INTERNATIONAL STANDARD

ISO/IEC 24730-62

First edition
2013-09-01

Information technology — Real time locating systems (RTLS) —

Part 62: High rate pulse repetition frequency Ultra Wide Band (UWB) air interface

Technologie de l'information — Systèmes de localisation en temps réel (RTLS) —

Partie 62: Interface aérienne ultra large bande (UWB) à impulsions haute fréquence de répétition

Reference number
ISO/IEC 24730-62:2013(E)

© ISO/IEC 2013

COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword v

Introduction vi

1 Scope 1

2 Normative references 1

3 Terms, definitions, and abbreviated terms 2
3.1 Terms and definitions 2
3.2 Abbreviated terms 3

4 Overview 4
4.1 Components 4
4.2 Not covered by the standard 5
4.3 System 5
4.4 Document structure 5

5 Physical (PHY) layer specification 5
5.1 General 5
5.2 Default operating mode for a HRP UWB tag 6
5.3 PPDU format 7
5.3.1 PPDU encoding process 7
5.3.2 Symbol structure 9
5.3.3 PSDU timing parameters 10
5.3.4 Preamble timing parameters 12
5.3.5 SHR preamble 13
5.3.6 PHY header (PHR) 16
5.3.7 Data field 18
5.4 UWB PHY modulation 19
5.4.1 Modulation mathematical framework 19
5.4.2 Spreading 19
5.4.3 Forward error correction (FEC) 21
5.5 UWB PHY RF requirements 23
5.5.1 Operating frequency bands 23
5.5.2 Channel assignments 23
5.5.3 Transmitter specification 23
5.6 Timestamps and time units 26
5.6.1 Time units 26
5.6.2 Antenna delays 26

6 Basic message format 26
6.1 Message structure and processing rules 26
6.1.1 Time of arrival / Time of sending 27
6.2 Frame Check Sequence (FCS) 27

7 One-way communication – blink message 28
7.1 Encoding of blink frames with ISO/IEC 15963 tag ID 28
7.1.1 Sub-fields of the blink frame with ISO ID 29
7.2 Encoding of blink frames with IEEE EUI-64 tag ID 31
7.2.1 Sub-fields of the blink frame with IEEE ID 31

8 Two-way communication – data messages 35
8.1 Data Messages 35
8.1.1 Data frame sub-fields 35
8.2 Operation of two-way communication 36
8.2.1 The mechanics of two-way Communication 37

© ISO/IEC 2013 – All rights reserved

8.2.2 Activity Control 38
8.2.3 Read Tag Capabilities 39
8.2.4 Read Tag Configuration 40
8.2.5 Set Tag Configuration 42
8.2.6 Perform two-way ranging 43
Annex A (informative) Using ISO/IEC 24730-61 and ISO/IEC 24730-62 for RTLS Applications 46
Bibliography 57

 © ISO/IEC 2013 – All rights reserved

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

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

ISO/IEC 24730-62 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

ISO/IEC 24730 consists of the following parts, under the general title *Information technology — Real time locating systems (RTLS)*:

— *Part 1: Application program interface (API)*

— *Part 2: Direct Sequence Spread Spectrum (DSSS) 2,4 GHz air interface protocol*

— *Part 5: Chirp spread spectrum (CSS) at 2,4 GHz air interface*

— *Part 21: Direct Sequence Spread Spectrum (DSSS) 2,4 GHz air interface protocol: Transmitters operating with a single spread code and employing a DBPSK data encoding and BPSK spreading scheme*

— *Part 22: Direct Sequence Spread Spectrum (DSSS) 2,4 GHz air interface protocol: Transmitters operating with multiple spread codes and employing a QPSK data encoding and Walsh offset QPSK (WOQPSK) spreading scheme*

— *Part 61: Low rate pulse repetition frequency Ultra Wide Band (UWB) air interface*

— *Part 62: High rate pulse repetition frequency Ultra Wide Band (UWB) air interface*

© ISO/IEC 2013 – All rights reserved

Introduction

This series of standards defines one Air Interface Protocol for Real Time Locating Systems (RTLS) for use in asset management and is intended to allow for compatibility and to encourage interoperability of products for the growing RTLS market.

