

Irish Standard I.S. EN 61162-450:2011&A1:2016

Maritime navigation and radiocommunication equipment and systems - Digital interfaces -Part 450: Multiple talkers and multiple listeners - Ethernet interconnection

 $\ensuremath{\mathbb O}$ CENELEC 2016 $\hfill No$ copying without NSAI permission except as permitted by copyright law.

I.S. EN 61162-450:2011&A1:2016

Incorporating amendments/corrigenda/National Annexes issued since publication:

EN 61162-450:2011/A1:2016

The National Standards Authority of Ireland (NSAI) produces the following categories of formal documents:

I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation — recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces/revises/consolidates the NSAI adoption of the document(s) indicated on the CEN/CENELEC cover/Foreword and the following National document(s):

NOTE: The date of any NSAI previous adoption may not match the date of its original CEN/CENELEC document.

This document is based on: EN 61162-450:2011 *Published:* 2011-08-19

<i>This document was published</i> under the authority of the NSAI and comes into effect on:			ICS number:
2016-06-07	,	NOTE: If bl	ank see CEN/CENELEC cover page
NSAI	T +353 1	807 3800	Sales:
1 Swift Square,	F +353 1	807 3838	T +353 1 857 6730
Northwood, Santry	E standa	rds@nsai.ie	F +353 1 857 6729
Dublin 9	W NSAI.i	e	W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann			

National Foreword

I.S. EN 61162-450:2011&A1:2016 is the adopted Irish version of the European Document EN 61162-450:2011, Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 450: Multiple talkers and multiple listeners - Ethernet interconnection

This document does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with this document does not of itself confer immunity from legal obligations.

In line with international standards practice the decimal point is shown as a comma (,) throughout this document.

This is a free page sample. Access the full version online.

This page is intentionally left blank

EUROPEAN STANDARD

EN 61162-450:2011/A1

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2016

ICS 47.020.70

English Version

Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 450: Multiple talkers and multiple listeners - Ethernet interconnection (IEC 61162-450:2011/A1:2016)

Matériels et systèmes de navigation et de radiocommunication maritimes - Interfaces numériques -Partie 450: Emetteurs multiples et récepteurs multiples -Interconnexion Ethernet (IEC 61162-450:2011/A1:2016) Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt - Digitale Schnittstellen - Teil 450: Mehrere Datensenden und mehrere Datenempfänger -Ethernet Verbund (IEC 61162-450:2011/A1:2016)

This amendment A1 modifies the European Standard EN 61162-450:2011; it was approved by CENELEC on 2016-05-05. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization Comité Européen de Normalisation Electrotechnique Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2016 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

This is a free page sample. Access the full version online. I.S. EN 61162-450:2011&A1:2016

EN 61162-450:2011/A1:2016

European foreword

The text of document 80/795/FDIS, future IEC 61162-450:2011/A1, prepared by IEC/TC 80 "Maritime navigation and radiocommunication equipment and systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61162-450:2011/A1:2016.

The following dates are fixed:

•	latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2017-02-05
•	latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2019-05-05

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61162-450:2011/A1:2016 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

Addition:

IEC 61174

NOTE Harmonized as EN 61174.

Delete

IEC 61996-1

NOTE Harmonized as EN 61996-1

This is a free page sample. Access the full version online. I.S. EN 61162-450:2011&A1:2016

EUROPEAN STANDARD

EN 61162-450

NORME EUROPÉENNE EUROPÄISCHE NORM

August 2011

ICS 47.020.70

English version

Maritime navigation and radiocommunication equipment and systems -Digital interfaces -Part 450: Multiple talkers and multiple listeners -Ethernet interconnection

(IEC 61162-450:2011)

Matériels et systèmes de navigation et de radiocommunication maritimes -Interfaces numériques -Partie 450: Emetteurs multiples et récepteurs multiples -Interconnexion Ethernet (CEI 61162-450:2011) Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt -Digitale Schnittstellen -Teil 450: Mehrere Datensenden und mehrere Datenempfänger -Leichte Schiffssystemzusammenschaltung (IEC 61162-450:2011)

This European Standard was approved by CENELEC on 2011-07-15. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization Comité Européen de Normalisation Electrotechnique Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

© 2011 CENELEC - All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Foreword

The text of document 80/615/FDIS, future edition 1 of IEC 61162-450, prepared by IEC TC 80, Maritime navigation and radiocommunication equipment and systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61162-450 on 2011-07-15.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

-	latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2012-04-15
_	latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2014-07-15

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61162-450:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60603-7	NOTE	Harmonized as EN 60603-7.
IEC 60603-7-3	NOTE	Harmonized as EN 60603-7-3.
IEC 60603-7-7	NOTE	Harmonized as EN 60603-7-7.
IEC 61076-2-101	NOTE	Harmonized as EN 61076-2-101.
IEC 61162-2	NOTE	Harmonized as EN 61162-2.
IEC 61162-3	NOTE	Harmonized as EN 61162-3.
IEC 61754-20	NOTE	Harmonized as EN 61754-20.
IEC 61996-1	NOTE	Harmonized as EN 61996-1.
IEC 62388	NOTE	Harmonized as EN 62388.

