



IEC 61162-460

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COMMENTED VERSION

INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems –
Digital interfaces –
Part 460: Multiple talkers and multiple listeners – Ethernet interconnection –
Safety and security**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD	6
Introduction to the Amendment	6
1 Scope	10
2 Normative references	10
3 Terms and definitions	11
4 High-level requirements	18
4.1 Overview	18
4.2 Description	18
4.3 General requirements	19
4.3.1 Equipment and system requirements	19
4.3.2 Physical composition requirements	20
4.3.3 Logical composition requirements	20
4.4 Physical component requirements	20
4.4.1 450-Node	20
4.4.2 460-Node	20
4.4.3 460-Switch	21
4.4.4 460-Forwarder	21
4.4.5 460-Gateway and 460-Wireless gateway	21
4.5 Logical component requirements	21
4.5.1 Network monitoring function	21
4.5.2 System management function	22
4.6 System documentation requirements	22
4.7 Secure area requirements	22
5 Network traffic management requirements	23
5.1 460-Node requirements	23
5.2 460-Switch requirements	23
5.2.1 Resource allocation	23
5.2.2 Loop prevention	24
5.3 460-Forwarder requirements	24
5.3.1 Traffic separation	24
5.3.2 Resource allocation	24
5.3.3 Traffic prioritization	25
5.4 System design requirements	26
5.4.1 Documentation	26
5.4.2 Traffic	26
5.4.3 Connections between secure and non-secure areas	26
6 Security requirements	26
6.1 Security scenarios	26
6.1.1 Threat scenarios	26
6.1.2 Internal threats	27
6.1.3 External threats	27
6.2 Internal security requirements	27
6.2.1 General	27
6.2.2 Denial of service protection	28
6.2.3 REDS security	28
6.2.4 Access control	30

6.2.5	Executable and non-executable file security	31
6.2.6	Recording of device management activities	32
6.3	External security requirements	33
6.3.1	Overview	33
6.3.2	Firewalls	34
6.3.3	Direct communication	34
6.3.4	460-Node Node requirements for direct communication n	36
6.3.5	460-Gateway	37
6.3.6	460-Wireless gateway	39
6.4	Additional security issues	39
6.5	Onboard software maintenance	40
6.5.1	General	40
6.5.2	Roll back to previous safe configuration	41
6.5.3	Software maintenance in maintenance mode	41
6.5.4	Semi-automatic software maintenance by the crew onboard the vessel	41
6.5.5	Remote software maintenance	42
6.6	Secure software lifecycle management	43
7	Redundancy requirements	43
7.1	General requirements	43
7.1.1	General	43
7.1.2	Interface redundancy	44
7.1.3	Device redundancy	44
7.2	460-Node requirements	44
7.3	460-Switch requirements	45
7.4	460-Forwarder requirements	45
7.5	460-Gateway and 460-Wireless gateway requirements	45
7.6	Network monitoring function requirements	45
7.7	System design requirements	45
8	Network monitoring requirements	45
8.1	Network status monitoring	45
8.1.1	460-Network	45
8.1.2	460-Node	45
8.1.3	460-Switch	46
8.1.4	460-Forwarder	46
8.2	Network monitoring function	47
8.2.1	General	47
8.2.2	Network load monitoring function	48
8.2.3	Redundancy monitoring function	49
8.2.4	Network topology monitoring function	49
8.2.5	Syslog recording function	52
8.2.6	Redundancy of network monitoring function	53
8.2.7	Alert management	53
9	Controlled network requirements	54
10	Methods of testing and required test results	55
10.1	Subject of tests	55
10.2	Test site	55
10.3	General requirements	56
10.4	450-Node	56

