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Information technology — Real-time locating system (RTLS) device performance test methods — Test methods for air interface communication at 2,4 GHz

Technologies de l'information — Système de localisation en temps réel (RTLS) méthodes dispositif de performance du test — Méthodes d'essai pour l'interface de communication de l'air à 2,4 GHz

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Foreword

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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 shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 24770 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

ISO/IEC 24770 cancels and replaces ISO/IEC TR 24770:2008.

Introduction

ISO/IEC 24730 defines the air interfaces and an application programming interface for Real Time Locating Systems (RTLS) devices used in asset management applications.

This International Standard provides test methods for measuring performance of equipment compliant with ISO/IEC 24730-2.

ISO/IEC 24769 contains all measurements required to be made on a product in order to establish whether it conforms to the corresponding part of ISO/IEC 24730.

Information technology — Real-time locating system (RTLS) device performance test methods — Test methods for air interface communication at 2,4 GHz

1 Scope

This International Standard defines the test methods for determining the performance characteristics of 2,4 GHz real time locating system (RTLS) equipment including tags, readers, and exciters which are applicable to the selection of equipment that conforms to ISO/IEC 24730-2 for specific applications. This International Standard does not apply to the testing in relation to regulatory or similar requirements.

The RTLS equipment performance parameters included in this International Standard include the mandatory direct sequence spread spectrum (DSSS) 2,4 GHz radio frequency beacon link between tags and readers. It includes the optional on–off keyed/frequency shift keyed (OOK/FSK) short range radio frequency link between tags and programmers. It also includes the optional magnetic air-interface between exciters and tags and between programmers and tags.

Unless otherwise specified, the tests in this International Standard apply exclusively to RTLS equipment defined in ISO/IEC 24730-2.

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 24730-2:2006, *Information technology — Real-time locating systems (RTLS) — Part 2: 2,4 GHz air interface protocol*

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

ISO/IEC 19762-3, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 3: Radio frequency identification (RFID)*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762-1 and ISO/IEC 19762-3 apply.

3.2 Abbreviated terms

ARB arbitrary waveform generator

BPSK binary phase shift keying

DSSS direct sequence spread spectrum

DUT device under test

EIRP effective isotropic radiated power

EVM error vector magnitude

FSK frequency shift keying

OOK on-off keying

PPM parts per million

RBW resolution bandwidth

RTLS real time location system

TIB timed interval blink

VBW video bandwidth

4 General

4.1 Performance requirements

This International Standard specifies a series of tests to determine the performance characteristics of RTLS equipment relative to the ISO/IEC 24730-2 air interfaces. The results of these tests can be used to determine the suitability of RTLS equipment for applications.

4.1.1 Location accuracy

The primary function of RTLS equipment is to locate tags within the area covered by the readers. Location accuracy determines the primary performance criteria of an RTLS. Location accuracy can be characterized by comparing the system's calculated location for a given set of tags to the actual location of the tags. The system must be able to locate tags to within the applications allowable error.

4.1.2 Tag capacity

A RTLS must typically locate a large number of tags. The number of tag blinks per second that can be processed and located through the readers can be used to determine a systems tag capacity. The system must be able to provide location information for an applications peak tag blink density.

4.1.3 Location latency

The latency between when the tag blink is transmitted and when the RTLS equipment can provide accurate location information determines the suitability of the equipment for the application.

4.1.4 Tag orientation

The ability of an RTLS to provide real time location information should be independent of the orientation of the tag. The location reported by the RTLS should not change as the tag is rotated in any orientation relative to the readers.

4.1.5 System range and packet error rates

The range of the tag-reader 2,4 GHz DSSS link determines the reader density requirements and also effects system capacity. The packet error rate will determine how often the equipment can successfully provide accurate location information for the tag.

The range, packet error rate, and orientation requirements of the optional air interfaces between the tags and exciters, and between the tags and programmers, determine the usability of the system in meeting the applications requirements.

