RP1	Voice packet detection	AComP-5634, Annex E, ch. 2.3	M	Yes [ ]
IOP-HD-RP2	Detection / PTT active / inactive	AComP-5634, Annex E, ch. 2.3	M	Yes [ ]
IOP-HD-RP3	Allowable RTP packet format	AComP-5634, Annex E, ch. 2.3	M	Yes [ ]
IOP-HD-RP4	Non-valid RTP packets / reaction	AComP-5634, Annex E, ch. 2.3	M	Yes [ ]
IOP-HD-RP5	Audio packet detection performance	AComP-5634, Annex E, ch. 2.3	M	Yes [ ]
IOP-HD-RP6	Multiple audio streams	AComP-5634, Annex E, ch. 2.3	M	Yes [ ]
IOP-HD-RP7	Simultaneous air traffic interface and IOP-HD traffic	AComP-5634, Annex E, ch. 2.3	X	No [ ]
IOP-HD-RP8	PTT confirmation	AComP-5634, Annex E, ch. 2.3	M	Yes [ ]
IOP-HD-RP9	MELPe timing criteria	AComP-5634, Annex E, ch. 2.4.1, 2.4.2	M	Yes [ ]
IOP-HD-RP10	Initial buffering and timer alignment	AComP-5634, Annex E, ch. 2.3	M	Yes [ ]

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ANNEX G BS FOR IOP-HD INTERFACE – RTP-HE BASED HALF-DUPLEX PROTOCOL

G.1 INTRODUCTION

1. The base standard describes the half-duplex radio network IOP-HD interface RTP-HE based half-duplex protocol
2. Reference to the following standard is made:
   a. Ref [9]: EUROCAE ED-137B: “Interoperability Standards for VoIP ATM Components, Volume 1: Radio”, July 2012

      Chapter 5: Real-Time Transport Protocol (RTP)
3. The RTP-HE based protocol is (in this Annex) presented as a separate base standard. The protocol specification is based on the principles outlined in the reference standard, but is simplified into PTT control only (not readily equivalent to Air Traffic Control - ATC – system prerequisites), in addition to reformatting the RTP header extension to facilitate possible service identifaction.
4. The RTP-HE based half-duplex signaling protocol shall adhere to the following characteristics:
   a. Real-time (time critical) voice applications
   b. Requirement that intended subscriber equipment adapting to specified protocol, e.g. SCIP terminals, must adapt to requirements specified herein (e.g. potential use of RTP-HE format)
   c. Solution readily adaptable into an all-IP communications infrastructure, including NATO NNEC and TACOMS infrastructure elements
   d. Support of point-to-multipoint voice services
   e. End-to-end signaling or traffic streaming capability between subscriber (host) and the half-duplex radio network without requirement for intermediate (routed) network capabilities (SIP or PTT server)

G.2 REFERENCE STANDARD APPLICABILITY

1. The reference standard for definition of the radio network IOP-HD RTP-HE based half-duplex protocol is:
   a. EUROCAE ED-137B: “Interoperability Standards for VoIP ATM Components, Volume 1: Radio”, July 2012
2. For IOP-HD edition 1, only the following part of the reference standard shall apply:
   a. Chapter 5: Real-Time Transport Protocol (RTP)

3. Only the following parts of the standard apply to the IOP-HD implementation:
    a. RTP protocol between User Agents to transport audio packets (when PTT or Squelch is activated)
4. The reference standard shall not be adapted “as is”. There are restrictions and deviations for the adapted IOP-HD protocol. Deviations are noted (in the protocol specification) referenced to specific paragraphs in the reference standard.
5. Examples of restrictions or deviations between the IOP-HD protocol and the reference standard’s “minimum requirements for the implementation in order to provide VoIP communication between User Agents”, include the following (to be “not applicable” to the IOP-HD implementation (Edition 1)):
    a. SIP protocol to initially establish a SIP session between User Agents
    b. Keepalive packets (when PTT or Squelch is deactivated)
6. In addition, there will be no requirement for RTCP protocol to allow for monitoring of the audio packet delivery
7. The following system roles of the reference standard are assumed towards the radio network system environment (when connected to an IP network):
    a. VCS (Voice Communication System): SCIP or VoIP telephone
    b. GRS (Ground-based Radio station): Half-duplex radio network (network connected radio)

G.3 IOP-HD PROTOCOL SPECIFICATION

1. The following paragraphs (in this chapter) define the IOP-HD RTP-HE protocol for half-duplex control of the radio network.
2. Reference is made to applicable sections and paragraphs of the EUROCAE ED-137B standard.
3. The IOP-HD specification is defined according to each section and paragraph of the reference standard relative to intended IOP-HD half-duplex control signaling implementation, and interpretation (an added details) towards mandatory requirements for the IOP-HD protocol.

G.3.1 Reference Standard Chapter 2: Radio Communication Model

In ED-137B, this chapter is an introductory chapter defining overall system requirements for the radio protocol. The IOP-HD half-duplex radio environment does not readily adapt to the ATC radio model definition, but shall conform to overall requirements for modes of operation in a half-duplex radio environment.

For the IOP-HD base standard, the following applies:

1. Section 2.4: Modes of Operation
    a. The following signaling information shall apply to the Real-time Transport Protocol (RTP) and Real-time Transport Header Extension:
        i. PTT (Push To Talk)
        ii. Squelch
        iii. PTT confirm
    b. Other required signaling information shall not be required (relative to EUROCAE ED-137B)
    c. Information to defined type of service shall be added to the RTP header extension format

G.3.2 Reference Standard Chapter 5: RTP, Real-Time Transport Protocol

In ED-137B, this chapter defines in detail functional requirements for the RTP protocol used with a half-duplex radio environment. Applicability in an IOP-HD half-duplex radio environment, including restrictions and deviations, will be defined for each section and paragraph in the reference standard.

G.3.2.1 Reference Standard Section 5.1: Real Time Protocol – General Issues

For the IOP-HD base standard, the following applies:

1. Section 5.1: Real-Time Transport Protocol – General Issues
    a. The standard does not include requirements for Real Time Session Supervision
    b. The standard shall not be required to support IP network performance functionality available via the RTP protocol, e.g. variable transport delay or out-of-sequence packet arrivals
    c. The standard assumes IP QoS mechanisms as defined in STANAG 4644
2. Section 5.1.1: Basic System Topology
    a. The standard does not include the requirements for the Real Time Control Protocol (RTCP)
3. Section 5.1.2: RTP-Payload compliant with RFC 3551
    a. The standard does not make any special provisions to support RFC 3551 and profile definitions suitable for audio and video conferences
4. Section 5.1.3: RTP Encoding Rules
    a. The standard hosts, i.e. VoIP terminals or half-duplex radio network, does not support silent suppression, i.e. when transmission across the IOP-HD interface is

active (PTT ON or Squelch active), a continuous transmission of RTP voice packets are transmitted

i. RTP packets with signaling (part of RTP-HE) and valid voice payloads

ii. RTP packets with signaling and no voice payloads

5. Section 5.1.4: RTP and RTCP UDP Port Number
    a. The standard does not support the RTCP protocol
    b. Requirements for UDP port number association between RTP and RTCP shall not applicable