10.5	460-Node	56
10.5.1	Network traffic management	56
10.5.2	Security	57
10.5.3	Redundancy	61
10.5.4	Monitoring	61
10.6	460-Switch	61
10.6.1	Resource allocation	61
10.6.2	Loop prevention	62
10.6.3	Security	62
10.6.4	Monitoring	66
10.7	460-Forwarder	66
10.7.1	Traffic separation	66
10.7.2	Resource allocation	67
10.7.3	Traffic prioritisation	67
10.7.4	Security	67
10.7.5	Monitoring	69
10.8	460-Gateway	69
10.8.1	Denial of service behaviour	69
10.8.2	Access control to configuration setup	69
10.8.3	Communication security	70
10.8.4	Firewall	70
10.8.5	Application server services	72
10.8.6	Interoperable access to file storage of DMZ	72
10.8.7	Additional security	72
10.9	460-Wireless gateway	73
10.9.1	General	73
10.9.2	Security	73
10.10	Controlled network	73
10.11	Network monitoring function	74
10.11.1	General	74
10.11.2	Network load monitoring function	74
10.11.3	Redundancy monitoring function	74
10.11.4	Network topology monitoring function	75
10.11.5	Syslog recording function	75
10.11.6	Alert management	76
10.12	System level	77
10.12.1	General	77
10.12.2	System management function	78
10.12.3	System design	78
10.12.4	Network monitoring function	80
10.12.5	Network load monitoring function	80
10.12.6	Redundancy monitoring function	80
10.12.7	Network topology monitoring function	80
Annex A (informative) Communication scenarios between an IEC 61162-460 network and uncontrolled networks		81
A.1	General	81
A.2	Routine off-ship	81
A.3	Routine on-ship	82
A.4	460-Gateway usage for direct connection with equipment	82

Annex B (informative) Summary of redundancy protocols in IEC 62439 (all parts)	83
Annex C (informative) Guidance for testing	84
C.1 Methods of test.....	84
C.2 Observation.....	84
C.3 Inspection of documented evidence.....	84
C.4 Measurement	84
C.5 Analytical evaluation.....	85
Annex D (informative) Some examples to use this document	86
Annex E (normative) IEC 61162 interfaces for the network monitoring function.....	90
Annex F (informative) Distribution of functions around 460-Network.....	91
Annex G (normative) USB class codes.....	93
Annex H (informative) Cross reference between IACS UR E26/E27 and IEC 61162-460.....	94
Bibliography.....	97
List of comments.....	99
Figure 1 – Functional overview of IEC 61162-460- requirement applications.....	19
Figure 2 – 460-Network with 460-Gateway.....	34
Figure 3 – Example of redundancy.....	44
Figure 4 – Example of network status recording information	48
Figure A.1 – Usage model for communication between a IEC 61162-460 network and shore networks	81
Figure D.1 – 460-Forwarder used between two networks.....	86
Figure D.2 – 460-Forwarder used between two networks.....	86
Figure D.3 – 460-Gateway used for e-Navigation services	87
Figure D.4 – 460-Gateway used for remote maintenance.....	87
Figure D.5 – 460-Forwarder used to separate an INS system based on its own controlled network from a network of -460 devices	88
Figure D.6 – 460-Forwarder used to separate a radar system based on its own controlled network from a network of -460 devices	89
Figure E.1 – Network monitoring function logical interfaces	90
Table 1 – Traffic prioritization with CoS and DSCP	25
Table 2 – Summary of alert of network monitoring	53
Table B.1 – Redundancy protocols and recovery times.....	83
Table E.1 – Sentences received by the network monitoring function.....	90
Table E.2 – Sentences transmitted by the network monitoring function.....	90
Table F.1 – Distribution of functions around 460-Network	91
Table F.2 – Equipment standards referencing IEC 61162-460.....	92
Table G.1 – USB class codes	93
Table H.1 – Cross reference between IACS UR E26/E27 and IEC 61162-460	94

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MARITIME NAVIGATION AND RADIOCOMMUNICATION
EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –****Part 460: Multiple talkers and multiple listeners –
Ethernet interconnection – Safety and security**

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This commented version (CMV) of the official standard IEC 61162-460:2024 edition 3.0 allows the user to identify the changes made to the previous IEC 61162-460:2018+AMD1:2020 CSV edition 2.1. Furthermore, comments from IEC TC 80 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 61162-460 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. It is an International Standard.