4.2 Default conditions applicable to the test methods

These conditions apply to all tests.

4.2.1 Test environment

Testing shall take place in an environment typical to that of the desired application. Testing can be performed indoors or outdoors with temperature and humidity profiles similar to that expected in the desired application. The RF noise floor at the test location should also represent typical conditions expected within the desired application.

4.2.2 Default tolerance

Unless otherwise specified, a default tolerance of ± 5 % shall be applied to the quantity values given to specify the characteristics of the test equipment and the test method procedures.

4.2.3 System Logging

The RTLS should provide sufficient data logging to allow determination of the number of packets received and sent, but this is not absolutely required.

5 Performance tests for ISO/IEC 24730-2

5.1 System locate performance

This subclause includes tests for location performance.

5.1.1 Test objective

The objective of this test is evaluate the system locate performance characteristics of the ISO/IEC 24730-2 equipment.

5.1.2 Test set up

The readers shall be connected to omni-directional antennas. It is preferred that the RTLS locate performance characteristics be evaluated with the system installed as it would for the desired application. If that is not possible, then the equipment shall be configured as shown in Figure 1, with four readers at the corners of a square measuring 300 m across the diagonal (outdoor applications) or 200 m across the diagonal (indoor applications). In addition to standalone tags, several tags mounted on the application's locatable assets (or items of comparable size and composition) shall be used to evaluate locate performance.

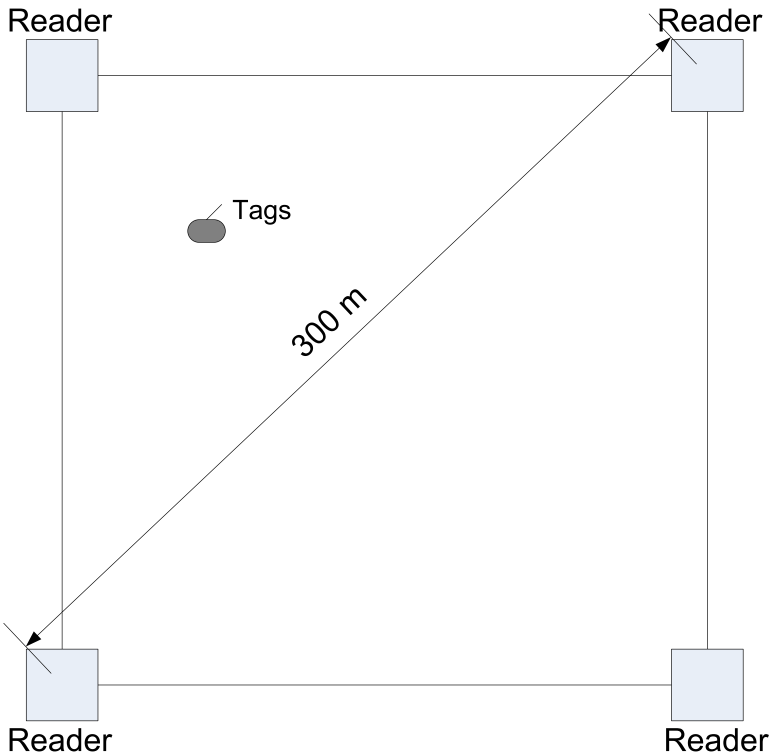

Figure 1 — Setup of equipment for RTLS locate accuracy test

5.1.3 Test procedure

The tag shall be configured to transmit 72-bit DSSS blinks as defined in ISO/IEC 24730-2:2006, 6.3.2.2. Unless otherwise indicated, the tags shall be configured at a blink interval such that the number of tags in the test divided by the blink interval used during test is equal to or greater than the planned number of assets tagged in the application (within range of a given set of readers) divided by the planned blink interval of application tags. Each blink shall be configured with at least two sub-blinks. The tag shall be configured to transmit at the extremes of class 1 power: 0 dBm and +10 dBm EIRP. The tag shall be attached to assets such as to reproduce the conditions of the desired application. Additional procedures specific to individual test are outlines in the test measurement and requirements.