G.3.2.2 Reference Standard Section 5.2: Operating Recommendations

For the IOP-HD base standard, the following applies:

1. Section 5.2.1: PTT Transmission Performance
    a. The half-duplex radio (network connected radio) shall activate its transceiver/transmitter based on incoming RTP packets with PTT-ON information as defined within this base standard
    b. Requirements for generation/synchronization of transmission of PTT signals from the VoIP terminals for activation of the PTT key at the radio does not apply in the IOP-HD protocol
        i. Considered national concern, and not part of this standard
2. Section 5.2.2: Squelch Transmission Performance
    a. Requirements for the radio's generation of Squelch signals for detection of an incoming radio call (from the air interface) does not apply to the standard
        i. Traffic from an incoming radio call may be terminated in the radio, be sent to national external interfaces in the radio, or transmitted to the IOP-HD interface. The standard does not define criteria for internal routing of air interface traffic in the radio network
    b. The standard does not comply with the requirement of "RTP audio packets SHOULD be sent from the GRS endpoint to the VCS endpoint only when the Squelch has been activated"

1. Section 5.2.3: Class of Service (CoS) and Quality of Service (QoS)
    a. This standard shall use QoS based on STANAG 4644
    b. This standard does not specify support for layer 2 CoS (IEEE 802.3p/802.3q)

c. Potential mapping of IOP-HD IP QoS values to available priority levels across the radio network air interface is not part of the standard (assumed part of the radio network service mapper or equivalent functionality)

G.3.2.3 Reference Standard Section 5.3: RTP Header

For the IOP-HD base standard, the following applies:

1. Section 5.3: RTP Header
    a. The Extension bit (X) shall be set to indicate that the fixed header shall be followed by exactly one header extension
    b. The RTP Marker (M) bit: The Standard shall not use the Marker bit.
    c. Valid RTP Payload Types: 96-127
    d. There is no requirement that the radio network use RTP sequence number to detect packet loss and restore packet sequence
    e. The CRSC[2] list shall not be required to be populated, i.e. it may be set to zero

G.3.2.4 Reference Standard Section 5.4: Real-Time Transport Protocol Header Extension (RTP-HE)

For the IOP-HD base standard, the following applies:

1. Section 5.4: Real-Time Transport Protocol Header Extension (RTP-HE)
    a. The RTP-HE shall minimum be used for transmission of PTT type and Squelch together with audio “within an established RTP communication”
    b. The RTP-HE may also be used for transmission of service identification (voice transmission)
    c. The half-duplex radio terminal shall employ the half-duplex protocol based on RTP-HE when receiving PTT or Squelch requests (e.g. from back-to-back connected radio) on equal format.
    d. In a mixed environment consisting of VoIP terminals supporting the RTP-HE format and VoIP terminals not supporting the RTP-HE format, e.g., standard VoIP terminals, the egress half-duplex radio shall default use the RTP-HE format for relaying Squelch information (with the assumption that RTP header extension may be ignored by other implementations that have not implemented it.)

[2] CRSC is the Contributing Source Identifier field of the RTP header. The CSRC list identifies the contributing sources for payload contained in this packet.

e. In a mixed environment, if the radio terminal initiates half-duplex control based on RTP-HE, but does not get equal protocol-based confirmation from the intended network host or back-to-back connected radio:

    i. No response to transmitted PTT ON

    ii. No response to transmitted PTT OFF

    it shall assume support of VARC from the network (default requirement for AComP-5634).

G.3.2.5 Reference Standard Section 5.5: RTP Header Extension for Radio Applications

For the IOP-HD base standard, the following applies:

1. Section 5.5.1: RTP Header Extension Packet Types

    a. The standard only supports the R2S (Real Time Session Supervision) protocol, i.e. sending of RTP keepalive packets – packets containing signaling without audio payload - when PTT or Squelch is activated, and no speech (audio) is to be transferred (silence periods)

    b. The standard does not support the R2S protocol when PTT and Squelch is not active

2. Section 5.5.2: GRS Transceiver/transmitter PTT activation / de-activation

    a. The standard only supports the R2S protocol when PTT or Squelch is activated, and not when PTT or Squelch is inactive.

    b. For the half-duplex radio terminal, generation of R2S packets “RTP packets with signaling without voice packets” may or may not include audio samples (when Squelch is active, and traffic is sent to the IOP-HD interface)

        i. E.g. audio samples or RTP payload content may be comfort noise packets

    c. The radio terminal shall detect and accept an incoming request for PTT ON from the network or back-to-back connected radio based on the following:

        i. Reception of minimum one (1) valid RTP packet with RTP header extension defining PTT ON

    d. Upon reception (approval) of the first RTP-HE packet with PTT-ON, the standard sends a confirmation message with an R2S keepalive packet with PTT-ON according to the following:

        i. Unicast message to the IP source address

        ii. Minimum three (3) R2S keepalive packets are sent for confirmation. The sending of minimum three (3) packets is to best assure reception of

confirmation at the original IP source address to which the unicast message is transmitted

iii. The response shall be sent within a maximum delay (after receiving, and accepting, the first valid RTP-HE packet with PTT-ON)

iv. The response time maximum confirmation delay shall be configurable

1. Recommended default value: PTT_CONF_ACC: 100 ms

e. If the half-duplex radio is unable to transmit (for a specific reason, e.g. already busy transmitting across the air traffic interface), the radio shall send a Media Busy message using an R2S keepalive packet with PTT-OFF according to the following:

i. Unicast message to the IP source address

ii. Minimum three (3) R2S keepalive packet are sent for busy indication. The sending of minimum three (3) packets is to best assure reception of confirmation at the original IP source address to which the unicast message is transmitted

iii. The response are sent within a maximum delay (after receiving, and rejecting, the first valid RTP-HE packet with PTT-ON)

1. Recommended default value: PTT_CONF_REJ: 100 ms

3. Section 5.5.2.1: GRS Transceiver/receiver PTT de-activation event

a. The half-duplex radio shall assume PTT to be de-activated based on the following:

i. Reception of minimum one (1) RTP packet with a RTP header extension defining PTT OFF

b. It is recommended that the standard also include a supervisory timer (equal to VARC) in the event that packet reception from an IP network host cease for a period of time without receiving PTT OFF to indicate end-of-transmission

i. Recommended value for supervisory timer:Tsup = 2 seconds

c. De-activation of PTT via PTT OFF (or supervisory timer expiry) shall result in the radio transmitter being disabled

d. The half-duplex radio shall ignore potential reception of R2S keepalive packets with PTT OFF once the PTT is deactivated

e. Upon deactivation of PTT (from network) the radio shall send a confirmation message with an R2S keep-alive packet with PTT-OFF according to the following:

i. Unicast message to the IP source address

ii. Minimum three (3) R2S keepalive packets shall be sent for confirmation. The sending of minimum three (3) packets is to best assure reception of confirmation at the original IP source address to which the unicast message is transmitted

iii. The response shall be sent within a maximum confirmation delay

1. Recommended default value: PTT_STP_CONF: 100 ms

f. The standard shall not be required to support parameter definition via Session Description Protocol (SDP) attribute negotiation (SIP session) as defined by the reference standard

g. The standard shall define own values for the following parameters:

i. How often PTT-ON or PTT-OFF signaling is sent in the RTP Header Extension of the RTP audio or R2S keepalive packets: each RTP signaling packet with or without audio payload