This third edition cancels and replaces the second edition published in 2018 and Amendment 1:2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) term application server in the 460-Gateway has been changed to application service and application services have been clarified;
- b) based on field experience the alert limit of the network monitoring load has been changed from 80 % to 90 %;
- c) default time for escalation of a warning to an alarm has been changed from max 60 seconds to max 5 minutes as allowed by IMO BAM rules and escalation from caution to warning has been removed from the use of direct access;
- d) recorded event size in network monitoring function has been changed from 1 000 bytes to 1 472 bytes (i.e. size of an ethernet datagram in the network);
- e) requirements have been incorporated for cyber resilience given by the International Association of Classification Societies (IACS) in their documents UR E26 and UR E27. A new Annex H has been added giving a cross reference between the IACS documents and this document.

The text of this International Standard is based on the following documents:

Draft	Report on voting
80/1103/FDIS	80/1112/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This International Standard is to be used in conjunction with IEC 61162-450:2024.

A list of all parts in the IEC 61162 series, published under the general title *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

The contents of the corrigendum 1 (2024-08) have been included in this copy.

~~Introduction to the Amendment~~

~~This amendment provides greater clarity to the external security requirements in 6.3, updates the alert management in 8.2.7 and associated tests in 10.11.6 to comply with bridge alert management and provides an improved test of firewalls in 10.8.4.~~

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 460: Multiple talkers and multiple listeners – Ethernet interconnection – Safety and security

1 Scope

This part of IEC 61162 is an add-on to IEC 61162-450 where higher safety and security standards are needed, for example due to higher exposure to external threats or to improve network integrity. This document provides requirements and test methods for equipment to be used in an IEC 61162-460 compliant network as well as requirements for the network itself and requirements for interconnection from the network to other networks. This document also contains requirements for a redundant IEC 61162-460 compliant network.

This document does not introduce new application level protocol requirements to those that are defined in IEC 61162-450.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60945, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61162-450:2018/2024 **1**, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection*

IEC 62923-1, *Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 1: Operational and performance requirements, methods of testing and required test results*

IEC 62923-2, *Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 2: Alert and cluster identifiers and other additional features*

IEEE 802.1D-2004, *IEEE Standard for Local and metropolitan area networks: Media Access Control (MAC) Bridges*

IEEE 802.1Q, *IEEE Standard for Local and metropolitan area networks: Virtual Bridged Local Area Networks*

~~INTERNET SOCIETY (ISOC), RFC 792, Internet Control Message Protocol (ICMP), Standard STD0005 (and updates) [online]. Edited by J. Postel. September 1981 [viewed 2018-01-08]. Available at <https://tools.ietf.org/html/rfc792>~~

~~INTERNET SOCIETY (ISOC), RFC 1112, Host Extensions for IP Multicasting [online]. Edited by S. Deering. August 1989 [viewed 2018-01-08]. Available at <https://www.ietf.org/rfc/rfc1112.txt>~~

~~INTERNET SOCIETY (ISOC). RFC 1157, A Simple Network Management Protocol (SNMP)~~
~~– [online]. Edited by J. Case et al. May 1990 [viewed 2018-01-08]. Available at~~
~~<https://tools.ietf.org/html/rfc1157>~~

~~INTERNET SOCIETY (ISOC). RFC 2021, Remote Network Monitoring Management~~
~~Information Base [online]. Edited by S. Waldbusser. January 1997 [viewed 2018-01-08].~~
~~Version 2~~
Available at <https://tools.ietf.org/html/rfc2021>

~~INTERNET SOCIETY (ISOC). RFC 2236, Internet Group Management Protocol, Version 2~~
~~– [online]. Edited by W. Fenner. November 1997 [viewed 2018-01-08]. Available at~~
~~<https://tools.ietf.org/html/rfc2236>~~

~~INTERNET SOCIETY (ISOC). RFC 2819, Remote Network Monitoring Management~~
~~Information Base~~
~~– [online]. Edited by S. Waldbusser. May 2000 [viewed 2018-01-08]. Available at~~
~~<https://tools.ietf.org/html/rfc2819>~~