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60825-2	-	Safety of laser products - Part 2: Safety of optical fibre communication systems (OFCS)	EN 60825-2	-
IEC 60945	-	Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results	EN 60945	-
IEC 61162-1	-	Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners	EN 61162-1	-
IEEE 802.3	-	IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications	-	-
ISOC RFC 768	-	User Datagram Protocol	-	-
ISOC RFC 791	-	Internet Protocol - DARPA Internet Program Protocol Specification	-	-
ISOC RFC 792	-	Internet Control Message Protocol	-	-
ISOC RFC 826	-	Ethernet Address Resolution Protocol	-	-
ISOC RFC 1918	-	Address Allocation for Private Internets	-	-
ISOC RFC 2474	-	Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers	-	-
ISOC RFC 5000	-	Internet Official Protocol Standards	-	-
ISOC RFC 5227	-	IPv4 Address Conflict Detection	-	-
ISOC RFC 5424	-	The Syslog Protocol	-	-
NMEA 0183	2008	Standard for interfacing marine electronic devices	-	-

This is a free page sample. Access the full version online.

This page is intentionally left blank



IEC 61162-450

Edition 1.0 2011-06

INTERNATIONAL STANDARD

Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection





All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office 3, rue de Varembé CH-1211 Geneva 20 Switzerland Email: inmail@iec.ch Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Catalogue of IEC publications: <u>www.iec.ch/searchpub</u>

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

IEC Just Published: <u>www.iec.ch/online_news/justpub</u>

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

Electropedia: <u>www.electropedia.org</u>

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

Customer Service Centre: <u>www.iec.ch/webstore/custserv</u> If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch Tel.: +41 22 919 02 11 Fax: +41 22 919 03 00



IEC 61162-450

Edition 1.0 2011-06

INTERNATIONAL STANDARD

Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE XB

ICS 47.020.70

ISBN 978-2-88912-492-3

CONTENTS

FO	REWO	DRD		5
1	Scop	e		7
2	Norm	ative re	eferences	7
3	Term	s and d	efinitions	8
4	Gene	eral netv	vork and equipment requirements	11
	4.1	Netwo	rk topology example	11
	4.2	Basic r	requirements	12
		4.2.1	Requirements for equipment to be connected to the network	12
		4.2.2	Additional requirements for network infrastructure equipment	12
	4.3	Netwo	rk function (NF) requirements	13
		4.3.1	General requirements	13
		4.3.2	Maximum data rate requirements	13
		4.3.3	Error logging function	13
	4.4	Systen	n function (SF) requirements	15
		4.4.1	General requirements	15
		4.4.2	Assignment of unique system function ID (SFI)	15
		4.4.3	Implementing configurable transmission groups	15
	4.5	Serial	to network gateway function (SNGF) requirements	16
		4.5.1	General requirements	16
		4.5.2	Serial line output buffer management	16
		4.5.3	Datagram output requirements	17
	4.6	Other i	network function (ONF) requirements	17
5	Low	level ne	twork requirements	17
	5.1	Electri	cal and mechanical requirements	17
	5.2	Netwo	rk protocol requirements	19
	5.3	IP Add	ress assignment for equipment	19
	5.4	Multica	ast address range	19
6	Trans	sport lay	yer specification	19
	6.1	Genera	al	
	6.2	UDP m	nessages	20
		6.2.1	UDP multicast protocol	20
		6.2.2	Use of multicast addresses and port numbers	20
		6.2.3	UDP checksum	21
		6.2.4	Datagram size	21
7	Appli	cation la	aver specification	22
	7 1	Dataor	am header	22
		7 1 1	Valid header	22
		712	Frror logging	22
	72	Genera	al IFC 61162-1 sentence transmissions	22
	• •	7.2.1	Application of this protocol	22
		7.2.2	Types of messages for which this protocol can be used	22
		7.2.3	TAG block parameters for sentences transmitted in the datagram	
		724	Requirements for processing incoming datagrams	<u>-</u> - 24
		725	Fror logging	<u>2</u> -7 24
	73	Binary	image transfer using UDP multicast	<u>-</u> -
		731	Application of this protocol	<u>-</u> -

This is a free page sample. Access the full version online. $I.S.\ EN\ 61162-450:2011\&A1:2016$

