# IEC/TS 62657-2

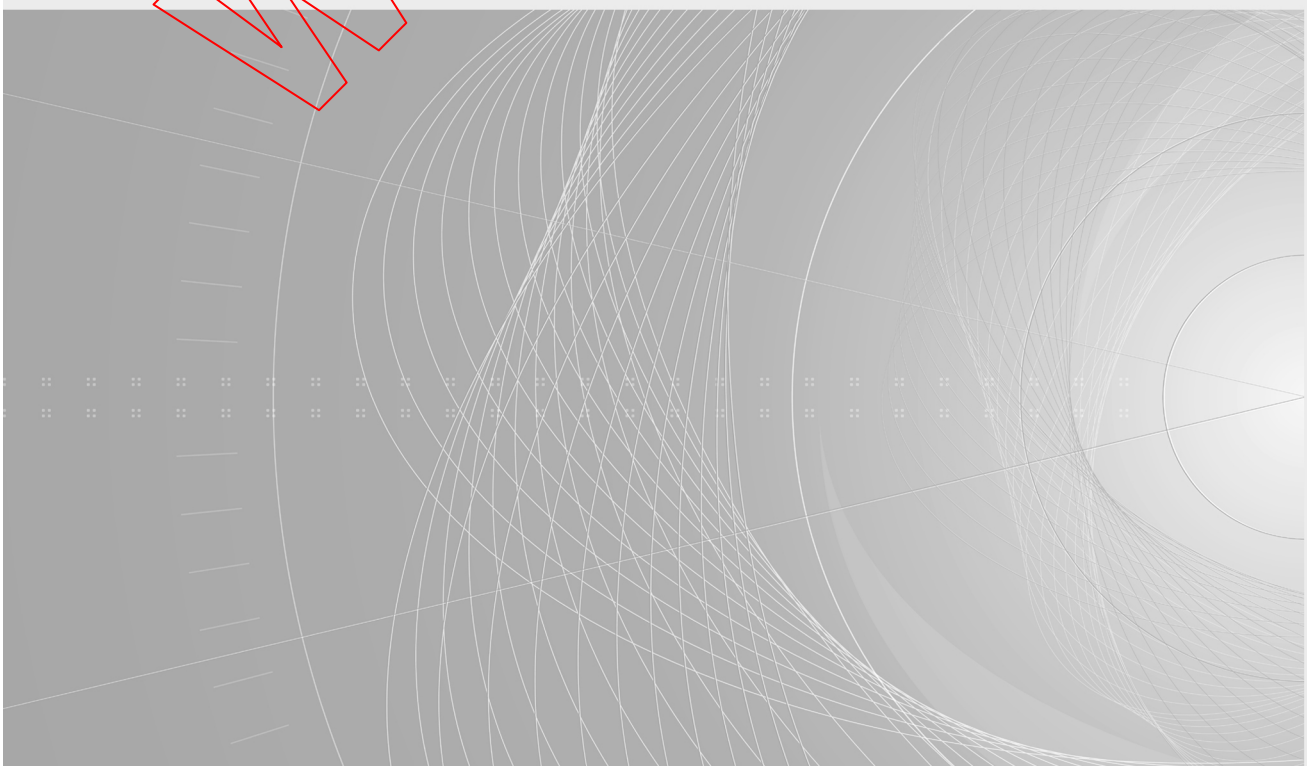
Edition 1.0 2011-11

# TECHNICAL SPECIFICATION

colour inside

## Industrial communication networks – Wireless communication network – Part 2: Coexistence management





IEC/TS 62657-2:2011(E)

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

## 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: www.iec.ch/searchpub

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 It also gives information on projects, withdrawn and replaced publications.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: www.iec.ch/online_news/justpub

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: www.electropedia.org

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: www.iec.ch/webstore/custserv

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/TS 62657-2

Edition 1.0 2011-11

# TECHNICAL SPECIFICATION




## Industrial communication networks – Wireless communication network – Part 2: Coexistence management

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE XB

ICS 25.040; 35.100

ISBN 978-2-88912-782-5

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

# INDUSTRIAL COMMUNICATION NETWORKS – WIRELESS COMMUNICATION NETWORK –

## Part 2: Coexistence management

## 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.
2) 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.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62657-2, which is a technical specification, has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this technical specification is based on the following documents:

| Enquiry draft | Report on voting |
|---|---|
| 65C/645/DTS | 65C/661A/RVC |

Full information on the voting for the approval of this technical specification 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.

A list of all parts of the IEC 62657 series, under the general title *Industrial networks – Wireless communication network,* can be found on the IEC website.

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.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.**

# INTRODUCTION

The market is in need of several network solutions, each with different performance characteristics and functional capabilities, matching diverse application requirements. Industrial automation applications covering different industrial applications such as process automation, factory automation, water/waste water treatments and other industrial applications up to power generation and power distributions applications, require different behaviours of wireless networks as, for example, in telecommunications, or for commercial items such as remote controls or toys. These requirements will be specified in the future IEC 62657-1.

