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Conformance test methods for RFID enabled tyres

Méthodes d'essai de conformité de pneumatiques RFID

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document is using passive RFID tags in the UHF RFID band from 860 to 930 MHz.

This document describes the conformance to ISO 20909 minimum reading distance within a specific radio frequency region.

Indeed, different RFID tag attachment solutions can be considered as per ISO 20911 and the tests reported in this document allow the tyre manufacturer to evaluate whether the selected option is suitable or not to grant the RFID enabled tyre minimum transmission performance level.

During the development of this document, attention was paid on the key parameters influencing the test results. However, others still remain non-specified therefore a testing lab can use those parameters to their discretion to perform the test.

The specifications in this document are not intended to limit any additional verification.

The use cases have been simplified by considering a standalone/unmounted tyre and describing a test set-up that can be used throughout the tyre's lifetime and/or the tyre's supply chain.

When conformity decisions are being done across various stakeholders, objective comparisons can be performed using the results obtained applying this document.

Additional use cases and more precise, detailed and traceable testing methodologies may be added in future revision of this document as RFID technology and its adoption moves forward.

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Conformance test methods for RFID enabled tyres

1 Scope

This document defines the test methods for validating the conformance of RFID enabled tyres with the minimum reading distance specifications given in ISO 20909.

The two presented methodologies give comparable test results only when the same radio frequency and energy power parameters are used.

Unless otherwise specified, the tests in this document are to be applied exclusively to a standalone RFID enabled tyre.

This document is not intended to set any requirement on mass production quality control, nor on the frequency for testing.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 20909, *Radio frequency identification (RFID) tyre tags*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
standalone tyre
non-mounted tyre

3.2
RFID enabled tyre
tyre featuring an RFID tag by means of an embedded, patch or sticker solution

3.3
measuring distance
d
linear distance between the RFID tag position and the interrogator antenna

3.4
received signal strength indicator
RSSI
indicative, non-calibrated value of the received power at the reader input

Note 1 to entry: This is the power backscattered by the tag towards the reader and measured at the reader input. RSSI is sometimes used to determine a tag's distance, as the signal is stronger from a tag that is closer to the reader antenna, however, the reflections and attenuation due to different materials may distort it.

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3.5
turn-on power
$P^{to}_{in,\ RFID\ enabled\ tyre}$
minimum input of conducted power that the interrogator must provide to its antenna to activate the RFID enabled tyre which is placed at the *measuring distance* (3.3)

3.6
effective isotropic radiated power
EIRP
product of the power supplied to the antenna and the maximum antenna gain in one direction relative to an isotropic radiator (absolute or isotropic gain)

$$EIRP = P_T - L_C + G_a$$

where

P_T is the output power of the transmitter (dBm);

L_C is the cable loss (dB);

G_a is the antenna gain (dBi).

Note 1 to entry: EIRP is limited by local regulation.

3.7
reads per seconds
RPS
indicative, non-calibrated value of the number of valid reads received per second, by an RFID reader, while interrogating an RFID tag for several seconds

3.8
interrogator antenna gain
G_R
unitless gain of interrogator antenna computed from the isotropic gain [10^(dBi/10)]

4 Conformance test methods

4.1 General

Two different test methods are described below. Both can be used to validate the conformance to ISO 20909 minimum reading distance requirement. It is up to the tyre manufacturer to choose one method or the other.

4.2 Open space method

4.2.1 General

This test method validates whether the RFID enabled tyre can be read at the minimum reading distance and can be performed even by using a hand-held RFID reader. The specified test is performed in an open environment as described in 4.2.2.

4.2.2 Testing site

The testing area shall be an open space with no object, wall or people (except the operator according to the details described below) in proximity of the tyre and reader in the range defined in 4.2.3.2 and 4.2.3.3.

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