4. Section 5.5.2.2: Transmit Path RTP audio to R2S-Keepalive packet transition

a. The standard shall not define any specific value for “RTP audio packet period” and “RTP-Keepalive period”

b. R2S-Keepalive packets must be sent to (potentially) avoid transmission timer expiry (for periods of no audio transmission with PTT-ON)

c. The standard shall apply dynamic RTP Payload Types, as supported radio services (currently) do not have defined IANA values for RTP Payload Type (SCIP, MELPe):

i. Acceptable RTP Payload Type values: 96-127

ii. R2S-Keepalive packets: PT=123 (as defined in reference standard)

iii. Setting of specific values (for RTP Payload Type) within the range of acceptable values for “active” voice services (i.e. RTP packets with audio content) shall be national concern.

d. The half-duplex radio shall require minimum transmission of one (1) RTP audio packet with PTT-OFF in order to (assure) deactivate an ongoing RTP audio session (from active terminal)

e. The radio terminal may require a transition period after receiving PTT_OFF before a PTT_ON (from a different IP host or same IP host) may be accepted

i. The presence of the transition timer and potential value is of national concern

f. The half-duplex radio shall ignore reception of R2S keepalive packets with RTP audio packet with PTT-OFF, irrespective of payload type, once the RTP session is deactivated

G.3.2.6 Reference Standard Section 5.5.3: GRS Transceiver/Receiver Squelch activation / de-activation

For the IOP-HD base standard, the following applies:

1. Section 5.5.3: GRS Transceiver/Receiver Squelch activation/ de-activation

    a. The half-duplex radio shall not transmit RTP packets with SQUELCH-OFF when Squelch is not active, i.e.R2S keepalive packets, whether as part of a “keepalive” function for a network connection, or part of a link monitoring function

    b. When Squelch is active, the half-duplex radio shall send RTP audio packets with SQUELCH-ON

    c. RTP-packets with SQUELCH-ON may or may not contain payload with audio samples

    d. The IOP-HD shall not be required to use RTP packet information for link monitoring

    e. Requirements pertaining to an A/G Call (transmission from an aircraft) shall not be applicable to the radio network and e.g. criteria for Squelch detection (and other defined functionality). The radio network criteria for Squelch detection (and potential relay of information to the IOP-HD interface shall be covered by the standards applicable to the radio network air interface (specific to each type of half-duplex radio network) – example AComP-5630-5633 “Narrowband Waveform Radio” standards.

2. Section 5.5.3.1: GRS Transceiver/receiver Squelch de-activation event

    a. The half-duplex radio shall transmit minimum three (3) RTP packets over the IOP-HD interface with SQUELCH-OFF to deactivate an active Squelch session (when the Squelch signal goes inactive on the air interface)

    b. The half-duplex radio shall not send R2S packets once transmission of the RTP packets with SQUELCH-OFF (to deactivate a session) has been completed

    c. The half-duplex radio shall accept potential confirmation of SQUELCH-OFF from the network and/or terminals, but there is no requirement for specific reaction to the signal

3. Section 5.5.3.1: GRS Transceiver/receiver Squelch de-activation event

    a. The half-duplex radio shall transmit minimum three (3) RTP packets over the IOP-HD interface with SQUELCH-OFF to deactivate an active Squelch session (when the Squelch signal goes inactive on the air interface)

    b. The half-duplex radio shall not send R2S packets once transmission of the RTP packets with SQUELCH-OFF (to deactivate a session) has been completed

    c. The half-duplex radio shall accept potential confirmation of SQUELCH-OFF from the network and/or terminals, but there is no requirement for specific reaction to the signal

4. Section 5.5.3.2: Receive Path RTP audio to R2S-Keepalive packet transition

    a. Criteria for detection of incoming RF signal, and potential reaction by the half-duplex radio network, shall be as defined in section 5.2.2: Squelch Transmission Performance

    b. The half-duplex radio shall not define any specific values for transmission frequency of RTP audio packets or R2S-Keepalive packets with SQUELCH-ON

    c. Requirements for definition of RTP Payload Types for voice service and R2S-Keepalive packets shall be as defined in criteria for reference standard section 5.5.2.

    d. The half-duplex radio shall transmit minimum three (3) RTP packets with SQUELCH-OFF over the IOP-HD to deactivate an active Squelch session (when the Squelch signal goes inactive on the air interface)

    e. The half-duplex radio shall not send R2S packets once transmission of the RTP packets with SQUELCH-OFF (to deactivate a session) has been completed

5. Section 5.5.4: RTP Header Extension Description

    a. The RTP Header Extension (RTP-HE) shall be as defined in Figure G-1 RTP Header Extension

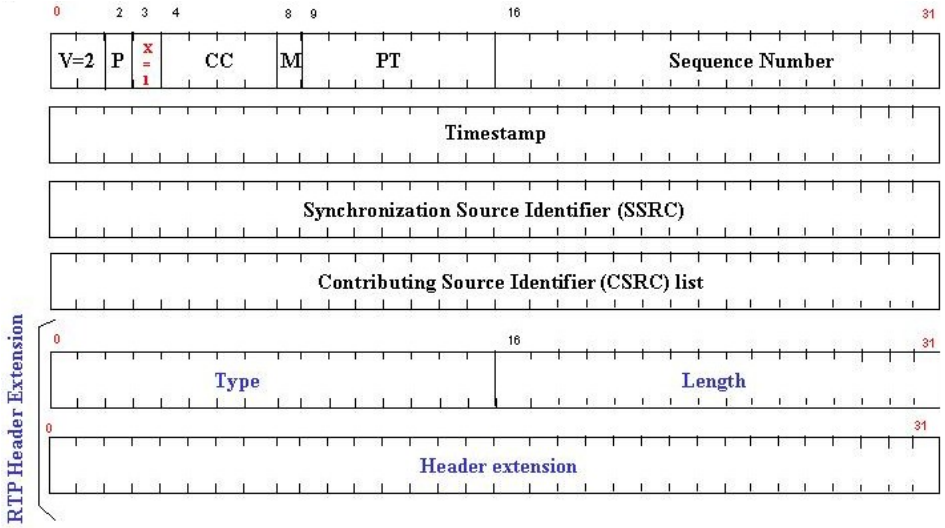

Figure G-1: RTP Header Extension

    b. RTP Header Extension - Type Field:

        i. For IOP-HD Edition 1 the following value is defined: 0x0117h

            1. Format: 0xBE, 0xDE: BE=01 (version), DE=17 (20**17**)

        ii. For incoming data, IOP-HD shall also accept the current ED-137B defined type field: 0x0167