In industrial premises, a lot of different wireless communication networks have to operate together such as IEC 62591 [9] (WirelessHART®[1])[2] and future IEC 62601[10][3] (WIA-PA), both using IEEE 802.15.4 for the process applications and such as IEC 61784-1 [5] and IEC 61784-2 [6] CPs using IEEE 802.11 [12] and IEEE 802.15.1 [13] for factory automation applications with different wireless communication systems. Different to wired fieldbuses, wireless communication interfaces can interfere with others on the same premises or in the same environment, disturbing each other. Therefore, it is not tolerable to have multiple wireless communication networks in the same facility or environment without a predictable assuredness of coexistence.

The IEC 62657 series has two parts:

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

Future IEC 62657-1 [11] provides requirements for regulators in order to obtain additional dedicated and worldwide unique spectrum and its standardized usage. It is intended to facilitate harmonization of future adjustments to the international, national and local regulations.

This part of IEC 62657, which is a technical specification, provides guidance to the users of wireless communication networks on selection and proper use of wireless communication 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 specification 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.



---

1 WirelessHART is the registered trade name of the HART Communication Foundation. 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.

2 Figures in square brackets refer to the bibliography.

3 To be published.

# INDUSTRIAL COMMUNICATION NETWORKS – WIRELESS COMMUNICATION NETWORK –

## Part 2: Coexistence management

## 1 Scope

This part of IEC 62657, which is a technical specification, specifies the fundamental assumptions, concepts, parameters, and procedure for wireless communication coexistence.

This specification provides guidelines, requirements, and best practices for wireless communications' availability and performance, covering the life cycle of wireless communication coexistence to help the work of all persons involved with the relevant responsibilities to cope with the critical aspects in each phase of wireless communication coexistence management in an automation plant.

Additionally this specification provides a common point of reference for wireless communication coexistence for industrial automation sites as a homogeneous guideline to help the users assess and gauge their plant efforts. Life cycle aspects include: planning, designing, installation, implementation, operation, maintenance, administration and training.

This specification deals with the operational aspects of wireless communication coexistence regarding both the static human/tool-organization and the dynamic network self-organization.

This technical specification specifies coexistence parameters and how they are used in an application requiring wireless coexistence.

NOTE Measurement methods of parameters could be the subject of a later edition.



## 2 Normative references

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.

IEC 61804-3, *Function blocks (FB) for process control – Part 3: Electronic Device Description Language (EDDL)*

IEEE 802.15.4, *IEEE Standard for Local and metropolitan area networks – Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs)*

## 3 Terms, definitions, abbreviated terms and conventions

### 3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

**3.1.1**
**adjacent channel interference**
interference that occurs when two or more wireless applications use adjacent frequency channels

**3.1.2**
**adjacent channel selectivity**
ability of a radio receiver to respond to the desired signal and to reject signals in adjacent frequency channels

**3.1.3**
**antenna**
structure or device used to collect or radiate electromagnetic waves

**3.1.4**
**antenna gain**
ratio of the power required at the input of a reference antenna to the power supplied to the input of the given antenna to produce, in a given direction, the same field strength at the same distance

[SOURCE: Federal Standard 1037C, modified] [16]

**3.1.5**
**antenna radiation pattern**
variation of the field intensity of an antenna as an angular function with respect to the axis

**3.1.6**
**automation application data length**
number of octets that are exchanged at the communication interface

**3.1.7**
**automation application**
application of measurement and automatic control in the industrial automation branches

**3.1.8**
**bandwidth**
difference between upper cut-off frequency and lower cut-off frequency

**3.1.9**
**centre frequency**
geometric mean of lower cut-off frequency and upper cut-off frequency of a radio channel

**3.1.10**
**channel occupation**
time in which the medium is busy

NOTE 1 to entry: Beyond the pure transfer of user data, this time includes all time slices necessary to process the transmission protocol, e.g. to transfer an acknowledgement.

**3.1.11**
**co-channel**
refers to emissions or transmissions in the same frequency channel

[SOURCE: IEC 60050-713:1998, 713-06-23, modified] [2]

**3.1.12**
**coexistence**
wireless communication coexistence
state in which all wireless communication solutions of a plant using shared medium fulfill all their application communication requirements

NOTE 1 to entry: The status of coexistence is characterized by meeting the limit values of relevant parameters for all wireless applications in the considered area. This status has to be ensured with appropriate measures in planning and in operation. This clarifies that coexistence is not a static attribute of a wireless communication solution, but rather a status within the life cycle of a plant. It is possible to leave this status temporarily or

permanently due to certain events. The parameter limit values are determined by the automation application in which the wireless communication takes place. This also implies that it is not reasonable to try to evaluate or ensure the coexistence separate from an automation application.

**3.1.13**
**coexistence assessment**
undertaking of an investigation in order to arrive at a judgment, based on evidence of the suitability of a set of products and their installation to achieve coexistence

[SOURCE: derived from IEC 62278] [8]

**3.1.14**
**coexistence planning**
process that describes the allocation of radio resources (such as time, frequencies, transmit power, space, etc.) to each wireless system in order to achieve coexistence

**3.1.15**
**coexistence management**
process to establish and to maintain coexistence that includes technical and organizational measures

**3.1.16**
**communication interface**
exposed interface between an automation application and the wireless component

NOTE 1 to entry: There is no consistently defined interface for measurement and automation. The interface of the device might be a serial or a parallel hardware interface, a fieldbus interface, a software interface, or serial, parallel, discrete, and analog interface.

**3.1.17**
**communication load**
requirement of the automation application to transfer a certain amount of user data within a certain period of time

**3.1.18**
**duty cycle**
ratio of the transmitter sequence referenced to a given observation time for the used radio channel

**3.1.19**
**dwell time**
period spent at a particular frequency during any single hop of a frequency hopping system

**3.1.20**
**effective radiated power**
power supplied to the antenna multiplied by antenna gain

**3.1.21**
**external wireless systems**
wireless applications beyond the scope of the coexistence management process, but potentially affecting the wireless communication systems administrated by the coexistence management

NOTE 1 to entry: External systems can be operated on adjacent sites and irradiate into the considered location.

**3.1.22**
**frequency band**
range in the frequency spectrum that is assigned for use to specific applications by regulatory organizations

**3.1.23**
**frequency channel**
part of a frequency band that is used under a specification (standard or device specification) by a wireless communication system

NOTE 1 to entry: The coordinated use of different frequency channels is one of the measures to achieve coexistence.

**3.1.24**
**immunity**
ability of an item to continue operating properly in the event of an interference, up to a certain level of interference, and to be resilient above this level

NOTE 1 to entry: Immunity changes if the environmental conditions change.

NOTE 2 to entry: Immunity of an item is achieved by adding to the robustness of the item the ability to be resilient to interference.

**3.1.25**
**intermodulation sensitivity**
levels of out-of-band interfering signals that, when mixed in the receiver front-end, produce an in-band third order non-linearity product

**3.1.26**
**jitter**
time variation of an expected occurrence

NOTE 1 to entry: Examples are variation of transmission time and update time.

**3.1.27**
**lower cut-off frequency**
frequency furthest below the frequency of maximum power where the power spectral density drops below a certain level

**3.1.28**
**mechanisms for adaptivity**
measures to modify one or more of the systems operational parameters in order to improve the systems robustness against interferences and to minimize the medium utilization

**3.1.29**
**metrics**
set of quantitative indicators corresponding to selected properties of a communication device, equipment, or wireless communication system

**3.1.30**
**plant**
complete set of technical equipment and facilities for solving a defined technical task

NOTE 1 to entry: A plant includes apparatus, machines, instruments, devices, means of transportation, control equipment and other operating equipment.

[SOURCE: IEC 60050-351:2006, 351-21-45] [1]

**3.1.31**
**power spectral density**
signal power per defined bandwidth

**3.1.32**
**radio channel**
span of the frequency spectrum which is characterized by lower cut-off frequency and upper cut-off frequency or by centre frequency and bandwidth

**3.1.33**
**(radio) resource**
means used by multiple wireless communication solutions for the purpose of radio signal transmission

**3.1.34**
**receiver blocking**
effect of a strong out-of-band interfering signal on the receiver's ability to detect a low-level wanted signal

**3.1.35**
**receiver maximum input level**
maximum signal power that the system can tolerate without distortion of the signal

**3.1.36**
**receiver sensitivity**
minimal signal power to receive data with a defined bit error rate

**3.1.37**
**robustness**
ability of an item to continue operating properly in the event of an interference, up to a certain level of the interference

NOTE 1 to entry: The robustness of an item may be increased with measures that modify one or more of its operational parameters

**3.1.38**
**spurious response**
receiver output due to unwanted signals (i.e. having frequencies other than those of the tuned frequency channel)

**3.1.39**
**radio robustness**
attribute of wireless communication to fulfill the designated function despite the presence of other active wireless communication applications interfering in the sphere of influence

NOTE 1 to entry: This is consistent with the definition of coexistence in IEEE 802.15.2 [14].

**3.1.40**
**shared medium**
frequency band shared by several wireless applications as assigned by regulatory organizations

NOTE 1 to entry: Especially in the industrial, scientific and medical (ISM)-bands, many wireless applications can be used. Due to this joint use, the term 'shared medium' is used in this technical specification. The frequency ranges are used by diverse ISM and wireless applications.

**3.1.41**
**transfer interval**
time difference between two consecutive transfers of user data from the automation application via the communication interface to the communication module

**3.1.42**
**wireless application**
any use of electromagnetic waves with devices or equipment for the generation and use of radio frequency energy

NOTE 1 to entry: This term is more comprehensive than the term wireless communication system, because in wireless applications the frequency energy is not only used for information transfer.