This document, the high rate pulse repetition frequency (HRP) UWB Air Interface Protocol, establishes a technical standard for Real Time Locating Systems that operate at an internationally available UWB frequency bands and that are intended to provide accurate location (e.g. within some tens of centimetres) with frequent updates (for example, every second).

Real Time Locating Systems are wireless systems with the ability to locate the position of an item anywhere in a defined space (local/campus, wide area/regional, global) at a point in time that is, or is close to, real time. Position is derived by measurements of the physical properties of the radio link.

Conceptually there are four classifications of RTLS:

- Locating an asset via satellite - requires line-of-sight - accuracy to 10 meters
- Locating an asset in a controlled area, e.g., warehouse, campus, airport - area of interest is instrumented - accuracy to 3 meters
- Locating an asset in a more confined area - area of interest is instrumented - accuracy to tens of centimetres
- Locating an asset over a terrestrial area using a terrestrial mounted receivers over a wide area, cell phone towers for example – accuracy 200 meters

With a further two methods of locating an object which are really RFID rather than RTLS:

- Locating an asset by virtue of the fact that the asset has passed point A at a certain time and has not passed point B
- Locating an asset by virtue of providing a homing signal whereby a person with a handheld can find an asset

Method of location is through identification and location, generally through multilateration

- Types
  - Time of Flight Ranging Systems
  - Amplitude Triangulation
  - Time Difference of Arrival (TDOA)
  - Cellular Triangulation
  - Satellite multilateration
  - Angle of Arrival

This standard defines the air interface protocol needed for the creation of an RTLS system using HRP UWB which is a physical layer UWB signalling mechanism (based on standard IEEE 802.15.4a UWB) and employing high rate pulse repetition frequencies (PRF) 16 MHz or 64 MHz, and a combination of burst position modulation (BPM) and binary phase-shift keying (BPSK.

© ISO/IEC 2013 – All rights reserved

Information technology — Real time locating systems (RTLS) —

Part 62:
High rate pulse repetition frequency Ultra Wide Band (UWB) air interface

1 Scope

This part of ISO/IEC 24730 defines the air-interface for real time locating systems (RTLS) using a physical layer Ultra Wide Band (UWB) signalling mechanism (based on IEEE 802.15.4a UWB). This modulation scheme employs high rate pulse repetition frequencies (PRF) 16 MHz or 64 MHz, and a combination of burst position modulation (BPM) and binary phase-shift keying (BPSK) giving an extremely high level of performance with a fully coherent receiver.

In addition to defining the air interface protocol (AIP) in terms of the physical layer modulation, this part of ISO/IEC 24730 also defines the AIP in terms of the messages sent over the air. This AIP supports simple one-way communication of a basic blink that may be used for a one-way Time Difference of Arrival (TDOA) based RTLS, where mobile tags periodically transmit the blink message which is received by an infrastructure consisting of a number of fixed reader nodes.

This AIP also optionally supports bidirectional communication and two-way ranging between the readers and tags of an RTLS. The support of two-way ranging depends on additionally including a UWB receiver in the tag and UWB transmitters in the reader infrastructure.

The mandatory default operational mode ensures interoperability between tags and infrastructure from various manufacturers, while the availability of several options offers flexibility to the developer of the infrastructure to adapt the behaviour of the overall system to the specific needs of his application.

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.

ISO/IEC/IEEE 8802-15-4, *Information technology — Telecommunications and information exchange between systems — Local and metropolitan area networks — Specific requirements Part 15-4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs)*

ISO/IEC 15963, *Information technology — Radio frequency identification for item management — Unique identification for RF tags*

ISO/IEC 19762, *Information technology AIDC techniques — Harmonized vocabulary — (all parts)*

© ISO/IEC 2013 – All rights reserved