Note:

The requirement of accepting current ED-137B defined type fields, is to support an enhanced range of possible user equipment, including ATM terminals. The acceptance of ED-137B type fields for the RTP-HE will also enable support of RTP-HE half-duplex control for the ED-137B compliant ATM terminals.

c. RTP Header Extension - Length Field:

   i. A 16-bit length field that counts the number of 32-bit words in the extension, excluding the four-octet extension header

d. RTP Header Extension - Header Extension Field:

   i. The Header Extension field for the RTP-HE shall minimum support the following (based on Type Field format):

      1. AComP-5634 format

      2. ED-137B format

   ii. The following format for the Header Extension Field shall be defined for the AComP-5634 format:

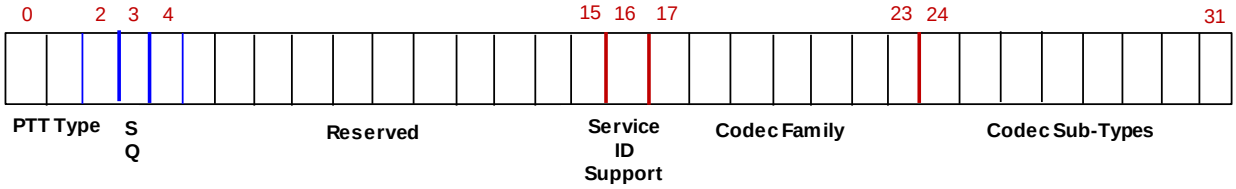

Figure G-2: RTP-HE for PTT Signaling and Voice Service Identification (AComP-5634 Format)

1. PTT Type and SQ shall be equal in definition to the current ED-137B format

2. The ED-137B field “Extension for additional features” shall be replaced by necessary information for identification of type of voice service – minimum including type of codec and needed details (e.g. MELPe and 2400 bps) – if using the option of a service identification field (“Service ID Support = 1”)

3. All other reference fields in the current ED-137B header extension shall for edition 1 attain “reserved status”, and be set to zero (unused)

4. In the event that the half-duplex radio receive and audio packet with RTP-HE , the radio shall not be required to use (or interpret) any information potentially defined in these fields

iii. The following parts for the Header Extension Field shall be supported for the ED-137B format:

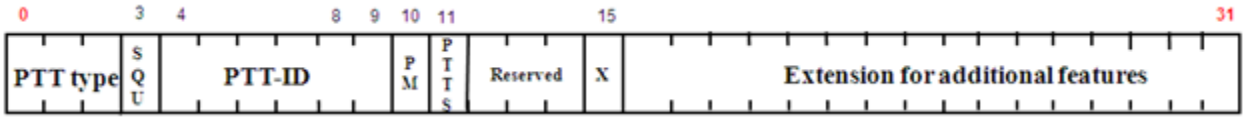

Figure G-3: RTP-HE for PTT Signaling (Current ED-137B Format)

1. PTT Type and SQ with values as defined in ED-137B
2. Information contained in all other fields shall be ignored, or non-applicable, to the RTP-HE half-duplex protocol

e. The minimum content of the RTP-HE from a terminal (e.g. SCIP) to the half-duplex radio shall be:

i. AComP-5634 format

1. PTT Type: PTT (Push-To Talk): ON/FF
2. Voice Service Identification

ii. ED-137B format

1. PTT Type: PTT (Push To Talk): ON/OFF

f. The minimum content of the RTP-HE from the half-duplex radio towards the network shall be (both formats):

i. Squelch (SQL): ON/OFF

ii. Voice Service Identification

Case: Support of back-to-back connected radio networks

iii. PTT Confirmation (R2S packets with defined PTT Type)

g. Information in the RTP-HE (PTT-ON/OFF and SQUELCH ON/OFF) shall be transmitted in each audio packet during an active PTT or Squelch session

h. Information for the service definition shall be transmitted in each audio packet from the half-duplex radio during an active PTT or Squelch session.

i. The RTP-HE for IOP-HD shall not support serialization of multiple Extensions to the RTP-HE within one RTPTx/Rx HE signaling (i.e. need to extend the Header Extension with further bits)

6. Section 5.5.5: RTPTx Information field
    a. In reference to section 5.5.5 (RTPTx Information field) and section 5.5.7 (RTPRx Information Field) the format of the Header Extension part of the RTP-HE shall be as defined in section Section 5.5.4: RTP Header Extension Description.

    b. Relative to the definition of the RTP-HE defined in ED-137B (format: ED-137B), the half-duplex radio shall support the following cases:

        i. Reception of ED-137B format for RTP-HE from terminal (network) to the half-duplex radio

    c. When transmitting RTP-HE from the half-duplex radio to network, the AComP-5634 format shall be used

    d. The number of bits allocated for PTT and Squelch shall be as defined in ED-137B.

    e. The Standard shall only support the following values for PTT-type:

        i. 0x00: PTT OFF

        ii. 0x01: Normal PTT ON

    f. The standard shall accept (reception of) the following values for PTT-type, but equal them to “Normal PTT ON”, as priority across the IOP-HD interface shall be based on IP QoS:

        i. 0x02: Coupling PTT ON: To be handled as 0x01: Normal PTT ON

        ii. 0x03: Priority PTT ON: To be handled as 0x01: Normal PTT ON

        iii. 0x04: Emergency PTT ON: To be handled as 0x01: Normal PTT ON

    g. Other values than the above defined shall be regarded as non-valid values for PTT information

    h. The SQU bit shall be set to 0 for PTT ON/OFF information from a terminal to the half-duplex radio

    i. The following bits defined in the ED-137B standard for RTP-HE format shall be set to zero (for transmission): This is equal to the field defined as “reserved” in the AComP-5634 format

        i. PTT-ID

        ii. PM – PTT Mute

        iii. PTTS – PTT Summation

        iv. Reserved

        v. X

    j. The following bits defined in the ED-137B standard for RTP-HE format shall be used for voice service identification

i. Extension for Additional Features

k. The “Extension for Additional Features” field shall be according to the list of voice service definitions given in section G.3.2.7 of this Base Standard.