611	62-45	0 © IEC	2:2011(E) - 3 -	
		732	Rinary image structure	25
		7.3.3	Header	25
		734	Binary image descriptor structure	23
		735	Binary image data fragment	27
		7.3.6	Sender process for binary image transfer	20
		737	Receiver process for binary image transfer	20
		738	Other requirements	30
		739	Error logging	30
8	Meth	ods of t	est and required results	
•	8 1	Test se	et-up and equipment	32
	8.2	Basic r	requirements	
	0.2	8 2 1	Equipment to be connected to the network	02
		822	Network infrastructure equipment	
	83	Networ	k function (NE)	02
	0.0	8.3.1	Maximum data rate	
		8.3.2	Fror logging function	
	84	System	a function (SE)	00
	0.4	8 4 1	General	00
		842	Assignment of unique system function ID (SFI)	
		843	Implementing configurable transmission groups	00
	8 5	Serial f	to network gateway function (SNGF)	
	0.0	8.5.1	General	
		852	Serial line output huffer management	00
		853	Datagram output	34
	86	Other r	network function (ONE)	
	8.7		vel network	
	0.1	871	Electrical and mechanical requirements	
		872	Network protocol	
		873	IP address assignment for equipment	35
		8.7.4	Multicast address range	35
	8.8	Transp	port laver	35
	8.9	Applica	ation laver	35
		8.9.1	Application	35
		8.9.2	Datagram header	35
		8.9.3	Types of messages	36
		8.9.4	TAG block parameters	36
	8.10	Error lo	paging	36
	8.11	Binary	image transfer using UDP multicast	37
		8.11.1	Sender process test	37
		8.11.2	Receiver process test	38
		8.11.3	Image descriptor test	38
		8.11.4	Image transfer error logging	38
Anr	iex A	(normat	ive) Classification of IEC 61162-1 talker identifier mnemonics and	
sen	tence	s	·	39
Anr	iex B	(informa	ative) TAG block example	45
Anr	iex C	(normat	ive) Reliable transmission of command-response pair messages	47
Anr	iex D	(informa	ative) Network and system design guidance	52
Bibl	liogra	ohy		60

Figure 1 – Network topology example	
Figure 2 – Ethernet frame example for a SBM from a rate of turn sensor	20
Figure C.1 – Command response communications	47
Figure C.2 – State diagram	49
Figure D.1 – General system design architecture	
Figure D.2 – Example of ship-shore communication architecture	53
Figure D.3 – Security infrastructure	54
Figure D.4 – Decoupled system	56
Figure D.5 – Loosely coupled system	
Figure D.6 – Strongly coupled system	57
Table 1 – Syslog message format	14
Table 2 – Syslog error message codes	14
Table 3 – Interfaces, connectors and cables	
Table 4 – Destination multicast addresses and port numbers	21
Table 5 – Destination multicast addresses and port numbers for binary data transfer	21
Table 6 – Destination multicast addresses and port numbers for other services	21
Table 7 – Description of terms	25
Table 8 – Binary image structure	25
Table 9 – Header format	26
Table 10 – Binary image descriptor format	27
Table 11 – Examples of MIME content type for DataType codes	28
Table 12 – Binary image data fragment format	28
Table A.1 – Classification of IEC 61162-1 talker identifier mnemonics	
Table A.2 – Classification of IEC 61162-1 sentences	41
Table B.1 – Defined parameter-codes	46
Table D.1 – Overview of possible security functions	55
Table D.2 – Network failure propagation possibilities	58

This is a free page sample. Access the full version online. I.S. EN 61162-450:2011&A1:2016

61162-450 © IEC:2011(E)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 450: Multiple talkers and multiple listeners – Ethernet interconnection

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61162-450 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

The text of this standard is based on the following documents:

FDIS	Report on voting
80/615/FDIS	80/621/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

- 6 -

61162-450 © IEC:2011(E)

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

61162-450 © IEC:2011(E)

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – DIGITAL INTERFACES –

Part 450: Multiple talkers and multiple listeners – Ethernet interconnection

1 Scope

This part of IEC 61162 specifies interface requirements and methods of test for high speed communication between shipboard navigation and radiocommunication equipment as well as between such systems and other ship systems that need to communicate with navigation and radio-communication equipment. This part of IEC 61162 is based on the application of an appropriate suite of existing international standards to provide a framework for implementing data transfer between devices on a shipboard Ethernet network.

This standard provides a higher speed and higher capacity alternative to the IEC 61162-1 and IEC 61162-2 standards while retaining these standards' basic data format. This standard provides a higher data capacity than IEC 61162-3.

This standard specifies an Ethernet based bus type network where any listener may receive messages from any sender with the following properties.

- This standard includes provisions for multicast distribution of information formatted according to IEC 61162-1, for example position fixes and other measurements, as well as provisions for transmission of general data blocks (binary image), for example between radar and VDR.
- This standard is limited to protocols for equipment (Network nodes) connected to a single Ethernet network consisting only of OSI level one or two devices and cables (Network infrastructure).
- This standard provides requirements only for equipment interfaces. By specifying protocols for transmission of IEC 61162-1 sentences and general binary image data these requirements will guarantee interoperability between equipment implementing this standard as well as a certain level of safe behaviour of the equipment itself.
- This standard permits equipment using other protocols than those specified in this standard to share a network infrastructure provided that it is supplied with interfaces which satisfy the requirements described for ONF (see 4.6).
- This standard does not contain any system requirements other than the ones that can be inferred from the sum of individual equipment requirements. Thus, to ascertain system properties that cannot be derived from equipment requirements alone, additional analysis or standards will be required. In particular, this applies to requirements to maintain system functionality in the face of a single point failure in equipment or networks. Informative Annex D contains guidance on how to address such issues.

2 Normative references

The following referenced documents are indispensable for the application 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 60825-2, Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)



This is a free preview. Purchase the entire publication at the link below:

Product Page

S Looking for additional Standards? Visit Intertek Inform Infostore

> Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation