This document is a preview generated by EVS

Industrial communication networks - Wireless communication networks - Part 2: Coexistence management

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

This document is a preview generated by EVS

See Eesti standard EVS-EN 62657-2:2017 sisaldab Euroopa standardi EN 62657-2:2017 ingliskeelset teksti.	This Estonian standard EVS-EN 62657-2:2017 consists of the English text of the European standard EN 62657-2:2017.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 14.07.2017.	Date of Availability of the European standard is 14.07.2017.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 25.040.40, 33.040, 35.100

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega: Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62657-2

July 2017

ICS 25.040.40; 33.040; 35.100

Supersedes EN 62657-2:2015

English Version

Industrial communication networks - Wireless communication networks - Part 2: Coexistence management (IEC 62657-2:2017)

Réseaux de communication industriels - Réseaux de communication sans fil - Partie 2: Gestion de coexistence (IEC 62657-2:2017)

Industrielle Kommunikationsnetze - Funk-Kommunikationsnetze - Teil 2: Koexistenz-Management (IEC 62657-2:2017)

This European Standard was approved by CENELEC on 2017-06-15. 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 CEN-CENELEC Management Centre 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 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, Serbia, 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

© 2017 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. EN 62657-2:2017 E

This document is a preview generated by EVS

European foreword

The text of document 65C/861/FDIS, future edition 2 of IEC 62657-2, prepared by SC 65C “Industrial networks” of IEC/TC 65 “Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62657-2:2017.

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)	2018-03-15
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-06-15

This document supersedes EN 62657-2:2015.

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

Endorsement notice

The text of the International Standard IEC 62657-2:2017 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 61158 Series	NOTE	Harmonized as EN 61158 Series.
IEC 61360 Series	NOTE	Harmonized as EN 61360 Series.
IEC 61784-1	NOTE	Harmonized as EN 61784-1.
IEC 61784-2	NOTE	Harmonized as EN 61784-2.
IEC 61918	NOTE	Harmonized as EN 61918.
IEC 62591	NOTE	Harmonized as EN 62591.
IEC 62601	NOTE	Harmonized as EN 62601.
IEC 62734	NOTE	Harmonized as EN 62734.
IEC 62890	NOTE	Harmonized as EN 62890.

This document is a preview generated by EVS

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

Publication	Year	Title	EN/HD	Year
IEC 62657-1	2017	Industrial communication networks - Wireless communication networks - Part 1: Wireless communication requirements and spectrum considerations	EN 62657-1	201X [1]
IEC 62443	Series	Industrial communication networks - Network and system security	EN 62443	Series [1]

[1] At draft stage.

This document is a preview generated by EVS

CONTENTS

FOREWORD 6
INTRODUCTION 8
1 Scope 10
2 Normative references 10
3 Terms, definitions, abbreviated terms and conventions 10
3.1 Terms and definitions 10
3.2 Abbreviated terms 21
3.3 Conventions 22
4 Coexistence concept in industrial automation 22
4.1 Overview 22
4.2 Objective 24
4.3 Necessity to implement a coexistence management 26
4.4 Interference potential 28
4.5 Ancillary conditions 29
4.6 Requirements to wireless devices for support of coexistence management 30
4.7 Concepts 30
4.7.1 Manual coexistence management 30
4.7.2 Automated non-collaborative metrics-based coexistence management 31
4.7.3 Automated collaborative metrics-based coexistence management 31
4.8 Best practices to achieve coexistence 32
4.9 Coexistence conceptual model 34
4.10 Coexistence management and selection of a wireless solution 36
4.11 Coexistence management system 38
5 Coexistence management parameters 38
5.1 General 38
5.1.1 Definition and usage of parameters 38
5.1.2 Physical link 38
5.2 Adjacent channel selectivity 38
5.3 Antenna gain 39
5.4 Antenna radiation pattern 39
5.5 Antenna type 39
5.6 Availability 39
5.7 Bandwidth 40
5.8 Bit rate of physical link 40
5.9 Centre frequency 40
5.10 Characteristic of the area of operation 40
5.11 Communication load 40
5.12 Cut-off frequency 42
5.13 Data throughput 43
5.14 Device type information 43
5.15 Distance between wireless devices 43
5.16 Duty cycle 44
5.17 Dwell time 46
5.18 Equivalent isotropic radiated power 47
5.19 Equivalent radiated power 47
5.20 Frequency band 47

This document is a preview generated by EVS

5.21 Frequency channel 47
5.22 Frequency hopping procedure 48
5.23 Future expansion plan 48
5.24 Geographical dimension of the plant 48
5.25 Infrastructure device 48
5.26 Initiation of data transmission 48
5.27 ISM application 49
5.28 Length of user data per transfer interval 49
5.29 Limitation from neighbours of the plant 49
5.30 Maximum number of retransmissions 49
5.31 Mechanism for adaptivity 49
5.32 Medium access control mechanism 50
5.33 Modulation 50
5.34 Natural environmental condition 50
5.35 Network topology 50
5.36 Packet loss rate 51
5.37 Position of wireless devices 51
5.38 Power spectral density 51
5.39 Purpose of the automation application 52
5.40 Receiver blocking 52
5.41 Receiver input level 52
5.42 Receiver sensitivity 53
5.43 Regional radio regulations 53
5.44 Relative movement 53
5.45 Response time 53
5.46 Security level 54
5.47 Spatial coverage of the wireless communication network 54
5.48 Spurious response 54
5.49 Total radiated power 54
5.50 Transfer interval 54
5.51 Transmission gap 55
5.52 Transmission time 56
5.53 Transmitter output power 59
5.54 Transmitter sequence 59
5.55 Transmitter spectral mask 60
5.56 Update time 60
5.57 Wireless device density 61
5.58 Wireless communication network density 61
5.59 Wireless technology or standard 62
6 Coexistence management information structures 62
6.1 General 62
6.2 General plant characteristic 63
6.3 Application communication requirements 64
6.3.1 Overview 64
6.3.2 Requirements influencing the characteristic of wireless solutions 65
6.3.3 Performance requirements 66
6.4 Characteristic of wireless system type and wireless device type 66
6.4.1 Overview 66
6.4.2 Wireless system type 67

This document is a preview generated by EVS

6.4.3 Wireless device type 67
6.5 Characteristic of wireless solution 70
6.5.1 Overview 70
6.5.2 Characteristic of a wireless network solution 70
6.5.3 Characteristic of a wireless device solution 71
7 Coexistence management process 72
7.1 General 72
7.1.1 Overview 72
7.1.2 Documentation 72
7.1.3 Suitable documentation method 75
7.1.4 Application of tools 76
7.2 Establishment of a coexistence management system 76
7.2.1 Nomination of a coexistence manager 76
7.2.2 Responsibility of a coexistence manager 77
7.2.3 Support by radio experts 77
7.2.4 Training 77
7.3 Maintaining coexistence management system 78
7.4 Phases of a coexistence management process 78
7.4.1 Investigation phase 78
7.4.2 Planning phase 81
7.4.3 Implementation phase 83
7.4.4 Operation phase 84
8 Coexistence parameter templates 86
Bibliography 90

Figure 1 – Issues of consideration 25
Figure 2 – Applications using frequency spectrum 26
Figure 3 – Progression of expense to achieve coexistence corresponding to the application classes 30
Figure 4 – Separation of wireless systems according to frequency and time 33
Figure 5 – Coexistence conceptual model 35
Figure 6 – Flow chart of the coexistence conceptual model 36
Figure 7 – Selection of a wireless system in the coexistence management process 37
Figure 8 – Communication load in case of two wireless devices 41
Figure 9 – Communication load in the case of several wireless devices 42
Figure 10 – Cut-off frequencies derived from maximum power level 43
Figure 11 – Distance of the wireless devices 44
Figure 12 – Duty cycle 45
Figure 13 – Maximum dwell time 46
Figure 14 – Power spectral density of an IEEE 802.15.4 system 52
Figure 15 – Communication cycle, application event interval and machine cycle 55
Figure 16 – Minimum transmission gap 56
Figure 17 – Example of the density functions of transmission time 57
Figure 18 – Example of the distribution functions of transmission time 58
Figure 19 – Transmitter sequence 59
Figure 20 – Transmitter spectral mask of an IEEE 802.15.4 system 60

This document is a preview generated by EVS

Figure 21 – Example of distribution functions of the update time 61
Figure 22 – Principle for use of coexistence parameters 63
Figure 23 – Parameters to describe the general plant characteristic 63
Figure 24 – Parameters to describe application communication requirements 65
Figure 25 – Parameters to describe wireless network type and device type 66
Figure 26 – Power spectral density and transmitter spectral mask of a DECT system 68
Figure 27 – Medium utilization in time and frequency of a DECT system 68
Figure 28 – Parameters to describe a wireless solution 70
Figure 29 – Relations of the documents in a coexistence management system specification 75
Figure 30 – Planning of a wireless system in the coexistence management process 82
Figure 31 – Implementation and operation of a wireless system in the coexistence management process 85