7. Section 5.5.6: Multiple RTP audio stream management at GRS Transceiver/Transmitter

   a. The section shall be superceded by the following requirement: The half-duplex radio network shall handle multiple incoming audio streams according to the following:

      i. Priority between audio streams shall be based on IP QoS (STANAG 4644)

      ii. In the event of equal priority (IP QoS) access to the half-duplex radio network shall be based on “first come first served” basis

      iii. The half-duplex radio network shall not differentiate audio streams based on different PTT values, as all valid PTT values shall be treated as “equal priority”

8. Section 5.5.7: RTPRx Information Field

   a. Relative to section 5.5.5 (RTPTx Information field) and section 5.5.7 (RTPRx Information Field) the format of the Header Extension part of the RTP-HE shall be as defined in section Section 5.5.4: RTP Header Extension Description.

   b. Relative to the definition of the RTP-HE defined in ED-137B (format: ED-137B), the half-duplex radio shall support the following cases:

      i. Reception of ED-137B format for RTP-HE from terminal (network) to the half-duplex radio

   c. When transmitting RTP-HE from the half-duplex radio to network, the AComP-5634 format shall be used

   d. The number of bits allocated for PTT and Squelch shall be as defined in ED-137B.

   e. The standard shall only support the following values for Squelch (Bit 3):

      i. 0x00: SQ OFF

      ii. 0x01: SQ ON

   f. The PTT ON/OFF bits shall be set to zero from the half-duplex radio towards the network

   g. The following bits defined in the ED-137B standard for RTP-HE format shall be set to zero (for transmission): This is equal to the field defined as “reserved” in the AComP-5634 format

      i. PTT-ID

      ii. PM – PTT Mute

      iii. PTTS – PTT Summation

iv. Reserved

v. X

h. The following bits defined in the ED-137B standard for RTP-HE format shall be used for voice service identification

i. Extension for Additional Features

i. The “Extension for Additional Features” field shall be according to the list of voice service definitions given in section G.3.2.7 of this Base Standard.

9. Section 5.6: Additional Features Block

a. The RTP-HE shall set the extension for additional features according to the AComP-5634 format as defined in Section 5.5.4: RTP Header Extension Description in this base standard.

G.3.2.7 List of Voice Services: AComP-5634 Edition 1

SERVICE	CODEC	CODEC RATE	SERVICE IDENTIFIER
CVSD Voice	CVSD	16 kbps	10000001 00000001
CVSD Voice	CVSD	32 kbps	10000001 00000010
MELPe Voice	MELPe	600 bps	10000010 00000001
MELPe Voice	MELPe	1200 bps	10000010 00000010
MELPe Voice	MELPe	2400 bps	10000010 00000011
SCIP Secure Voice – Blank and Burst (FCT)	MELPe	2400 bps	10000100 00000010
SCIP Secure Voice –Burst w/o Blank (FCT)	MELPe	2400 bps	10000100 00000100
Secure G.729D Voice – Burst w/o Blank (FCT)	G.729D	6.4 kbps	10000100 00000101
FMN Voice (CS-ACELP)	G.729	8 kbps	10000100 00000110
PCM Voice	G.711μ-law	64 kbps	10001000 00000001
FMN/PCM Voice	G.711 a-law	64 kbps	10001000 00000010
FMN Voice	G.722.1	14 kbps	10001000 00000011
TSVCIS Voice	Enhanced MELPe	8 kbps	10010000 00000001
TSVCIS Voice	Enhanced MELPe	12 kbps	10010000 00000010
TSVCIS WB Voice 16 with FEC	Enhanced MELPe	16 kbps	10010000 00000011
TSVCIS WB Voice 16 w/o FEC	Enhanced MELPe	16 kbps	10010000 00000100
TSVCIS NB Voice	MELPe	2400 bps	10010000 00000101
TSVCIS NB Voice	MELPe	1200 bps	10010000 00000110
TSVCIS NB Voice	MELPe	600 bps	10010000 00000111
STaC-IS Legacy WB Voice 16	Enhanced MELPe	16 kbps	10010000 00001000
STaC-IS Legacy WB Voice w/o SC	Enhanced MELPe	16 kbps	10010000 00001001
STaC-IS NB Voice 2400	MELPe	2400 bps	10010000 00001010
National Use	X	X	11000000 xxxxxxxx

ANNEX H NPICS FOR IOP-HD INTERFACE – EUROCAE ED-137B BASED HALF-DUPLEX PROTOCOL

H.1 INTRODUCTION

1. Guidance, notations and instructions for completing the NPICS proforma can be found in Annex B of the AComP-5634 (this AComP).

H.2 NPICS

1. Section H.2.1 applies to implementation of the IOP-HD half-duplex protocol based on reference standard EUROCAE ED-137B and defined in Annex G in this document.
2. The half-duplex radio needs to implement the defined NPICSs in order to be compliant to the IOP-HD interface for half-duplex control.
3. Non-supported mandatory capabilities are to be identified in the NPICS, with an explanation of why the implementation is non-conformant. Such information shall be provided as exception information.

H.2.1 Identification of the Implementation and General Statement of Conformance

H.2.1.1 Implementation Identification

Nation/Supplier	AComP-5634 Annex I IOP-HD Interface - EUROCAE ED-137B Based Half-Duplex Protocol
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:

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

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

H.2.1.2General Statement of Conformance

Identification of protocol specification	AComP-5634 Annex I IOP-HD Interface - EUROCAE ED-137B Based Half-Duplex Protocol
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? (The answer Yes means that the implementation does not conform to the AComP)	No [ ] Yes [ ]

Date of Statement	

H.2.1.3NPICS for IOP-HD Half-Duplex Protocol based on EUROCAE ED-137B

Base Standard Features				
Item	**Protocol**	**Reference**	**Status**	**Support**
IOP-HD-ED1	Content of RTP-HE limited to PTT, PTT-ID and Squelch status	AComP-5634, Annex G, ch. 3.1	M	Yes [ ]
IOP-HD-ED2	RTP – General issues	AComP-5634, Annex G, ch. 3.2.1	M	Yes [ ]
IOP-HD-ED3	Basic system topology	AComP-5634, Annex G,, ch. 3.2.1	X	No [ ]
IOP-HD-ED4	RTP compliance to RFC 3550	AComP-5634, Annex G, ch. 3.2.1	M	Yes [ ]
IOP-HD-ED5	RTP payload compliance with RFC 3551	AComP-5634, Annex G, ch. 3.2.1	X	No [ ]
IOP-HD-ED6	RTP encoding rules	AComP-5634, Annex G, ch. 3.2.1	M	Yes [ ]
IOP-HD-ED7	RTP and RTCP UDP port numbers	AComP-5634, Annex G, ch. 3.2.1	X	No [ ]
IOP-HD-ED8	PTT transmission performance	AComP-5634, Annex G, ch. 3.2.2	M	Yes [ ]