~~INTERNET SOCIETY (ISOC). RFC 3411, An Architecture for Describing Simple Network~~
~~Management Protocol (SNMP) Management Frameworks~~
~~– [online]. Edited by D. Harrington. December 2002 [viewed 2018-01-08]. Available at~~
~~<https://www.ietf.org/rfc/rfc3411.txt>~~

~~INTERNET SOCIETY (ISOC). RFC 3577, Introduction to the Remote Monitoring RMON family~~
~~of MIB modules – [online]. Edited by S. Waldbusser. August 2003 [viewed 2018-01-08]. Available~~
~~at <https://tools.ietf.org/html/rfc3577>~~

~~INTERNET SOCIETY (ISOC). RFC 4604, Using Internet Group Management Protocol Version~~
~~3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific~~
~~Multicast~~
~~– [online]. Edited by H. Holbrook et al. August 2006 [viewed 2018-01-08]. Available at~~
~~<https://tools.ietf.org/html/rfc4604>~~

~~INTERNET SOCIETY (ISOC). RFC 5424, The Syslog Protocol~~
~~– [online]. Edited by R. Gerhards. March 2009 [viewed 2018-01-08]. Available at~~
~~<https://tools.ietf.org/html/rfc5424>~~

INTERNATIONAL STANDARD



**Maritime navigation and radiocommunication equipment and systems – Digital interfaces –
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Safety and security**

CONTENTS

FOREWORD.....	6
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	9
4 High-level requirements.....	16
4.1 Overview.....	16
4.2 Description	16
4.3 General requirements	16
4.3.1 Equipment and system requirements	16
4.3.2 Physical composition requirements	17
4.3.3 Logical composition requirements	17
4.4 Physical component requirements.....	17
4.4.1 450-Node.....	17
4.4.2 460-Node.....	18
4.4.3 460-Switch	18
4.4.4 460-Forwarder	18
4.4.5 460-Gateway and 460-Wireless gateway	19
4.5 Logical component requirements.....	19
4.5.1 Network monitoring function	19
4.5.2 System management function	19
4.6 System documentation requirements	19
4.7 Secure area requirements.....	20
5 Network traffic management requirements.....	20
5.1 460-Node requirements.....	20
5.2 460-Switch requirements.....	20
5.2.1 Resource allocation	20
5.2.2 Loop prevention.....	21
5.3 460-Forwarder requirements	21
5.3.1 Traffic separation.....	21
5.3.2 Resource allocation	22
5.3.3 Traffic prioritization.....	22
5.4 System design requirements	23
5.4.1 Documentation	23
5.4.2 Traffic.....	23
5.4.3 Connections between secure and non-secure areas	23
6 Security requirements.....	24
6.1 Security scenarios	24
6.1.1 Threat scenarios.....	24
6.1.2 Internal threats	24
6.1.3 External threats	24
6.2 Internal security requirements.....	25
6.2.1 General	25
6.2.2 Denial of service protection	25
6.2.3 REDS security	25
6.2.4 Access control	26
6.2.5 Executable and non-executable file security	28

6.2.6	Recording of device management activities	29
6.3	External security requirements	30
6.3.1	Overview	30
6.3.2	Firewalls	30
6.3.3	Direct communication	31
6.3.4	Node requirements for direct communication	32
6.3.5	460-Gateway	33
6.3.6	460-Wireless gateway	34
6.4	Additional security issues	35
6.5	Onboard software maintenance	36
6.5.1	General	36
6.5.2	Roll back to previous safe configuration	36
6.5.3	Software maintenance in maintenance mode	37
6.5.4	Semi-automatic software maintenance by the crew onboard the vessel	37
6.5.5	Remote software maintenance	38
6.6	Secure software lifecycle management	39
7	Redundancy requirements	39
7.1	General requirements	39
7.1.1	General	39
7.1.2	Interface redundancy	39
7.1.3	Device redundancy	40
7.2	460-Node requirements	40
7.3	460-Switch requirements	40
7.4	460-Forwarder requirements	40
7.5	460-Gateway and 460-Wireless gateway requirements	40
7.6	Network monitoring function requirements	41
7.7	System design requirements	41
8	Network monitoring requirements	41
8.1	Network status monitoring	41
8.1.1	460-Network	41
8.1.2	460-Node	41
8.1.3	460-Switch	41
8.1.4	460-Forwarder	42
8.2	Network monitoring function	42
8.2.1	General	42
8.2.2	Network load monitoring function	43
8.2.3	Redundancy monitoring function	44
8.2.4	Network topology monitoring function	45
8.2.5	Syslog recording function	47
8.2.6	Redundancy of network monitoring function	48
8.2.7	Alert management	48
9	Controlled network requirements	49
10	Methods of testing and required test results	50
10.1	Subject of tests	50
10.2	Test site	50
10.3	General requirements	51
10.4	450-Node	51
10.5	460-Node	51