5.1.4 Test measurements and requirements

5.1.4.1 Location accuracy

Tags, or sets of tags shall be distributed throughout the area of coverage at about a 20 m spacing as shown in Figure 2. The actual location of all tags shall be recorded. The test shall be run long enough to capture a minimum of 250 tag blinks from each tag. This will typically be several hours minimum. The total number of tag locates calculated during the test shall be divided by expected number of blinks from all the tags included in the test for the duration of the test using the formula: [(N tags) * (test duration)/(tag blink interval)]. Each location calculation shall be compared to appropriate tag's actual location to produce the location error. The location accuracy shall be represented as a percentage of all locations calculated by the system in which the errors fall within the specified maximum error divided by the total number of locations calculated. The radius of acceptable error shall be determined by the requirements of the application.

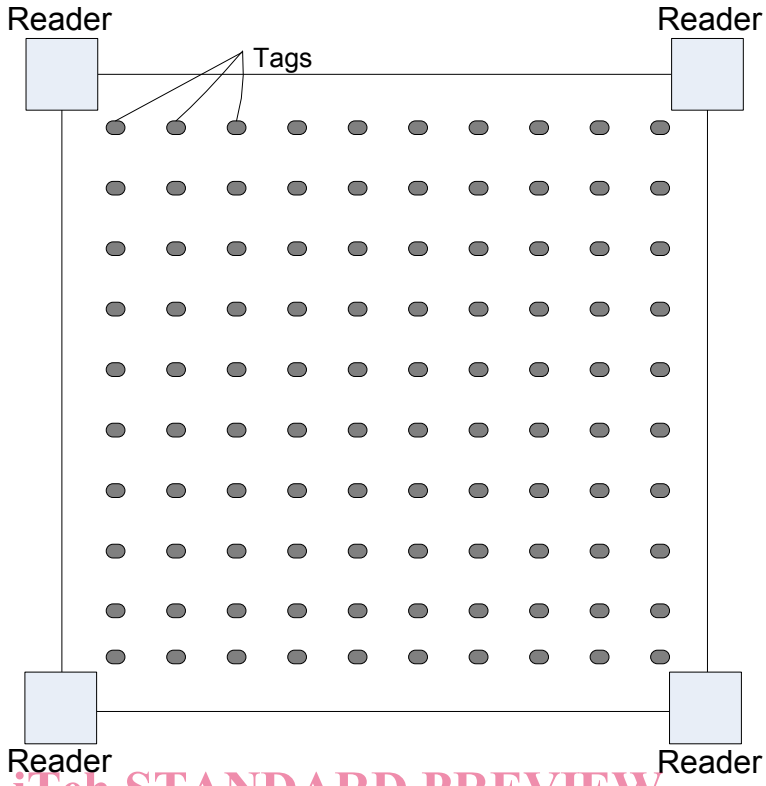

Figure 2 — Setup of equipment showing tag spacing

5.1.4.2 Location reporting latency

The test shall include at least 50 tag location changes to capture a statistically significant number of tag blinks. Tags, or groups of tags, shall be moved from one known location to another known location throughout the test. The exact time of each actual move shall be logged, as well as the exact time of reported location change. Record the difference between the time of reception and the time of the location report which location is within the maximum error allowed by the application.

5.1.4.3 Tag capacity

The tags shall be configured at a blink interval such that the total number of blinks per second during the test is at least 2,5 times the expected blinks per second in the application. This ensures that the system will continue to perform at times when tag blinks cluster in time. The location accuracy and locate latency shall be compared to the results from test results at the expected number of blinks per second to determine performance degradation.

5.1.4.4 Tag orientation

This test is required only for applications where the tag orientation when attached to the asset is not predicable. For the duration of the test, compare the errors in the calculated location as the tag is rotated through all three axes. Changes in location accuracy as a result of orientation should be noted in the test report quantitatively.