Base Standard Features				
Item	**Protocol**	**Reference**	**Status**	**Support**
IOP-HD-ED9	Squelch transmission performance	AComP-5634, Annex G, ch. 3.2.2	M	Yes [ ]
IOP-HD-ED10	QoS	AComP-5634, Annex G, ch. 3.2.2	M	Yes [ ]
IOP-HD-ED11	CoS	AComP-5634, Annex G, ch. 3.2.2	X	No [ ]
IOP-HD-ED12	RTP header	AComP-5634, Annex G, ch. 3.2.3	M	Yes [ ]
IOP-HD-ED13	RTP-HE	AComP-5634, Annex G, ch. 3.2.4	M	Yes [ ]
IOP-HD-ED14	RTP-HE packet types	AComP-5634, Annex G, ch. 3.2.5	M	Yes [ ]
IOP-HD-ED15	PTT activation / De-activation	AComP-5634, Annex G, ch. 3.2.5	M	Yes [ ]
IOP-HD-ED16	PTT de-activation event	AComP-5634, Annex G,, ch. 3.2.5	M	Yes [ ]
IOP-HD-ED17	TX path audio to R2S transition	AComP-5634, Annex G, ch. 3.2.5	M	Yes [ ]
IOP-HD-ED18	Squelch activation / de-activation	AComP-5634, Annex G, ch. 3.2.6	M	Yes [ ]
IOP-HD-ED19	Squelch de-activation event	AComP-5634, Annex G, ch. 3.2.6	M	Yes [ ]
IOP-HD-ED20	RX path audio to R2S transition	AComP-5634, Annex G, ch. 3.2.6	M	Yes [ ]
IOP-HD-ED21	RTP-HE description	AComP-5634, Annex G, ch. 3.2.6	M	Yes [ ]

Base Standard Features				
Item	**Protocol**	**Reference**	**Status**	**Support**
IOP-HD-ED22	RTPTx information field	AComP-5634, Annex G, ch. 3.2.6	M	Yes [ ]
IOP-HD-ED23	Multiple RTP audio streams	AComP-5634, Annex G, ch. 3.2.6	M	Yes [ ]
IOP-HD-ED24	RTPrx information field	AComP-5634, Annex G, ch. 3.2.6	M	Yes [ ]
IOP-HD-ED25	Additional Features Block	AComP-5634, Annex G, ch. 3.2.6	M	Yes [ ]

ANNEX I BS FOR IOP-HD INTERFACE – SERVICE ADMISSION CONTROL, IDENTIFICATION, AND MAPPING BETWEEN THE IP NETWORK INTERFACE AND RADIO NETWORK

I.1 INTRODUCTION

1. The base standard describes the functions needed to properly map services accessing the IOP-HD network interface to a radio network:
    a. Service admission control
    b. Service identification
    c. Service mapping between the network interface and the radio network
2. The Service Mapper will be dependent on applicable waveform characteristics and demands.
3. To be able to fully specify compliance between two half-duplex radios, it is necessary to define user profiles based on the NPICS for this base standard, in which selection of options to “mandatory” or “not applicable” or “not allowed” requirements is made.
    a. User profiles are not part of this base standard or AComP
    b. User profiles should be defined in respective STANAGs or supporting standards for specific waveforms, eg NBWF.

I.2 SERVICE ADMISSION CONTROL

1. The IOP-HD service admission control function shall control which service or IP data received at the IOP-HD network interface that is eligible for transmission across the radio network
2. Service admission control is established to avoid using (potentially) limited radio network resources to forward traffic not intended or not approved for the radio network
3. Also service admission control will be useful to reduce unwanted traffic onto a radio network due to erroneous configurations, failure situations or unintended distribution of data into the radio network
4. Exact implementation of service admission control will be national responsibility.
5. The service approval service may be based on the following:
    a. Service admission control
        i. Blacklist policy : If identified to be on the blacklist, the data is dropped
        ii. QoS policy: If identified to have non-valid QoS, the data is dropped

b. Radio network multi-hop grant list

i. Multi-hop grant list: Approval for multi-hop transmission

c. TCP filtering

i. Identification of TCP traffic: To be discarded, sent to TCP proxy or passed without any processing

6. For edition 1, the blacklist entries shall minimum be based on:

a. IP destination addresses (ranges)

Figure I-1 represents a simplified sequence diagram for Service Admission control

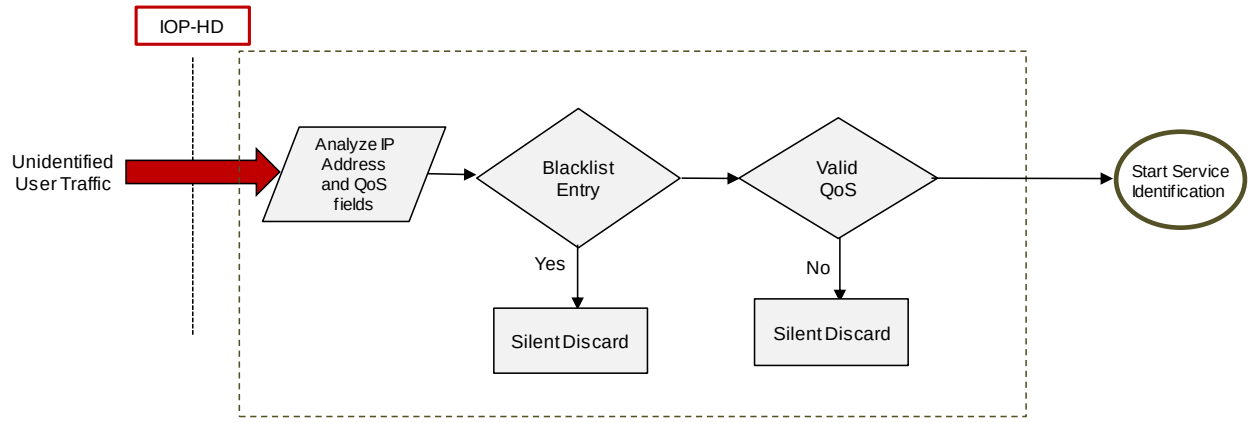

Figure I-1: IOP-HD Service Admission Control (Edition 1): Simplified

I.3 SERVICE IDENTIFICATION

1. Minimum the following services shall be supported (and identified) for IOP-HD Edition 1: Service identification

a. Voice service identification (list of applicable voice services listed in Annex G)

b. IP services: Multicast forwarding services

c. IP services: Unicast forwarding service

2. Further identification will be handled by the radio Service Mapper or Service Admission Control functions. Characteristics include:

a. Multicast radio network transmission: Multi-hop grant list

i. Approval for multicast multi-hop transmission request

b. Mutlicast radio network transmission: Single hop or multi-hop

i. Single-hop multicast forwarding services

ii. Multi-hop multicast forwarding services

iii. Two-hop multicast forwarding service

iv. Last update multicast forwarding services

3. In IOP-HD Edition 1, the primary service discriminators shall be:

a. IP destination address

b. IP QoS field

c. RTP header extension validity and content

4. Based on the IP address, QoS field and (potential) RTP-HE format, the Service mapper will be able to identify type of service and towards which Service Access Point (SAP) to forward the user traffic.

Figure I-2 represents a simplified sequence diagram for Service Identification.