10.5.1	Network traffic management	51
10.5.2	Security	52
10.5.3	Redundancy	55
10.5.4	Monitoring	55
10.6	460-Switch	55
10.6.1	Resource allocation	55
10.6.2	Loop prevention	56
10.6.3	Security	56
10.6.4	Monitoring	59
10.7	460-Forwarder	60
10.7.1	Traffic separation	60
10.7.2	Resource allocation	60
10.7.3	Traffic prioritisation	61
10.7.4	Security	61
10.7.5	Monitoring	62
10.8	460-Gateway	63
10.8.1	Denial of service behaviour	63
10.8.2	Access control to configuration setup	63
10.8.3	Communication security	63
10.8.4	Firewall	64
10.8.5	Application services	65
10.8.6	Interoperable access to file storage of DMZ	65
10.8.7	Additional security	66
10.9	460-Wireless gateway	66
10.9.1	General	66
10.9.2	Security	66
10.10	Controlled network	66
10.11	Network monitoring function	67
10.11.1	General	67
10.11.2	Network load monitoring function	67
10.11.3	Redundancy monitoring function	68
10.11.4	Network topology monitoring function	68
10.11.5	Syslog recording function	69
10.11.6	Alert management	69
10.12	System level	70
10.12.1	General	70
10.12.2	System management function	71
10.12.3	System design	71
10.12.4	Network monitoring function	73
10.12.5	Network load monitoring function	73
10.12.6	Redundancy monitoring function	73
10.12.7	Network topology monitoring function	73
Annex A (informative) Communication scenarios between an IEC 61162-460 network and uncontrolled networks		74
A.1	General	74
A.2	Routine off-ship	74
A.3	Routine on-ship	75
A.4	460-Gateway usage for direct connection with equipment	75
Annex B (informative) Summary of redundancy protocols in IEC 62439 (all parts)		76

Annex C (informative) Guidance for testing	77
C.1 Methods of test	77
C.2 Observation	77
C.3 Inspection of documented evidence	77
C.4 Measurement	77
C.5 Analytical evaluation	78
Annex D (informative) Some examples to use this document	79
Annex E (normative) IEC 61162 interfaces for the network monitoring function	83
Annex F (informative) Distribution of functions around 460-Network	84
Annex G (normative) USB class codes	86
Annex H (informative) Cross reference between IACS UR E26/E27 and IEC 61162-460	87
Bibliography	90
Figure 1 – Functional overview of IEC 61162-460 applications	16
Figure 2 – 460-Network with 460-Gateway	30
Figure 3 – Example of redundancy	39
Figure 4 – Example of network status recording information	43
Figure A.1 – Usage model for communication between a IEC 61162-460 network and shore networks	74
Figure D.1 – 460-Forwarder used between two networks	79
Figure D.2 – 460-Forwarder used between two networks	79
Figure D.3 – 460-Gateway used for e-Navigation services	80
Figure D.4 – 460-Gateway used for remote maintenance	80
Figure D.5 – 460-Forwarder used to separate an INS system based on its own controlled network from a network of -460 devices	81
Figure D.6 – 460-Forwarder used to separate a radar system based on its own controlled network from a network of -460 devices	82
Figure E.1 – Network monitoring function logical interfaces	83
Table 1 – Traffic prioritization with CoS and DSCP	22
Table 2 – Summary of alert of network monitoring	48
Table B.1 – Redundancy protocols and recovery times	76
Table E.1 – Sentences received by the network monitoring function	83
Table E.2 – Sentences transmitted by the network monitoring function	83
Table F.1 – Distribution of functions around 460-Network	84
Table F.2 – Equipment standards referencing IEC 61162-460	85
Table G.1 – USB class codes	86
Table H.1 – Cross reference between IACS UR E26/E27 and IEC 61162-460	87

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Ethernet interconnection – Safety and security**

FOREWORD

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IEC 61162-460 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. It is an International Standard.

This third edition cancels and replaces the second edition published in 2018 and Amendment 1:2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) term application server in the 460-Gateway has been changed to application service and application services have been clarified;
- b) based on field experience the alert limit of the network monitoring load has been changed from 80 % to 90 %;

- c) default time for escalation of a warning to an alarm has been changed from max 60 seconds to max 5 minutes as allowed by IMO BAM rules and escalation from caution to warning has been removed from the use of direct access;
- d) recorded event size in network monitoring function has been changed from 1 000 bytes to 1 472 bytes (i.e. size of an ethernet datagram in the network);
- e) requirements have been incorporated for cyber resilience given by the International Association of Classification Societies (IACS) in their documents UR E26 and UR E27. A new Annex H has been added giving a cross reference between the IACS documents and this document.

The text of this International Standard is based on the following documents:

Draft	Report on voting
80/1103/FDIS	80/1112/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This International Standard is to be used in conjunction with IEC 61162-450:2024.

A list of all parts in the IEC 61162 series, published under the general title *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

The contents of the corrigendum 1 (2024-08) have been included in this copy.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 460: Multiple talkers and multiple listeners – Ethernet interconnection – Safety and security

1 Scope

This part of IEC 61162 is an add-on to IEC 61162-450 where higher safety and security standards are needed, for example due to higher exposure to external threats or to improve network integrity. This document provides requirements and test methods for equipment to be used in an IEC 61162-460 compliant network as well as requirements for the network itself and requirements for interconnection from the network to other networks. This document also contains requirements for a redundant IEC 61162-460 compliant network.

This document does not introduce new application level protocol requirements to those that are defined in IEC 61162-450.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60945, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61162-450:2024, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection*

IEC 62923-1, *Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 1: Operational and performance requirements, methods of testing and required test results*

IEC 62923-2, *Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 2: Alert and cluster identifiers and other additional features*

IEEE 802.1D-2004, *IEEE Standard for Local and metropolitan area networks: Media Access Control (MAC) Bridges*

IEEE 802.1Q, *IEEE Standard for Local and metropolitan area networks: Virtual Bridged Local Area Networks*

ISOC RFC 792, *Internet Control Message Protocol (ICMP), Standard STD0005 (and updates)*
Available at <https://tools.ietf.org/html/rfc792>

ISOC RFC 1112, *Host Extensions for IP Multicasting*
Available at <https://www.ietf.org/rfc/rfc1112.txt>

ISOC RFC 1157, *A Simple Network Management Protocol (SNMP)*
Available at <https://tools.ietf.org/html/rfc1157>

ISOC RFC 2021, *Remote Network Monitoring Management Information Base Version 2*
Available at <https://tools.ietf.org/html/rfc2021>

ISOC RFC 2236, *Internet Group Management Protocol, Version 2*
Available at <https://tools.ietf.org/html/rfc2236>

ISOC RFC 2819, *Remote Network Monitoring Management Information Base*
Available at <https://tools.ietf.org/html/rfc2819>

ISOC RFC 3411, *An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks*
Available at <https://www.ietf.org/rfc/rfc3411.txt>

ISOC RFC 3577, *Introduction to the Remote Monitoring RMON family of MIB modules*
Available at <https://tools.ietf.org/html/rfc3577>

ISOC RFC 4604, *Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast*
Available at <https://tools.ietf.org/html/rfc4604>

ISOC RFC 5424, *The Syslog Protocol*
Available at <https://tools.ietf.org/html/rfc5424>