Table 1 – Example of a classification of application communication requirements 24
Table 2 – Application profile dependent observation time values 45
Table 3 – Parameter options for frequency channel 48
Table 4 – List of parameters used to describe the general plant characteristic 64
Table 5 – List of parameters used to describe the requirements influencing the characteristic of wireless solutions 65
Table 6 – List of parameters used to describe performance requirements 66
Table 7 – List of parameters used to describe the wireless system type 67
Table 8 – List of parameters used to describe the transmitter of a wireless device type 69
Table 9 – List of parameters used to describe the receiver of a wireless device type 69
Table 10 – List of parameters used to describe a wireless network solution 70
Table 11 – List of parameters used to describe the transmitter of a wireless device solution 71
Table 12 – List of parameters used to describe the receiver of a wireless device solution 72
Table 13 – Template used to describe the general plant characteristic 86
Table 14 – Template used to describe the application communication requirements 87
Table 15 – Template used to describe the wireless system type 87
Table 16 – Template used to describe a wireless device type 88
Table 17 – Template used to describe the wireless network solution 88
Table 18 – Template used to describe a wireless device solution 89
Table 19 – Template used to describe an ISM application 89

This document is a preview generated by EVS

INTRODUCTION

The overall market for wireless network solutions spans a range of diverse applications, with differing performance and functional requirements. Within this overall market, the industrial automation domain could include:

- process automation, covering for example the following industry branches:
  - oil and gas, refining,
  - chemical,
  - pharmaceutical,
  - mining,
  - pulp & paper,
  - water & wastewater,
  - steel
- electric power such as:
  - power generation (for example wind turbine),
  - power transmission and distribution (grid),
- factory automation, covering for example the following industry branches:
  - food and beverage,
  - automotive,
  - machinery,
  - semiconductor.

Industrial automation requirements for wireless networks are different from those of, for example, the telecommunications, commercial and consumer markets. These industrial automation requirements are identified and provided in IEC 62657-1.

Industrial premises may contain a variety of wireless network technologies and other sources of radio frequency emissions.

This document is intended for designers and persons responsible for production and process plants, system integrators and mechanical engineers having to integrate and start up wireless systems in machines and plants, and producers of industrial wireless solutions. In particular, it is intended to motivate exchange of information between automation and radio engineers.

Many wireless industrial automation applications are also located in physical environments over which the operator/owner can exert control. That is, within a physical facility where the presence and operation of all radio frequency emitting devices are under the control of a single entity. This allows wireless management strategies to be employed which are not feasible for equipment installed in public or other unmanaged areas.

This document is a preview generated by EVS

In industrial automation, many different wireless networks may operate in the same premises. Examples of these networks are IEC 62591 [8][2] (WirelessHART®[3]), IEC 62601 [9] (WIA-PA) and IEC 62734 [10] (ISA100.11a); all these networks use IEEE 802.15.4 [19] for the process automation applications. Other examples of wireless networks are specified in IEC 61784-1 [4] and IEC 61784-2 [5] CPs that use IEEE 802.11 [17] and IEEE 802.15.1 [18] for factory automation applications. Different to wired fieldbuses, the wireless communication devices can interfere with others on the same premises or environment, disturbing each other. Other sources of radio frequency energy in these bands, often at high energy levels, include radio-frequency process heating, plastic welding, plasma lamps, and microwave irradiation devices.

Clearly, without a means to manage the coexistence of these varied emitters, it would be problematic to ensure that wireless networks meet the time-criticality and other performance requirements of industrial automation.

The IEC 62657 series has two parts:

- Part 1: Wireless communication requirements and spectrum considerations
- Part 2: Coexistence management

IEC 62657-1 provides general requirements for industrial automation and spectrum considerations that are the basis for industrial communication solutions. This document specifies the coexistence management of wireless devices to ensure predicable performance. It is intended to facilitate harmonization of future adjustments to international, national, and local regulations.

This document provides the coexistence management concept and process. Based on the coexistence management process, a predictable assuredness of coexistence can be achieved for a given spectrum with certain application requirements. This document describes mechanisms to manage the potential mutual interference that might occur due to the operation of multiple wireless devices in a plant.

This document provides guidance to the users of wireless networks on selection and proper use of wireless networks. To provide suitable wireless devices to the market, it also serves vendors in describing the behaviours of wireless devices to build wireless networks matching the application requirements.

This document is based on analyses of a number of International Standards, which focus on specific technologies. The intention of this standard is not to invent new parameters but to use already defined ones and to be technology independent.

This document is a preview generated by EVS

---

2 Numbers in square brackets refer to the bibliography.

3 WirelessHART is the registered trade name of the FieldComm Group, see www.fieldcommgroup.org. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.