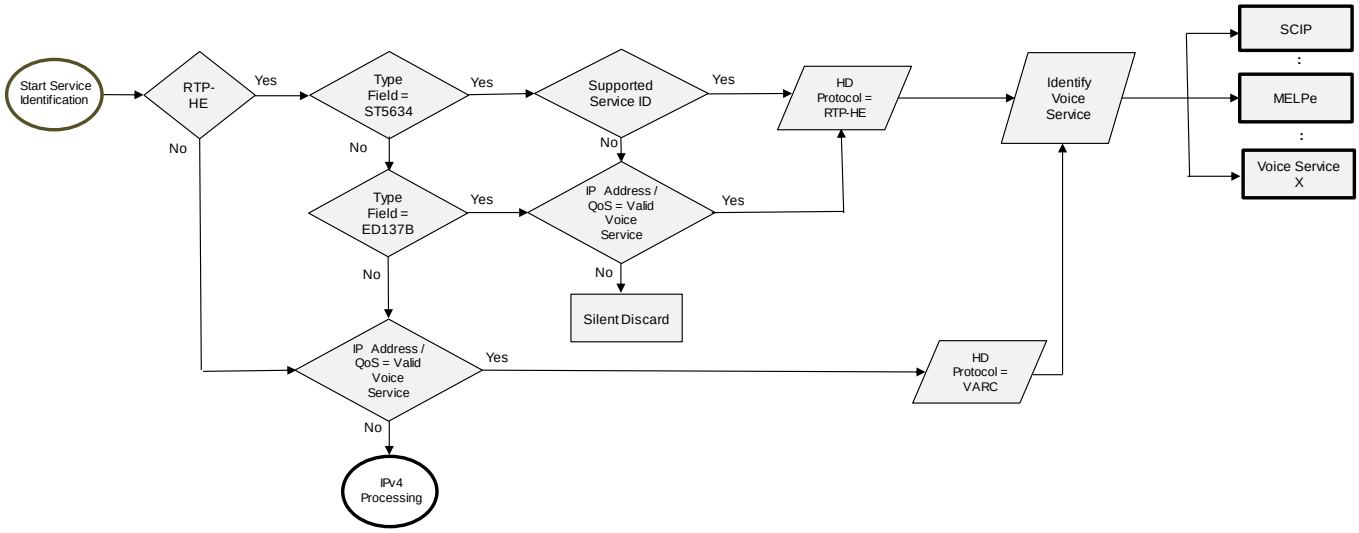

Figure I-2: IOP-HD Service Identification (Edition 1): Simplified

I.5 SERVICE MAPPING

1. When requested IOP-HD services have passed the service admission control and identification process, the service shall then be processed and mapped for transmission to the radio network via a service mapper function, which will be specific to each waveform or type of radio

2. IOP-HD Service Mapping is a set of rules and potential applications (e.g. proxys) that maps the incoming datagrams to identified service with the correct parameters set for transition to transmission in the radio network, and vice-versa.

3. The Service Mapper will be required to perform a minimum of service mapping based on type of service to be processed, and the relation between IP network and radio network characteristics.

4. Mapping services include (but are not limited to):
    a. Default set of rules for Quality of Service parameter transition between the IP network and radio network (e.g. radio network only supporting a subset of available QoS levels compared to the IP network, or support for policies for “Expedited Forwarding”)
    b. Identify or apply radio network characteristics, e.g. whether transmission is single hop or multihop, potentially type of multi-hop

5. Formatting for potential scaling and rebuilding of IP datagram to be transmitted or received on the radio interface datagrams (in the event that the entire package may not be transmitted due to bandwidth restrictions), including:
    a. Reconstruction of complete IP datagrams for receiving radio (over-the-air)
    b. Process for redistribution of route information across the air-interface

6. The Service Mapping function is included in the AComP-5634 for descriptional use only, and is not a part of the required standard to be conformant to the IOP-HD protocol.

ANNEX J NPICS FOR IOP-HD INTERFACE – SERVICE ADMISSION CONTROL, IDENTIFICATION AND MAPPING BETWEEN THE IP NETWORK INTERFACE AND RADIO NETWORK

J.1 INTRODUCTION

1. Guidance, notations and instructions for completing the NPICS proforma can be found in Annex B of the AComP-5634 (this AComP).

J.2 NPICS

1. Section J.2.1 applies to implementation of the IOP-HD Service Admission Control, Identification and Mapping between the IP Network interface and the radio network, defined in Annex I in this document.
2. An AComP-5634 compatible radio needs to implement according to defined NPICSs in order to be compliant to the IOP-HD Service Admission Control, Identification and Mapping functions.
3. Non-supported mandatory capabilities are to be identified in the NPICS, with an explanation of why the implementation is non-conformant. Such information shall be provided as exception information.

J.2.1 Identification of the Implementation and General Statement of Conformance

J.2.1.1 Implementation Identification

Nation/Supplier	AComP-5634 Annex K IOP-HD Interface –Service Admission Control, Identification and Mapping
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:

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

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

J.2.1.2 General Statement of Conformance

Identification of protocol specification	AComP-5634 Annex I IOP-HD Interface: Service Admission Control, Identification and Mapping
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? (The answer Yes means that the implementation does not conform to the AComP)	No [ ] Yes [ ]

Date of Statement	

J.2.1.3 NPICS for IOP-HD Interface: IOP-HD Service Admission Control, Identification and Mapping

Base Standard Features				
Item	**Protocol**	**Reference**	**Status**	**Support**
IOP-HD-SA1	Availability of Admission Control Blacklist function	AComP-5634, Annex I, ch. 2	M	Yes [ ]
IOP-HD-SA2	Availability of Admission Control QoS Validity fucntion	AComP-5634, Annex I, ch. 2	M	Yes [ ]
IOP-HD-SA3	Availability of Admission Control Multi-Hop Grant List	AComP-5634, Annex I, ch. 2	M	Yes [ ]
IOP-HD-SA4	Availability of Admission Control TCP Filtering	AComP-5634, Annex I, ch. 2	O	Yes [ ] No [ ]
IOP-HD-SA5	Admission Control Discrimination based on IP Addresses	AComP-5634, Annex I, ch. 2	M	Yes [ ]
IOP-HD-SI1	Service Identification of IP (data) multicast forwarding service	AComP-5634, Annex I, ch. 3	M	Yes [ ]
IOP-HD-SI2	Identification of IP (data) unicast forwarding service	AComP-5634, Annex I, ch. 3	M	Yes [ ]

IOP-HD-SI3	Identification of radio network single-hop or multi-hop characteristics	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-SI4	Identification of radio network type of multi-hop characteristics	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-SI5	Voice Service Identification based on RTP-HE Service Definition	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-SI6	Voice Service Identification based on IP addresses	AComP-5634, Annex I, ch. 3	M	Yes [ ]
IOP-HD-SI7	Voice Service Identification based on QoS field	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-SI18	Voice Service Identification based on RTP-HE content: Supported Service ID format	AComP-5634, Annex I, ch. 3	IOP-HD-SI5: M	N/A Yes [ ]
IOP-HD-SI9	Voice Service Identification based on IP addresses: Valid Voice Service format	AComP-5634, Annex I, ch. 3	M	Yes [ ]
IOP-HD-SM1	Service Mapping: QoS	AComP-5634, Annex I, ch. 4	X	-
IOP-HD-SM2	Service Mapping: Radio network hop characteristics	AComP-5634, Annex I, ch. 4	X	-
IOP-HD-SM3	Service Mapping: Datagram formatting	AComP-5634, Annex I, ch. 4	X	-
List of Voice Services (Edition 1)				
IOP-HD-VS1	Service Identification of CVSD Voice – 16 kbps	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS2	Service Identification of CVSD Voice – 32kbps	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS3	Service Identification of MELPe Service: 600 bps	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS4	Service Identification of MELPe Service: 1200 bps	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]

IOP-HD-VS5	Service Identification of MELPe Service: 2400 bps	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS6	Service Identification of SCIP Service: Secure 2400 bps MELPe Voice - Blank and Burst (FTC	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS7	Service Identification of SCIP Service: Secure 2400 bps MELPe Voice – Burst w/o Blank (FCT	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS8	Service Identification of SCIP Service: Secure G.729D Voice – Burst w/o Blank	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS9	Service Identification of FMN Service: G.729	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS10	Service Identification of PCM service: G.711µ-law / 64 kbps	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS11	Service Identification of FMN/PCM service: G.711a-law / 64 kbps	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS12	Service Identification of FMN Service: G.722.1	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS13	Service Identification of TSVCIS service: 8 kbps TSVCIS	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS14	Service Identification of TSVCIS service: 12 kbps TSVCIS	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS15	Service Identification of TSVCIS service: 16 kbps TSVCIS WB with FEC	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS16	Service Identification of TSVCIS service: 16 kbps TSVCIS WB w/o FEC	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS17	Service Identification of TSVCIS service: 2400 bps TSVCIS NB Voice	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS18	Service Identification of TSVCIS service: 1200 bps TSVCIS NB Voice	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]

IOP-HD-VS19	Service Identification of TSVCIS service: 600 bps TSVCIS NB Voice	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS20	Service Identification of STaC-IS service: Legacy WB Voice 16	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS21	Service Identification of STaC-IS service: Legacy WB Voice w/o SC	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS22	Service Identification of STaC-IS service: NB Voice 2400	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]
IOP-HD-VS23	Service Identification of Voice Service: National Use	AComP-5634, Annex I, ch. 3	O	Yes [ ] No [ ]

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ANNEX K EXAMPLE BASE PROFILE FOR AN ACOMP-5634 COMPLIANT HALF-DUPLEX RADIO

K.1 INTRODUCTION

1. The following NPICS Proforma tables represent a sample profile for an AComP-5634 compliant radio supporting NBWF, ref [19]
2. The overall “criteria” for the sample profile is:
    a. Static routing
    b. NBWF radio: Mandatory voice service: SCIP Blank and Burst (FCT) and PCM G.711 a-law
    c. Half-duplex protocol support: VARC
    d. Single-hop and multi-hop identification

K.2 BASE PROFILE ACOMP-5634

K.2.1 IOP-HD Interface

Base Standard Features					Profile Features	
Item	**Protocol**	**Clause of Base Standard**	**Status**		**Status**	**Support**
IOP-HD-TL2	IP Access Protocols – TCP	TACOMS standards for IP access protocols STANAG 4644 Annex F-1	-		X	No [ ]
IOP-HD-NL2	Dynamic Routing	TACOMS standard for gateway protocols STANAG 4647 Annex A-1	-		X	No [ ]
IOP-HD-NL9	IP QoS	Federated Mission Networking (FMN Spiral 3) standard for service instructions for protected core communications, IP QoS Profile	-		X	No [ ]
IOP-HD-HD1	IP Access Protocols – RTP-HE	EUROCAE Interoperability Standards for VOIP ATM Components, Volume 1: Radio	-		X	No [ ]

K.2.2 Service Admission Control, Identification and Mapper

Base Standard Features				
Item	**Protocol**	**Reference**	**Status**	**Support**
IOP-HD-SA4	Availability of Admission Control TCP Filtering	AComP-5634, Annex I, ch. 2	X	No [ ]
IOP-HD-SI3	Identification of radio network single-hop or multi-hop characteristics	AComP-5634, Annex I, ch. 3	M	Yes [ ]
IOP-HD-SI4	Identification of radio network type of multi-hop characteristics	AComP-5634, Annex I, ch. 3	M	Yes [ ]
IOP-HD-SI5	Voice Service Identification based on RTP-HE Service Definition	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-SI7	Voice Service Identification based on QoS field	AComP-5634, Annex I, ch. 3	X	No [ ]
List of Voice Services (Edition 1)				
IOP-HD-VS1	Service Identification of CVSD Voice – 16 kbps	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS2	Service Identification of CVSD Voice – 32kbps	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS3	Service Identification of MELPe Service: 600 bps	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS4	Service Identification of MELPe Service: 1200 bps	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS5	Service Identification of MELPe Service: 2400 bps	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS6	Service Identification of SCIP Service: Secure 2400 bps MELPe Voice - Blank and Burst (FTC)	AComP-5634, Annex I, ch. 3	M	Yes [ ]
IOP-HD-VS7	Service Identification of SCIP Service: Secure 2400 bps MELPe Voice – Burst w/o Blank (FCT)	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS8	Service Identification of SCIP Service: Secure G.729D Voice – Burst w/o Blank	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS9	Service Identification of FMN Service: G.729	AComP-5634, Annex I, ch. 3	X	No [ ]

IOP-HD-VS10	Service Identification of PCM service: G.711µ-law / 64 kbps	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS11	Service Identification of PCM service: G.711a-law / 64 kbps	AComP-5634, Annex I, ch. 3	M	Yes [ ]
IOP-HD-VS12	Service Identification of FMN Service: G.722.1	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS13	Service Identification of TSVCIS service: 8 kbps TSVCIS	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS14	Service Identification of TSVCIS service: 12 kbps TSVCIS	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS15	Service Identification of TSVCIS service: 16 kbps TSVCIS WB with FEC	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS16	Service Identification of TSVCIS service: 16 kbps TSVCIS WB w/o FEC	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS17	Service Identification of TSVCIS service: 2400 bps TSVCIS NB Voice	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS18	Service Identification of TSVCIS service: 1200 bps TSVCIS NB Voice	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS19	Service Identification of TSVCIS service: 600 bps TSVCIS NB Voice	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS20	Service Identification of STaC-IS service: Legacy WB Voice 16	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS21	Service Identification of STaC-IS service: Legacy WB Voice w/o SC	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS22	Service Identification of STaC-IS service: NB Voice 2400	AComP-5634, Annex I, ch. 3	X	No [ ]
IOP-HD-VS23	Service Identification of Voice Service: National Use	AComP-5634, Annex I, ch. 3	X	No [ ]

AComP-5634(A)(1)